Journal of Environmental and Public Health

Advanced Public Health using Artificial Intelligence and Big Data-enabled Internet of Things

Lead Guest Editor: Zhiguo Qu
Guest Editors: Sudha Subramani and Songya Ma

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Tongzhang Zheng, USA

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Retraction

Retracted: Analysis of the Effect of Classroom Reform of English Literature on the Theme of Environmental Protection in Universities Based on Artificial Intelligence Technology

Journal of Environmental and Public Health

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(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Manipulated or compromised peer review

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We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] X. Li, "Analysis of the Effect of Classroom Reform of English Literature on the Theme of Environmental Protection in Universities Based on Artificial Intelligence Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2178579, 10 pages, 2022.

Hindawi
Journal of Environmental and Public Health
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Retraction

Retracted: Accident Liability Determination of Autonomous Driving Systems Based on Artificial Intelligence Technology and Its Impact on Public Mental Health

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[1] Y. Xiao and Z. Liu, "Accident Liability Determination of Autonomous Driving Systems Based on Artificial Intelligence Technology and Its Impact on Public Mental Health," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2671968, 12 pages, 2022.

Hindawi
Journal of Environmental and Public Health
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Retraction

Retracted: Analysis of the Effects of Arts and Crafts in Public Mental Health Education Based on Artificial Intelligence Technology

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[1] L. Ji and Z. Liu, "Analysis of the Effects of Arts and Crafts in Public Mental Health Education Based on Artificial Intelligence Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 9201892, 12 pages, 2022.

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Journal of Environmental and Public Health
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Retraction

Retracted: The Influence of Public Mental Health Based on Artificial Intelligence Technology on the Teaching Effect of Business Administration Major

Journal of Environmental and Public Health

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Retraction

Retracted: Evaluation Method of Public Physical Training Quality Based on Global Topology Optimization Deep Learning Model

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Hindawi
Journal of Environmental and Public Health
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Retraction

Retracted: Artificial Intelligence Technology Driven Environmental Factors Extraction and Analysis Method in Traditional Clothing Handicraft

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Journal of Environmental and Public Health
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Retracted: Analysis of News Dissemination Path and Impact of Big Data Technology in Public Health Emergencies

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Retraction

Retracted: Analysis of the Correlation between College Music Education and Public Mental Health Based on Deep Learning

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[1] J. Huang, "Analysis of the Correlation between College Music Education and Public Mental Health Based on Deep Learning," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6593850, 9 pages, 2022.

Hindawi
Journal of Environmental and Public Health
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Retraction

Retracted: The Black-Box Deconstruction of Dynamic Sustainable Development Ability Driving Environmental Performance of Manufacturing Enterprises

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[1] Q. Liu, W. Zhang, Z. Gao, and W. Yang, "The Black-Box Deconstruction of Dynamic Sustainable Development Ability Driving Environmental Performance of Manufacturing Enterprises," *Journal of Environmental and Public Health*, vol. 2022, Article ID 1734008, 20 pages, 2022.

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Journal of Environmental and Public Health
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Retraction

Retracted: The English Teaching Methods in the Field of Public Health in Colleges and Universities Based on Artificial Intelligence Technology

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Journal of Environmental and Public Health
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Retraction

Retracted: Analysis of the Stage Performance Effect of Environmental Protection Music and Dance Drama Based on Artificial Intelligence Technology

Journal of Environmental and Public Health

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Journal of Environmental and Public Health
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Retraction

Retracted: The Mining Method of Ideological and Political Elements in University Public Mental Health Courses Based on Artificial Intelligence Technology

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Retraction

Retracted: Evaluation Model of Music Therapy's Auxiliary Effect on Mental Health Based on Artificial Intelligence Technology

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Retraction

Retracted: Analysis on the Effect of Wushu Project Propagation in Nonmaterial Cultural Field of Environmental Protection Based on Artificial Intelligence Analysis Technology

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Retraction

Retracted: Analysis of the Impact of the Development Level of Aerobics Movement on the Public Health of the Whole Population Based on Artificial Intelligence Technology

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Retraction

Retracted: Grey Correlation Analysis of Low-Carbon Governance in Yangtze River Delta Cities

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Retraction

Retracted: Evaluation Method of Comprehensive Quality of Environmental Protection Teachers Based on Big Data Analysis Technology

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We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] W. He and W. Zhou, "Evaluation Method of Comprehensive Quality of Environmental Protection Teachers Based on Big Data Analysis Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6848352, 9 pages, 2022.

Hindawi
Journal of Environmental and Public Health
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Retraction

Retracted: Closed Home Physical Education Teaching Model and Response Strategies Based on Big Data Technology

Journal of Environmental and Public Health

Received 19 September 2023; Accepted 19 September 2023; Published 20 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

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Retraction

Retracted: The Construction of Civics in University English Courses in the New Media Environment

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Retraction

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Retraction

Retracted: Evaluation Method of Comprehensive Quality of Environmental Protection Teachers Based on Big Data Analysis Technology

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Research Article

Evaluation Method of Comprehensive Quality of Environmental Protection Teachers Based on Big Data Analysis Technology

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In order to improve the shortcomings that the weight of each index is easily affected by human influence in the evaluation of traditional teachers' comprehensive literacy, on the basis of the analysis of index coefficients, feature reorganization, and feature analysis, this paper constructs the comprehensive literacy of environmental protection professional teachers' education in the big data environment. The evaluation model is proposed, and a weight distribution scheme for teachers' comprehensive literacy evaluation indicators is proposed based on the hierarchical Bayesian beta-return model, so as to improve the rationality of the indicator distribution and make the prediction results more accurate. The simulation results further verify the superiority of the proposed model in improving the comprehensive quality evaluation level of environmental protection teachers.

1. Introduction

The century-old plan is education-oriented; the education plan is teacher-oriented. As the pioneers in the process of education reform, the teachers' professional quality improvement is the core of ensuring the quality of education [1]. We are in an era of globalization. With the continuous maturity of the Internet, big data, blockchain, and artificial intelligence technologies and their application in education, new types of procedural evaluations and diagnostic evaluations emerge as the times require [2–4]. Evaluation is the "bull's nose" and "baton" of educational development and will become the "steering wheel" of educational development. The development of education evaluation and talent evaluation has accumulated a lot of rich theories for us to learn from and use. Multiple intelligences theory, various talent theories, educational goal classification theory, cognitive diagnosis theory, nonintelligence factor theory, and brain science theory have been widely used in the field of educational evaluation and talent evaluation in western countries. These theories all show a common feature, that is, the evaluation of people is more and more a comprehensive and complex process. Evaluation issues are extremely complex and critical [5–7]. To cultivate a team of teachers with high comprehensive quality, we must fundamentally solve the problem of the baton of education evaluation. Therefore, evaluating teachers' comprehensive literacy through big data analysis can well solve some of the current problems. In this paper, an evaluation model of English teachers' educational ability under the big data environment is constructed, and a weight distribution model of English teachers' educational ability evaluation indicators is obtained based on the hierarchical Bayesian beta regression model.

2. Research Status of Big Data Analysis Methods

2.1. Basic Concepts of Big Data. From a macro perspective, big data links the physical world, information space, and human society [8–10]. The physical world is transformed into a big data reflection in the information space through technologies such as the Internet and the Internet of Things, and human society generates its own big data image in the information space by means of human-machine interfaces, mobile internet, and other means. For the information industry, big data has vigorously promoted the new generation of information technology industry (the new generation of information technology industry is built on the third-generation platform, mainly big data, cloud computing, etc.). From the perspective of socioeconomics, big data is the core connotation and key support of the second economy [11]. The concept of the second economy was proposed by the American economist author in 2011, that is, it consists of processors, linkers, sensors, actuators, and economic activities that run on them [12].

Compared with traditional data, big data has four basic characteristics (called 4 V characteristics in the industry), namely, huge data volume (volume), low value density (value), wide sources, diverse characteristics (variety), and growth rate (velocity). Among them, the diversity of data is the most important feature, which describes the nature of multisource heterogeneity of data. It can be seen that the core problem of big data is how to quickly obtain valuable information from a wide variety of data [13, 14].

Big data is usually inseparable from data mining, artificial intelligence, machine learning, etc. There are both connections and differences between these terms, which can be represented by a Piatetsky-Shapiro Venn diagram (Figure 1) [15]. Big data is often thought of as datasets that are beyond the capabilities of conventional software tools to capture, manage, and process as input for data mining, machine learning, and more. Machine learning is a core component of data science, employing techniques from computer science, statistics, and artificial intelligence to facilitate the automatic improvement of algorithms with experience. Data mining is defined as the specific application of algorithms to extract patterns from data, focusing on the application of the algorithm rather than the algorithm itself. Data mining is a process in which machine learning algorithms are used as tools to extract potential patterns of value in datasets. Deep learning is a process similar to data mining, which uses a deep neural network architecture and is a specific type of machine learning algorithm. The concept of artificial intelligence is relatively broad. It is a discipline about knowledge. It mainly studies how to represent knowledge and how to acquire and use knowledge [16]. Big data, machine learning, etc. are the foundations that support artificial intelligence.

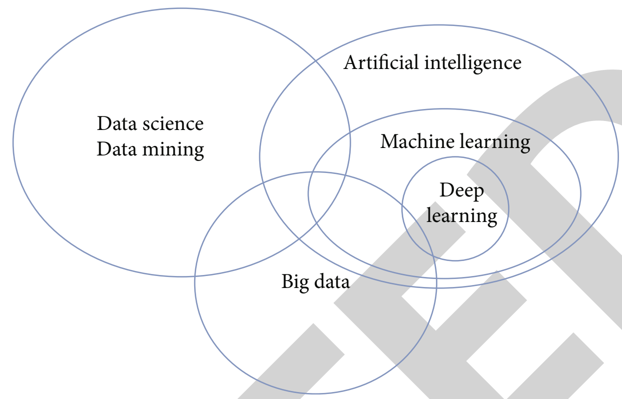

Figure 1: Venn diagram of important areas of data science.

2.2. Basic Process of Big Data Processing. The big data workflow analysis process is shown in Figure 2. Among them, data preparation and model building are the key tasks, the difficulty lies in data preparation, and the focus is on normative modeling. Data is modeled in terms of databases, data streams, data collections, and data warehouses. The magnitude of data and the diversity of data require data integration, cleaning, and filtering before processing to ensure follow-up work. The data preparation phase often encounters the problem of saturation of the analytical system. Therefore, the efficiency of data storage, filtering, migration, and retrieval must be considered when analyzing large-scale data.

2.3. The Main Research Direction of Big Data. According to the different focus of analysis, the related research on big data can be divided into two directions: (1) data processing and representation, mainly emphasizing the methods of collection, access, processing, and visualization; (2) statistical laws of data, focusing on microdata extraction of essential features and discovery of patterns. The collection, storage, and calculation of big data are mostly presented in the form of software tools, such as the Internet of Things and the Internet for data acquisition, the Hadoop Distributed File System and NoSQL database for data storage, and the Hadoop ecosystem for data computing, MapReduce, etc. Big data statistical analysis methods are largely the improvement and combination of various data analysis methods, including hypothesis testing, significance testing, etc. Data mining is also an important step and is used to probe large databases to discover unknown patterns or information. Deep mining of big data can achieve data classification, estimation, prediction, and other goals. After years of practice and exploration, the industry has become more and more aware that only coordinated and balanced development in two directions can ensure the steady growth and sustainable development of big data applications [17]. At present, the development focus of big data analysis is gradually transitioning from the technology of data processing to the science of data analysis.

2.4. Application of Big Data. As shown in Figure 3, big data was first used in business and financial fields and then gradually expanded to medical, energy, transportation, and other fields [18–21]. Among them, smart grid is one of the important technical fields of big data application. With the advancement of power informatization and the support of hardware systems such as smart substations, smart meters, and monitoring systems, it is possible to analyze smart grid big data. The data sources of the power grid mainly include electricity information acquisition system, wide area monitoring system, power distribution management system, and electric vehicle charging management system [22]. Among them, important research directions include socioeconomic status analysis, forecasting, demand side management/demand response, and power system transient stability analysis and control. IBM and C3-Energy developed a big data analysis system for smart grid, and Oracle proposed a public data model for smart grid big data.

Overall, the research on the evaluation method of teachers' comprehensive literacy is still in its infancy.

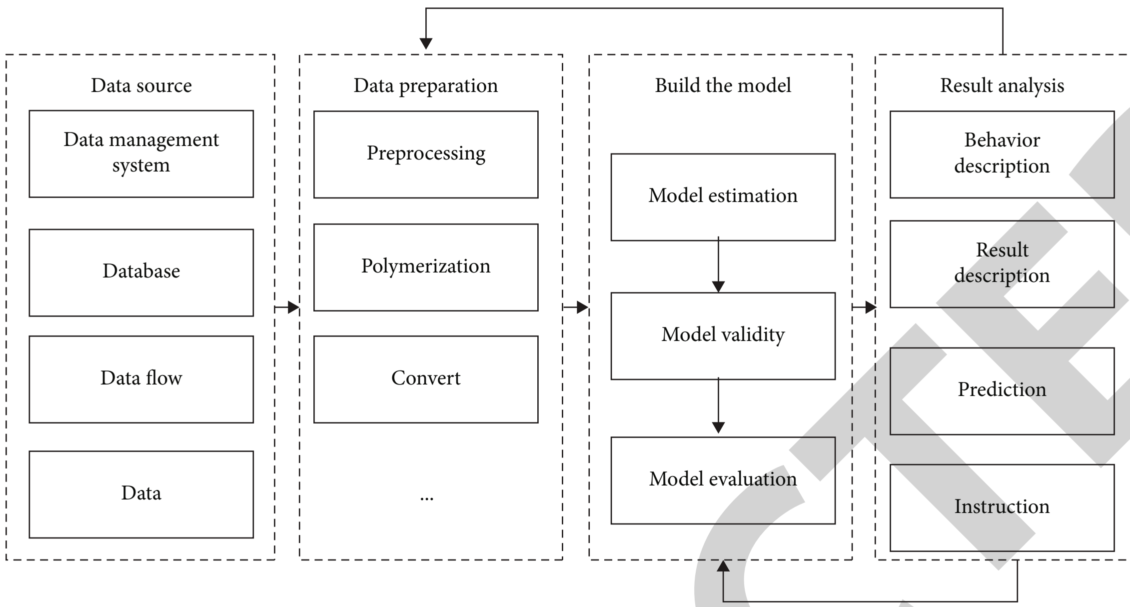

Figure 2: Big data workflow analysis process.

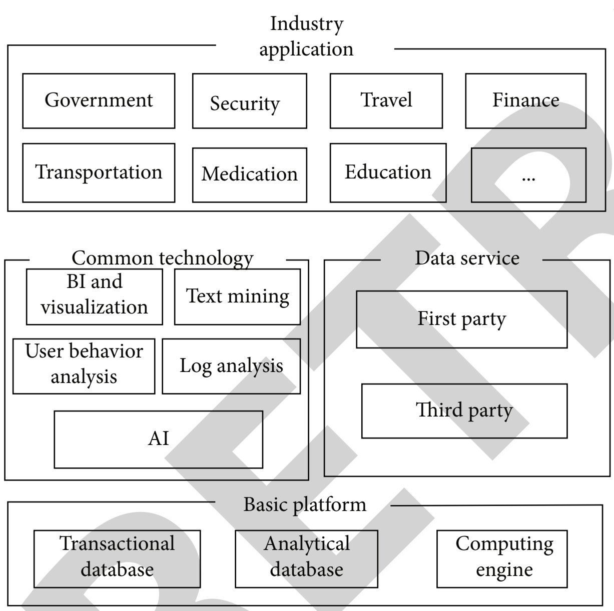

Figure 3: Big data industry map.

Multisource heterogeneous characteristics, multisource data fusion technology, and heterogeneous data processing technology will become the direction of future research.

3. The Connotation of Teachers' Comprehensive Quality

3.1. Teacher's Morality and Virtue. The so-called teacher's morality and style refers to the professional ethics of teachers and their ideological and work styles, including teachers' professional ethics, professional spirit, ideas, and other aspects. Noble teacher morality and good teacher style are the inherent requirements of the special profession of teachers. Teachers are the mirrors of students' moral cultivation. A good teacher should take the law from the top, see the wise and think together, constantly improve moral cultivation, improve the quality of personality, and impart correct moral values to students.

3.2. Professionalism. Solid knowledge, excellent teaching ability, diligent teaching attitude, and scientific teaching methods are the basic qualities of teachers. Because education and teaching is a challenging, intelligent, and creative work, teachers need to have profound professional knowledge and scientific and cultural knowledge, and they need to constantly update their teaching concepts and knowledge structure and constantly improve their teaching level. We require students to master the basic knowledge and skills of the subject, to comprehend the thinking method of the subject, and to have the courage to explore and the innovative spirit and the practical ability to solve practical problems. Our teachers must first have higher requirements.

In the information age, a series of cross-cutting frontier issues have arisen, which puts forward new requirements for teachers, and it is necessary to cultivate compound teacher talents. Compounding is not just mastery of professional skills, but also the ability to apply intersecting knowledge to solve problems. This requires the teachers of the university to have a broad knowledge reserve and cannot be limited to the field of study. As a university teacher, in addition to professional knowledge in this field, they also need to understand multidisciplinary knowledge such as Chinese, English, politics, history, chemistry, physical resources, mathematics, society, psychology, art, and philosophy. A university teacher who teaches human anatomy should first know how to appreciate fine arts and painting, so that he can draw an accurate map of human tissues and organs; a teacher who teaches biochemistry and molecular biology should first understand organic chemistry and inorganic chemistry. Be able to explain the metabolic pathways of sugar, protein, and fat in the chemical reaction of the human body; a teacher teaching pathology should first understand the knowledge of histology and embryology, so as to guide students to compare the changes in the morphological structure of normal tissues and organs and diseased tissues and organs. Just imagine, if a medical university teacher does not understand physics, he can neither find the mechanism of external force in the case of spinal injury nor understand the basic principle of radiation therapy for tumors. University teachers must have a broad knowledge reserve, in order to be able to draw inferences from other facts in teaching, to elicit extensive references, to arouse classroom interest and enthusiasm for learning, and to teach students to learn thoroughly and masterfully.

3.3. Strong Scientific Research Ability. College teachers should coordinate scientific research and teaching well, use scientific research to drive teaching, and use teaching to promote scientific research. With the continuous innovation of medical technology in the information age, college teachers will also encounter some problems that cannot be explained by textbooks in the teaching process. Teachers should reflect, question, and ask questions to the extent that they are familiar with the existing knowledge, and trace the source one by one through scientific research practice, explore solutions, innovate practice, and understand the past and present and the ins and outs of knowledge. The latest achievements in scientific research can also be reflected in teaching activities. Through free and flexible application expansion, reform and innovation, and updating and reorganizing teaching materials knowledge, students' academic horizons can be broadened. Only when teachers coordinate scientific research and teaching well, will they have high-level scientific research results and high-quality teaching effects, and explore frontier and difficult issues in the field of discipline development. To engage in scientific research is not only to write project applications, formulate research plans, implement project research, and conduct seminars and exchange meetings, but the most important thing is to continuously learn, discuss, accumulate, and innovate in these processes, so as to cultivate the courage to explore rigorous and realistic scientific research. Attitudes are transmitted to students through teaching activities to improve the quality of personnel training.

3.4. Information-Based Teaching Methods. In today's internet era, the popularization of computers, tablets, and smart phones has made various information technologies one of the indispensable skills of college students, and the learning methods and learning scenarios of college students have undergone tremendous changes. Therefore, teachers cannot simply adopt traditional teaching methods to design teaching links but build a new teaching mode and learning mode according to the changes of the times. During the new crown epidemic, large-scale online teaching was carried out across the country, and teachers across the country used various information technologies to deeply integrate education and teaching, effectively promoting the development of intelligent teaching in the field of teaching supported by emerging technologies such as artificial intelligence, cloud computing, and virtual reality [23].

The development of intelligent teaching is supported by emerging technologies such as reality in the field of teaching. With the development of information technology, the traditional teacher-led classroom is gradually transformed into a student-centered intelligent classroom, and the interactive experience of teacher-student interaction, student-student interaction, and human-computer interaction will become the key link of teaching. Facing the reform of the education system, teachers need to continuously learn and master various information-based teaching software and platforms, such as MOOC, Xuetong, Classroom School, and Rain Classroom, relying on cutting-edge technologies such as information technology and artificial intelligence to integrate teaching resources and design teaching interaction, implementing intelligent teaching, and evaluating teaching effects [24].

3.5. Excellent Teaching Art. Teaching is an art, shaping the mind and delivering the spirit. The object of teaching is a variety of people with independent, complex, changeable thoughts, and characteristics. Teaching activity is not a one-way interpersonal activity but a two-way transfer and exchange of ideas, emotions, culture, and knowledge between teachers and students. The expression of language and the matching of manners are the keys to reflect the teacher's superb teaching art. Appropriate teaching methods are the way to realize the superb teaching art. Accurate, clear, fluent, humorous, and funny language can make the knowledge level logical and clear and guide students to grasp and understand knowledge simply and clearly.

Elegant and confident posture can make the classroom atmosphere infectious. And these also can attract students' enthusiasm and interest of learning. What's more, the use of various teaching methods such as question-based, heuristic, case-based which are based on information technology can present the knowledge interesting and concise, so that can guide students to become interested in the course and then extends to the enthusiasm of the course [2, 25]. This is the teaching art that university teachers need to have.

3.6. Advanced Spirit of Innovation. Innovation is the soul of the development of a country, a nation, an enterprise, and a school, and its essence is to emancipate the mind and make breakthroughs. Without innovation, there will be no development, no innovation, and no progress. Looking back at the five thousand years of history, from the four ancient inventions, to the modern industrial revolution, and then to the modern information age, the penetration of innovative thinking is inseparable. The development of the times and the progress of science and technology have brought about essential changes in people's ideas, and put forward new requirements for the level of university education in terms of depth and breadth, that is, focusing on the cultivation of talents' innovative thinking [3, 26]. As a university teacher who cultivates innovative talents, it should have innovative consciousness and innovative spirit. University teachers should maintain the desire and demand for information and knowledge acquisition, not stick to the traditional teaching mode, dare to question, be good at experimenting, have the courage to transcend in teaching and research, and constantly explore new ideas and methods for teaching and research. The future of the nation is crucial [27].

4. The Status Quo of Teacher Development in Colleges and Universities in My Country Based on Big Data

4.1. Insufficient and Perfect System and Mechanism for the Development of Higher Vocational Teachers. First of all, in most colleges and universities, because they have not established relatively sound systems and rules and regulations for cultivating outstanding talents, the organizational management system has been in a state of "absence." An insufficiently sound management mechanism cannot train vocational teachers in an all-round way or promote their own development. Due to the lack of overall planning and top-level design for the development of teachers in vocational colleges, some vocational colleges are still in a relatively passive situation in cultivating outstanding teachers and staff. Secondly, colleges and universities have not invested a lot of funds in the direction of teachers' own development, so they have not established and established a sound guarantee mechanism, which has led to a serious lack of close communication between schools, departments, and teachers. The work of cultivating teachers in the school is incapable of continuing, and it does not help the school to create a good school spirit. Thirdly, the traditional and outdated evaluation mechanism is used, which is usually one-way evaluation or directional evaluation. This evaluation mechanism will directly lead to excessive demands on teaching results by college teachers, thus gradually ignoring the entire process of carrying out educational activities, making it difficult to improve and cultivate students' comprehensive literacy and comprehensive ability. Finally, my country's education is at a critical stage of development. In most colleges and universities, there is usually a serious lack of an effective reward mechanism. When teachers achieve excellent results, the lack of an effective mechanism for praise and incentives will also hinder teachers' initiative to improve their own abilities.

4.2. The Groups Covered by Teacher Development Are Not Comprehensive Enough. For most vocational colleges, it is a long process to improve teachers' own scientific research ability and practical teaching level. In this process, whether it is a senior and experienced teacher or a younger group of teachers, it is necessary to continuously update the basic professional knowledge system through continuous training and learning from beginning to end, so as to help teachers keep pace with the latest academic the frontier and progress together with the times. At this stage, most colleges and universities generally pay more attention to cultivating teams of young teachers. From different points of view, improving the comprehensive quality and comprehensive ability of young teachers is of great help and benefit to improving teachers as a whole, but this does not mean that improving young teachers' own teaching level can represent the group of teachers. Therefore, improving some groups does not mean to improve the overall ability. If the actual training needs of teachers at all levels are not really taken into account, the training of a certain group across the board will directly affect the sustainable and steady development of the professional group of teachers.

4.3. Lack of Professional Content Aimed at Cultivating Teacher Development. In most colleges and universities in my country, school-based training has always been one of the important measures to cultivate teachers' development. On the one hand, because the content of training is too broad, and the content focuses on experience guidance and practical teaching theory, there is a lack of practical training and no in-depth exploration of detailed issues, resulting in the development of teachers that cannot be targeted. On the other hand, the training topics carried out are relatively typified and similar [28]. Most colleges and universities have proposed "training for all staff," but the universality of a large number of training topics that carry out full-staff training lacks stratification or classification. Guidance and training teacher development is not achieved overnight. The measures taken by college teachers at different stages are different, and the needs of training teachers for development are also different. From this, it can be seen that colleges need to put teachers at different stages. Sexual development needs are regarded as comprehensive development needs, which directly leads to the invisibility of the effectiveness of cultivating teacher development [29].

5. Model Building

Assessments are generally based on four broad categories of criteria: teaching, research, academic programs, and supporting organizational facilities and services, which form the main pillars of academic quality [30]. At the heart of the academic assessment process is the assessment of the teaching quality of individual courses/faculties by students taking the course. Under the traditional mode, the evaluation of teachers' educational ability mainly adopts the methods of setting teaching evaluation forms, reviewing textbooks, classroom teaching observation, and discussing evaluation results [31, 32]. In order to arrive at an evaluation result, some attributes (variables/indicators) inevitably need to be assigned weights. By changing the relative weights, it is possible to increase or decrease the importance of certain attributes that have a crucial impact on the outcome of the evaluation process for these attributes. In this case, the evaluation process itself becomes unreliable and easily subject to subjective factors.

In the large-scale network open course environment, the evaluation of teachers' teaching ability has the characteristics of openness and randomness [33]. Therefore, it is necessary to use quantitative mathematical model analysis methods to accurately evaluate the educational ability of university teachers, such as intelligent algorithms and big data processing technology. Evaluate and predict the educational ability of language teachers. Yu [34] conducted research on the improvement of teachers' teaching ability under the Internet "+" environment. Feng [35] put forward effective countermeasures to improve the teaching ability of college teachers from four dimensions: correct cognition of teaching ability, active participation in professional training, comprehensive innovation of teaching mode, and good after-class reflection.

5.1. Index Coefficient Analysis and Feature Recombination. Assume that the prior knowledge based on time series sampling in the statistical environmental protection teacher's educational ability evaluation coefficient data is expressed as $\{x_i\}_{i=1}^{n}$. At the same time, it is assumed that the evaluation coefficient data has a linear correlation Gaussian process characteristic. Let the sequence of teacher educational ability evaluation coefficients be y_n', and the fitting model of the statistics-based teacher educational ability evaluation coefficient data can be expressed as follows:

$$x_n = \varphi_0 + \sum_{i=1}^{p} \varphi_i x_{n-i} + \sum_{j=0}^{q} \theta_j \eta_{n-j}, \tag{1}$$

where $\{\eta_{n-j}\}$ is a standard positive distribution with mean 0 and variance σ^2; $\varphi_0, \varphi_1, \cdots, \varphi_p$ is the time-reversed assessment of teachers' teaching ability; $\theta_1, \theta_2, \cdots, \theta_q$ are the average coefficients of the sliding time window; and p and q are the prior knowledge representation based on time series sampling and the number of sliding time windows, respectively.

In order to simplify the model, this paper assumes that the data distribution of teachers' teaching ability evaluation coefficients is calculated in a two-dimensional feature space. At the same time, the high-dimensional phase space reconstruction method is used to reconstruct the characteristics of teachers' teaching ability, and the multidimensional reconstruction is used to describe the performance attributes of teachers' teaching ability. The characteristic distribution matrix L of teachers' teaching ability can be described as follows:

$$L = \begin{bmatrix} x_1^T \\ x_2^T \\ \cdots \\ x_N^T \end{bmatrix} = \begin{bmatrix} x_1 & x_{1+\tau} & \cdots & x_{1+(m-1)\tau} \\ x_2 & x_{2+\tau} & \cdots & x_{2+(m-1)\tau} \\ \vdots & \ddots & \ddots & \vdots \\ x_{N-1} & x_{N-1+\tau} & \cdots & x_{N-1+(m-1)\tau} \end{bmatrix}. \tag{2}$$

Among them, m is the correlation dimension of the feature information in the multidimensional teacher's teaching ability statistical data sequence; τ is the data sampling time delay; N is the number of data.

By combining formulas (1) and (2), the index coefficient analysis and feature reorganization of teachers' teaching ability evaluation can be realized, and further standard data input can be provided for the evaluation and prediction of teaching ability.

5.2. Characteristics. In the reconstructed m-dimensional feature matrix L, a sparse matrix of principal component distribution of teachers' teaching ability is constructed, and singular value points $L = U \cdot S \cdot C$ are used to analyze teaching ability in big data environment. U and C are linear correlation matrices, expressed as follows:

$$C = \{c_1, c_2, \cdots, c_n\}, \tag{3}$$

where n is the number of elements in the linear correlation matrix C.

Further, the singular value of L is represented by S, and then the attribute set of big data eigenvalues is described as follows:

$$S = \operatorname{diag}\,(\sigma_1, \sigma_2, \cdots, \sigma_n). \tag{4}$$

Among them, $\sigma_1 > \sigma_2 > \cdots > \sigma_n > 0$.

Using any orthogonal matrix to remove the dimension of the original data of English teachers' teaching ability, the reconstruction moment L of the attribute feature set of teaching ability can be obtained. In the reconstructed matrix space, the big data analysis method can be used to perform cluster analysis on teachers' teaching ability data, and the reconstructed matrix of teachers' teaching ability indicators can be expressed as follows:

$$X = \begin{bmatrix} x_1 \\ x_2 \\ \cdots \\ x_N \end{bmatrix} = \begin{bmatrix} a_1^T c_1 & a_N^T c_2 & \cdots & a_1^T c_m \\ a_2^T c_1 & a_N^T c_2 & \cdots & a_2^T c_m \\ \vdots & \ddots & \ddots & \vdots \\ a_N^T c_1 & a_N^T c_2 & \cdots & a_2^T c_m \end{bmatrix}. \tag{5}$$

Among them, $\mathrm{x_i}(\mathrm{i} \in (1, \mathrm{N}))$ is the i-th capability index, and $a_i^T(\mathrm{i} \in (1, \mathrm{N}))$ are the matrix coefficients.

6. Model Introduction

Based on the method of big data analysis, this section established a data fusion model for the evaluation index of teachers' educational ability and analyzes the fusion of hierarchical Bayesian and beta regression model [36] of the teaching evaluation index. A hierarchical Bayesian beta regression model was proposed. Next, the model was introduced in detail.

A random survey was conducted among school teachers and students when the sample data was collected, and $j = 1$, 2 represents two different sampling time periods. Let $n = n_1 + n_2$ be the total sample size, and y_{ij} denote the score given by the i-th assessor at time j (overall teaching/course assessment score). $X_{ij} = (x_{ij}, 1, x_{ij}, 2, \cdots, x_{ij}, k)^T$ represents the observations of k known attribute vectors. Without loss of generality, this paper assumed that all data have been normalized, that is, the values of all assessments are between (0, 1). To simplify the model, it was assumed that the data follows a beta distribution, that is, the mean of the data can be defined as the observed and unobserved attributes and a weighted linear combination of constant variance. Therefore, the coefficients of the model can be defined as weights, i.e., the addition of positive random variables.

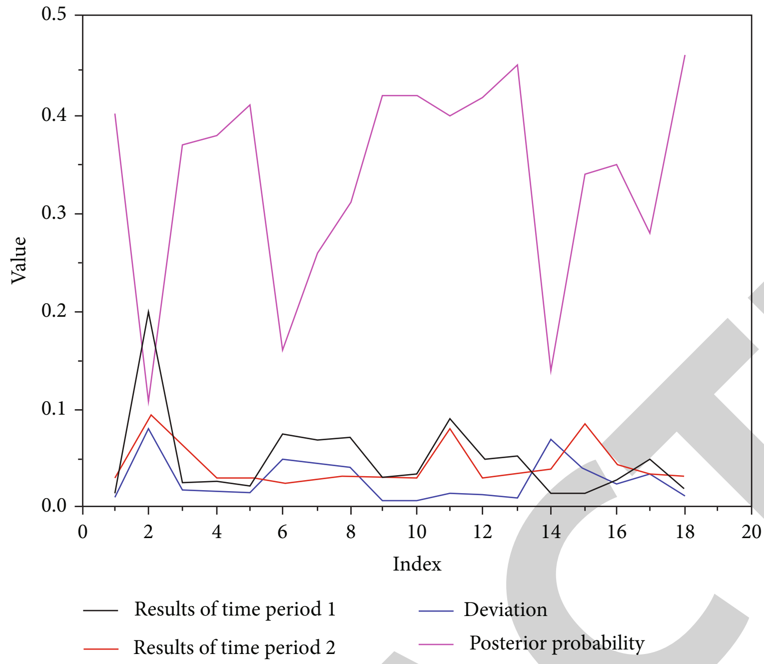

Figure 4: Comparison results of indicator weights in different time periods.

For two different time periods ($j = 1, 2$), the model proposed in this paper was used for analysis, and its form was described as follows:

$$\begin{aligned} Y_{ij} &\sim \text{Beta}\left(a_{ij}, b_{ij}\right), \\ a_{ij} &= \frac{\left(1-\mu_{ij}\right)\mu_{ij}^{2} - \mu_{ij}\sigma_{j}^{2}}{\sigma_{j}^{2}}, \\ b_{ij} &= \frac{\left(1-\mu_{ij}\right)\left(\mu_{ij} - \mu_{ij}^{2} - \sigma_{j}^{2}\right)}{\sigma_{j}^{2}}, \\ \mu_{ij} &= w_{j,1}x_{ij,1} + \cdots + w_{j,k}x_{ij,k} + w_{j,k+1}z_{ij}, \end{aligned} \tag{6}$$

where μ_{ij} represents the average of the response variable Y_{ij} (overall evaluation score) mean; σ_{j}^{2} is the variance of the response variable; $W_{j} = (w_{j,1}, \cdots, w_{j,k}, w_{j,k+1})^{T}$ is a random variable that measures the relative importance of different attributes and latent variables at time j. z_{ij} represents the assessment of rater i's unspecified factor at time j, that is, an unobserved random variable.

Use the Dirichlet prior distribution, $W_{j} \sim D(1,\ldots,1)$ in weight processing. σ_{j}^{2} obeys uniform prior distribution, namely $\sigma_{j}^{2} \sim U(0, m)$, and $m = \text{mm}\{(1-\mu_{ij}, \mu_{ij})\}$. Furthermore, this article assumes that all variables are independent and come from a beta distribution with both parameters equal to 0.5.

7. Simulation and Analysis

During the simulation, a questionnaire survey was conducted on 95 students in the school to obtain the dataset. The structure, content, and selected topics of the questionnaire were determined by teachers with rich teaching experience (more than 20 years of teaching experience). Based on the principles of courseware teaching materials, examination process, teaching ability, high quality of teaching methods, and reasonable arrangement, some indicators are selected for the study. The indicators were shown as follows:

(1) Clarity of course objectives, (2) relevance of course content to course objectives, (3) relevance of course content to established standards, (4) the value of courseware, (5) the course content meets academic and professional requirements, (6) whether the course is completed or not, (7) the degree to which the examination subjects are compatible with the course content and teaching, (8) the degree to which the difficulty of the examination is compatible with the difficulty of the course, and (9) adaptability, (10) fairness and impartiality of exams, (11) curriculum preparation, (12) curriculum content excellence, (13) curriculum language organization, (14) teacher professionalism, (15) subject atmosphere and interaction, (16) fair treatment of students, (17) respect for students, and (18) overall teaching/course assessment score.

Figure 4 shows the comparison results of the indicator weights in two different time periods. In order to highlight the results of the weight changes of the indicators in different time periods, this paper used two indicators, the deviation and the posterior probability, for analysis, where the deviation refers to the difference between the two weight comparison results; the posterior probability π_0 was to set the tail probability to zero, which is defined as the formula (7) shown

$$\pi_0 = \min\left\{f(w_{1,l} - w_{2,l} > 0 | y), f(w_{1,l} - w_{2,l} < 0 | y), l = 1, \cdots, g\right\}, \tag{7}$$

where $f(.)$ is the tail probability density function.

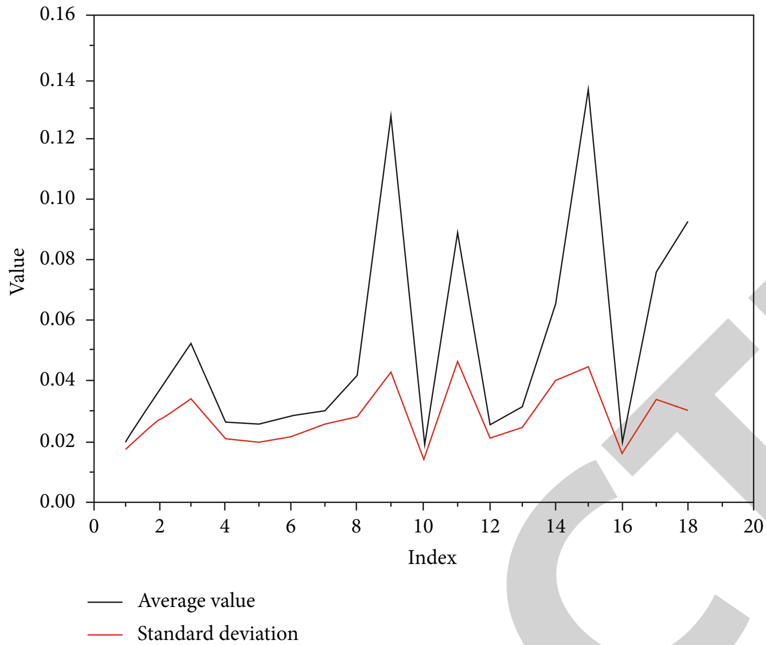

Figure 5: Weighted posterior statistics.

As can be seen from Figure 4, when the zero value is in the center of the posterior distribution, the value of π_0 is expected to be close to 0.5, indicating that there is no significant difference in the indicator weights between the two different time periods. When π_0 is low (for example, below 5%), it can be concluded that there is a difference in indicator weights between two different time periods.

Further, Figure 5 presents the posterior statistical results of the indicators. It can be seen that the relative importance of the indicator of attribute number 15 is relatively high for students (the average posterior weight is about 14%), followed by the attribute number 9 (the average posterior weight is about 13%), and the attribute number 11 (the average posterior weight is about 13% and about 9%).

8. Conclusion

This paper used a hierarchical Bayesian beta regression model to evaluate and test the main components of teachers' teaching ability and quality. The coefficients of the model can be interpreted as weights, which are used to measure the relative importance of students to different attributes. Further, based on the big data analysis method, this paper established a data fusion model for the evaluation indicators of teachers' educational ability in environmental protection majors, so as to improve the rationality of index allocation and make the evaluation results more accurate. Future research directions include data cleaning and teacher ability evaluation under partial information problem to further improve the performance of the model.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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Retraction

Retracted: Artificial Intelligence Technology Driven Environmental Factors Extraction and Analysis Method in Traditional Clothing Handicraft

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] R. Tao and Q. Guo, "Artificial Intelligence Technology Driven Environmental Factors Extraction and Analysis Method in Traditional Clothing Handicraft," *Journal of Environmental and Public Health*, vol. 2022, Article ID 1883641, 9 pages, 2022.

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Research Article

Artificial Intelligence Technology Driven Environmental Factors Extraction and Analysis Method in Traditional Clothing Handicraft

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The application of artificial intelligence (AI) technology in the field of clothes can provide a good development mode and system under the social context of AI technology development. AI provides help for the development of intelligent clothing. Intelligent clothing is a high-tech product that integrates intelligent technology and clothing. It combines cutting-edge technologies in electronic information technology, sensor technology, textile science, and material science. In the extraction and analysis of environmental factors in clothing handicraft, AI technology has a considerable application prospect and a certain development potential. In order to improve the accuracy of environmental factors extraction in clothing handicraft, this paper uses convolutional neural network (CNN) to extract and analyze environmental factors in traditional clothing handicraft. We carried out experiments on the extraction of environmental factors in clothing handicrafts with pure color, few patterns, patterns, and complex background. The experimental results show that the CNN has a good effect on the extraction of environmental factors in clothing handicraft under different backgrounds. In addition, the model in this paper has good stability, accuracy, and feature extraction speed, which has high practical value and research significance.

1. Introduction

The fashion design trend of the 21st century will be based on the appearance of the fabric material as the conception basis, through the material to play out the distinctive characteristics, but also can convey the essence of the beauty of clothing. Decoration can not only sublimate the overall beauty of clothing but also highlight the important way of design concept and personality [1]. In the past decades, the emergence of the Internet has made a great contribution to the development of human society. Artificial intelligence (AI) has begun to appear in people's vision and integrated into all aspects of people's lives. It is known as the most groundbreaking technology in future science and technology. With the innovation of science and technology, the traditional clothing industry will inevitably be subjected to new changes and impacts. In the early years, some fashion designers applied high technology to fashion design, and the extraction of environmental factors in clothing also appeared in the public's view [2]. In the context of intelligent life, the combination of AI and clothing design will adapt to people's various clothing needs in the future, and gradually integrate into people's daily life to bring more convenience. Being a labor-intensive sector, the clothing business will have enormous profit potential once AI is implemented. By interpreting customer information, such as customer preferences and purchase histories, AI may use the well-known e-commerce and mobile commerce platforms to offer more appropriate products to online buyers, so as to create a truly personalized shopping experience [3, 4]. The combination of various technologies will inevitably lead to the use of new smart materials or wearable devices to improve the performance of products. When applying AI technology in smart clothing, it is necessary to consider not only the functionality of the clothing but also the comfort and safety of the human body when the fabric or wearable device touches the human skin, whether the clothing conforms to ergonomics, and whether the clothing is safe when wearing.

AI can also be involved in various jobs in the clothing industry, such as improving communication with customers by learning languages and helping companies talk to sellers. The garment sector can also benefit from AI technology's assistance in processing, analyzing, and predicting future consumption trends [5]. In the future, when AI is a necessity for China's economic growth, the garment sector can employ AI to complete industrial transformation and upgradation. The primary function of AI clothing as a functional article of clothing is to offer services to certain users [6]. Users will accept new products differently due to differences in their living conditions, social classes, and educational backgrounds. This necessitates that designers assess user cognition, product experience, and emotional acceptance of AI throughout the design process in order to satisfy users' psychological and physiological demands. Additionally, designers must keep up with the introduction of new technology, integrate it in real-time with scientific and technological advancements, and better cater to consumer needs [7].

The volume of clothes image data on the Internet has rapidly expanded as a result of the e-commerce for apparel's quick expansion. How to extract environmental factors from traditional clothing handicraft has become a research hotspot in recent years. There are now two different types of traditional ways for retrieving images of apparel. One is text-based image retrieval, which performs semantic matching on the text description of the clothing image [8, 9]. The other type is image retrieval based on image content, which extracts features from the color, texture, and other aspects of the image. However, these two methods have some limitations, and the artificial semantic labels for text description are very complicated [10]. However, the content features cannot fully reflect the rich visual features of the image, resulting in poor retrieval results [11]. At present, with the rapid development of deep learning technology and image processing technology, the powerful feature extraction ability of AI can be used to directly process images, which can eliminate the influence brought by different underlying features. According to statistics, the research interest has increased sharply since 2005, indicating that image extraction technology is gradually widely used in the field of clothing, and AI technology driven environmental factors extraction in traditional clothing handicraft has been further developed [12, 13].

Image segmentation and object extraction has been a hot topic in the field of computer vision and multimedia. Its application scope involves biomedicine, remote sensing aviation, industrial automation, and other fields. In recent years, the field of clothing gradually uses image extraction technology to extract clothing manual environmental features and process all kinds of clothing, and has made preliminary progress, which also shows that the use of AI technology to solve the problems in the clothing industry has attracted more and more attention and attention of AI research and clothing industry personnel [14]. From the perspective of garment contour and pattern extraction, many new garment styles are designed every year in the world, but few people have studied the extraction and analysis methods of environmental factors in traditional garment handicraft driven by AI technology. If the image extraction technology is used to extract the required clothing items from the clothing images, the second utilization of clothing styles can be realized. The clothing designers will be able to store the clothing styles electronically and extract their previous clothing design features easily. The construction of pattern database can also link the pattern database with the virtual platform to realize the independent personalized design of consumers [15, 16]. Traditional clothing is mainly made of ordinary fiber cutting and production, the main function is to cover the body, beautiful fashion. Intelligent clothing is mainly composed of intelligent materials, such as optical fiber and memory fiber. Intelligent clothing needs to consider the configuration of electronic components to ensure intelligence and wear comfort. For intelligent clothing combined with AI, the interactivity between clothing and AI, the availability of intelligent clothing materials, and supporting services should also be considered in the design.

It can be seen from the above that in order to improve the accuracy and efficiency of fashion image and contour extraction, many scholars use a combination of various algorithms [17]. In recent years, Fourier and clustering algorithms are widely used in fashion image style and contour extraction. Although the use of traditional algorithms cannot effectively complete the contour recognition of clothing background features, but to a large extent completed the extraction of clothing background features. Because of the diversity of clothing styles and background features, the existing single algorithm is usually suitable for the simple structure of clothing style map extraction. The stability and applicability of the algorithm still needs to be further improved for the extraction of garment background features with complex contour structure features [18]. Future smart clothing will be the product of the integration of various fields of technology and will have greater development potential.

In view of the mentioned problems, this paper uses convolutional neural network (CNN) to extract and analyze the environmental factors in traditional clothing handicrafts, and carries out experiments on the extraction of environmental factors in clothing handicrafts with pure color, few patterns, color, and complex background, respectively. The experimental results show that our model has better representation ability for high-level features formed by low-level feature learning, abstraction, and combination. We randomly take the average value of 1000 extraction times, and the result shows that feature extraction has a fast speed, which can meet the needs of daily image feature extraction. In view of the advantages of computing speed and storage space in feature extraction, CNN model ensures excellent feature extraction speed of the model, which has high theoretical value and research significance.

2. Related Works

The potential for traditional handicrafts to flourish sustainably was covered by Li et al. [19]. It is demonstrated through a review of the literature and an analysis of it that design science, as a link between the natural sciences and the humanities, seeks to advance key research techniques and instruments for the long-term sustainability of traditional handicrafts. This paper demonstrates that scientific design is the present and future of the sustainable development of traditional handicrafts, and presents five dynamic thinking methods and design strategies that provide the most direct method and theoretical foundation for the sustainable development of traditional handicrafts. According to Xue et al. [20], who investigated a unique fashion consumption theory of traditional handicraft mode based on the mature theories of planned behavior and self-concept theory, a new area for the study of slow fashion consumption has now been opened up. In order to improve product planning and marketing for traditional fashion businesses, the key drivers of the resurrection of the Chinese traditional handicraft industry are identified and elaborated.

Jiang [21] concentrated on the modeling approach of manufacturing resources relational database for the design and optimization of large-scale handicrafts in light of the issues that currently exist in the modeling of manufacturing resources. The manufacturing resource library is constructed as intended, and it is easy to retrieve many types of handicrafts. The experimental findings demonstrate an increase of 7.3% in the index efficiency of SQL AI for various sorts of handicrafts. By examining sample cases of Chinese traditional handicraft cultural brands, Xinchang and Jifeng [22] investigated how and why to develop traditional handicraft brands in the modern period. By establishing a distinctive brand identity, creating novel items, increasing new media exposure, and reviving Jiangsu region's handcraft tradition. This will help Jiangsu, and possibly the entire nation, preserve its traditional handicraft culture and advance it internationally. By examining the creative and aesthetic qualities of the handicraft, Osman et al. [23] established the identity of printed women's accessories. It is beneficial to emphasize the significance of national handicraft history because it is a significant component of human culture. A set of complementing fabrics for women's printing patterns is created by combining the design of the craft traditions of various nations with modern printing technology.

3. Models and Related Methods

3.1. Convolutional Neural Network. As science and technology have advanced quickly, AI has taken center stage. This technology is now widely used across a variety of industries and fills an essential role. The comprehensive application of AI technology in the clothing sector allows for a more rapid and accurate understanding of the fashion trend of garment attributes. Simultaneously, the use of AI to extract environmental factors from traditional clothing handicrafts can play a role in saving manpower and financial resources while achieving the objective of improving labor productivity. Traditional handicrafts and costumes advocate ecological spirit, symbolizing the harmonious coexistence between man and nature. Due to its unique attribute of handmade, it forms the characteristic branch of slow fashion, which marks the sustainable development trend in the field of fashion design.

The research of CNN originated from the visual cortex of the brain and was applied to the field of image recognition since 1980s [24, 25]. In the past decades, with the improvement of computer power and the increase of good datasets, CNN have achieved breakthrough levels in some complex computer vision tasks, often approaching or even sometimes exceeding human capabilities. In addition to visual tasks, CNN can also be applied to other tasks involving feature extraction stages, such as speech recognition and natural language processing. The main structure of CNN is composed of a large number of convolutional layers and pooling layers [26, 27]. The process of CNN processing the input image is shown in Figure 1. The convolutional layer simulates the local receptive fields of neurons in the visual cortex to translate and convolve the input image. Then the pooling layer reduces the dimension of the feature map obtained by the convolution layer to obtain a smaller feature map with more concentrated information. The operation is repeated for a certain number of times, and the final feature map is expanded into a one-dimensional tensor, which is input to the final classification layer for probabilistic output [28].

The most crucial part of CNN is the convolutional layer. Convolution is a mathematical operation that slides one function over another function and computes the integral of its dot product [29]. It is widely used in signal processing. The convolution layer is similar to the convolution in that it actually uses cross correlation. In the process of using the convolution layer to process the input image, the convolution kernel is actually used to extract local features by using the sliding average of the image. Figure 2 shows the convolution process of the 2×2 convolution kernel for the input image matrix. The convolution kernel slides the input image from left to right and from top to bottom according to a predetermined step size and calculates the dot product sum of the convolution kernel and the corresponding window elements as the corresponding element value on the new feature map [30, 31]. The feature information extracted by the multilayer convolution process on the image corresponds to the basic texture features of the image to the abstract semantic features from top to bottom.

The pooling layer usually appears at the end of the feature map of a certain size and at the beginning of the downsampling layer [32]. The function of pooling layer is to reduce the size of feature map, reduce the amount of calculation and parameters, and prevent overfitting. Each neuron in the pooling layer is connected to the output of a limited number of neurons in the preceding layer that are situated in a constrained rectangular receptive field, just like the convolutional layer [33]. Different from the convolution layer, the neurons in the pooling layer do not contain weight parameters, and the neurons only process the mean or maximum value of the elements in the feature map. As shown in Figure 3, a 3×3 pooling kernel performs local mean processing on the feature map. Generally, the sliding step size of the pooling kernel is 2 from left to right and from top to bottom, so that the size of the feature map obtained after pooling is half of that before pooling [34, 35].

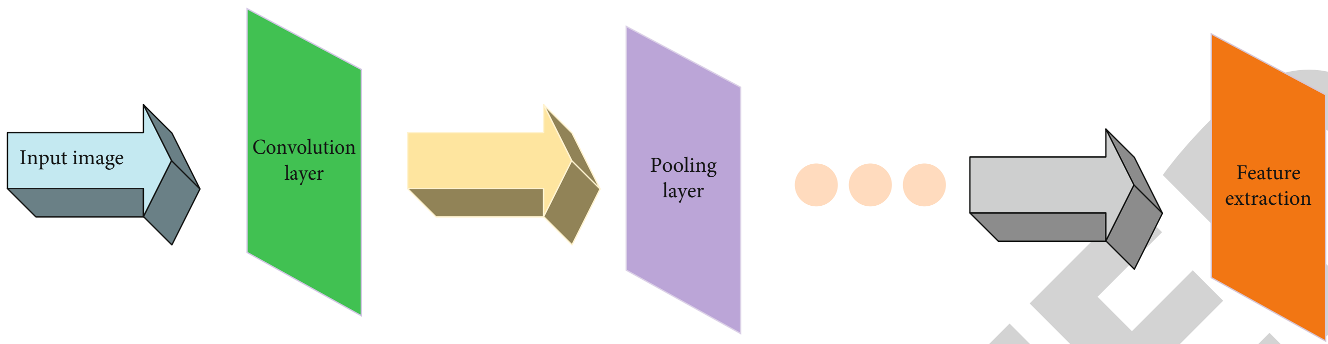

Figure 1: Image processing process of convolutional neural network.

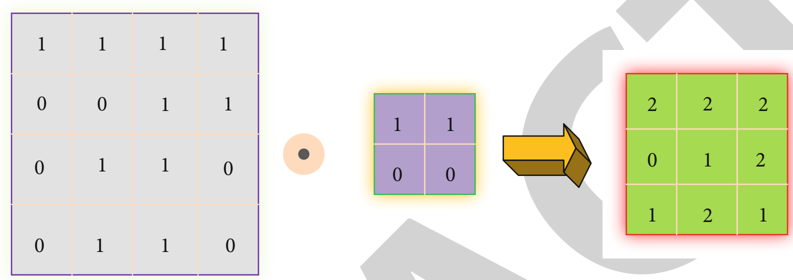

Figure 2: Convolution process of convolution kernel.

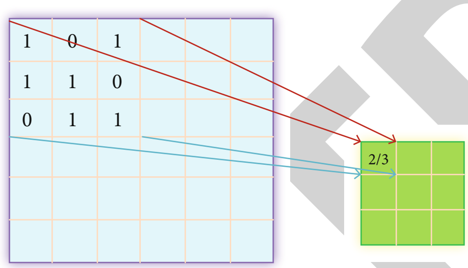

Figure 3: Schematic diagram of the pooling process.

At the end of the network, the feature classification layer adopts a fully connected method for the feature information obtained after convolution and pooling [36]. As shown in Equation (1), where the output x_i of each category is mapped to [0, 1] after activation by softmax function to represent the probability of multiple classification, and the sum of probabilities of all categories is 1.

$$y(x_i) = \frac{\exp(x_i)}{\sum_{i=1}^{m} \exp(x_i)}. \tag{1}$$

In order for the convolutional neural network to be able to approximate any function, the activation function is applied in the convolutional layer to improve its nonlinear representation capability. The Rectified Linear Unit (ReLu) shall be calculated to the reasonable satisfaction as shown in Equation (2), where $i = 0.1, \cdots, n$ and n refers to the number of network layers. For the output x_i of layer i, the positive original value is output and the negative value is assigned zero [37]. Compared with other activation functions, there is no need to calculate $\exp(x_i)$, and the output value is not centered at zero after activation. The ReLu function directly assigns zero to negative values, making this part of the neuron unable to be activated.

$$f(x_i) = \max(0, x_i) \tag{2}$$

Leaky ReLu activation function improves the ReLu function to give a nonzero slope to all negative values to prevent this part of the neuron from failing to activate. The calculation formula is as follows:

$$y_i = \begin{cases} x_i & \text{if } x_i \geq 0, \\ \dfrac{x_i}{a_i} & \text{if } x_i < 0. \end{cases} \tag{3}$$

In order to improve the accuracy of environmental factor feature extraction in traditional clothing handicraft, the clothing image data participating in the training were preprocessed with normalization and mean removal for subsequent numerical experiments. Normalization is also a way to simplify calculation. After transformation, the dimensionless expression is reduced to a dimensionless expression, so that indexes of different units or magnitude can be compared and weighted [38]. Normalization maps the data to the specified range reduces the difference of data values of each dimension, and reduces the influence on the classification experiment results caused by the large difference of data value range [39, 40]. Common normalization methods include feature standardization and simple scaling of image pixels. This paper adopts min-max normalization.

$$x_{\text{new}} = \frac{x - x_{\min}}{x_{\max} - x_{\min}}, \tag{4}$$

where x_{new} is the new data value obtained after normalization, $x_{\max}$ is the maximum value of the sample data, and $x_{\min}$ is the minimum value of the sample data.

The mean removal operation means that the feature mean of all the images participating in training is subtracted from the feature mean of each image participating in training, so as to centralize the input data of each dimension to 0, so as to reduce the computational load. For m input samples, the j th pixel of sample $x^{(i)}$ is represented as $x_{(j)}^{(i)}$, and the mean value of this pixel is calculated using the following formula:

$$\mu = \frac{1}{m} \sum_{i=1}^{n} x_{(j)}^{(i)}, \tag{5}$$

where μ is the average vector of the whole training set data.

Color moment is a common algorithm to extract color features of images. It uses the concept of moments in linear algebra to represent the color distribution in images by moments. The formula of the color moment can be expressed as:

$$\mu_i = \frac{1}{N} \sum_{j=1}^{N} P_{i,j}, \tag{6}$$

$$\sigma_i = \left(\frac{1}{N} \sum_{j=1}^{N} \left(P_{i,j} - \mu_1 \right)^2 \right)^{1/2}, \tag{7}$$

$$S_i = \left(\frac{1}{N} \sum_{j=1}^{N} \left(P_{i,j} - \mu_1 \right)^3 \right)^{1/3}, \tag{8}$$

where $P_{i,j}$ represents the occurrence probability of pixels with gray level j in the ith color channel of the clothing image, and N represents the number of pixels in the image.

3.2. Combination of AI Technology and Extraction and Analysis of Environmental Factors in Traditional Clothing Handicraft. In the modern information age, intelligence has become a trend of the current era. The creation and use of new scientific and technological materials offers a significant assurance for the continued growth of the apparel sector. Additionally, clothing will play a significant role in the clothing industry. The development of AI has also opened up endless possibilities for clothing. From the perspective of the development prospect of AI in fashion design, the transformation of the fashion industry is inevitable, as is the combination with science and technology. The marriage of AI and apparel can keep up with the development of the quick-paced age, offer people more comfortable and convenient life services, and has a promising future for market growth. The clothing industry is bound to help the development of AI industry usher in its own era in the future [41]. The traditional clothing industry has also ushered in the wave of reform and upgrading. The emergence of AI technology can effectively solve the pain points of the clothing industry, especially in the field of promoting the clothing industry to achieve flexible production, AI technology will help more enterprises to transform efficiently.

The use of computer technology and human-computer interaction technology can effectively improve the efficiency of manufacturing; enhance the flexibility of all aspects of work. Therefore, AI technology has the potential to accelerate economic growth, enhance the environment for the growth of the clothing business, and change the way the clothing industry has traditionally developed. The garment industry is labor intensive, and the adoption of AI technology can expand the profit margin, especially in the sales of the garment industry. To a certain extent, this cannot only break the development mode and mechanism of the traditional clothing industry but also effectively reform the sales and management work of the traditional clothing industry, and fundamentally promote the improvement of work quality in all aspects. It can be seen that the extraction and analysis methods of environmental factors in traditional clothing handicraft under AI technology have a considerable prospect, which should be paid enough attention to and effective measures should be taken to complete their own tasks.

People have progressed from the level of material pursuit to the level of quality of life in the actual course of life, from the standpoint of the market and future development prospects, and the collocation of clothing and surrounding environment can meet people's needs for quality of life to a certain extent. In the rapid development of our economy and science and technology, the development of environmental factors extraction in costume handicraft has become an inevitable trend. The application of AI technology in the extraction of environmental factors in traditional clothing handicraft can form a good development prospect. The effect of clothing design and manufacture can be successfully optimized by the use of AI technology in the extraction of environmental parameters in traditional clothing handcraft. The convenience of design, the functionality of intelligent clothing, the user's operation process and operation links, and the provision of user support services can all be effectively improved with the aid of AI technology, particularly in the field of design. It is feasible to adopt AI technology in the extraction of environmental factors in traditional clothing handicraft, which should be actively promoted and applied.

We first input the image to be processed into the network model for forward propagation, and then retrieve image characteristics through sampling, in order to fully extract garment environmental elements. To achieve the extraction of environmental factors in traditional clothing handicraft, the results of the softmax classifier based on the CNN model are hashed and then passed into the relevant index database for an approximatively nearest neighbor search. The image results are then returned sorted by similarity. The overall structure of the model in this paper is shown in Figure 4. In the process of clothing feature extraction, the input image is subjected to the same feature

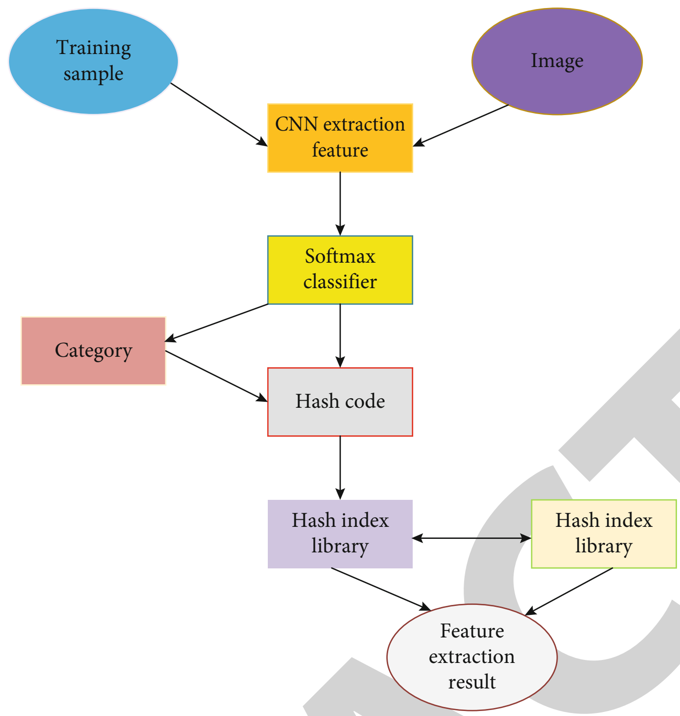

Figure 4: Overall framework of environmental factors extraction in traditional clothing handicraft based on GNN.

Table 1: Extraction and analysis of environmental factors in traditional clothing handicraft test environment.

Hardware environment	CPU: Intel core i3-2330M, memory: 4 GB
Software environment	Windows 10, Tomcat 7.0, and MySQL 5.5
Development environment	JDK1. 7, OpenCV 2.4, and MyEclipse 10.0
System framework	Struts2.0, spring, and MyBatis

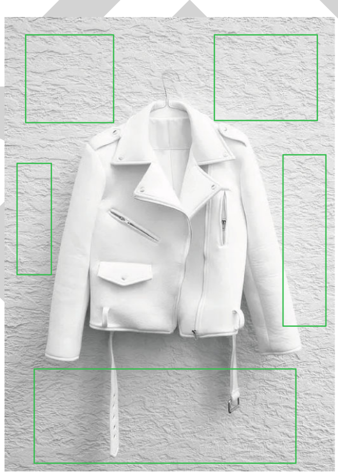

Figure 5: Environmental factors in the pure color clothing handicraft extraction effect.

extraction and mapping, and the index library of the samples with high similarity to the input image is obtained by comparison. The binary hash code of the input image and the hash code in the library are used to measure the similarity one by one, so as to achieve the fast feature extraction of the clothing image.

4. Numerical Experiments

In this paper, Java language is used to implement an AI technology-driven extraction and analysis method for environmental factors in traditional clothing handicraft. The detailed test environment is shown in Table 1. Images of the garments used in the tests were downloaded from websites such as Taobao and Baidu.

The evaluation index of feature extraction of environmental factors is generally the average precision MAP calculation. True positive (TP), false positive (FP), and false negative (FN) should be used to calculate the evaluation index, and the calculation formula is as follows:

$$TP = \sum_{Iou_i > Iou_{threshold}} 1, \tag{9}$$

$$FP = \sum_{0 < Iou_i \le Iou_{threshold}} 1, \tag{10}$$

$$FN = \sum_{Iou_i = 0} 1, \tag{11}$$

where $Iou_{threshould}$ is the preassumed threshold of intersection and union ratio, Iou_i is the intersection and union ratio of the ith detection box, and n is the total number of

Table 2: Data volume and feature extraction accuracy.

Amount of experimental data	Feature extraction accuracy
50000	0.8842
100000	0.9056
150000	0.9213
20000	0.9286
250000	0.9349
300000	0.9398

Figure 6: Extraction effect of environmental factors in traditional clothing handicraft with few patterns.

detection boxes. Precision and recall can be calculated as follows:

$$\text{Precision} = \frac{TP}{TP + FP}, \tag{12}$$

$$\text{Recall} = \frac{TP}{TP + FN}, \tag{13}$$

By testing 20,000 random samples of clothing image set, the extraction accuracy of softmax classifier is 92.71%. Experiments show that CNN network has a good pertinence for the extraction of environmental factors in traditional clothing handicraft, and can achieve the expected extraction effect. Figure 5 shows the extraction effect of environmental factors in solid-color clothing handicraft. It can be found that even if the color of clothes is similar to the environment, the surrounding environment of clothes can also be extracted.

We further confirmed the impact of various datasets on the precision of feature extraction. The detection accuracy produced by experiment is displayed in Table 2 for the verification data.

The experimental findings demonstrate that as the dataset is expanded, feature extraction accuracy increases and

Figure 7: Extraction effect of environmental factors in traditional color and dress handicraft.

Figure 8: Extraction effect of environmental factors in clothing handicraft under complex background.

gradually tends to stabilize; ensuring that the model will also have a certain degree of stability for the dataset of images of oversized clothing. Figures 6 and 7, respectively, show the extraction effect of environmental factors in the traditional costume handicraft with a small number of patterns and the extraction effect of environmental factors in the traditional costume handicraft with color. The numerical results show clearly that our model has better representation ability for high-level features formed by low-level feature learning, abstraction and combination.

We randomly take the average value of 1000 times of extraction time, and the average time of feature extraction is 3.2416 s. Feature extraction has a fast speed and can meet the needs of daily image feature extraction. In view of the advantages of computing speed and storage space of CNN model in feature extraction, the excellent feature extraction speed of the model is guaranteed. Figure 8 shows the extraction effect of environmental factors in clothing handicraft under complex background. The experimental results show that the CNN model cannot only ensure the extraction speed but also efficiently extract clothing background features under complex background.

As a functional clothing, the main purpose of AI clothing is to provide services for specific users, and can serve different needs, and can withstand the subjective choice of the buyer's market. Due to the different living environment, social class and educational background of users, their acceptance of new products will also be different. Designers are required to evaluate user cognition, product experience, and emotional acceptance of AI in the process of design, so as to meet the psychological and physical needs of customers. At the same time, designers also need to pay attention to the release of new technology, real-time integration with the development of science and technology, better adapt to the needs of users.

5. Conclusions

In the overall design effect of clothing beauty, clothing handicraft is often an important means to beautify clothing. Based on the revolution wave of AI, the future garment industry will face both opportunities and challenges. Most designers generally hold the clothing modeling characteristics, material properties, and the use of color. In fact, in the field of fashion design, a variety of artistic and technical means should be used to make clothing more perfect and more distinctive. In this study, trials are conducted to determine how environmental elements can be extracted from clothing handicrafts with simple color schemes, few patterns, and complex backgrounds. The experimental results show that the convolutional neural network has a good effect on the extraction of environmental elements in apparel handicraft under varied backgrounds. In addition, the model has good stability, accuracy, and retrieval speed, which has high practical value and research significance.

Future work can also extract features from clothing with more colors and textures. On the basis of the development of the fashion pattern database, the extracted fashion pattern data information can also be fitted to the virtual image, so that the user can experience a more real 3D fitting effect. In addition to the optimization of the virtual fitting process of professional equipment, the high definition image brought by the upgrading of the clothing feature extraction technology. In the future, modern fashion database can be connected with traditional clothing database, and virtual design experiment adjustment can be carried out through virtual platform, intelligent design, and other systems to complete more excellent design works.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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Research Article

Garden Landscape Design Method in Public Health Urban Planning Based on Big Data Analysis Technology

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Aiming at the goal of high-quality development of the landscape architecture industry, we should actively promote the development and integration of digital, networked, and intelligent technologies and promote the intelligent and diversified development of the landscape architecture industry. Due to the limitation of drawing design technology and construction method, the traditional landscape architecture construction cannot really understand the public demands, and the construction scheme also relies on the experience and subjective aesthetics of professionals, resulting in improper connection between design and construction. At present, under the guidance of the national strategy, under the background of the rapid development of digital technologies such as 5G, big data, cloud computing, Internet of Things, and digital twins, the high integration of landscape architecture construction and digital technology has led to the transformation of the production mode of landscape architecture construction. Abundant professional data and convenient information processing platform enable landscape planners, designers, and builders to evaluate the whole life cycle of the project more scientifically and objectively and realize the digitalization of the whole process of investigation, analysis, design, construction, operation, and maintenance. For the landscape architecture industry, the significance of digital technology is not only to change the production tools but also to update the environmental awareness, design response, and construction methods, which makes the landscape architecture planning and design achieve the organic combination of qualitative and quantitative and also makes the landscape architecture discipline more scientific and rational. In this paper, the new method of combining grey relational degree with machine learning is used to provide new guidance for traditional landscape planning by using big data information in landscape design and has achieved very good results. The article analyzes the guidance of landscape architecture design under the big data in China and provides valuable reference for promoting the construction of landscape architecture in China.

1. Introduction

1.1. Research Background. The concept of "big data" first appeared in the 2014 government work report. Since then, many policies have been introduced, and the big data industry has developed with the support of national policies [1, 2]. The four key supports in the Platform for Action to Promote Big Data Development released in August 2022 pointed out the direction for the growth of China's big data industry. The implementation of the national big data strategy was first proposed in the Fourteenth Five Year Plan Outline. The document points out that the era of "big data" has come. It is necessary to deepen the application of big data in various industries, build a perfect industrial chain, and promote the robust development of big data [3, 4].

With the continuous improvement of China's information technology development level, the level of collecting, mining, and applying data resources is also constantly improving. In order to promote the sustainable development of the big data industry, implement the national big data strategy, and realize the important measures from a big data country to a powerful data country, the Party Central

Committee and the State Council made a major strategic deployment and issued the Big Data Industry Development Plan. At present, China's economic development has entered a new normal [5], and big data will play a more important role in stabilizing growth, promoting reform and restructuring, and benefiting the people's livelihood. At the same time, in the economic and social development, big data reflects an increasingly important foundation, strategy, and guiding position. The development and utilization of big data is changing all aspects of society and promoting the transformation and development of the industry [6].

Big data brings new technologies and equipment to other industries. For landscape architecture, big data brings more changes in planning thinking, allowing professionals to rely more on rational analysis of problems. Planning and design is a process of solving problems. Aiming at complex problems, appropriate solutions are proposed by analyzing a large number of multitype data. Only in this way can the planning be more objective and rational [7, 8].

1.2. Research Purpose and Significance

1.2.1. Research Purpose. Landscape architecture has always maintained a close relationship with nature and is considered as a discipline to explain the relationship between man and nature. Landscape value evaluation, which has always been a hot topic in research, began to develop in the direction of combining qualitative and quantitative research under the influence of quantitative analysis. In recent years, landscape planners have actively explored the combination of quantitative and qualitative methods and constructed many mathematical analysis models by drawing on the quantitative analysis technology of related disciplines and combining professional theories [9, 10].

As a new type of rural landscape display mode, landscape design in public health urban planning is based on conventional planning methods and industrial planning. Compared with urban parks, urban green spaces, scenic spots, ecological conservation areas, etc., the landscape design in public health urban planning lacks targeted and systematic planning procedures and regulations. This paper provides a systematic planning content and procedure through the study of landscape design and landscape planning in public health urban planning.

1.2.2. Research Significance. With the penetration of data into all walks of life, data has become a new field of competition between countries and enterprises. More importantly, data is compared to the core of the second economy, which shows the importance of mastering and using data for industry development [11]. At present, big data is mainly used in the financial industry, service industry, medical research and development, and other industries closely related to our lives, affecting our lives. As an important basic factor of human settlements, landscape planning should use the analysis and guidance function of big data to plan and design landscape sites that are more in line with the site and people's needs [12]. In order to improve the scientificity of landscape planning, the part of traditional planning that relies on subjective rational experience and perceptual creation is expressed in the form of data to form a more scientific quantitative planning method. In the planning, the data on the network that can reflect tourists' concerns and perceptions are cited [13]. It avoids the problem of low data accuracy caused by the small coverage of data statistics and reduces the workload of going out for investigation. Through the network, public opinions are introduced into the planning, which also reflects the people-oriented public participation planning concept [14].

As a comprehensive development model integrating modern agriculture, leisure tourism, and rural communities, garden landscape design in public health urban planning meets the needs of building an integrated urban-rural pattern, meets the requirements of reforming the rural supply side structure, developing new industries, and reforming the rural property rights system, and is a sustainable model to promote rural modernization, new urbanization, and socioeconomic development. Landscape planning is an important part of landscape design and construction in public health urban planning, which determines the development prospect of landscape design in public health urban planning [15].

1.3. Research Contents and Methods

1.3.1. Research Content. By learning the data collection and processing technology of big data, the big data processing method and guidance method are introduced into landscape planning and combined with the processing method of big data algorithm combining grey correlation degree and machine learning in the conventional planning program, so as to affect the thinking of planning design and improve the objectivity and scientificity [16]. The main procedure is to introduce the big data collection and processing technology combined with grey correlation degree and machine learning based on field investigation and site data collection, screen and process the data, establish a database, and use the thousand layer cake analysis method to overlay and analyze different data by quantifying different types of influencing factors to guide landscape planning. The landscape planning method under the influence of big data is applied in the landscape design of public health urban planning, and the planning procedures of traditional planning methods and data planning methods are compared to find out the similarities and differences [17].

1.3.2. Research Methods. This paper uses landscape planning theory, psychology theory, spatial syntax theory, etc. to study the big data landscape planning method based on the combination of grey correlation and machine learning [18]. The main research methods include big data survey and analysis, field survey, DEM (digital elevation model), thousand layer cake analysis, and document retrieval.

(1) Big data survey and analysis method

Through the collection of big data, establish the connection between the data and crowd activities and venues. Big data is used as the basis for planning, which avoids the limitations of investigation and access in traditional planning and expands the accuracy of data. At the same time, the workload of field investigation is reduced.

(2) Big data algorithm combining grey relational degree with machine learning

Through field inspection, UAV aerial photography, photography, and villagers' communication, we can obtain first-hand information about the site and supplement the details of satellite images and some nonwritten human landscape information.

(3) DEM (digital elevation model)

The collected data are vectorized and transformed into 3D DEM (digital elevation model) through GIS for later site feature analysis and planning guidance.

2. The Relationship between Big Data Analysis Technology and Landscape Design in Public Health Urban Planning

2.1. Limitations and Improvement Measures of Big Data

2.1.1. Accuracy of Big Data Attributes. At present, with the development and application of information technology, information technology has made great changes in people's life and work. Big data has been well known and used in people's lives to provide convenience for people's life and work. For landscape design planning, in terms of information data collection, visitors' information data can be collected through Sina Weibo, Baidu, and other social platforms to understand the use of tourist activity space and green space. However, during the actual study, visitors were widely distributed and information was scattered. Therefore, the amount of information that can be studied is large and the scope is wide. Supermarkets, coffee bars, fast food restaurants, etc. are the main distribution centers for tourists. The general scope of people's life can be understood through the way of big data information collection, but further research is needed for more detailed content. During the specific implementation, the service data of leisure places need to be processed to improve the accuracy of landscape green space evaluation [19].

2.1.2. Location Accuracy of Big Data. During the development and application of information technology, the position recognition function has been gradually applied to various tools. Among them, LBS data collected by mobile computing devices such as smartphones and tablets can record the current position of instrument users and upload the current position to the system data platform through the position recognition function, and the data platform analyzes and studies the acquired information data to obtain timely and effective information [20]. In the current process of economic development, mobile phone positioning has been widely used by using location precision positioning tools. And this technology is mainly used in the research of park tourists. Visitors can collect information about tourists within the park coverage by using mobile phones and learn about the number of tourists inside the landscape garden through information feedback. During the implementation of the park visitor information collection, the base station mainly adopts the cell system, covering a range of 3.5 km. With the accurate detection tool of data point location, we can analyze the popularity of landscape design and people's preference for landscape style [21].

2.1.3. Big Data Information Is Comprehensive. In the process of landscape design and construction in the public health urban planning, the research on landscape architecture construction through big data technology mainly focuses on the collection and sorting of urban green space system, green space quality, and other data. Because the green space system and green space quality have very important basis for the research on landscape design and design in the public health urban planning, through a large amount of information data research, we can understand the common characteristics of landscape architecture. It provides valuable guidance for the construction of landscape architecture in China. Big data technology can make up for traditional data technology to some extent [22]. Therefore, using big data technology is more convenient and accurate in obtaining information data. Due to the wide range of information and data obtained and the wide range of sources of information obtained, the data obtained is not universal. In view of the current problems, in addition to using big data information technology to obtain information, questionnaire, interview, action observation, and other methods have been added to obtain information [23].

2.2. Application Process of Big Data

2.2.1. Define the Type of Big Data. During the research on landscape design and construction in public health urban planning, it is necessary to analyze the planning and design research objectives, actual information data, and other related attributes on the basis of big data, and a large number of data sources and data volumes are required. Therefore, for landscape researchers, it is necessary to define the type of big data and carry out research in different steps according to different types of big data.

2.2.2. Analysis of Data Resources Formed by Big Data Acquisition and Integration. Because urban landscape design is closely related to urban construction and urban-scale expansion, it is necessary to analyze and integrate data resources during the use of big data to obtain accurate information. Landscape researchers obtain corresponding data according to the characteristics of big data, develop research plans, finally form data resources, use big data technology to establish a unified data model, and apply the data model to landscape design research. Because the data model needs a large amount of information data, during the establishment of the data model, if the information data obtained is not perfect, the staff need to further preprocess the information data to improve the accuracy of the data model for information processing [24].

2.2.3. Mining and Analysis of Big Data. Because big data information technology is not widely used and the scope of specific implementation is small, landscape architecture researchers need to clarify the data mining methods and analysis methods and the main content of the work after encountering problems during the actual application of big data and apply it to the data model by using sea volume and complex and irregular information data. Through a variety of big data information data analysis methods, the obtained information data are finally analyzed on the problems of landscape design and construction in public health urban planning, providing valuable reference for landscape design and construction in public health urban planning [25].

2.3. Problems in Landscape Design in Public Health City Planning. In the process of landscape design in public health urban planning, the collision between rational engineering technology and perceptual artistic thinking not only brings sparks of creativity, but also causes many problems, mainly in the following aspects:

2.3.1. The Current Design Concept Is Backward. In terms of landscape architecture design, China is still in the stage of reference and imitation, and even many design schemes have obvious traces of plagiarism. Designers lack personalized design awareness, environmental protection concept, and innovative thinking mode. The government has always advocated "green environmental protection." We have been growing up under the slogan of "everyone is responsible for protecting the environment." We live in cities that have always wanted to establish sound rules and regulations to stop environmental pollution. In addition, China is a multiethnic country, and each region and city has different cultural heritage and humanistic characteristics, which should be reflected in the urban landscape architecture. However, these cannot be achieved in the current urban landscape architecture design of most cities in China, resulting in the phenomenon of stereotyped, copied, nonenergy-saving, and nonenvironmental protection. Although the industrial revolution has brought us the possibility of "standardized and batch" production, it is not suitable for urban landscape design. We should avoid the appearance of excessive similarity, lack of individuality, and unsustainable development.

2.3.2. Insufficient Current Technical Level. Landscape architecture design is a field combining art and technology, involving a wide range of professional knowledge and a wide range of fields, such as architectural engineering, botany, soil biology, computer application, and energy-saving technology. This requires designers engaged in landscape architecture design to have various knowledge and skills at the same time. At present, many designers have difficulties to do so, which leads to the phenomenon of insufficient technical level in the design scheme. In addition to the insufficient technical level of personnel, the current construction technology is also lagging behind. After many excellent design schemes are produced, they cannot be realized due to the limitation of insufficient construction technology.

2.3.3. The Current Design Is Divorced from Reality. The design of landscape architecture is actually the design of people's living environment. People living in different regions are in different living environments, and there are differences in climate, terrain, temperature, humidity, etc. In order to pursue economic benefits, the current landscape architecture design ignores the practical significance of design. Our requirements for ourselves are basically the requirements for the environment. Safety, comfort, convenience, and quickness are the main thrust of our life. The word "enjoy" will never change for small families or everyone. Whether enjoying a warm family or enjoying the fun of life, it needs to be set off by the surrounding environment. Designers have invested a lot in human and material resources, but why is it feasible in some places, while others cannot be compared? This is because the design scheme is divorced from reality, so designers should seriously tell themselves that it is necessary to be responsible for the design behavior.

2.4. Relationship between Landscape Design and Big Data in Public Health Urban Planning. In the landscape design of public health city planning, there are problems such as backward design concept, insufficient technical level, and design divorced from reality. The emergence of big data technology can largely solve these problems. The technical problems involved in landscape architecture design are difficult to solve for people with insufficient knowledge reserves, but not for big data computers with large data storage capacity and supercomputing capacity.

Using intelligent design to transform garden design can not only let us have better leisure and entertainment but also let us participate in the environment more efficiently. For example, intelligent lighting enables us not only to be free from light pollution but also to be a free man living in harmony with nature. The combination of intelligent public facilities and background music not only brings a kind of enjoyment in life but also helps to alleviate people's psychological pressure.

A large part of the carriers of landscape design are green plants and public facilities. In the past, the park landscape was mostly for self-entertainment, while the big data landscape garden could share resources and help each other in environmental protection. Intelligent garden design is also conducive to the promotion of local human customs and complementing each other. It integrates multiple interests without violating the laws of nature.

3. Discussion on the Application of Big Data in the Planning Process

3.1. Use of Big Data in Planning. As an emerging research direction, big data has received increasing attention. Big data has caused an upsurge of planning and research through quantitative information in landscape architecture, playing a role in providing new technology or new methods at all stages of landscape planning. In the preliminary analysis of landscape planning, big data mainly introduces new survey methods, expands the data collection methods, and broadens the data collection scope. The added relevant information provides a basis for comprehensive, high-precision, and high granularity research. For example, in the data collection set, data on the characteristics of the user population and emotional information are added, and positioning information is collected through the network. The research in the planning stage focuses on the analysis stage, which is mainly used to discover and mine the relationship between related elements. New types of data commonly used in planning include location communication data, network text data, and network photos. Because it can reflect the spatial location and behavior of individuals, location-based access data is widely used in the identification of spatial functions, the analysis of space use and spatial structure, road planning, and other spatial related issues, as well as the analysis of space-time characteristics of crowd aggregation, crowd activity distribution, crowd behavior, and other analysis related to human activities. As social networks have the characteristics of wide coverage, fast propagation, and good interoperability, they are important channels for building public participatory planning and design. Online text data is generated with the development of social networks. By quantifying the text and finding the public's concerns, interests, and emotional evaluation, it can be used to analyze the advantages and disadvantages of site management and to build an evaluation system. Network photos not only contain location data but also reflect the current situation of the site. Overlaying this visualized big data on the map can evaluate the space quality, street greening, and road landscape, which is of positive significance to improve the landscape. In the later stage of planning and design, big data mainly enriched the public's feedback platform and established an online communication network for the public, planners, and decision-makers through social networks and mobile terminals.

3.2. Comparison of Data Analysis Methods. While big data brings quantitative analysis to landscape planning, it also introduces new analysis methods. There are two analysis methods for text information, high-frequency word analysis and emotion analysis. High-frequency word analysis is similar to our common frequency distribution, but there are some differences. Frequency distribution is an effective analysis method, which divides the variable value into several intervals according to a certain interval value, and represents the distribution value of each interval. High-frequency word analysis is an analysis method that aims at text data, counts the frequency of each word occurrence, and ranks them according to the number of occurrences, so as to reflect people's concerns. Although both methods are based on frequency analysis, there are differences between the two methods in terms of objects, methods, scope, etc. The comparison between the two methods is shown in Table 1.

Emotional analysis is similar to the traditional psychological experimental investigation and analysis. Emotional analysis is the software analysis of words in travel notes or comments, analyzing words with emotional color and understanding tourists' evaluation and overall impression of the scenic spot. The psychological experiment is to find out the influence of space environment on psychology. It is the same way to quantify psychological feelings. It can be seen from the definition that although both analysis methods are aimed at the user's feelings, attitudes, preferences, and impressions, the emotional analysis is to collect and summarize the words expressing their emotions without the user's knowledge, so as to analyze their emotional attitudes towards the research site. The psychological experiment is to quantify the psychological feelings by means of questionnaire survey when the respondents are informed. Specific differences are shown in Table 2.

In the research, the author found that the thermal map combined with TBI browsing data method can be used to study the use of space. The thermal map can reflect the activity characteristics of the crowd in real time, while TBI browsing data can reflect the concerns and characteristics of the crowd. The combination of the two can help planners understand the distribution of people's behavior and activities and the reasons behind them. Its function is similar to the action observation method, which can be applied to large range, adult flow, large time span of research sites.

In the age of big data, many new analysis methods have emerged. These methods may be similar to or have the same functions as traditional analysis methods. There may also be different data sources, different application objects, and different data processing methods. However, both new analysis methods and traditional analysis methods are desirable as long as they can truly reflect the actual situation and provide scientific basis for planning.

3.3. Network Media Data and Participatory Landscape Planning. Network media data is particularly important for building public participatory landscape planning and design. Considering the overall planning structure, the role of network media data in analysis, evaluation, and management is only described in the planning procedure, without a systematic introduction to its role in building public participation in planning and design. With the rise of "humanism," public participation in planning and design has become a hot trend. Network media is a platform for people to express their feelings and ideas, which can be used to build a communication platform among planners, the public, and decision-makers. At the early stage of the planning, the network media data can feed back the needs of the public, and it is also an important supplement to the site information. In the planning, the activity characteristics and emotional changes of the crowd can be analyzed through the network positioning data and the network text data, and the relationship between the user's emotional changes and the environment can be found to plan and design the site. The network media data is an indispensable resource for the evaluation and management in the later stage of planning. Through the collection and analysis of network media data, problems in planning and design can be found in time, which is conducive to the transformation of planning and design. It can be seen that the network media data enable the planning designers to better understand the needs of the crowd, expand the communication platform, and lay a foundation for planning and designing better works.

3.4. Conventional Planning Data and Big Data. In addition to new big data types, traditional data is still the basis of planning and design. In the planning process, although the utilization rate of various conventional data is high, the breadth and depth of data utilization are not enough. Even so, in the process of using data, we should put big data and

Table 1: Comparison of frequency analysis methods.

Project	High-frequency word analysis	Frequency distribution
Application object	Text data	Data value
Data sources	Network media text	Site investigation or official provision
Data nature	Long time attribute	Comparative time periods are selected
Application method	Sort	After setting the interval, it indicates the distribution value
Scope of application	Points of interest for finding people	It is often used to master the frequency distribution of visitors

Table 2: Comparison of psychoanalysis methods.

	Emotional analysis	Psychology
Application object	Written words	Psychological feelings
Relationship of respondents	Unknown	Field experiment
Data processing	Analyze the proportion of different emotional words by dividing words into emotional colors	Quantification of psychological feeling
Scope of application	Quantify emotions, analyze users' emotional attitudes, and find out the relationship between space environment and psychology	

conventional data in the same important position and cannot blindly pursue and rely on big data. Conventional data cannot be ignored or even discarded because of the rise of microblog positioning, mobile phone signaling, bus swiping, and POI data. Conventional data and big data are mutually verified, supplemented, and reconstructed. When analyzing the temporal and spatial changes of a large range of sites, big data can give play to its advantages of large samples and fast collection speed. However, for small sites, big data cannot accurately reflect the actual situation of the site due to its high universality to meet the needs of users. In the era of big data, we seek to integrate multiple data and consider issues comprehensively. That is, we should continue to collect conventional landscape planning data and emerging planning big data, set a unified standard, compare and verify the data with each other, and screen and clean the data to ensure the quality of the data, so as to give full play to the actual value of big data. Because wrong information cannot guide the planning and design, it will cause greater losses.

4. Research on Garden Landscape Design Method in Public Health Urban Planning Based on Grey Relational Analysis and Machine Learning Algorithm

4.1. "Three-Dimensional Index Model" of Garden Landscape Design Method in Public Health Urban Planning. Under the indicator of the effectiveness of garden landscape design method in public health urban planning, three three-level indicators are set, as shown in Table 3.

On this basis, we will introduce the grey relational analysis and machine learning algorithm model proposed for landscape design in public health urban planning.

4.2. Algorithm Research Based on Grey Relational Analysis and Machine Learning Algorithm Model

4.2.1. Fuzzy c-Means. The objective function formula of FCM is shown in

$$J_m = \sum_{i=1}^{N}\sum_{j=1}^{C} u_{ij}^m \left\|x_i - c_j\right\|^2, 1 \le m < \infty. \tag{1}$$

Membership degree is U_{ij} and cluster center is C_j. The calculation formula of iterative update is expressed as [20–22]

$$\begin{aligned} u_{ij} &= \frac{1}{\sum_{k=1}^{C}\left(\left(\left\|x_i - c_j\right\|\right)/\left(\left\|x_i - c_k\right\|\right)\right)^{2/(m-1)}}, \\ c_j &= \frac{\sum_{i=1}^{N} u_{ij}^m \cdot x_i}{\sum_{i=1}^{N} u_{ij}^m}. \end{aligned} \tag{2}$$

The termination condition of iteration update is

$$\max_{ij}\left\{\left|u_{ij}^{(k+1)} - u_{ij}^{(k)}\right|\right\} < \delta. \tag{3}$$

Because FCM is an unsupervised algorithm, there is a problem of validity test. Therefore, it is necessary to evaluate the performance of the algorithm through some clustering evaluation indicators. The commonly used clustering evaluation indicators include entropy, Pearson correlation coefficient, mutual information, and Davies-Bouldin index [23].

Table 3: Evaluation index model of garden landscape design method in public health urban planning.

Primary index	Secondary index	Level III indicators
Quantitative index model of different landscape design methods and combination of grey relational degree and machine learning	Effectiveness of landscape design subjects (A)	Capital ratio (A1)
		Site ratio (A2)
		Personnel ratio (A3)
		Number of hosted projects (A4)
		Number of training participants (A5)
		Number of papers published (A6)
		Internet platform activity (A7)
		Participation of nonstudent workers (A8)
	Effectiveness of landscape design process (B)	Weibo influence index (B1)
		WeChat WCI index (B2)
		QQ platform activity (B3)
		Shift occupancy rate (B4)
		Financial media construction (B5)
		Core team ratio (B6)
		Product quantity (B7)
		Product quality (award winning) (B8)
		Number of interactive activities (B9)
		Interactive communication coverage (B10)
	Effectiveness of landscape design outcomes (C)	Party membership application rate (C1)
		Participation rate of public welfare activities (C2)
		Failure rate (C3)
		Library running rate (C4)
		Library running rate (C4)
		Advanced collective of garden landscape design method in public health urban planning (C6)

4.2.2. Adjust Mutual Information. Assuming the distributions of samples, the entropy of the two distributions are

$$H(U)=\sum_{i=1}^{|U|}P(i)\log(P(i)),$$
$$H(V)=\sum_{j=1}^{|V|}P'(j)\log\left(P'(j)\right). \tag{4}$$

Then, the mutual information between u and V can be expressed as

$$\mathrm{MI}(U,V)=\sum_{i=1}^{|U|}\sum_{j=1}^{|V|}P(i,j)\log\left(\frac{P(i,j)}{P(i)P'(j)}\right). \tag{5}$$

The closer the AMI value is to 1, the more consistent the sample point is with the actual category.

$$\mathrm{AMI}=\frac{\mathrm{MI}\text{-}E(\mathrm{MI})}{\mathrm{mean}(H(U),H(V))-E(\mathrm{MI})}. \tag{6}$$

4.2.3. Feature Selection Method. The implementation steps of AMISR are as follows:

Then, the matrix formed by the mth feature of all n sample signals is shown in

$$\mathrm{OF}^m=\begin{bmatrix} F_{11}^m & F_{12}^m & \cdots & F_{1N}^m \\ F_{21}^m & F_{22}^m & \cdots & F_{2N}^m \\ \vdots & \vdots & \ddots & \vdots \\ F_{C1}^m & F_{C2}^m & \cdots & F_{CN}^m \end{bmatrix},$$
$$\mathrm{SD}_c^m=\sqrt{\frac{1}{N-1}\sum_{i=1}^{N}\left(S_{ci}^m-\overline{S_c^m}\right)^2},$$
$$\overline{S_c^m}=\frac{1}{N}\sum_{i=1}^{N}S_{ci}^m. \tag{7}$$

Then, after calculation, the standard deviations of all C states are constructed in turn, and the standard deviation set of the mth feature is obtained as $[\mathrm{SD}_1^m,\mathrm{SD}_2^m,\cdots\mathrm{SD}_C^m]$, and sum it to get

$$\mathrm{SSD}(m)=\sum_{j=1}^{M}\mathrm{SD}_j^m. \tag{8}$$

The calculation formula of AMISR is defined to obtain the AMISR value sequence, and the calculation method is shown in

$$\mathrm{AMISR}(m)=\frac{\mathrm{AMI}(m)}{\mathrm{SD}(m)},\, m=1,2,\Lambda,M. \tag{9}$$

4.2.4. Support Vector Machine. In the course of decades of development, support vector machine has been improved and perfected many times by hard margin [24], soft margin, kernel function, and other methods, gradually theorized as a part of statistical learning theory, and has been successfully applied in pattern classification tasks in many fields, as shown in Figure 1.

In order to divide as many sample data as possible correctly, SVM must first obtain the optimal separation hyperplane that maximizes the spacing between different categories of samples.

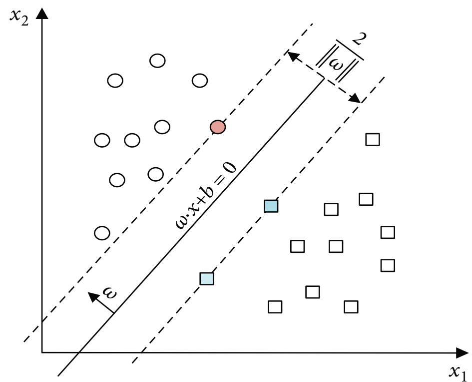

Figure 1: Linear support vector machine partitioning interface.

4.3. Extreme Learning Machine. Compared with the traditional feedforward fuzzy complex set-valued measure learning, elm has faster training speed and better generalization performance while ensuring accuracy, as shown in Figure 2.

Figure 2 shows the typical structure of elm, which is usually composed of input layer, hidden layer, and output layer. The neurons between different network layers are fully connected.

Suppose a single hidden layer fuzzy complex set-valued measure learning with L hidden nodes can be expressed as

$$\begin{gathered}\sum_{i=1}^{L}\beta_i g\left(W_i\cdot X_j+b_i\right)=o_j,\, j=1,2,\cdots,N,\\ H(W_1,W_2,\cdots,W_L;b_1,b_2,\cdots,b_L;X_1,X_2,\cdots,X_L)=\begin{bmatrix} g(W_1\cdot X_1+b_1) & \cdots & g(W_L\cdot X_1+b_L)\\ \vdots & \cdots & \vdots\\ g(W_1\cdot X_N+b_1) & \cdots & g(W_L\cdot X_N+b_L)\end{bmatrix}_{N\times L},\\ \beta=\begin{bmatrix}\beta_1^T\\ \vdots\\ \beta_L^T\end{bmatrix}_{L\times m},\, T=\begin{bmatrix}T_1^T\\ \vdots\\ T_N^T\end{bmatrix}_{N\times m}\end{gathered} \tag{10}$$

4.4. Fuzzy Complex Valued Measure Learning Structure

4.4.1. Convolution Layer. The convolution layer usually contains a set of convolution kernels. Each convolution kernel only convolutes the local area of the input signal or the feature map and then integrates the local features in the next level network to obtain the global feature map.

4.4.2. Activation Layer. The nonlinear mapping of the input features of the convolution layer is realized through the activation function, and the features in the original multidimensional space are mapped to another space to increase the linear separability of the data.

4.4.3. Pool Layer. In the structure of fuzzy complex set-valued measure learning, the pooling layer is usually placed between continuous convolution layers, which is used to realize the downsampling operation of the feature map and reduce the feature map step by step, so as to reduce the parameters and computation in the network and control overfitting, as shown in Figure 3.

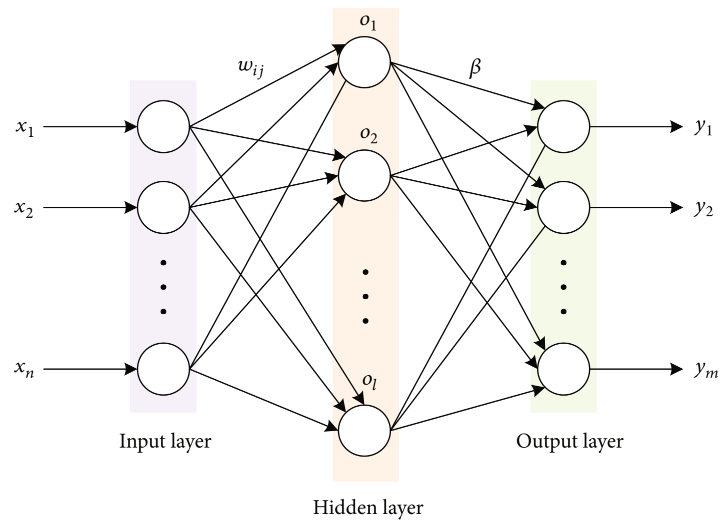

FIGURE 2: Structure of extreme learning machine.

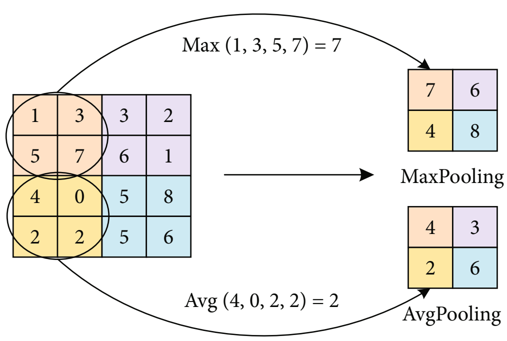

FIGURE 3: Pooling operation diagram.

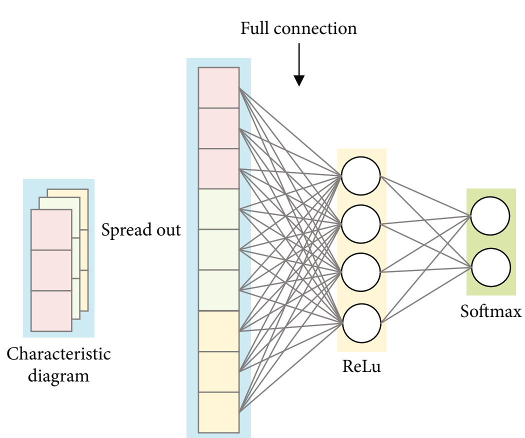

FIGURE 4: Schematic diagram of fully connected layer.

4.4.4. Full Connection Layer. Form the input of the full connection layer and then through the hidden layer using the ReLu function as the activation function, combined with the softmax function to realize the output of the classification results. Its structure is shown in Figure 4.

4.5. Verification of the Evaluation Model of Garden Landscape Design Method in Public Health Urban Planning. The training result is shown in Figure 5. After 1282 iterations, the error value reaches 0.0009929. The actual output shown in Figure 5 is very close to the expected output result, and the error between the actual output value and the expected output value reaches the preset target; Table 4 shows the evaluation results of garden landscape design method in public health urban planning. The evaluations of different evaluation method are classified based on the evaluation methods of grey correlation and machine learning algorithms. The error between the expected value and the actual output value of the evaluation is very small, which meets the consistency requirements of the evaluation, as shown in Figure 5. It is worth mentioning that in Figure 6, the different output results of the grey correlation and machine learning algorithms proposed in this paper and the original algorithm are shown.

Through the verification of simulation examples, Figure 7 shows the excellent performance of the algorithm based on the combination of grey correlation degree and mechanical learning proposed in this paper.

5. The Development Trend of Big Data Analysis Technology in Landscape Design in Public Health Urban Planning

Nowadays, Internet information technology has been integrated into people's work and life and has had a greater impact on people's lifestyle, providing convenience for people's lives. At the same time, in the urban planning and construction of our country, the role of landscape architecture in urban construction is becoming increasingly prominent. In order to improve the role of landscape architecture in the city, we should not only improve the beauty of landscape architecture but also improve the health of landscape architecture. State the role of urban construction. Nowadays, big

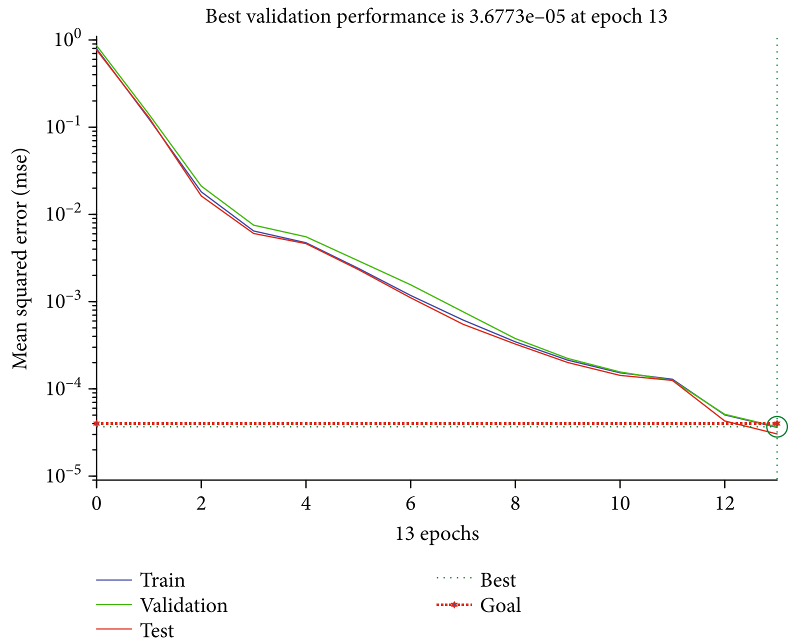

FIGURE 5: Training curve of machine learning algorithm.

TABLE 4: Evaluation results of garden landscape design method in public health urban planning.

Different garden design methods	Training results	Training classification	Expected value
UC1	0.6707	Good	0.6968
UC2	0.7336	Good	0.7410
UC3	0.7193	Good	0.7405
UC4	0.6679	Good	0.6984
UC5	0.8011	Excellent	0.8067
UC6	0.6625	Good	0.6417
UC7	0.6112	Good	0.5741
UC8	0.7513	Good	0.7516
UC9	0.6352	Good	0.6350
UC10	0.6612	Good	0.6432
UC11	0.7311	Good	0.7246
UC12	0.5792	Commonly	0.5852
UC13	0.7681	Good	0.7695
UC14	0.7331	Good	0.7238
UC15	0.6451	Good	0.6383

data technology is used in landscape architecture planning and construction to promote the development of landscape architecture in China.

5.1. Development Process of Big Data in Landscape Planning and Design Research. In the process of landscape architecture planning and design research, landscape architecture construction is mainly planned and designed according to the green space area and green space quality of the city and closely combined with the development degree and trend of the city. At present, the application of big data technology in landscape architecture planning and design research mainly goes through two stages: from phenomenon description to planning guidance and from planning guidance to cause analysis.

First is from phenomenon description to planning guidance stage. In the application process of big data information technology, people's dynamic spatial activities are described in detail mainly through the use of technology. At this stage, they mainly stay at the level of description technology, unable to accurately obtain the specific location. However, with the application of Internet data, social network data, mobile communication data, and other aspects, people's space can be understood from many aspects of activities. At the same time, it is also possible to understand the scope of people's activities and the personnel density of each activity scope through the data analysis of each platform and plan the scale of landscape architecture construction according to the population distribution, so as to achieve the purpose of rational allocation and use of green space resources. At present, big data technology is used in landscape planning and design research as an auxiliary tool to improve the utilization rate of urban green space.

Second is from planning guidance to cause analysis measures. At the beginning of the application of information technology, landscape architecture mainly focuses on the research of landscape planning and construction. With the further development of information technology, people can obtain more information through information technology, which is more accurate. The analysis of urban landscape planning through big data technology can reflect the use and distribution of green space of landscape architecture and make reasonable planning according to the current use to reduce damage and pollution to the urban environment. With the application of big data technology, problems in

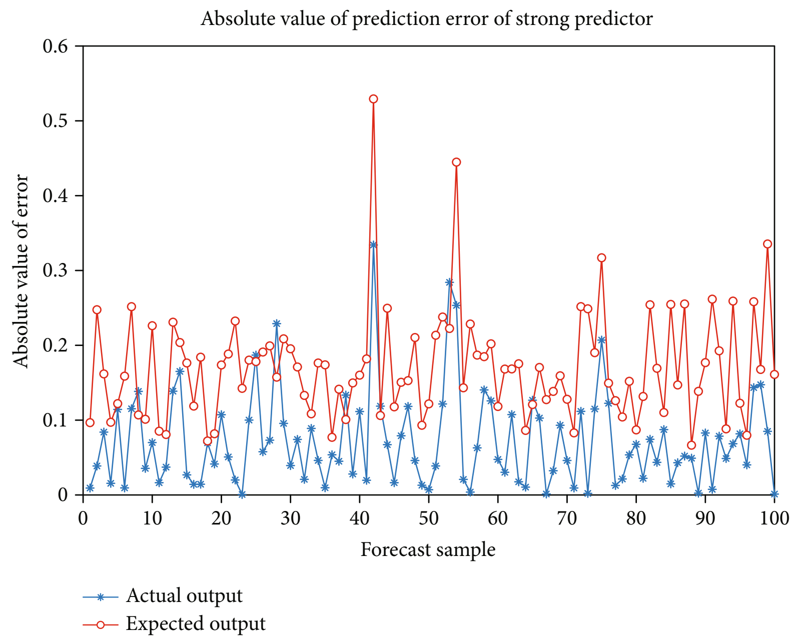

Figure 6: Actual output and expected output.

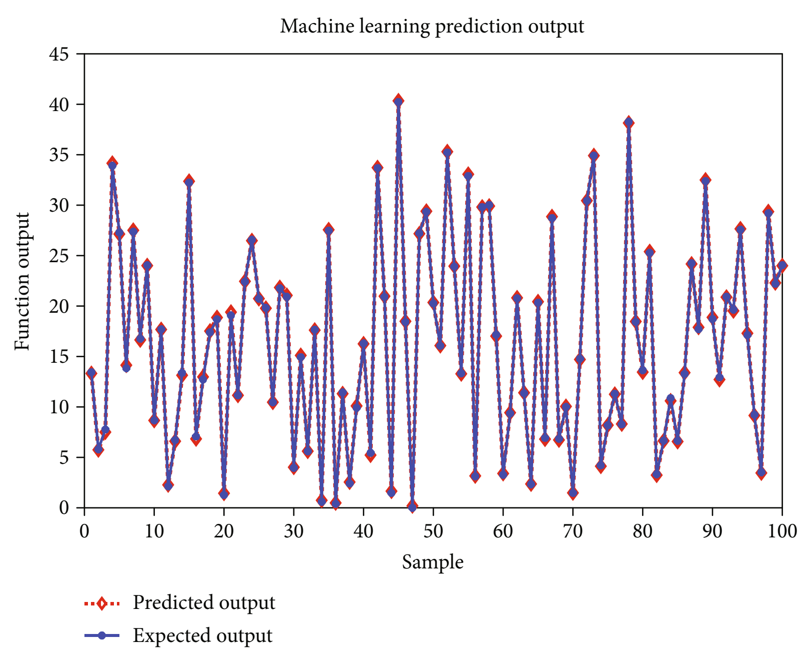

Figure 7: Output value of test sample.

urban landscape planning and construction can be found, and targeted solutions can be proposed.

5.2. Prospect of Big Data Application in Landscape Architecture Planning and Construction. At present, big data technology has been used in social development and construction, promoting the development of various industries. In landscape architecture planning and construction, urban space is mainly planned through big data technology, and urban resources are adjusted and optimized according to the development trend of the city and the current social needs. Today, economic big data, medical and health big data, etc. all provide a basis for social development. Through the analysis of big data information technology, all sectors of society understand people's needs and provide accurate services for people. In terms of landscape architecture planning and design research, learn about the current advanced technology of landscape architecture construction and people's preferences for landscape architecture through big data. At the same time, it also analyzes the effect of landscape architecture on the improvement of urban ecological environment. According to the data results of big data analysis, it guides the further improvement of landscape architecture planning and construction in China, especially for the planning and construction of scenic spots, so as to improve the viewing quality of scenic spots as a whole.

6. Conclusion

With the development and application of information technology, the application of big data information technology has broken the status quo of traditional information technology and improved the accuracy and comprehensiveness of information technology in obtaining various information. Using big data information technology to simulate urban population, transportation, construction, transportation, industry, etc. and then carry out reasonable planning and design for landscape projects improves the utilization rate of urban green space, improves the overall city appearance, and improves the urban ecological environment as a whole. "Landscape design method in public health urban planning" has complex information, diverse content, and different data forms. By applying the design method proposed in this paper based on the combination of grey correlation degree and mechanical learning algorithm, it is verified by simulation experiments. It can be well proved that the methods proposed in this paper can effectively solve the "intangible cultural heritage" planning problem information and environmental resources. Big data analysis makes content delivery more accurate and helps to improve the speed and efficiency of its cultural dissemination.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The author declares no conflicts of interest.

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Retraction

Retracted: Analysis of the Correlation between College Music Education and Public Mental Health Based on Deep Learning

Journal of Environmental and Public Health

Received 17 October 2023; Accepted 17 October 2023; Published 18 October 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] J. Huang, "Analysis of the Correlation between College Music Education and Public Mental Health Based on Deep Learning," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6593850, 9 pages, 2022.

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Research Article

Analysis of the Correlation between College Music Education and Public Mental Health Based on Deep Learning

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With the continuous changes of college music education and public mental health problems, conventional solutions are no longer sufficient. At this time, we adopted a method based on deep learning to study them. The experiments showed that ① deep learning can be well integrated into two. Among them, the rapport rate between them reached 91%, and the sometimes-unstable state of the system was solved by optimizing the model. Finally, through the evaluation algorithm, the overall score of the model was obtained to fluctuate between 85 and 90. ② According to the data in the figures and tables, it can be concluded that university music education under deep learning has received more attention in my country, and the investment amount has also increased from 2.4 billion to 3.7 billion. The highest music education activities in universities have become 55% of concerts and 41% of musical instrument experience classes, and finally, my country's public mental health problem has become a country with the lowest level in the world.

1. Introduction

Deep learning can have many computing models to learn abstract data, and many top technologies are applied in it. It uses back propagation algorithm to solve the structural and complex problems of big data, so that the machine itself can change the data to represent each data. Layers, deep convolutional networks, and recurrent networks have all achieved great breakthroughs under the influence of deep learning [1]. Deep learning is applied to artificial neural networks, in which pattern recognition and machine learning have won major competitions. The biggest difference between deep learning and shallow learning is the depth of their credit paths, and they learn through these paths. The causal link between deep, unsupervised learning is widely spread in high-tech [2]. Deep learning algorithms still need to be continuously updated. In the update, great success has been achieved in several fields of vision and language. These algorithms have been able to be trained in deep learning models, but how are they trained without supervision? What goes down? Experimental investigations were conducted to this end, with results showing that unsupervised pretraining steers training to the least attractive regions that support optimal generalization to the training set; evidence from these results supports the interpretation of training [3]. In order to solve the noncoding mutation effect of sequence identification in human genes, a deep learning algorithm framework was developed. This model framework can directly learn the gene sequence code in chromatin, so that the mutation situation can be predicted in advance, and this feature can be used to improve gene: the order of variation [4]. Deep learning is widely used in medicine. It mainly helps some problems in medical images. The depth is constantly improving to improve the functions of many medical machines. The application of deep learning in image anatomy, cell result inspection, and auxiliary diagnosis is reviewed. Basic knowledge provide some directions for future deep learning research [5]. To explore the causal relationship between factors affecting educational satisfaction in order to improve the quality of college music education, and to make recommendations for educational satisfaction by analyzing this causal relationship, the willingness to learn has a positive impact and a negative impact on the learning process, and research shows the need to improve the quality of college music education by creating an educational environment that promotes motivation and immersion in learning, thereby increasing student satisfaction with education [6]. The colonial nature of music education in Nigerian universities is a serious issue, and he uses the framework of polycolonialism to see the Nigerian higher education system as a historical and contemporary relic of colonialism, where Nigerian universities are engaged in the production of musical knowledge. It is based on information from academic sources that must be critiqued, questioned, transformed, revised as needed, and studied in context, context, and comparison, and it has been suggested that decolonization of academic music education in any society implies a focus on creating, understanding, and sharing musical knowledge of diversity and affiliation [7]. College music education is closely related to culture. It is an important cultural heritage carrier of human beings, carrying the essence of human civilization. Our broad and profound national culture is the treasure house of Chinese culture. Education and cultural heritage go hand in hand. University music education is an important means to popularize ethnic music culture, and conservatories are the main link of ethnic music culture. Finally, the importance and role of ethnic music culture in the popularization of music in higher education are proposed, and specific implementation methods and means are proposed [8]. In order to study issues such as university music education, an in-depth look at several university music institutions in France, the UK, Poland, and other European countries, although similar institutions in the former Yugoslav capital deal with the same topics as the Zagreb Academy of Music, here, the other EU countries mentioned have well-organized university-level music institutions, only one, thus becoming one of the most important institutions of the Zagreb Academy of Music [9]. University music education is an important part of quality education in public universities. Based on the current development status of music education in many domestic colleges and universities, the relevant achievements of higher education in my country are sorted out, the shortcomings and roots of music education in colleges and universities are analyzed, and corresponding measures are put forward. The countermeasures and suggestions put forward concrete solutions [10]. Substance nonadherence is a very serious problem in public mental health, and numerous studies have been carried out on it. Using information on patterns, screening programs that identify those most likely to be nonadherent in this population may be more effective [11]. DBT can be well used to treat BPD patients in public mental health, and we propose a long-term experimental comparative study of six months versus only four days of treatment in hospital settings and in public mental health settings. It is a very good approach to provide DBT therapy to patients [12]. There are many models of public mental health services in the United States, and it has been suggested that analyzing the different patterns of inpatient and outpatient mental health service use among Asian Americans may shed light on the reasons for their widespread overuse; in particular, despite many studies showing that Asian Americans tend to underutilize mental health services, this study identifies racial differences between groups and subgroups using inpatient and outpatient mental health services and mental health referral resources and discusses their impact: these findings of clinical and research findings [13]. There is a survey of 50 people in Australia with public mental health problems, their average age is in their 30s, most patients are unmarried and unemployed, schizophrenia is common and expensive to treat, such records can help the healthcare system identify patients in this subgroup and guide management strategies for these often disadvantaged and disadvantaged patients [14]. Public mental health includes promoting mental health, preventing mental disorders and suicide, reducing mental health inequalities, and managing and organizing mental health services. Modern mental health public policy aims to improve mental health by influencing mental health determinants in all areas of public policy. The stigma of mental disorders is a pervasive phenomenon that creates barriers to seeking care and developing health services and has become an important issue in the public health response [15].

2. Deep Learning Analysis

2.1. Definition of Deep Learning. Most modern deep learning models use neural networks. Cumulative neural networks, although they may consist of propositions or hidden variables, arranged hierarchically in deep genomic models, such as in deep learning. Each level of training changes a certain input type. Aggregate and abstract inputs in image recognition applications, the last one can design the shape of a human face. The caveat is that in deep learning, you will find which level the function is best suited for. The "depth" in "deep learning" refers to the number of levels of data transformation. In particular, the deep learning system is very deep in the credit allocation roadmap (CAP); for this network, the signal can pass through a layer multiple times, and the depth of the CAP can be unlimited. And there is no generally accepted depth threshold that differentiates surface learning from deep learning. Most researchers agree that WTP depth > 2; in deep learning, a CAP depth of 2 is considered a general approximation since it can simulate any function. That is, more layers do not increase the network capacity of WTP. Deep models (CAP > 2) estimate features that can have more features than flat versions. Therefore, additional layers help to study properties. Deep learning architectures are often built using a layered approach, and deep learning can help you understand these abstractions and identify features that can improve efficiency. For supervised learning problems, deep learning works by transforming the data into a compact intermediary representation similar to the parent component and removing redundant representations, which is a significant advantage since unlabeled data contains more information than labeled data. Examples of deep structures that can be trained without supervision include neural history and deep belief networks.

2.2. The Difference between Deep Learning and Shallow Learning. Shallow learning is a machine learning method

Table 1: University music education.

Problems with college music education	Features	Teaching methods
Cultivating students' minds	Listen and learn	To enable students to master music knowledge
Exercise learning and creativity	Through sports and games	Improve students' interest in music
Positively influence their worldview	Promote students' self-creation	Deepen students' love of music

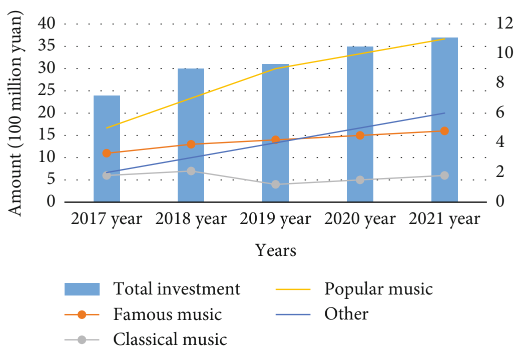

Figure 1: My country's university music education investment.

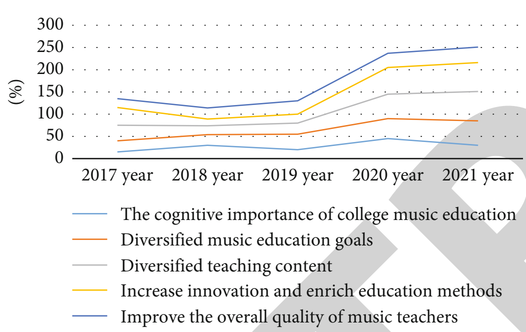

Figure 2: The trend of university music education reform.

that gets the job done. Students casually accept and please both and get information about scars when it does not matter when they get and get. Such a review results in memorizing exam prep exercises in a short amount of time, which does not help, and facilitates long-term understanding and retention of knowledge and information that students forget immediately after class. Superficial learners need external forces to stimulate learning. Often, grading, passing, and conferring degrees are usually done to facilitate student learning. The purpose of learning is not to fail or fail an exam. Students are only interested in the knowledge content of the next exam. Deep learning means that students can critically learn and incorporate new concepts and facts, into raw mental structures, by making connections between disparate ideas and integrating existing ones, mechanically compared to surface learning and passively acquire knowledge and store data separately. Deep learning emphasizes active and critical learning of learners. The learner must understand the full meaning of the content, including the connections between the content and with other topics and ideas, as seen by the definition of deep learning, which involves critical reflection and avoidance of passive acquisition of knowledge, including integrating what students develop. The information needed is also lifelong learning. In terms of time and space outside the school, after various restrictions, everyone's demand for deep learning will be stronger.

2.3. Applications of Deep Learning. Automatic speech recognition is the first and most interesting success case of deep learning, and LSTM neural network can learn tasks. In "extremely deep learning" at intervals of seconds, speech events are separated by thousands of discrete time steps. One of them is about 10 ms. LSTMs with forget filters are comparable to task-based speech recognition. According to TIMIT, the initial success of speech recognition was only a small recognition task. Image recognition is as follows: like TIMIT, its small size allows users to try multiple configurations. There is a list of all the results of this collection, which first appeared in 2011, and the vehicle can perform multifaceted rotation monitoring after adding deep learning. Visual art processing is as follows: increasing the use of deep learning methods in various visual arts, closely related to the advancement of image recognition, the proven DNN function can generate engaging images based on random visual input fields and provide an interesting browsing experience. Natural language processing is as follows: neural networks have been used for language modeling since the early 2000s. LSTMs have helped improve machine translation and language modeling. Other techniques in this area include word sampling and word embedding. This can be seen as a layer of representation in deep learning architectures, representing positions as points in vector space relative to other elements in the dataset. Medical image analysis is as follows: deep learning provides results comparable to other methods. In medical applications such as cancer cell classification, lesion detection, organ segmentation, and image improvement, mobile advertising is as follows: finding the right mobile audience for mobile advertising is always a challenge. This is because many data points need to be validated and processed before an ad server can be created and used. Use audiences to serve ads. Image restoration is as follows: deep learning can solve image problems such as distortion, high resolution, color correction, and film color correction. These applications include training methods such as field reduction for efficient retrieval of training images on image datasets and enhanced depth-of-field reproduction on newly created images.

2.4. The Relationship between Deep Learning and the Human Cognitive Domain and Brain. Deep learning is closely related to a class of brain development theories proposed by cognitive neuroscientists in the early 1990s and adopted as

Table 2: Differences between deep music learning and shallow music learning.

The difference	Deep music learning	Shallow music learning
Music learning attitude	Passive acceptance of learning	Actively learn
Music learning method	Low-end thinking	The operation of high-end thinking
Music learning goals	Basic knowledge and basic skills	Sublimation of thinking, improvement of personal value
Music learning process	Simple, repetitive, and mechanical	Association, transformation, and agility

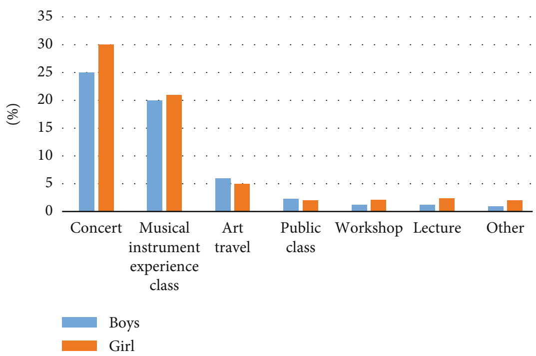

Figure 3: Types of activities that a university hopes to increase.

computer models. Making them the precursors to deep learning systems, these developmental models are generally characterized by the self-organization of available support in the brain for various learning dynamics. It is like neural networks used in deep learning models, and neocortical neural networks use a hierarchy of filters, where each layer processes data from the previous layer and redirects its output to another layer. This process produces a self-organizing stack of sensors that can easily adapt to the work environment, so-called trophic factor waves, where different regions of the brain connect in tandem, with one layer of tissue maturing before another. Wait until the whole brain is fully grown using various methods. On the other hand, to test the viability of deep learning models from a neuroscience perspective, we identified variables. In the inverse diffusion algorithm, which improves the processing realism, other researchers believed that unsupervised deep learning models such as hierarchical phylogenetic models and deep belief networks can estimate biological reality. In this context, neural network models have been linked to model-driven neural processing data in the cerebral cortex; although, there are no systematic comparisons between the organization of the human brain and deep neural encoding and similar reports, for example, that computations done by deep learning modules can be like real neurons and populations of neurons, and that deep learning models developed perform similarly to real neurons by showing the primate visual system measured at the individual and population levels.

3. Research on Public Mental Health Model

① During initialization, k sample points are randomly selected from the N initial samples and use it as the cluster center. ② Calculate the Euclidean distance from each remaining sample in ① to the cluster center k according to formula (1). ③ According to the calculation results in ②, divide each sample into the closest one. ④ Calculate the groups centered on each new group and then use formula (7) to calculate the SSE values for all groups. ⑤ Check whether the total SSE value changes. If there is a change, return to ②, if not ⑥, then ⑥ grouping ends, and the final result of the grouping is displayed.

3.1. Create a Database of Public Mental Health Models. The purpose of grouping is to group objects with similar properties. The data collected is unlabeled in most cases, and grouping can separate the data into different groups, the more similar the data within each group. And the data between groups is unique, and most grouping algorithms belong to partition-based grouping, density-based clustering from tables, density-based clustering, and instance clustering that are one of the most common techniques in traditional machine learning algorithms. Cluster analysis is popular for its usefulness, simple, and efficient. It has been successfully used in many fields such as document synthesis. In this study, we chose a K-means clustering algorithm to separate the number of meals and entropy of students. The algorithm is a partition-based grouping algorithm. It has the advantages of good efficiency, easy to understand, and fast calculation speed. The main idea of the K-mean clustering algorithm is as follows: first, a database is designed, k sample points are randomly selected from a database and take it as the center of the cluster, and the calculation formula is

$$d(x, C_i) = \sqrt{\sum_{j=1}^{m} \left(x_j - c_{ij}\right)^2}. \tag{1}$$

Above, x is the data, C_i is the i-th cluster center, and m is their dimension. The error analysis and SSE calculation formula for this database are as follows:

$$\mathrm{SSE} = \sum_{i=1}^{k} \sum_{x \in c_i} \left|d(x, c_i)\right|^2. \tag{2}$$

In formula (2) $\sum_{i=1}^{k}\sum_{x\in c_i}$ indicates that the data in SSE can be randomly selected from 1 to n, $|d(x, c_i)|^2$ indicates that the data objects in the public mental health database extract a cluster center to the SSE for calculation and arrange the calculated SSE values neatly one by one to see if there are obvious wrong data values, if not, put all their values. Add up to determine whether the overall value is changing. If

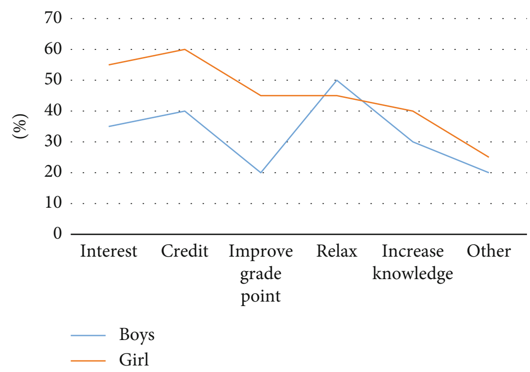

Figure 4: The purpose of studying music in a university.

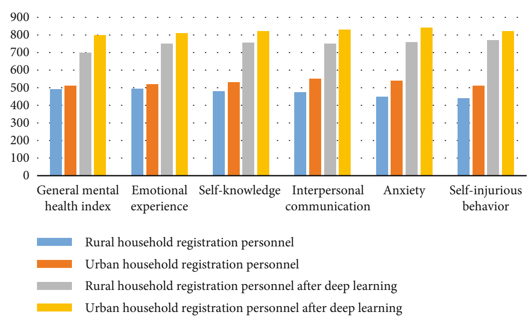

Figure 5: Differences in mental health under different household registrations.

Table 3: Comparison of public mental health algorithms and models.

Compliance	Speed (1-10)	Safety performance
Excellent	8	High
Good	6	Generally
Good	5	Good
Good	7	Good
Good	7	Medium
Qualified	5	Generally

there is a change, it must return to the previous level for reprocessing. If there is no change, proceed to the next step.

Subsequently, we select the optimal data in the public mental health model database for differentiation and increase. At this time, the ID3 algorithm is used for analysis. Extracting and splitting the optimal data in public mental health can help us speed up the analysis of public mental health. The problem of health is that the splitting of data is carried out on the information entropy, and then it is a mathematical formula:

$$\mathrm{Entropy}(D) = -\sum_{i=1}^{m} p_i \log_2 p_i. \tag{3}$$

If the attribute a in the public mental health database is divided, the value of a may have

$$V = \left\{a^1, a^2, a^3, \cdots, a^v\right\}. \tag{4}$$

By discussing and calculating a with formula (3), the information gain of D in the public mental health database can be obtained: by discussing and calculating a with formula (3), the information gain of D in the public mental health database can be obtained:

$$\mathrm{Gain}(D, a) = \mathrm{Entropy}(D) - \sum_{V=1}^{V} \frac{|D^v|}{D} \mathrm{Entropy}\left(D^V\right). \tag{5}$$

However, information gain likes more useful information value. In order to overcome this shortcoming, the famous C4.5 algorithm is proposed, which uses retrieval speed when selecting attributes, and the calculation formula is as follows. The detailed process of attribute selection is as follows: calculated attribute library. Choose a high level of gain. Then, choose the maximum gain division of these properties:

$$\mathrm{Gain\_ratio}(D, a) = \frac{\mathrm{Gain}(D, a)}{\mathrm{SI}(a)}. \tag{6}$$

In

$$\mathrm{SI}(a) = -\sum_{v=1}^{V} \frac{D^V}{D} \log_2 \frac{\left|D^V\right|}{D}, \tag{7}$$

the CART algorithm uses the Gini index to select the most appropriate analytical properties and is faster to compute than to compile. The purity of the public mental health database D can be measured by the Gini index, and the calculation formula is shown in formula (8):

$$\mathrm{Gini}(D) = 1 - \sum_{i=1}^{n} p_i^2. \tag{8}$$

Equation (8) is expressed as the Gini index, which is used in the model to select the best analytical attribute value in the public mental health database. It is very high, this algorithm is very simple and easy to understand, and it is very consistent with the optimal properties of judgment data.

The concept of the algorithm is very simple, easy to understand, and easy to extract. Target data and digital information can be processed in a way that does not consider information and can handle external features, but also has the disadvantage of being easily overloaded. Second, it is easy to ignore the relationship between features.

3.2. Optimizing the Public Mental Health Model. A single decision tree classifier for accuracy and diversity is prone to overload, and unstable classifiers lead to classification problems. Gradient boosted tree algorithms fill these gaps, and the final base classifier is generated to reduce the loss

Table 4: Overall analysis of mental health.

Good	Mild	Moderate	Severe
1985 (46.6)	1859 (43.6)	374 (8.8)	33 (0.8)
2626 (61.6)	1367 (32.1)	211 (4.9)	43 (0.3)
2860 (67.1)	1081 (25.4)	245 (5.7)	56 (1.3)
2278 (53.4)	1560 (36.6)	358 (3.5)	77 (2.3)
1804 (42.3)	1707 (40.0)	570 (13.4)	14 (1.1)
2181 (51.2)	1749 (41.0)	287 (6.7)	31 (1.8)
3213 (75.4)	930 (21.8)	91 (2.1)	14 (0.5)

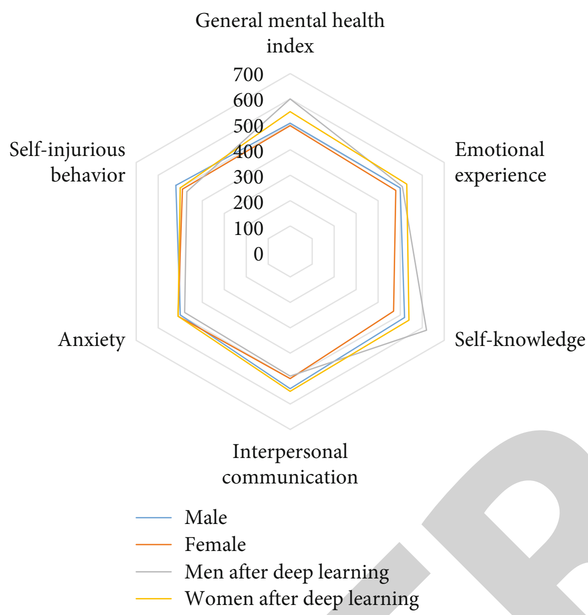

Figure 6: Changes in mental health by gender.

caused by the old base classifier. The loss reduction process includes reducing the residual of the previous weak classifier in the gradient direction and the subsequent accumulation of the weak classifier to obtain a strong classifier. Its basic principles are as follows:

Input: loss function L and public mental health model database:

$$T = \{(x_1, y_1), (x_2, y_2), \cdots, (x_m, y_m),\}. \tag{9}$$

Output: additive model:

$$f(\hat{x}) = f_M(x) \tag{10}$$

The classifier at the beginning:

$$f_0(x) = \arg\ \min_\gamma \sum_{i=1}^{N} L(y_i, \gamma). \tag{11}$$

These classifiers need to perform the following steps:

(1) According to L, get the negative gradient in each database and use it as an estimated value:

$$r_{im} = -\left[\frac{\partial L(y_1, f(x_i))}{\partial, f(x_i)}\right]. \tag{12}$$

(2) Build a regression tree and get its leaf nodes $R_{mj}, j = 1, 2, \cdots, J$, j. These leaves are quite the type of public mental health

(3) Compute node leaves:

$$c_{mj} = \arg\ \min_c \sum_{x_{i\in R_{mj}}} L(y_i, f_{m-1}(x_i + c)). \tag{13}$$

Formula (13) is the function of calculating the leaves of nodes. It plays the role of branches in the system. The whole system is like a tree, and the type of public mental health is the branches and leaves of this big tree. It clearly shows the complexity and diversity of public mental health types, and using the form of leaves as a metaphor for psychological types can be very good for classification and statistics. All leaves on a tree trunk will be of the same type, and the same method can be used. To solve it, the complexity of the system is solved virtually, and the response speed of the system is improved.

(4) Update the regression tree

$$f_m(x) = f_{m-1}(x) + \sum_{j=1}^{J} c_{mjI}\left(x \in R_{mj}\right). \tag{14}$$

Output gradient boosting tree:

$$f(\hat{x}) = f_m(x) + f_M(x) \tag{15}$$

The gradient boosting tree algorithm is generated based on the result of the previous tree, which can ensure the continuity of the object. There are many nonlinear transformations, which are very helpful for object transformation and the creation of multidimensional objects. In addition, the slope gradient tree overcomes the tendency of decision trees. It will be excessive, and it is not easy to produce outliers.

3.3. Extract Scoring of Data. Filtering evaluates each attribute based on its difference or relevance. And select properties based on preset criteria or selected number of properties. The following are some popular filtering process algorithms, where the variance selection method selects objects based on the difference between each object and its target and the correlation coefficient method, the chi-square test, and the maximum data coefficient law for properties and objectives.

The variance selection method is used to express the degree of deviation of the random variable from the expected value. When using the variance selection method, the variance of each subject is first calculated using the variance formula, and vice versa, according to different needs analysis. Different standard selection rules are defined, and

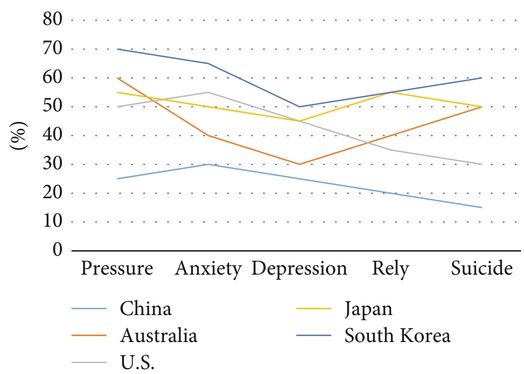

Figure 7: Overall public mental health by country.

finally, qualified attributes are selected according to the predefined standard selection rules and calculated according to formula (16):

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2. \tag{16}$$

When using the correlation coefficient method, the correlation coefficient is usually represented by the letter r. First, use the correlation coefficient formula to calculate the correlation coefficient for each target geographic feature; second, calculate the P value for the correlation coefficient. The P value is calculated based on the feature selection target value. The calculation of the correlation coefficient is expressed by formula (17):

$$r(X, Y) = \frac{\operatorname{Cov}(X, Y)}{\sqrt{\operatorname{Var}[X]\operatorname{Var}[Y]}}. \tag{17}$$

The chi-square test is used to find the difference between the actual observed value and the theoretical value. The chi-square is linearly related to the degree of deviation between the actual observed value and the theoretical value. The smaller the chi-square, the smaller the deviation. Hour usually matches the chi-square value of 0 if the actual observed value agrees exactly with the obtained theoretical value. The calculation of the test statistic is shown in formula (18):

$$\chi^2 = \sum \frac{(f_a - f_e)^2}{f_e}, \tag{18}$$

where f_a is the observed frequency, and f_e is the expected frequency.

The mutual information method is used to solve the interoperability between two variables. The mathematical formula is

$$I(X, Y) = \sum_{x\in X}\sum_{y\in Y} P(x, y) \log \frac{p(x, y)}{p(x)p(y)}. \tag{19}$$

In L1 regularization, it can calculate the loss of the system, and its function expression is

$$J = J_0 + \alpha \sum_{W} W^2. \tag{20}$$

Among them, J represents a function with absolute value, J_0, which is α the original loss function, and is a kind of coefficient.

3.4. Evaluation Indicators. In order to obtain the public mental health assessment, we use the accuracy rate T and the false positive rate F as the evaluation indicators for the model we created.

The function expression of the accuracy rate T and the false positive rate F is as follows:

$$T = \frac{A}{B} \times 100\%, \tag{21}$$

$$F_{ij} = \frac{W}{H} \times 100\%. \tag{22}$$

Finally, the values obtained by formula (21) and formula (22) are analyzed to summarize the result analysis:

$$Z = \left(T + F_{ij}\right)^2 + \ln z_c. \tag{23}$$

Equation (23) evaluates the entire model. The range of evaluation is very wide. It is the final evaluation function of the system. It combines the previous accuracy rate T with the false positive rate F and randomly adds a new evaluation factor. This new factor is the opinion of the model, and the purpose of this is to make the model more humanized. If the overall result of Z is greater than 1, this indicates that this set of evaluation indicators gives a good evaluation in this model. If the overall result of Z is less than 1, then it shows that this set of evaluation indicators gives a bad evaluation in this model.

There are still many areas for improvement in this evaluation system, and we will continue to work hard to improve it in the future.

To analyze the correlation between college music education and public mental health based on deep learning, the public mental health model, clustering algorithm, and filtering algorithm are used. This model has a complete system, which records the information of public mental health into the database. There is also model optimization technology. Even a little error is normal. After all, there are too many factors to be considered in the system. With the continuous development of public mental health, the psychological characteristics and cognitive characteristics generated by this will also be constantly changing and updating, and the system saves these data in each area and solves them slowly.

4. Analysis of College Music Education and Public Mental Health in Deep Learning

4.1. Deep Learning Analysis of College Music Education. Judging from the current situation of university music teaching, it still maintains a relatively consistent teaching method, which is not conducive to the development of university music teaching nor can it promote the development of music talents. The driving force of social development has entered a new era and must use a variety of abilities to face this situation. Colleges and universities need to expand music education in a diversified direction. At this time, deep learning is introduced to change the university music education model, cultivate versatile university students, and improve the competition in the labor market to enable them to participate in social and economic development. Through the survey, the relevant content of college music education was obtained, and the data are shown in Table 1.

According to the data in Table 1, there are still some unresolved problems in college music education, but the existing education methods can allow students to absorb the knowledge of music education. In response to these problems, my country has increased investment in college education in recent years, using money to invest in it and then adopting the deep learning model to slowly change the status quo of college music education. The following data chart is the amount of investment in recent years and the changes in the direction and direction of college music education reform after investment.

According to the data shown in Figure 1, we can see that my country's investment in college music education is increasing, which shows that my country attaches great importance to the education of music. By 2021, my country's total investment will reach 3.7 billion yuan. Among them, it is the highest. On the contrary, after the decline and rise of classical music, there is basically no change. My country's famous music still needs to be constantly updated. Compared with popular music, it is not very popular among young people.

According to the data in Figures 1 and 2, my country's investment in college music education has increased every year, but this increased amount is not a blind investment but a selective increase in the amount invested in this amount. During the changes, the direction of change in university music education is also different, but in Figure 2, their totality is also rising again. In addition, compared with the previous shallow music learning, there are many benefits of deep music learning.

According to the data in Table 2, it can be known that deep music learning is obviously better than shallow learning. Deep learning can change the attitude of students who do not accept music knowledge and turn them into active learning by themselves. Finally, we specifically investigated a university in our country, hoping to get more useful information from this.

In Figure 3, we can see that both boys and girls have chosen two activities: concert and musical instrument experience class. These are the two most helpful activities for music, and they are the most popular in their universities. Then we investigated them for the purpose of learning music, and we were very satisfied with the final result. Most of them were motivated by interest and wanted to learn music from their hearts.

According to the data in Figures 3 and 4, no less than 55% of the students chose the concert, and nearly 40% of the students chose the musical instrument experience category. While the percentage of lectures and seminars is relatively low, it can be seen from the data in Figure 4 that students often like to listen to concerts, which can also provide a good aesthetic experience, and they are also particularly interested in musical instrument courses. In Figure 5, 90% of the surveyed students choose music class because of their interest. No matter what the reason is, since they choose music class, it shows that they have a certain favorable impression of music.

4.2. Public Mental Health Analysis of Deep Learning. Whether the models and algorithms mentioned in experiment 3 are in line with public mental health needs to be further analyzed and explained, and experimental explanations are carried out for many aspects, not only to analyze the mentioned models and algorithms but also to use other to analyze and compare them.

According to the data in Table 3, the public mental model in experiment 3 is generally high in terms of speed and safety performance and is better than other models. Although the data presented by the algorithm is mediocre, however, each has its own characteristics and is sufficient for various operations in the model. There are many problems in public mental health, most of which are listed in Table 4.

According to the data in Table 4, public mental health problems are becoming more and more serious. Anxiety is the most serious problem at present, and the lowest is psychological imbalance. Therefore, we need to solve the problem of people's anxiety and anxiety in a targeted manner, analyze the source of anxiety, and then resolve. For such a serious public mental health problem, we introduce deep learning to optimize and change this phenomenon and discuss and analyze the differences between different household registrations and different genders.

Public mental health has a great influence on people's environment. For example, in Figure 5, it can be clearly seen that there is a big difference in public mental health between people with rural hukou and those with urban hukou, followed by males and females. There are also differences between them. Men's mental health problems are lower than women's. This should be related to the reason why men's psychological pressure is greater than that of women. Finally, after they accept deep learning, their public mental health problems are declining, even in my country of public mental health problems has dropped to a global low, which indirectly illustrates the powerful role deep learning has played in it.

According to the data in Figures 5 and 6, before deep learning was carried out, the public mental health types of the experimental subjects in the two figures were not optimistic. After deep learning, it can be clearly seen from the data that the public mental health level has changed. The psychological endurance of men is stronger than that of women, and people with urban hukou are better than those in rural areas. After deep learning is implemented in my country, the proportion of public mental health personnel in my country has dropped significantly. Our situation has improved markedly in other countries.

Hindawi
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Retraction

Retracted: Analysis on the Effect of Wushu Project Propagation in Nonmaterial Cultural Field of Environmental Protection Based on Artificial Intelligence Analysis Technology

Journal of Environmental and Public Health

Received 17 October 2023; Accepted 17 October 2023; Published 18 October 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

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Research Article

Analysis on the Effect of Wushu Project Propagation in Nonmaterial Cultural Field of Environmental Protection Based on Artificial Intelligence Analysis Technology

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Since the beginning of the new century, the party and the government have always attached great importance to youth sports work and cared about the healthy growth of youth. The CPC Central Committee and the State Council have issued the opinions on strengthening youth sports and strengthening youth physique, which has initially formed a social consensus on promoting the healthy growth of young students. With the process of school education reform and the promulgation and implementation of the Ministry of Education's opinions on implementing and ensuring the time of daily sports activities for primary and middle school students, especially the official launch of the "national sunshine sports for hundreds of millions of students" in 2021, the school sports work in China has entered a new historical stage. Under this premise, the status and importance of Wushu in the intangible cultural field of schools have been gradually improved. As an important part of school sports, Wushu in the field of intangible culture plays an important role in strengthening students' physique, improving students' health, and promoting students' intellectual development. It is also one of the basic ways to realize school sports. How to better play its role has attracted the attention of many experts and scholars. This study focuses on the current situation of Wushu projects in the field of intangible culture in Weixian Middle School of Xingtai City, trying to understand its advantages and existing problems through the current situation, and put forward targeted solutions, so as to enable Wushu projects in the field of intangible culture to play their educational and fitness functions in school sports and provide help for the comprehensive development of middle school students.

1. Introduction

1.1. Selection Basis. In the 21st century, in the new form of rapid economic development and fierce scientific and technological competition, the fundamental task of socialism is of course to develop the productive forces, and science and technology are the primary productive forces. The key to the country's rapid modernization is that science and technology should keep pace with the times [1–3]; to develop science and technology, the primary task is to do a good job in education. As the main body of education, students are the hope of the motherland and the sun rising tomorrow. Their growth is valued by the whole country. School education undertakes the task of cultivating talents for the prosperity and rapid development of the motherland. Under the background of this era, the main task of school education is to implement the educational policy of "moral, intellectual, and physical" all-round development and promote students' physical and mental development and social adaptability [4, 5].

The CPC Central Committee and the State Council clearly pointed out the "decision on deepening education reform and comprehensively promoting quality education": "healthy physique is the basic premise for young people to serve the motherland and the people, and is the embodiment of the vitality of the Chinese nation. School education should establish the guiding ideology of health first, and effectively strengthen physical education." During the fifth session of the Tenth National People's Congress [6], Wang Sheng, the President of Qidong middle school in Jiangsu Province, said bluntly to the school sports: "the implementation of quality education is weak, and the concept of examination oriented education is still strong. Therefore, the middle school students are overloaded with schoolwork, have no experience and have no time to carry out necessary physical exercises, resulting in the phenomenon that physical exercises are important in people's mouth, secondary in practice, and do nothing when busy." In order to implement the party's education policy and further improve and improve the physical health level of primary and middle school students, the full-time physical education and health syllabus for ordinary high schools was promulgated and implemented in 2010 [7]. It is pointed out in the curriculum that "according to the provisions of the curriculum plan for ordinary high schools, each school shall arrange more than three extra-curricular sports activities per week by itself, and one class hour of the three extra-curricular sports activities must be conducted under the guidance of a physical education teacher." In 2015, the Ministry of Education formulated and issued the opinions on implementing the work of ensuring students' daily physical activity time. The opinions are formulated by the Ministry of Education to strengthen the implementation and ensure that students have one hour of physical activity time every day. They are also the most specific and explicit guiding documents stipulated by the Ministry of Education in history. While the state attaches importance to the students' physique, it also clarifies the task of school physical education [8, 9].

School physical education is a very important part of school education, so school physical education should play the educational function of physical education. In our country, the main teaching goal of school physical education is to teach students sports culture, health care, and sports technical skills; promote physical health; strengthen physique; improve basic physical quality; cultivate students' sports ability and good moral character; and educate them to become comprehensive people with moral, intellectual, and physical development, so as to make contributions to socialist construction. It can be seen that school sports should not only transmit sports culture but also strengthen students' physique and develop students' physical quality, for many years [10].

School physical education includes physical education teaching and extracurricular physical education, including extracurricular physical training, extracurricular sports training, and extracurricular sports competition. Wushu in the field of nonmaterial culture is a part of extracurricular physical training. It is an organized and purposeful activity form clearly stipulated in the school curriculum, and it is also the legal sports content of the regulations on school physical education; Wushu in the intangible cultural field is a very valuable physical education resource that every student must do every day and every school has space. Wushu in the field of nonmaterial culture is one of the contents of our school sports work, and it occupies a very important position in school sports [11–13].

1.2. Research Significance and Purpose

1.2.1. Research Significance. As the cultural heritage of the Chinese nation, Wushu needs to be actively inherited and developed. Through the form of Wushu entering the campus, students can better understand and learn Wushu culture, cultivate, and promote students' moral sentiment and will training. This article provides suggestions and opinions for the development of Wushu projects in the field of intangible culture in Weixian Middle School of Xingtai City. It will play a positive role in promoting the development of Wushu projects in the field of nonmaterial culture in secondary schools in the future [14–16].

1.2.2. Research Purpose. In China, Wushu has a profound historical and cultural heritage and a mass foundation. The birth of Wushu gymnastics has helped Wushu enter the campus. Now, Wushu operation is the main content of recess activities coexisting with radio gymnastics. Its role is conducive to strengthening the body of middle school students, improving their interest in learning, promoting their physical and mental health development, and cultivating their patriotism. Through the research and analysis of the current situation of Wushu project in the intangible cultural field in Weixian Middle School of Xingtai City, this paper provides guidance or suggestions for the development of Wushu project in the intangible cultural field in primary and secondary schools in this area [17–19].

1.3. Literature Review. The authors consulted a large number of periodicals and literature through the Internet and studied books such as school physical education, physical education, and school sports dictionary [20–22]. His understanding of the concept of Wushu in the intangible cultural field is as follows.

The school physical education edited by Li Xiang defines the martial arts projects in the intangible cultural field as follows: martial arts projects in the intangible cultural field are also called extracurricular sports activities, which generally refer to sports activities arranged between two or three classes in the morning. The main function of Wushu in the field of nonmaterial culture is to eliminate the mental fatigue and local fatigue of the body caused by learning and transfer the dominant excitation center of the brain and regulate the spirit, so that the body and mind can have a positive rest and enter the next class with energy [23, 24].

The school physical education edited by Zhou dengsong defines the martial arts project in the intangible cultural field as follows: the martial arts project in the intangible cultural field is a sports activity arranged after the second class every morning. The time is generally 15-20 minutes. The activities generally include broadcast gymnastics, quality gymnastics, instrument gymnastics, games, martial arts, running, dancing, and other activities. The exercise load should not be too large to achieve active rest. Wushu in the nonmaterial cultural field is the most common and guaranteed form of after-school sports activities in primary and secondary schools in China and is the most important measure to implement students' one-hour sports activities every day [25–27].

The school sports dictionary published by Wuhan University of Technology Press defines radio gymnastics as a kind of unarmed gymnastics that commands the masses to exercise through radio. According to the characteristics of teenagers, children, and adults, the movements of upper and lower limbs, chest, back, waist, abdomen, whole body, and jumping are organized into different difficulty and different number of sections of unarmed exercises, which are combined with music, so that people can exercise in morning exercises, nonmaterial cultural martial arts, or work exercises. Since its implementation in 1951, China has successively announced 20 sets with remarkable effects, which have become an important exercise content for the broad masses of young people and the people in their daily life [28, 29].

It mainly refers to the relevant research on the reform of Wushu project management mode, development mode, and development content in the nonmaterial cultural field. In terms of the content distribution of the paper, there are 167 articles on the martial arts projects in the intangible cultural field and 49 articles on the reform of the martial arts projects in the intangible cultural field, accounting for 29.34% of the total. It can be seen that there are more studies on the martial arts projects in the intangible cultural field. Studying and highlighting the martial arts projects in the field of nonmaterial culture are not only a window to show the school image but also a means to test the quality of the school sports campus culture.

2. Research Object and Method

2.1. Research Object. Weixian Middle School in Xingtai City has carried out the research on the dissemination of Wushu in the field of nonmaterial culture.

2.2. Research Methods

2.2.1. Literature Method. Refer to school physical education, curriculum and teaching theory, pedagogy, hygiene, and other treatises on martial arts in the nonmaterial cultural field, as well as relevant books and literature on school physical education. Through the academic journal network, 167 papers related to the martial arts projects in the nonmaterial cultural field and the big break between 1994 and 2010 were retrieved, including four excellent master's degree theses. Some documents on the martial arts projects in the nonmaterial cultural field since 2010 were consulted, which provided rich materials for this study.

On the comprehensive study of Wushu in the intangible cultural field with the state's attention to Wushu in the intangible cultural field, educators' deep understanding of the diversified functions of Wushu in the intangible cultural field, the relationship between Wushu activities in the intangible cultural field, and the comprehensive development of students is gradually recognized by people. In practice, it also strengthens the research on the influence of Wushu activities in the field of nonmaterial culture and the multifunction education of students. Through the experimental research, it is shown that the large recess sports activities are well received by teachers and students, and the school campus culture, students' physical, and psychological aspects have been developed.

2.2.2. Questionnaire Survey Method. In recent years, the state has continuously put forward the requirement of ensuring that primary and middle school students can have one hour of activities every day. Especially after the Ministry of Education formally proposed the "big break" sports activities in 1999, most scholars have expounded on the new understanding and new concepts of the martial arts projects in the intangible cultural field and the martial arts sports activities in the large intangible cultural field. It also points out the problems and problems that should be paid attention to in the development of Wushu projects in the intangible cultural field and puts forward new suggestions for the better development of Wushu projects in the intangible cultural field. There are many studies in this area. For example, Wu Hao put forward new ideas on the sports activities during the big break. First, the development of sports activities during the big break complements and enriches the sports curriculum theory. Secondly, the big break sports activities explain the educational concept of "people-oriented and double main education." Third, the large recess sports activities ensure that the students can exercise for one hour every day. Finally, the big break activity has taken a big step forward for the construction of healthy sports. Zhao Jun also concluded that in order to improve the quality of Wushu projects in the intangible cultural field, targeted measures have been taken to deal with the adverse phenomena in the development of Wushu projects in the intangible cultural field.

2.2.3. Physical Statistics Method. Excel application software was used to sort percentage and frequency of the data obtained from the questionnaire.

The main research content is the nonmaterial cultural field martial arts project management system, management regulations, and how to organize. The emphasis of the new form is to take students as the main body and teachers as the leading. People-oriented, from the interests of students and students' health, let the campus live, let students take the initiative, change the "operation" based on the traditional form of education. For example, Zhu Hongsheng put forward new measures for the management mode of Wushu projects in the field of morning exercises and intangible culture.

3. Research Results and Analysis

3.1. Organization and Management of Martial Arts Projects in Intangible Cultural Field. The management we usually talk about refers to the whole process of social activities in order to achieve the objectives of the organization and effectively and reasonably plan, organize, lead, and control all the resources that the organization can control under a certain social environment. School physical education management refers to the whole process of planning, implementing, and testing all the work of school physical education by using the most economical means and methods and the basic laws of school physical education and physical education with the minimum human, financial and material resources. Management can make the division of labor of the organization clear, cooperate together, and make the operation process orderly. It can also give full play to the role of the collective and different division of labor and cooperation depend on management, which is an objective need. The school's management of Wushu projects in the nonmaterial cultural field includes the organizational form, the arrangement of venues and facilities, and the mode of activities.

3.1.1. The Importance of School Leaders to Wushu in the Field of Intangible Culture. A very important factor in the development of Wushu project activities in the field of intangible culture in middle schools is the concern and attention of the school's competent departments and leaders for Wushu project activities in the field of intangible culture, as shown in Table 1.

24% of the middle schools regularly hold Wushu project evaluation activities in the intangible cultural field, 55% of the middle schools occasionally hold Wushu project evaluation activities in the intangible cultural field, and 21% of the middle schools never hold Wushu project evaluation activities in the intangible cultural field. In terms of class meetings related to martial arts in the intangible cultural field, 25% of the classes often hold class meetings, 63% of the classes occasionally hold class meetings, and 12% of the classes never hold class meetings related to the theme. It can be seen from this that most middle schools in Weixian County, Xingtai, have evaluation activities for Wushu events in the intangible cultural field. However, there are few schools and classes that regularly hold and hold events, most of which are held and held occasionally. To a large extent, the degree of attention and investment in Wushu events in the intangible cultural field are not ideal.

3.1.2. Publicity of Wushu Projects in Intangible Cultural Field by the School. In order to carry out the Wushu project in the intangible cultural field well, we should first carry out publicity and education for middle school students. The effect of Wushu project in the intangible cultural field depends on publicity to a large extent. The national health plan can be publicized through campus radio, posters, and other forms to promote middle school students' understanding of the "outline of the national fitness plan," and establish a fitness consulting website to help many middle school students understand various sports activities. Some lectures on fitness principles, accidental injury treatment, refereeing, etc. will be held at different levels and at different times to correctly guide middle school students how to exercise scientifically and how to reduce unnecessary injuries, so as to create a strong campus sports cultural atmosphere and drive students who have not actively participated in the martial arts projects in the intangible cultural field to participate in the martial arts projects in the intangible cultural field as soon as possible.

3.1.3. Venues and Facilities of Wushu Activities in the Intangible Cultural Field of Middle School. Sports venues and facilities are the basis and premise for all sports activities. Therefore, martial arts activities in the nonmaterial cultural field are no exception. Affected by the good conditions of sports venues and facilities, according to the survey, the per capita occupancy rate of sports venues and facilities in Weixian Middle School in Xingtai is far from the standard issued by the State Education Commission. See Table 2 for the specific survey results.

It can be seen that in the martial arts activities in the nonmaterial cultural field of Weixian Middle School in Xingtai, most of the venues are mainly track and field venues, followed by basketball and volleyball venues, and the utilization rate of other venues is low. Due to the different conditions of each school, the site facilities and other conditions are different, and the sites used are also quite different.

3.2. Characteristics of Middle School Students in Weixian County, Xingtai, Participating in Wushu Events in the Intangible Cultural Field. Participation includes procedural participation and substantive participation. Procedural participation refers to pure behavioral participation, while substantive participation includes reasonable psychological participation, which can promote the development of students' high-level thinking. The participation we usually say refers to procedural participation, which is simple behavior participation. In the martial arts project activities in the nonmaterial cultural field, students are the main participants. Whether the contents, organizational forms, assessment, and evaluation are reasonable and effective directly depends on the participation of students.

3.2.1. Investigation and Analysis on the Attitude and Satisfaction of Middle School Students to Participate in Wushu Events in the Nonmaterial Cultural Field. As shown in Table 3, 9.0% of the middle school students in Weixian County, Xingtai, are "very conscious and active in learning and exercising," and these middle school students have the habit of actively exercising and can consciously participate in sports; 30.3% of the students are "interested in active learning and exercise." This part of the students mainly chooses whether to participate in the activities according to whether the activities and contents arranged by the teachers are consistent with their own interests and whether the sports venues are satisfied when they are engaged in Wushu activities in the nonmaterial cultural field; 47.9% of the students "learn and exercise according to the strict requirements of teachers." This part of the students is mainly due to their lack of understanding of martial arts in the nonmaterial cultural field and the importance of physical and mental health; 18.7% of the students "never take the initiative to study and exercise."

3.2.2. Effect of Middle School Students' Participation in Wushu Events in Intangible Cultural Field. Students' participation in the martial arts projects in the intangible cultural field has been improved in different aspects and to different degrees. Among them, it is mainly to enhance sports ability and improve physical health, which shows that the martial arts projects in the intangible cultural field of Weixian County, Xingtai, have received certain effects in enhancing students' physique. However, in terms of cheerful personality, self-confidence, and collectivism, students feel little

Table 1: Statistics of the importance attached by school leaders to Wushu in the nonmaterial cultural field.

	Regularly	Occasionally	Never held	Total
Number of matches held	337	773	295	1405
Percent (%)	24%	55%	21%	101%
Number of class meetings	351	885	169	1405
Percent (%)	25%	63%	12%	101%

Table 2: Venues and facilities for Wushu activities in the field of learning nonmaterial culture.

Place	Track-and-Field ground	Basketball court	Volleyball court	Corridor	Front and back of the building
Quantity (*n*)	29	11	6	2	2
Sort	1	2	3	4	4

Table 3: Investigation and analysis on the attitude and satisfaction of middle school students to participate in Wushu events in the nonmaterial cultural field.

Participation attitude	Very active exercise	Be interested	The teacher is strict	Never take the initiative	Total
Male	89	207	251	102	649
	13.7%	31.9%	38.7%	15.7%	101%
Female	38	219	422	77	756
	5.0%	29.0%	55.8%	10.2%	101%
Total	127	426	673	179	1405
	9.0%	30.3%	47.9%	12.7%	101%

improvement, which indicates that school physical education has less education in students' emotional field. Only 8.7% of the students have improved their communication ability, which is far from the requirements of "social adaptation goals" in the five fields proposed by the new curriculum standard. Therefore, the martial arts projects in the nonmaterial cultural field should strengthen the cultivation of students' emotional field and interpersonal communication ability.

The intensity of exercise is what we usually call the load during exercise. Its size is generally measured by the number of exercises, total distance, total time, and exercise density. The load intensity has a great influence on the fitness effect. Therefore, the authors divide the exercise intensity of Wushu events in the intangible cultural field of middle school students in Weixian County, Xingtai, into five levels: minimum, small, medium, large, and maximum, based on the exercise index of Wushu events in the intangible cultural field; i.e., the exercise index = the average heart rate of middle school students in class /the quiet heart rate before class and the exercise index evaluation table.

3.2.3. Motivation of Students to Participate in Wushu Events in Intangible Cultural Field. Behavioral science tells us that all kinds of human activities are related to their motivation, interest, psychology, etc., and human motivation and interest are based on whether the subject needs them. If there is no need, there will be no corresponding motivation and interest, and of course, there will be no action. Therefore, motivation is the internal force that directly promotes one's external activities. On the basis of human needs, it plays a role in encouraging, maintaining, and stopping human behavior. Sports motivation refers to the internal motivation to promote one's participation in sports activities. It is an internal process, and the behavior of sports activities is the result of this internal process ⑨. Therefore, it is an important link of communication and interaction between teachers and students to deeply understand the motivation of middle school students to participate in Wushu activities in the field of nonmaterial culture. Sports participation motivation is the basis of physical exercise and is the internal power to promote middle school students to participate in martial arts activities in the nonmaterial cultural field.

3.2.4. Middle School Students' Participation in Wushu Events in the Intangible Cultural Field. The sports interests of middle school students directly affect the projects that middle school students choose in the martial arts project activities in the nonmaterial cultural field. It has a very important reference value for studying the current situation of the martial arts project activities in the nonmaterial cultural field of middle school students. It is also an important aspect that sports management departments, middle schools at all levels, and sports workers should understand when carrying out sports work. The main body of Wushu projects in the intangible cultural field is students and mainly serves students. Therefore, the selection of Wushu projects in the intangible cultural field directly determines the effect of Wushu projects in the intangible cultural field. This requires that the selection of Wushu projects in the intangible cultural field by schools should not only conform to the psychological and physiological development of students but also conform to the actual situation of schools. In this study, the students in Weixian County, Xingtai, who actually participated in the martial arts events in the intangible cultural field and their favorite martial arts events in the intangible cultural field were investigated, and the differences between them were found out.

3.3. Characteristics of Wushu Project in Intangible Cultural Field of Weixian Middle School in Xingtai. Due to the influence of traditional martial arts in the field of intangible culture, the martial arts in the field of intangible culture did not play the expected role. On the contrary, some students took the martial arts in the field of intangible culture as a burden. In order to change this phenomenon, the Ministry of Education has repeatedly proposed that all secondary schools should organize and arrange Wushu events in the field of nonmaterial culture suitable for the school according to the actual situation of the school's venues, facilities, number of students, etc. and highlight the characteristics of the school. The selection of activity content should be based on the students' sports foundation, hobbies, and age characteristics, as well as the venues, facilities, and the number of students, so that the students' participation attitude will change from "I want to practice" to "I want to practice." The particularity of Wushu in the intangible cultural field is that it needs to be done every day and practiced every day. Therefore, the content of Wushu in the intangible cultural field is easy to make students feel repetitious. In addition, the weather in the North varies greatly all year round, the spring and autumn are windy and dry, but the temperature is appropriate, while the summer temperature is high and hot, the winter temperature is low and cold, and the content is unchanged, so that the intensity of Wushu activities in the nonmaterial cultural field is different, and the expected exercise effect cannot be obtained.

3.4. Students' Understanding of Wushu

3.4.1. How Much Students Like Wushu. Students' interest plays a decisive role in the development of Wushu courses. The improvement of students' interest in Wushu can improve learning efficiency, promote physical and mental development, and thus promote the development of Wushu courses.

It can be seen from Figure 1 that the proportion of people who like, like and like Wushu is 74.5%. It can be seen that Wushu is still popular in primary and middle schools, and Wushu is more popular in primary schools. Most of the students think that Wushu is awesome and cool to play. Some of the students think that Wushu is a Chinese tradition and should be studied and carried forward. Students who do not like or dislike martial arts account for 25.5% of the total number. The main reason why these students do not like or dislike martial arts is that they are too tired to learn martial arts and are afraid of hardship. On the other hand, they are worried that their poor learning of martial arts will lead to students' ridicule.

3.4.2. Wushu Teaching Contents That Students Are Interested in. As shown in Figure 2, among the sources of students' cognition of Wushu, 82.3% of primary and middle school students come from Kungfu action movies, TV, and martial arts novels. They think that Wushu is powerful and magical, and they can make themselves heroes by learning it. It can be seen that the spread of Wushu among primary and middle school students mainly comes from Internet media and books. This way of communication makes most students tend to learn the contents of online media and books such as Sabre stick sword and martial arts Sanda. On the contrary, students have little interest in learning the basic routines such as five step boxing and long fist stipulated in sports textbooks.

3.4.3. Students' Cognition of Wushu Class. Through the sorting of the questionnaire, 68.72% of the students have studied martial arts in physical education, 28.61% of the students have never studied martial arts in physical education, and 2.67% of the students forget whether they have studied martial arts in physical education. Among the 68.72% primary and middle school students who have studied martial arts in physical education, 65.14% have only learned basic martial arts skills and basic martial arts movements, 30.51% have learned some martial arts routines, and 4.35% have learned equipment and martial arts Sanda. While learning martial arts skills, 32% of the students said that the teacher had taught martial arts culture, knowledge and morality, of which 24.7% forgot what the teacher taught, and only 7.4% could remember what the teacher said. It can be seen that Wushu cultural knowledge is a short board of the effect of Wushu project in the field of environmental protection and nonmaterial culture.

4. Analysis on the Effect of Wushu Communication Based on Neural Network

4.1. Modeling of Characteristics of Imitation V1 Zone. At present, researchers mostly use the Gabor filter to simulate the receptive field characteristics of simple cells in V1 region. The Gabor filter applied in this paper decomposes the Gabor complex exponential function into odd filter and even filter after being expanded by sine and cosine in the spatial domain and performs filtering operations, respectively. Finally, the sum of squares of odd and even filter outputs is normalized as the final output of V1 region.

$$H(\mathrm{x}, \mathrm{y}, \theta, f_s) = Be^{\left(-\left(x^2+y^2\right)/2\sigma^2\right)} e^{j2\pi(f_s \cos(\theta)x + f_s \sin(\theta)y)}. \quad (1)$$

It is assumed that the real part and the imaginary part of the decomposed spatial filter are: H_e and H_o. The parity filters are

$$G_o(x, y, \theta, f_s) = H_o(x, y, \theta, f_s), \quad (2)$$

$$G_e(x, y, \theta, f_s) = H_e(x, y, \theta, f_s). \quad (3)$$

Complex cell responses are obtained by aggregation of simple cell responses, θwhich is defined as the energy sum of odd f_s and even responses of simple cells, as shown in

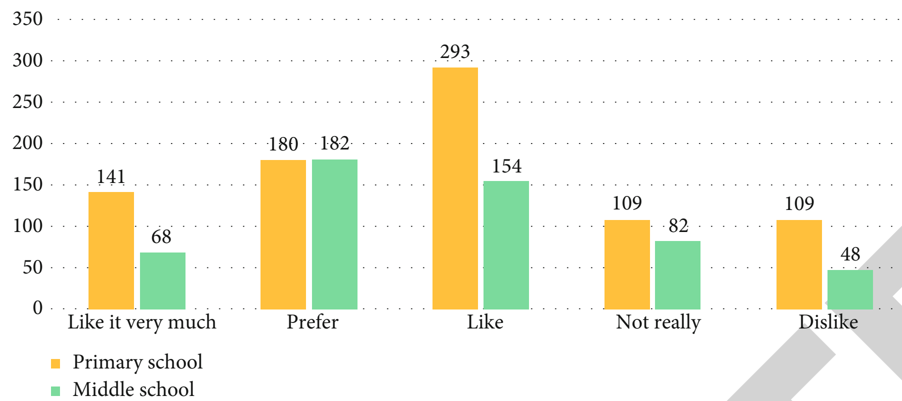

Figure 1: Schematic diagram of students' liking for Wushu.

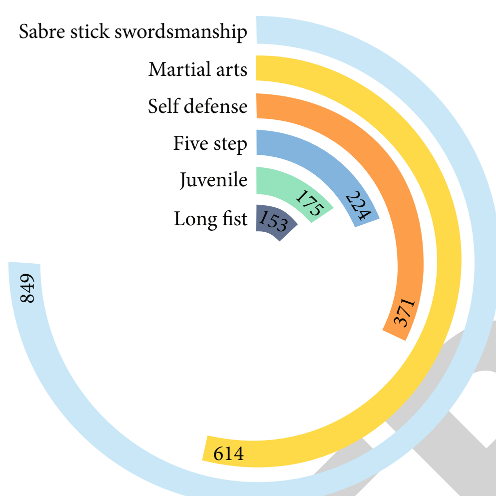

Figure 2: Wushu teaching contents of interest to students.

formula (6):

$$R_o(x, y, \theta, f_s) = G_o(x, y, \theta, f_s) * I(x, y), \tag{4}$$

$$R_e(x, y, \theta, f_s) = G_e(x, y, \theta, f_s) * I(x, y). \tag{5}$$

Complex cell responses are obtained by aggregation of simple cell responses, which is defined as the energy sum of odd and even responses of simple cells, as shown in formula (6):

$$E(x, y, \theta, f_s) = R_o(x, y, \theta, f_s)^2 + R_e(x, y, \theta, f_s)^2. \tag{6}$$

It is assumed that there are n spatial filters, representing n simple cells whose preference directions are uniformly distributed in space; i.e., $\theta = \theta_1, \cdots, \theta_N$, the output of the final V1 cell is obtained after normalization, as shown in

$$E^{v1}(x, y, \theta, f_s) = \frac{E(x, y, \theta, f_s)}{\sum_{i=1}^{N} E(x, y, \theta, f_s) + \varepsilon}, \tag{7}$$

where $0 < \varepsilon < 1$ is a small constant to avoid the denominator being 0 in equation (7).

The surrounding suppression term proposed in this paper is realized by combining with Gabor kernel function. The details are as follows.

Firstly, a suppression range function expressed by Gabor kernel function is defined; that is, the difference between two Gaussian functions is used to represent the annular range of the nonclassical receptive field. The value of the part located in the classical receptive field is 0, and the value of the area outside the classical receptive field is positive and attenuates with the increase of the distance from the center, as shown in the following formula:

$$I_{k1,k2}(x, y, \theta, f_s) = |G_{k2}(x, y, \theta, f_s) - G_{k1}(x, y, \theta, f_s)|^+, \tag{8}$$

where $G_k(p, t, \theta, v_c)$ is the Gabor kernel function with the carrier removed and is a parameter for adjusting the range of the nonclassical receptive field, as shown in the following formula:

$$G_k(\mathrm{x}, \mathrm{y}, \theta, f_s) = Be^{\left(-\left(x^2+y^2\right)/2(k\sigma)^2\right)}. \tag{9}$$

$|g^+|$ represents half wave rectification, which ensures that the suppression effect only occurs in the defined area. The formula is as follows:

$$|z|^+ = \begin{cases} z, & z \geq 0, \\ 0, & z < 0, \end{cases} \tag{10}$$

The distance weighting function is defined as $\omega(x, y, \theta, f_s)$, determined by the normalization of formula (8):

$$\omega(x, y, \theta, f_s) = \frac{I_{k1,k2}(x, y, \theta, f_s)}{\left\| I_{k1,k2}(x, y, \theta, f_s) \right\|_1}, \tag{11}$$

where $\| \|_1$ represents the L-1 norm.

Next, the surrounding suppression energy at any point in space is simulated by formula (12), and its value is the convolution of the output of V1 area and the distance weighting function:

$$S(x, y, \theta, f_s) = E^{v1}[x, y, \theta, f_s] * \omega[x, y, \theta, f_s]. \tag{12}$$

The final output result of the image after the surround suppression processing is

$$\tilde{E}^{v1}(x, y, \theta, f_s) = \left|E^{v1}(x, y, \theta, f_s) — \alpha S(x, y, \theta, f_s)\right|^{+}. \quad (13)$$

In this paper, MATLAB 2021b is used as a simulation platform, and four SAR images of villages, rivers, highways, and straits are used for edge detection simulation experiments. The filter parameters$\sigma f_s$are based on the control variable method in Reference [30]; the following results are obtained from experimental statistics: $f_s = 0.26$, $\sigma = 1.2\sqrt{\log 2/(\pi \cdot f_s/3)} \approx 2.59$.

4.2. Classical Modeling Method. This paper focuses on the research and functional simulation of V1 region in the visual cortex pathway. The following are some classical V1 region modeling methods.

4.2.1. Simple Cell Modeling. For simple cells in V1 area, the two-dimensional Gabor function is most similar to the receptive field profile of simple cells in mammalian visual cortex. It is the most commonly used method to simulate simple cells and can be used in edge detection, texture extraction, image enhancement, and other fields.

4.2.2. Complex Cell Modeling. The modeling of complex cells is generally based on the model of simple cells, because biologically, the response of complex cells is converged by simple cells, and the convergence process is generally considered to be nonlinear. At present, there is no unified theory to accurately describe the connection process between simple cells and complex cells, so there are different modeling methods, mainly including the following three types: in the energy model, that is, the response of complex cells is expressed by the square sum of the responses of two simple cells with the same direction and a phase difference of 90 degrees; in the Max model, that is, select the strongest response of all simple cells as the response of complex cells; the learning model is to automatically learn the convergence process from simple cells to complex cells through machine learning.

4.3. Convolutional Neural Network. A convolutional neural network is an important branch of deep learning. It is a network model specially created for image processing, and it is also the first real multilayer structure learning algorithm. The simplest understanding of "depth" in deep learning is that "there are many layers." An improved feature space can be established by superimposing multiple layers. The lower layer is used to learn the most basic features (such as color and edge), and the later layer is used to learn more advanced features (such as parts and local shapes) and finally classify the features with a classifier. Convolutional neural networks are described in Figure 3.

After feature extraction, it usually goes through a full connection layer and then classifies the feature vector with support vector machine or softmax classifier. Recent research shows that the full connection layer is not helpful to the final detection rate, and the results of classification using the feature map generated by the convolution layer of the last layer are similar. Therefore, the final fully connected layer becomes dispensable.

4.4. Typical Model of Convolutional Neural Network. In theory, convolutional neural networks can have countless combinations. Different layers and different convolution kernels in each layer can produce different network structures. Redesign of a network often requires a lot of experimental verification, and it is prone to unexpected situations such as overfitting and inability to converge. Most of the points that can improve the performance are the accurate grasp of details. In the competition, most of the key technical points mentioned by the top teams are small skills, and verifying the effectiveness of these skills requires a lot of time and computing resources. There are many parameters for deep learning, including many parameters that can be manually adjusted. For a new task, the number of layers, the number of feature maps, the size of convolution kernel, and the learning rate need to be adjusted, and experience plays a very important role. If you are inexperienced and still need to improve the basic model, it is likely that the input is large but the output is small. The residual network proposed by Bihe Kaiming's team requires a lot of experimental accumulation and strong inspiration, which is difficult for individuals to do. Those classical network models have been verified by numerous experiments. It is very important to make full use of these classical convolution network structures created by Daniel, directly use or modify them by reference.

4.4.1. LeNet. LeNet is composed of the first convolutional neural network model, which was applied to handwritten font recognition and reached the commercial application standard. The size of the input image is fixed to 32×32, which is large enough for a handwritten font. After the input image passes through the convolution layer and the down sampling layer twice, a new image with lower dimension is obtained, which is called a feature map. The feature map is then input to the full connection layer and converted into a vector and finally sent to the output layer to calculate the class probability. Note that the activation function used by the network at this time is sigmoid function. The structure of LeNet is shown in Figure 4.

4.4.2. ZFNet. ZFNet is improved on the basis of AlexNet, introducing a new visualization method to realize the visualization of the middle layer and classifier, that is, the method based on antipooling and deconvolution. The visualization method can help to find the problems in the model by observing the evolution process of the features. It is through visualization that the network structure exceeding the performance of AlexNet is found. Through the ablation experiment of controlled variable method, the practical role of the middle layer in the network was explored. The model trained on Imagenet was retrained, and the classifier was generalized to the data sets caltech-101 and caltech-256, and the results exceeded the best model at that time. The structure diagram of ZFNet is shown in Figure 5:

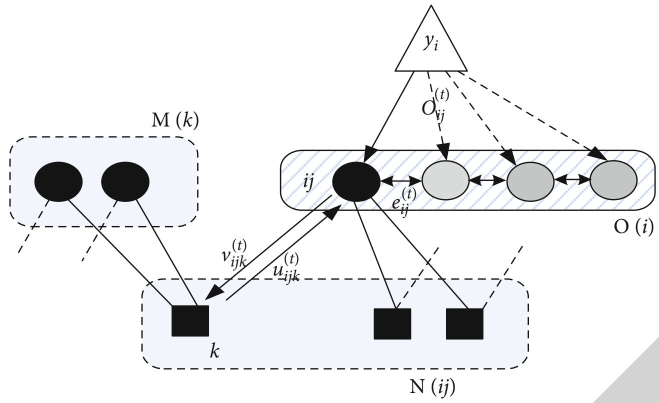

Figure 3: General structure of convolution deep channel network.

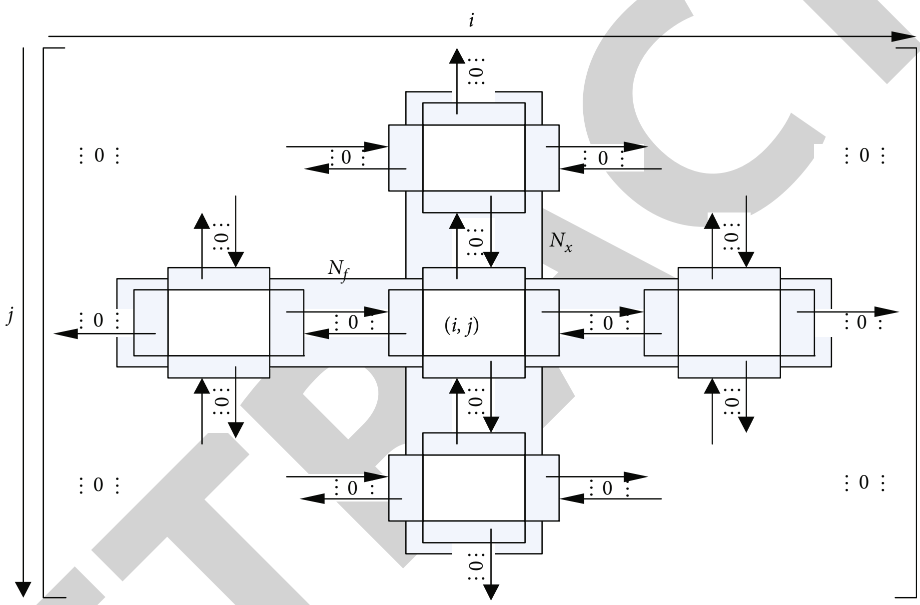

Figure 4: Structure diagram of LeNet.

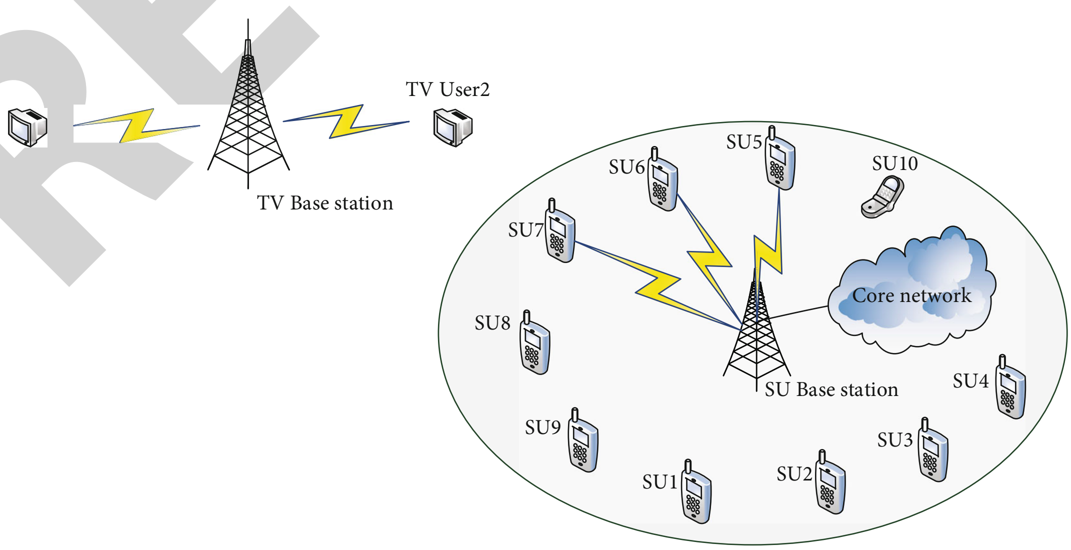

Figure 5: Structure diagram of ZFNet.

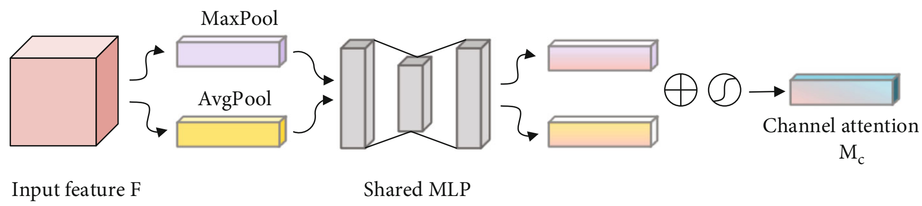

FIGURE 6: AlexNet network structure.

4.4.3. AlexNet. Due to the popularity of support vector machines and the problems of the network itself, such as overfitting and easy to fall into local optimization, deep learning has been silent for a long time before AlexNet. It was not until the Imagenet image classification competition in 2012 that the classification accuracy of AlexNet far exceeded the second place at that time, bringing revolutionary progress to image classification, that the deep neural network began to become popular.

AlexNet can be seen as an extension and improvement of LeNet, which can be used to learn the features of more complex input images. The main improvements are as follows: the network scale is increased, with 5 convolution layers, 3 full connection layers, and 1 softmax classification layer. Replacing sigmoid function with linear rectifying unit, the gradient descent speed and convergence speed are accelerated, and the problem of "gradient disappearance" is avoided. Increase the number of data sets through data enhancement or data expansion to avoid overfitting. Common data enhancement methods include random clipping, flip, and color jittering. The method of random inactivation is proposed and used to selectively inhibit some neurons during the training period to alleviate the over fitting problem of the model. Local response normalization and overlapping pooling were used to avoid overfitting. Using two GPUs, NVIDIA GTX 580 to work in parallel greatly reduces the training time, and the two GPUs only communicate at a specific layer. The structure diagram of AlexNet is shown in Figure 6.

4.4.4. VGGNet. VGGnet was proposed by the visual geometry group of Oxford University to explore the impact of network depth on model accuracy in large-scale image recognition tasks.

The network uses 3×3 convolution cores (step size of 1) and 5 2x2 pooling layers (step size of 2) smaller than AlexNet and ZFNet, raising the depth of the network convolution layer to 16-19 layers, and won the first and second places in the positioning and classification tasks in the Imagenet challenge that year.

5. Conclusion

From the holding of competitions, thematic class meetings, and fitness consulting websites in Weixian Middle School in Xingtai City, we can understand that the significance of Wushu project activities in the intangible cultural field of the school is not publicized by the middle schools, and the degree of attention is low. They only deal with relevant inspections and competitions. The utilization rate of venues is also low, and most schools are mainly track and field venues. The activity mode is single. Middle school students in Weixian County, Xingtai City, are less satisfied with the content and site facilities of Wushu projects in the nonmaterial cultural field. The content is old and single, and the replacement frequency is low, which cannot meet the needs of students. And they are satisfied with the teachers' guiding attitude. The motivation of middle school students participating in Wushu events in the field of nonmaterial culture is not optimistic. The main motivation is the mandatory "school system requirements." The participation effect of middle school students is not ideal, and the overall activity intensity is concentrated below the medium and small intensity, which cannot achieve the effect of fitness and active rest. In terms of emotional experience and interpersonal skills, little effect has been achieved, and most middle school students feel depressed after class. Most middle school students do not understand the significance of Wushu projects in the intangible cultural field. The teachers of Weixian Middle School in Xingtai City do not have a comprehensive understanding of the functions of Wushu projects in the intangible cultural field. In the process of participation, except for some physical education teachers, teachers of other disciplines have less communication with students in the management of Wushu projects in the intangible cultural field, and the participation rate is low, which does not fully play the role of intangible constraint and enlightenment. As for the attitude towards negative students, teachers of all subjects can take the initiative to help, but some regulations are still formalized and ignored.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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Research Article

Construction of Online Teaching Acceptance Model of University Library under the Epidemic Situation

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In order to improve the online teaching quality of university libraries, this paper puts forward the construction of the online teaching acceptance model of university libraries under the background of the epidemic situation, constructs the basic theoretical framework of the teaching evaluation system, establishes the basic evaluation indicators, takes the online teaching quality evaluation and the operability of the evaluation system as the constraint object, and determines the index parameter set after class review; the three modules were guided and trained. Based on the big data analysis of the evaluation index system, accurate teaching quality scores or grades were calculated, and the online teaching acceptance evaluation of university libraries was realized. The results of empirical analysis show that this method can realize the accurate evaluation of teaching quality, promote the deep integration of online teaching theory and practice in university libraries, and improve the acceptance level of online teaching quality.

1. Introduction

The sudden attack of novel coronavirus in 2019 has directly led to the delay of the spring opening of colleges and universities across the country in 2020. Students in colleges and universities across the country are isolated at home to fight against the virus [1, 2]. During the epidemic period, in order not to delay students' learning, the ministry of education advocated that all localities provide learning support for students through network technology, so as to "stop teaching and stop school". In the process of school education, the online teaching course of university library always occupies an important position [3, 4]. It plays an important role in promoting students to form the core quality of library teaching, learn library skills, develop healthy behaviors, cultivate library ethics, and promote students' comprehensive development [5, 6]. During the epidemic period, online teaching courses of university libraries can improve students' physical and mental conditions and carry out online teaching education of university libraries, which is conducive to the safety of students through the isolation period and the comprehensive development of online teaching of university libraries [7, 8]. After the outbreak of the epidemic, the working mode of network teaching in university libraries has changed to some extent, from the previous offline service to the online service. In this case, the number of visits to the library's website has increased dramatically [9, 10]. Due to insufficient preparation, the network speed and the configuration of software and hardware facilities cannot keep up with each other, resulting in the jam of the electronic server, which seriously affects the access speed of teachers and students. With the increase of the number of visits, readers' demand for the types of electronic resources has also increased, and the original electronic resources can obviously not meet the needs of teachers and students.

Whether it is the basis of reality, the experience of online courses in China, or the future development of education, it is forced to speed up the construction of online teaching courses in university libraries. It can no longer be passively accepted that the construction of online courses in university libraries requires detailed planning, of which the teaching quality evaluation index system is the most important. Online teaching in university libraries is Internet distance education. It refers to educational activities that break through time and space constraints. It refers to activities that organize teaching and two-way interaction in classes. There are several common forms such as live teaching, video teaching, and live face-to-face teaching. It has been used as an auxiliary teaching method in the field of education. However, the outbreak of COVID-19 in 2020 ushered in a historic turning point for online teaching, which changed from the auxiliary teaching mode in the ordinary period to the main teaching mode in the epidemic period. As a temporary alternative to offline teaching, the education mode not only breaks the restrictions of time and space, saves teaching costs, and brings convenience to students' learning, but also attracts a large number of online education and learning users with its unique openness and flexibility, diversified online teaching modes of university libraries, rich teaching contents, and increasingly mature online teaching technologies. This not only shows that online education plays a positive role in the education of today's society, but also highlights its strong vitality and bright development prospects.

In addition, online teaching, as a product of the times, is the embodiment of the deep integration of modern information technology and education. Although it is not yet mature, it is a teaching method that cannot be ignored in the future. This research topic and research method not only ensure that this paper has strong theoretical support, but also make the research results have strong practical guiding significance. It provides reference and guidance for the better development of university library teaching in the future, provides better solutions for dealing with emergencies and critical teaching, provides teaching examples for exploring the deep integration of university library teaching and information technology, provides reference for better exploring the reform of university library teaching mode, plays a positive role in the good development of education, and has profound practical significance for understanding the profound influence of science and technology on teaching reform. Taking the teachers, students, and parents of library and information major in a university as the investigation objects, through oral research and interview, we can objectively and accurately understand the online teaching situation of the university library during the COVID-19 epidemic. Before the interview and investigation, determine the questions and make the interview records in time, so that the investigators can accurately capture the information, fully understand the facts, collect factual information according to the interview and investigation, and help the research work of the paper. This paper puts forward the construction of the online teaching acceptance model of university libraries under the epidemic situation, constructs the basic theoretical framework, establishes the basic evaluation indicators, takes the online teaching quality evaluation and the operability of the evaluation system as the constraint object, sets the index parameter set, determines the information of various online teaching resources at all levels, and conducts guidance and training with the three modules of preliminary preparation, online classroom and after-class review. The big data analysis based on the evaluation index system calculates the accurate teaching quality score or grade and realizes the online teaching acceptance evaluation of university libraries. The results of empirical analysis show that the model can realize the accurate evaluation of teaching quality, promote the deep integration of online teaching theory and practice in university libraries, and improve the acceptance level of online teaching quality.

2. Evaluation Index System of Online Teaching Acceptance of University Library under Epidemic Situation

2.1. Questionnaire Method and Online Teaching Quality Evaluation Index Parameter Model. 15 experts and scholars from library science major of a university, and 5 external experts and scholars were selected to conduct a questionnaire survey. The 20 experts and scholars were selected as the research objects. Since the consent of all experts was obtained in advance, 20 questionnaires were distributed, and all valid questionnaires were collected, with a total of 20 questionnaires. The recovery rate was 100%. The reliability test of the questionnaires was conducted by the test-retest reliability analysis method. The purpose of the questionnaire survey is to understand the survey objects through the closed-ended and open-ended questions on the questionnaire. With the help of this tool, the researchers accurately and concretely measure the online teaching acceptance of the library, describe and analyze the quantity, and obtain the required survey data.

After completing the expert questionnaire, 10 experts were randomly selected from the respondents of the expert questionnaire at intervals of 10 days, and the same questionnaires were distributed again. The data collected from the two questionnaires were analyzed and sorted out. The results were as follows: experts unified the opinions of students, and students hoped that the library would provide information services for key majors and key courses, accounting for 36.97%; Tracking scientific research and providing information services, accounting for 19.70%; Regularly compile and print special reference materials, accounting for 25.15%; Providing users with proxy search, proxy connection, proxy copy, etc., accounting for 18.18%; The correlation coefficient $R = 0.87$ was obtained, which confirmed the reliability of the questionnaire data.

In this study, it is one of the most commonly used scientific research methods to screen and weight indicators. The questionnaire designed in advance was distributed to scholars and experts in library colleges, and each of them gave his own opinions and judgments on the same academic problem. In order to prevent the influence of other experts' suggestions, the opinions are expressed anonymously, and there is no connection between the experts. Finally, the suggestions of each expert are summarized. After repeated filling, the high convergence of expert suggestions is maintained in terms of results. In the process of this research, the deep integration of theory and practice has been realized. The theoretical route is as follows: based on the analysis of online teaching theory and practice at home and abroad, the theoretical basis and logical framework of this research are discussed from the key factors and motivations that affect the evaluation of teaching quality in university libraries. Systematic analysis, from the perspectives of pedagogy, evaluation, school library, and other disciplines, analyzes the conceptual connotation and theoretical support of online teaching quality evaluation in university libraries. The research roadmap is shown in Figure 1.

According to Figure 1, we can understand the current situation of the library, sort out the development of online teaching quality evaluation of university libraries through questionnaires and case studies, and understand the actual needs of teachers, students, and managers, thus laying a solid empirical foundation for the subject research. According to the results of theoretical research and empirical research, through logical analysis, this paper systematically analyzes the online teaching quality evaluation index system of university library courses and probes into its operability.

2.2. Integration of Online Teaching Acceptance Evaluation Parameters in University Libraries under the Epidemic Situation. In the evaluation indicators of layered teaching, there are mainly the following evaluation methods: the main body of evaluation is divided into others' evaluation and self-evaluation; The evaluation is divided into relative evaluation and absolute evaluation according to the evaluation reference standard; The time of evaluation is divided into pre learning, learning and post learning evaluation. There are various evaluation methods. When evaluating hierarchical teaching, we cannot use a single evaluation method, but use multiple methods to evaluate scientifically. The specific principles of evaluation are: the foothold of education is the evaluation and examination of students. In order to carry out the evaluation index model of layered teaching, we must innovate the evaluation mechanism of achievements. We should break the traditional quality evaluation concept of "one test paper for life" and establish an incentive mechanism for diversified evaluation. It combines the summative evaluation with the formative evaluation, and unifies the evaluation of students' academic achievements with the evaluation of learning attitudes and values. As a course, teaching includes students' theoretical lessons, practical lessons, and ordinary performances. Therefore, when evaluating a student's learning effect, we should not evaluate the student from one aspect of the student but should evaluate the student's learning effect from many aspects.

The basic theoretical framework of the online teaching evaluation system of university libraries under the epidemic situation is constructed, and the basic evaluation indexes are established. With the online teaching quality evaluation and the operability of the evaluation system as the constraint object, the index parameter set is combined and sorted with the horizontal distribution sequence of the acceptance estimation index samples. The mathematical description of the constrained optimization objective problem is as follows:

$$\begin{aligned}&\min F(x)=[f_1(x), f_2(x),\ldots, f_n(x)]\\&s.t. g_i(x)\le 0(\text{或}\ge 0) i=1,2,\ldots,n\\&h_j(x)=0 j=1,2,\ldots,m\end{aligned} \tag{1}$$

wherein $f_i(x)$ $(i=1,2,\cdots,n)$ is the objective function of online teaching acceptance estimation of university libraries under the epidemic situation, $g_i(x)$ is the inequality constraint condition, and $h_j(x)$ is the correlation statistical constraint condition. This paper introduces the ambiguity detection technology of online teaching characteristics distribution in university libraries under the epidemic situation, and estimates the acceptance of online teaching in university libraries under the epidemic situation. In the process of this research, the deep integration of theory and practice has been realized. The theoretical route is as follows: based on the analysis of online teaching theory and practice at home and abroad, the theoretical basis and logical framework of this research are discussed from the key factors and motivations that affect the evaluation of teaching quality in university libraries [11, 12]. Systematic analysis, from the perspectives of pedagogy, evaluation, school library, and other disciplines, analyzes the conceptual connotation and theoretical support of online teaching quality evaluation in university libraries. The route of empirical research is: understanding the current situation of libraries, combing the development of online teaching quality evaluation of university libraries in China through questionnaires and case studies, and understanding the actual needs of teachers, students and administrators, thus laying a solid empirical foundation for the research. Finally, according to the results of theoretical research and empirical research, through logical analysis, this paper systematically analyzes the online teaching quality evaluation index system of university library courses in China, and probes into its operability [13–15].

Definition 1. The dominating set of online teaching acceptance estimation in university libraries under epidemic situation: the decision variable x^* dominates x in online teaching acceptance estimation in university libraries under epidemic situation: all x, and there is at least one $f_i(x^*)$ $<f_j(x)$, where =1,2, …, n. At this time, the dominating set of autocorrelation fuzzy state of online teaching acceptance estimation in university libraries under epidemic situation satisfies local convergence.

Definition 2. Pareto optimal solution: for the discriminant statistic $X^* \in S$ of online teaching acceptance estimation of university libraries under epidemic situation, if and only if there is a boundary constraint solution $X \in S$, all inequalities are established, where $f_i(X^*) \le f_i(X)$ D in the distribution

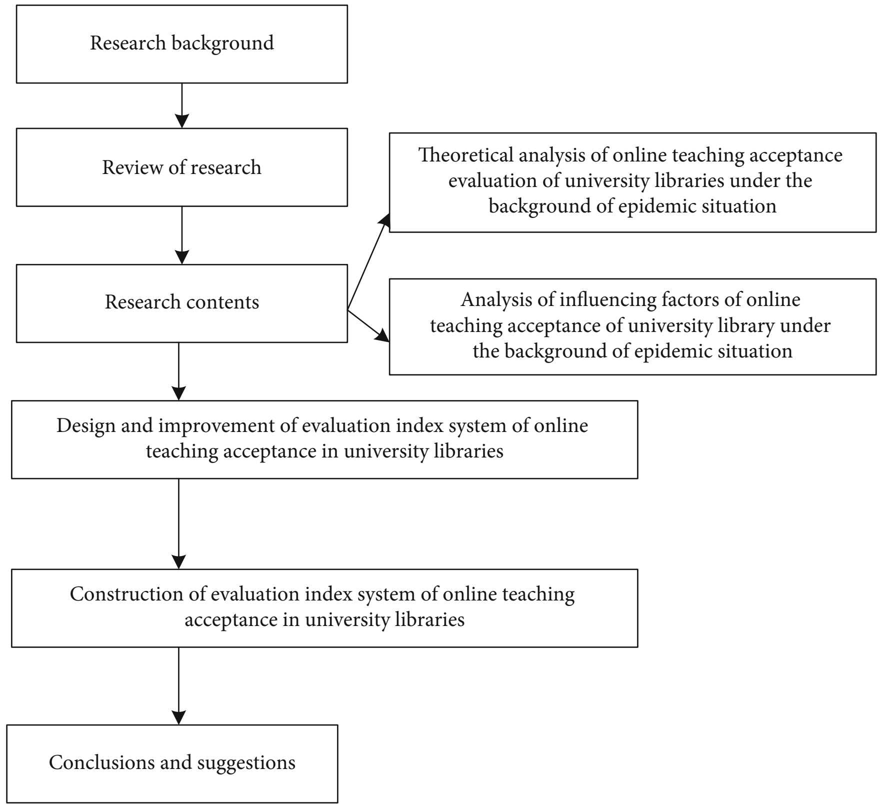

Figure 1: Technology roadmap.

Table 1: First-level indicators of online teaching acceptance evaluation of university libraries under the background of epidemic situation.

Primary index	Serial number
Teachers' accomplishment	Q1
Teaching process	Q2
Curriculum resources	Q3
Course effect	Q4

range of online teaching acceptance of university libraries under epidemic situation, there is an i, This makes the characteristic distribution of online acceptance estimation of university library satisfy the strict inequality $f_i(X^*) < f_i(X)$, and the statistics of online acceptance estimation of university library in epidemic background is a multi-objective optimization problem. By obtaining the Pareto optimal solution of the objective function of online acceptance estimation of university library in epidemic background, the convergence of the estimation model can be satisfied [16, 17].

3. Optimization of Online Acceptance Estimation Model of University Library under Epidemic Situation

3.1. Quantitative Analysis of Online Teaching Acceptance of University Libraries in the Context of Epidemic Situation. Establish a hierarchical analysis structure model based on the evaluation method, evaluation process and evaluation index system, determine the information of various online teaching resources at all levels, and give the constraint function of acceptance estimation [18–20]. Initialize the characteristic parameters of the acceptance estimation, modify the redundant vector set in the conclusion to obtain the optimal constraint index parameter *Pbest*, and determine the ambiguity function of the online teaching acceptance estimation of university libraries under the epidemic situation. The expression is

$$\begin{aligned} V_{ij}(g+1) = V_{ij}(g) + c_1 r_{1ij}(g)\left[Pbest_{ij}(g) - x_{ij}(g)\right] \\ + c_2 r_{2ij}(g)\left[Gbest_j(g) - x_{ij}(g)\right], \end{aligned} \tag{2}$$

wherein $V_{ij}(g)$ is the joint estimation parameter of evaluation index and evaluation function, c_1 is the fitness factor, $r_{1ij}(g)$ is the ambiguity coefficient, $Pbest_{ij}(g)$ is the fitness explanation parameter, $x_{ij}(g)$ is the statistical probability density function, and $Gbest_j(g)$ is the autocorrelation feature distribution set [21]. The learning model of online teaching acceptance estimation of university libraries under epidemic situation is set, and the number of nodes and vector elements k of online teaching acceptance distribution of university libraries under epidemic situation are obtained through fuzzy mathematical model [22, 23]. The autocorrelation feature distribution vector of online teaching

Table 2: Secondary indicators of online teaching acceptance evaluation of university libraries under the epidemic situation.

Index	Serial number	Contribution level	Confidence level	Support degree
Professional teaching ability	QH11	0.534	0.616	0.233
Online teaching ability	QH12	0.687	0.415	0.488
Professional background	QH13	0.479	0.864	0.492
Online teaching attitude	QH14	0.362	0.962	0.328
Teachers' morality and style in online teaching	QH15	0.991	0.344	0.833
Online teaching research level	QH16	0.632	0.006	0.862
Online teaching content	QH17	0.665	0.002	0.842
Online teaching method	QH18	0.961	0.539	0.839
Online teaching mode	QH19	0.135	0.712	0.534
Online teaching management	QH20	0.841	0.266	0.510
Online teaching feedback on campus	QH21	0.800	0.669	0.460
Online teaching resources off campus	QH22	0.201	0.846	0.624
Online teaching sprang from construction.	QH23	0.988	0.322	0.202
Online resource student satisfaction	QH24	0.316	0.940	0.105
Cultivate lifelong learning awareness and ability	QH25	0.543	0.476	0.635
Achievement award	QH26	0.024	0.504	0.222
Examination	QH27	0.980	0.071	0.822

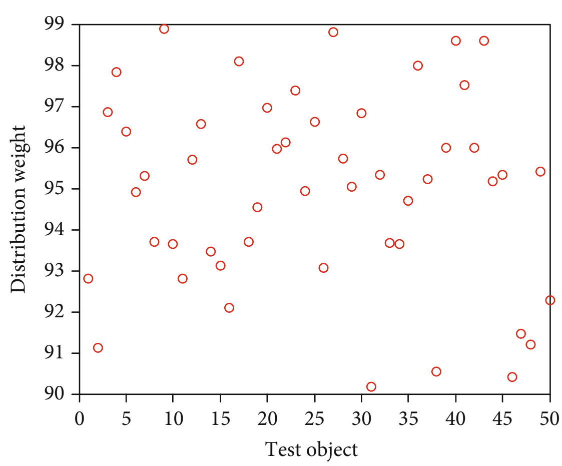

Figure 2: Scatter diagram of primary index distribution.

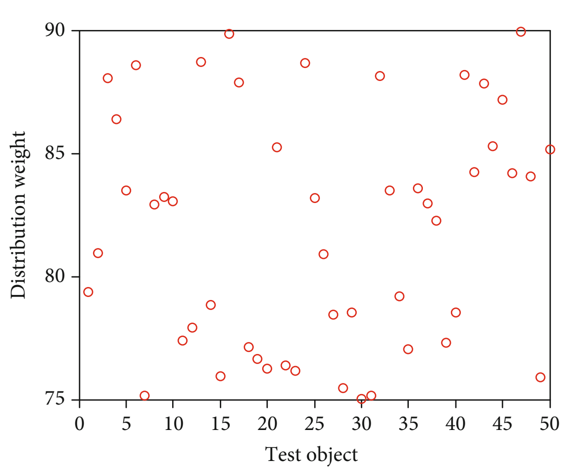

Figure 3: Scatter diagram of secondary index distribution.

acceptance estimation of university libraries under epidemic situation is:

$$x(t) = (x_0(t), x_1(t), \cdots, x_{k-1}(t))^T, \tag{3}$$

wherein $x_0(t), x_1(t), \cdots, x_{k-1}(t)$ is the subsequence of online teaching acceptance evaluation of university libraries. Combining with the association rule mining method, the formal distribution feature set of the association rule mining problem of online teaching acceptance evaluation of university libraries under epidemic situation is given [24, 25], and the weighted vector of online teaching acceptance evaluation of university libraries under epidemic situation is obtained as follows:

$$Gbest_i(g+1) = \arg^{\min}_{Pbest_{ij}} f\left(Pbest_{ij}(g+1)\right), \tag{4}$$

wherein $f(Pbest_{ij}(g+1))$ represents the load balancing scheduling parameter, and g is the association rule item of acceptance evaluation. This paper establishes the constraint parameter model of online teaching acceptance evaluation of university libraries under the epidemic situation.

3.2. Big Data Mining of Online Acceptance Estimation of University Libraries in the Context of Epidemic Situation. To determine the information of online teaching resources at all levels of online teaching in university libraries under the background of the epidemic situation, provide guidance and training in the three parts of early preparation, online classroom and after-school review, analyze the hierarchical structural characteristics of teaching quality, and integrate data standardization [26]. The correlation factors between X_i and X_j in the characteristic distribution of online teaching acceptance of university libraries under the epidemic

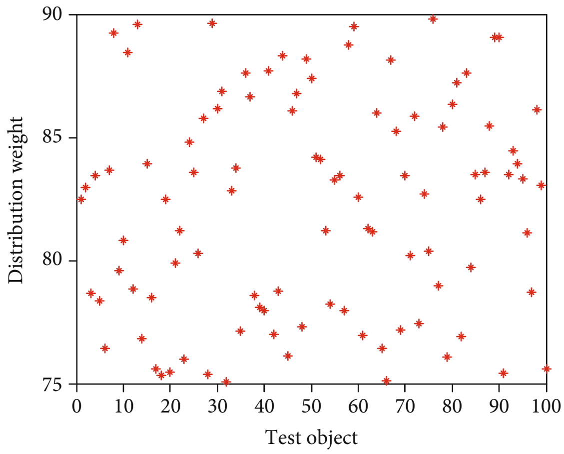

Figure 4: scatter diagram of tertiary index distribution.

Table 3: Estimation and analysis of online teaching acceptance parameters of university libraries under the background of epidemic situation.

Test object	Library practice teaching investment	Practical classroom teaching effect in library	Student satisfaction level	Regression analysis value
QH11	0.176	0.282	0.940	0.176
QH12	0.997	0.762	0.678	0.997
QH13	0.015	0.359	0.227	0.015
QH14	0.261	0.346	0.888	0.261
QH15	0.418	0.454	0.081	0.418
QH16	0.251	0.120	0.991	0.251
QH17	0.637	0.804	0.192	0.637
QH18	0.408	0.631	0.657	0.408
QH19	0.543	0.677	0.595	0.543
QH20	0.876	0.250	0.544	0.876
QH21	0.721	0.309	0.494	0.721

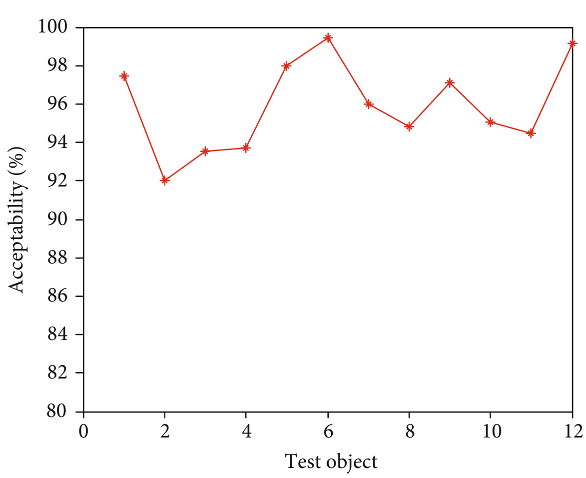

Figure 5: Evaluation results of acceptance of this method.

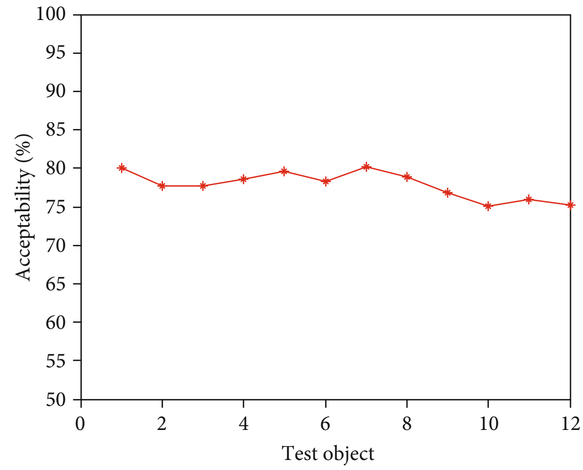

Figure 6: Acceptance evaluation results of principal component analysis.

situation are described as the similarity between the two characteristic quantities of teaching acceptance, expressed as follows:

$$l(X_i, X_j) = \|X_i - X_j\|, \tag{5}$$

wherein X_i and X_j, respectively, represent the statistical time distribution sequence, and the above-mentioned distance similarity level represents the difference degree of online teaching acceptance estimation of university libraries under the epidemic situation. Through local convergence learning, the optimized weight subset $\{W_O\}_{i=1}^{N-m-a}$ and the fuzzy parameter distribution subset of online teaching acceptance estimation of university libraries under the epidemic situation are obtained. Optimizing the distribution structure of online teaching quality in university libraries under the background of post-epidemic situation is expressed as follows:

$$\{W_O\}_{i=1}^{N-m-a} = \left\{ \{x_O^i\}_{i=1}^{N-m-a} \right\}, \tag{6}$$

wherein x_O^i is the optimization characteristic quantity, and $\{x_O^i\}_{i=1}^{N-m-a}$ is the price system, which defines the evaluation range. If $(N_f/N) < \delta$ the sample attribute set of the evaluation index of online teaching quality of university library under epidemic situation is recorded as $w'\Phi(x_i)$ by using big data mining technology. Through collaborative optimization method, the online teaching acceptance of university library under epidemic situation is evaluated by using stochastic simulation and association rule decision method, and the online acceptance evaluation model of university library under epidemic situation is established by combining stochastic simulation dynamic detection and maximum matching analysis method.

$$GD = \frac{\sqrt{\sum_{i=1}^{n} d_i^2}}{n}, \tag{7}$$

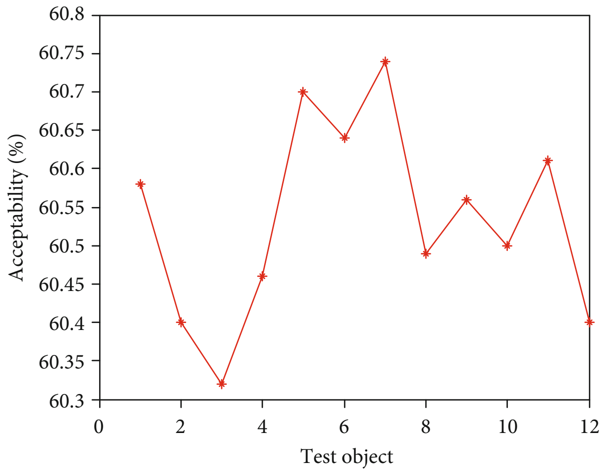

Figure 7: Acceptance evaluation results of autocorrelation matching analysis.

wherein d_i is the evaluation standard adopted by quality evaluators, and n is the dynamic distribution set of acceptance. When $GD = 0$, the convergence formula of online acceptance estimation of university libraries under the epidemic background is expressed as follows:

$$DM = \frac{d_e + d_b + \sum_{i=1}^{n-1} \left| d_i - \sum_{i-1}^{n-1} d_i / n - 1 \right|}{d_e + d_b + (n-1)\left(\sum_{i=1}^{n-1} d_i / n - 1 \right)}, \quad (8)$$

wherein, d_e is the extreme point in the online teaching acceptance distribution set of university libraries under the epidemic situation, and d_b is the edge dynamic optimization function. To sum up, combined with random simulation dynamic detection and maximum matching degree analysis method, the online teaching acceptance of university libraries under the epidemic situation was evaluated.

4. Empirical Analysis

At present, there are many components involved in the course of university library, and the related research results are also extremely rich. Experts and scholars show different perspectives, showing different research needs, so they will have different conclusions and suggestions on this understanding. Some scholars believe that three key elements should be covered in university library courses: teaching objectives, teaching methods and teaching effects. However, the research on the basic elements needs to be closely related to the particularity of the library discipline at first, because the library discipline needs not only theoretical knowledge but also practical training. Therefore, researchers generally believe that besides curriculum objectives, curriculum contents and curriculum resources, sports theory and practice should also be demonstrated. In view of this, the basic elements of university library courses can be classified into the following categories: teacher quality, teaching process, curriculum resources and curriculum effectiveness. The quality of online teaching is bound to be influenced by these four basic elements. The first-level evaluation index system includes four dimensions: online teaching environment, professional background of school education, core team, and teachers, that is, the initial online teaching acceptance evaluation index framework includes four first-level indicators and 18 second-level indicators. See Table 1 for the first-level indicators of online teaching acceptance evaluation of university libraries under the epidemic situation. See Table 2 for the distribution of second-level indicators.

It can be seen from Table 1 that the first level indicators of online teaching acceptance evaluation of university libraries under the epidemic situation are divided into teacher quality, teaching process, course resources, and course effect.

It can be seen from Table 2 that in the secondary index classification, professional teaching ability, online teaching ability, professional background, and online teaching attitude play an important role. According to the setting of the above index parameters, the scatter diagrams of the first level indicators, second level indicators, and third level indicators of online acceptance evaluation of university libraries under the epidemic background are shown in Figures 2–4, respectively.

It can be seen from Figures 2–4 that the distribution of the three grade indicators is scattered in the overall range, and the distribution is relatively uniform. In order to realize the accurate selection of evaluation indexes and construct a scientific index evaluation system, this study uses Delphi method to investigate 20 experts and scholars inside and outside the school, and it is implemented by questionnaire. In terms of questionnaire distribution, it is mainly distributed on the spot, supplemented by mail. Through the preliminary statistical analysis of the questionnaire results, the evaluation index of online teaching quality is preliminarily drawn up. After the first round of expert questionnaire, the statistical results are analyzed, and the first, second, and third-level indicators, which are 4 items, 18 items, and 58 items, respectively, are selected with an average value of ≥ 4.0. Then, the second screening is conducted and combined with expert suggestions; it is more appropriate to change the first-level indicator "curriculum resources" to "teaching resources". Among the four secondary indicators included in the course effect, such as student satisfaction, lifelong library awareness, ability training, and achievement award, there are unreasonable structures, which need to be changed to teaching goal achievement, student satisfaction, ability training, and participation achievement, and the cultivation of lifelong library awareness should be included in the achievement of teaching goal. Under the second-level indicator "online teaching ability", three-level indicators such as "being able to choose an appropriate online teaching platform according to the teaching content", "controlling reasonable exercise load", and "having targeted teaching methods" are added, and under the second-level indicator "student satisfaction", three-level indicators such as "looking forward to attending library classes" and "students' feedback information is better" are added. The third-level index "can accurately explain the technical essentials of movements" is changed to "can accurately explain and demonstrate the essentials of movements", while the third-level index "motivation to participate in the experience" is changed to "actively participate in the experience teaching process". The estimated analysis results of online teaching acceptance parameters of university libraries under the epidemic situation are shown in Table 3, the acceptance evaluation results of the three methods are shown in Figures 5–7, respectively.

It can be seen from table 3 that in the online teaching quality evaluation index system, which is based on university library courses, the first-class indexes and their weight ranking are teaching resources, course effect, teachers' quality, and teaching process. The main reason for this result is that the current online teaching mode has realized the gradual improvement of the teaching quality evaluation standard, and the focus is not only on teaching quality. It also includes the individualized development of students and emphasizes the objective evaluation of the process and results. In the process of specific activities, it cannot only fully display the main status of students but also implement the humanistic thought, pay attention to the development of students' personalities, and cast the concept of lifelong library in this process.

From Figures 5–7, it can be seen that compared with the results of the acceptance evaluation of principal component analysis and the acceptance evaluation of autocorrelation matching analysis, the acceptance of this method is higher because this method provides guidance and training in the three parts of preliminary preparation, online class and after-class review. Through the developmental characteristic analysis of acceptance estimation, To a certain extent, it is beneficial to improve the acceptance by analyzing the hierarchical structure characteristics of online teaching quality of University Libraries under the epidemic situation and integrating the data standardization.

To sum up, the method of this paper constructs the online teaching acceptance model of the university library, realizes the accurate evaluation of the teaching quality, promotes the deep integration between the online teaching theory and practice of the university library, and improves the acceptance level of the online teaching quality.

5. Discussion and Analysis

5.1. Continuously Improve the Remote Service Support Capability. The long-distance service guarantee ability is an important embodiment of the service ability of university library. Off campus remote access to various digital resources is the core demand of teachers and students. Only through preparation in advance, accurate assessment, timely disposal and all-round response can we ensure the solution of remote access needs. Although various university libraries can guarantee the acquisition demand of teachers and students' periodical literature through various ways, the protection of electronic teaching materials and auxiliary resources is still relatively backward. Many universities cannot effectively provide teaching materials and auxiliary books required by online courses. Therefore, the construction of electronic teaching materials and auxiliary libraries is an effective guarantee to ensure the acquisition demand of readers' resources.

5.2. Continuously Improve the Operation Ability of New Media. Compared with the traditional ways for readers to obtain library information (such as face-to-face consultation, web page publicity, e-mail notification, poster posting, etc.), the new media played a great role in the publicity of emergency services during the epidemic. At home, students can get all kinds of notices from the library through the library's wechat official account, wechat group, wechat applet, and microblog. Excellent wechat push can greatly facilitate readers to quickly obtain the information they need and accurately grasp the various services of the library. The librarian can also be on duty online to solve the reader's consultation problems in real time through wechat. At present, the wechat tweets of many university libraries need to be strengthened in terms of content. Not only should the themes be more diverse, and a certain type of wechat tweets can be pushed into a fixed brand, but also special personnel should be arranged to be responsible for the operation of new media, further strengthen the personnel team and technical ability, and form a stable and efficient operation and maintenance team.

5.3. Continuously Strengthen Cooperation with Other Units. "Unity, cooperation and coordination" is another feature of library services during the epidemic. In addition to cooperating with other departments in the school in terms of policy, technology, and application, the library also needs to cooperate with the database providers outside the school to obtain the dynamic resources in a timely manner and ensure the stable and orderly use of resources through technical means. Collaborative cooperation can increase the influence of libraries, expand the scope of services, and is conducive to the sharing of resources and collaborative development. In the future, major university libraries need to further develop ideas, fully mobilize the advantages and resources of other departments, and connect relevant resources and services through information service technology. Only in this way can they help each other overcome difficulties in emergency services and provide services that satisfy readers.

6. Conclusions

With the rapid development of China's economy, education is also developing rapidly. The teaching concept has been greatly changed, which has led to the subversive change of teaching activities. Teachers are no longer the dominant role, and students are more and more prominent in them. At the level of innovation and development of the teaching evaluation system, the proportion of student evaluation is getting higher and higher. This is consistent with quality education and can fully implement the humanistic teaching concept. This paper puts forward the construction of online teaching acceptance model of university library under the background of epidemic situation and draws the following conclusions through research:

(i) in the current indicator system, the online teaching mode, online teaching feedback, in school online teaching resources and out of school online teaching resources with the secondary indicator weight of more than 0.20

(ii) compared with other methods, the method of constructing the online teaching acceptance model of university library in this paper has a higher acceptance under the background of epidemic situation

(iii) the construction of online teaching acceptance model in university library is of great significance

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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Retraction

Retracted: Evaluation of Multimedia Courseware-Assisted Teaching Effect of Medical Images Based on the Deep Learning Algorithm

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Y. Chen and X. Zhang, "Evaluation of Multimedia Courseware-Assisted Teaching Effect of Medical Images Based on the Deep Learning Algorithm," *Journal of Environmental and Public Health*, vol. 2022, Article ID 5991087, 9 pages, 2022.

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Hindawi

Research Article

Evaluation of Multimedia Courseware-Assisted Teaching Effect of Medical Images Based on the Deep Learning Algorithm

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In order to improve the dynamic evaluation ability of medical image multimedia courseware-assisted teaching effect, the evaluation of medical image multimedia courseware-assisted teaching effect based on a deep learning algorithm is proposed. The statistical data analysis model of medical image multimedia courseware-assisted teaching effect is established to estimate its utilization rate and scale parameters. Based on the prediction of spatial attribute parameters, the classification big data mining model of medical image multimedia courseware-assisted teaching is constructed by using the deep learning algorithm, mining association rules and frequent item sets that can dynamically reflect the quality of medical image multimedia courseware-assisted teaching, and extracting the statistical feature of the dataset of constraint indicators of medical image multimedia courseware-assisted teaching effect to improve the teaching quality of medical imaging course. The simulation results show that this method has a better precision delivery effect, higher dynamic matching degree of teaching evaluation parameters, more than 90% reliability, and better clustering of statistical eigenvalues.

1. Introduction

Through the evaluation of the effect of medical image multimedia courseware-assisted teaching, combined with the analysis of the use characteristics of medical image multimedia courseware-assisted teaching, it is necessary to evaluate the effect of medical image multimedia courseware-assisted teaching under the multisource information resource as a service (miraas) mode so as to improve the intelligent service level of medical image multimedia courseware-assisted teaching [1, 2].

The research on the evaluation of the effect of medical image multimedia courseware-assisted instruction is realized by analyzing the utilization state characteristics of medical image multimedia courseware-assisted instruction [3, 4] and analyzing the data quantification index parameters. In the traditional methods, the attribute parameter analysis of the auxiliary teaching evaluation of medical image multimedia courseware is realized through coordinate convolution information fusion and remote sensing resolution control [5]. Currently, the multimedia resource management method of medical image multimedia courseware auxiliary teaching based on statistical feature extraction [6] is adopted to establish a data classification detection model to realize the auxiliary teaching effect evaluation of medical image multimedia courseware. However, the fusion degree and sharing level of traditional methods for medical image multimedia courseware-assisted teaching effect evaluation are not high. Through multisource remote sensing parameter analysis, combined with high-standard medical image multimedia courseware-assisted teaching construction feature parameter fusion, the medical image multimedia courseware-assisted teaching effect evaluation is realized. However, the traditional methods have low evaluation accuracy and large calculation cost.

In view of the above problems, this paper proposes an evaluation method of medical image multimedia courseware assistant teaching effect based on the deep learning algorithm. It shows the superiority of this method in improving the evaluation ability of medical image multimedia courseware. Finally, the simulation test analysis shows the superiority of this method in improving the teaching effect of medical image multimedia courseware.

2. Deep Learning Algorithm Theory

Deep learning is to learn the inherent rules and representation levels of sample data. The information obtained in the learning process is of great help to the interpretation of data such as words, images, and sounds [7, 8]. The ultimate goal of deep learning is to enable machines to have analytical learning ability like people and to recognize data such as words, images, and sounds. Deep learning is a complex machine learning algorithm, and its effect on speech and image recognition is far superior to the previously related technologies. Deep learning has made many achievements in search technology, data mining, machine learning, machine translation, natural language processing, multimedia learning, voice, recommendation, personalization technology, and other related fields [9, 10]. Deep learning has made great achievements in search technology, data mining, machine learning, machine translation, natural language processing, multimedia learning, and other related fields. Deep learning is a general term for a class of pattern analysis methods. As far as the specific research content is concerned, it mainly involves three kinds of methods: convolutional neural network, sparse coding, and deep confidence network [11, 12]. After the initial "low-level" feature representation is gradually transformed into a "high-level" feature representation through multilevel processing, complex learning tasks such as classification can be completed with a "simple model". Therefore, deep learning can be understood as "feature learning" or "representation learning." Deep learning is a kind of machine learning, and machine learning is the only way to realize artificial intelligence. The concept of deep learning originates from the research of artificial neural networks, and the multilayer perceptron with multiple hidden layers is a deep learning structure. Deep learning forms more abstract high-level representation attribute categories or features by combining low-level features to discover distributed feature representations of data. The calculation involved in deep learning to generate an output from an input can be represented by a flow chart. The depth of the structure usually has 3, 6, or even 10 layers of hidden nodes, as shown in Figure 1.

Each node in the deep learning model represents a basic calculation and a calculated value, and the calculated result is applied to the values of the child nodes of this node. We consider a computational set, which can be allowed in every node and possible graph structure, and define a family of functions. The input node has no parent node, and the output node has no child nodes. Through layer-by-layer feature transformation, the feature representation of the sample in the original space is transformed into a new feature space, thus making classification or prediction easier. Compared with the method of constructing features by artificial rules, using big data to learn features can better depict the rich internal information of data.

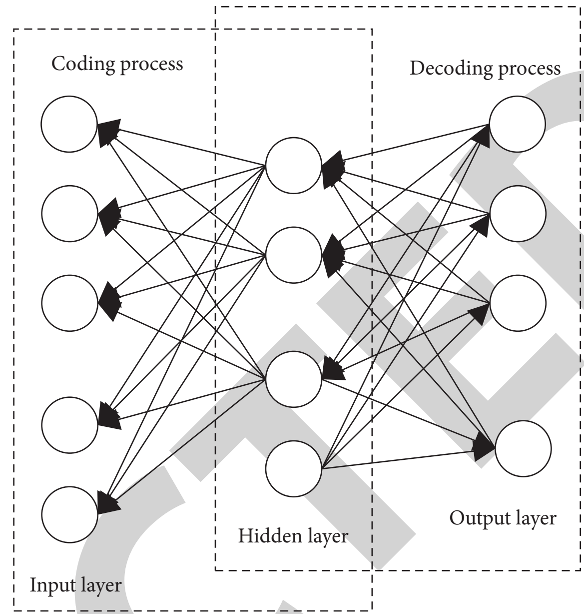

Figure 1: Deep learning model with multiple hidden layers.

3. Overall Structure Design and Modular Analysis of Medical Multimedia Courseware-Aided Teaching Effect Evaluation System

3.1. Overall Framework. The networked control technology of the Internet of things is used to realize the networked control of the process of medical image multimedia courseware-assisted teaching effect evaluation. The constructed medical image multimedia courseware-assisted teaching effect evaluation system includes an information collection module, a data analysis module, and a resource scheduling module. The data bus development platform of the medical image multimedia courseware-assisted teaching effect evaluation system is established. The utilization rate and scale parameters of the medical image multimedia courseware-assisted teaching effect are estimated [13, 14]. The standard IEEE interface protocol is adopted to realize the component management, data management, and report management of resource information of the medical image multimedia courseware-assisted teaching effect evaluation system. The medical image multimedia courseware is the standardized content of the auxiliary teaching system, so it has the following characteristics:

(1) The design of medical image multimedia courseware-aided teaching system is to apply the system method to study and explore the essential relationship between each element in the teaching and learning system and between the element and the whole and comprehensively consider and coordinate their relations in the design so that each element can be organically combined to complete the function of the teaching system. If we do not consider the

various elements that affect the implementation of the solution and the relationship between them, the designed solution will not achieve its expected goals.

(2) The research object of teaching system design is the system of learning and teaching at different levels. This system includes the contents, conditions, resources, methods, and activities to promote students' learning. The process of teaching system design is the process of making specific plans for these elements that affect the teaching effect.

(3) The purpose of teaching system design is to transform the principles and methods of basic theories such as learning theory and teaching theory into solutions to practical teaching problems. It is to creatively solve problems in teaching by using known teaching laws. The results or products of teaching system design are verified teaching system implementation plans that can achieve the expected functions, including teaching objectives, teaching activities, and implementation plans required to achieve certain teaching objectives and relevant supporting materials.

Based on the principles of intensive construction, coconstruction and sharing, overall planning and promotion, the evaluation system of medical image multimedia courseware-assisted teaching effect is constructed. The overall structure of the system is shown in Figure 2.

The web framework system is adopted to evaluate and optimize the effect of medical image multimedia courseware-assisted teaching under multimedia technology. The image teaching is the main content, the advanced client-server system is selected, the switching fast Ethernet technology and the relevant supporting network equipment are applied, and the star topology structure and integrated wiring technology are adopted to realize the automatic control of the evaluation of medical image multimedia courseware-assisted teaching effect, The network design of the system is shown in Figure 3.

3.2. Statistical Dataset of Medical Multimedia Courseware-Assisted Teaching Effect. In order to evaluate the teaching effect of medical image multimedia courseware based on the deep learning algorithm, first, a statistical data analysis model of medical image multimedia courseware teaching effect is established by using the multidimensional spatial hierarchical depth information mining method. Combined with spatial resolution parameter analysis, the image data feature detection method and the pixel division method are adopted to analyze the object model of medical image multimedia courseware teaching effect [15]. Then, we establish the spatial detail level parameter analysis model of medical image multimedia courseware-assisted teaching effect, build the database platform of medical image multimedia courseware-assisted teaching effect evaluation system through the parameter analysis of the spatial statistics model, and realize the bus transmission control of medical image multimedia courseware-assisted teaching effect evaluation system by using uniform resource locator SIP. Based on ORACLE, MYSQL, and other professional database processing tools, the information visualization reconstruction of the medical image multimedia courseware-assisted teaching effect evaluation system is realized, and we get the multilayer interactive functional component realization process of the system as shown in Figure 4.

According to the component design of Figure 4, the development platform of the medical image multimedia courseware-assisted teaching effect evaluation system is established in an embedded ARM environment [16], and the bottom control module of the medical image multimedia courseware-assisted teaching effect evaluation system adopts the integrated information interactive control method to construct the big data statistical data set of medical image multimedia courseware-assisted teaching effect evaluation, as shown in Table 1.

4. Evaluation and Optimization of Multimedia Courseware-Assisted Teaching Effect of Medical Images

4.1. Analysis of Constraint Characteristics of Medical Imaging Multimedia Courseware-Assisted Teaching Effect Evaluation. Based on the prediction of spatial attribute parameters, the classification big data mining model of medical image multimedia courseware-assisted teaching is constructed by using the deep learning algorithm with constraint index parameters such as courseware design appreciation, multimedia courseware theory, diversity of teaching methods, and discipline construction requirements, and the association rules and frequent item sets that can dynamically reflect the quality of medical image multimedia courseware-assisted teaching are mined [17, 18]. According to the spatial characteristics and attribute characteristics of medical image multimedia courseware-assisted teaching distribution, the statistical data analysis model of medical image multimedia courseware-assisted teaching effect is established, and the utilization rate of medical image multimedia courseware-assisted teaching effect is obtained based on spatial statistical analysis. The statistical dataset of medical image multimedia courseware-assisted teaching effect can be represented as

$$\Omega = \left\{ \begin{array}{ll} \vec{x} \in s | g_j(\vec{x}) \leq 0, & j = 1, \ldots, l; \\ h_j((\vec{x}) = 0, & j = l+1, \ldots, p \end{array} \right\}. \tag{1}$$

In formula (1), $\vec{x}$ represents the feature distribution set traversed by the global image, and s represents the comprehensive semivariance distribution neighborhood. $g_j(\vec{x})$ represents the statistical sample information of the j quantitative evaluation point, l represents the characteristic value of the attribute space control variable, $h_j(\vec{x})$ represents the best attribute parameter jump value, and p is the local variance of the multimedia image. Based on the constraint index parameters such as courseware design appreciation, multimedia courseware theory, diversity of teaching methods, and discipline construction requirements, a threshold analysis model of medical image

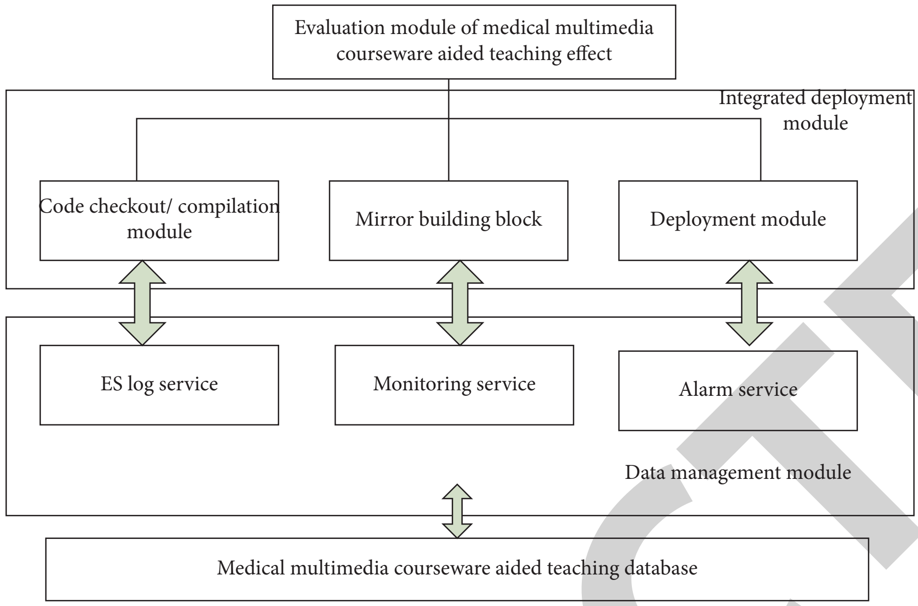

Figure 2: Overall system architecture.

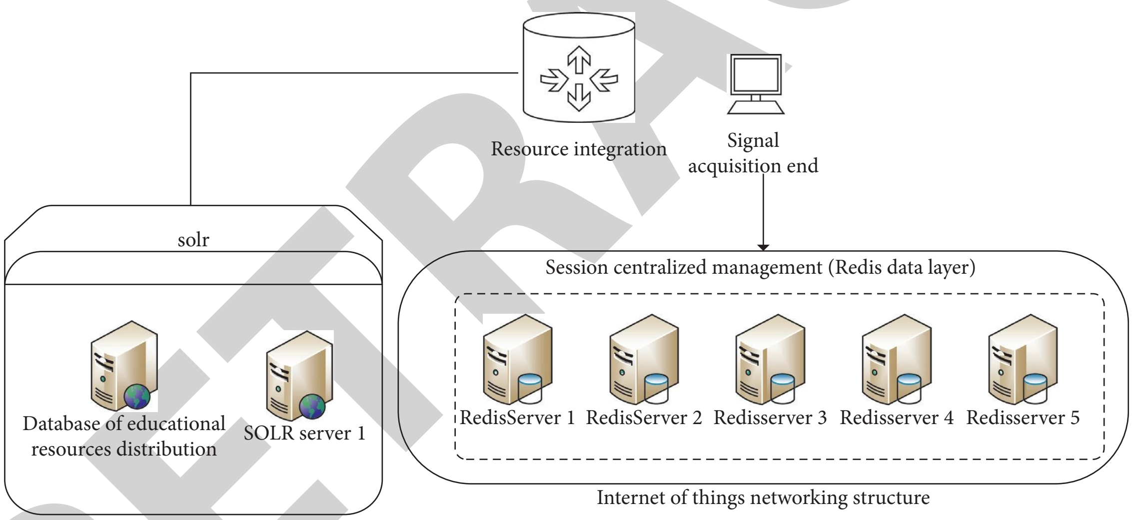

Figure 3: Network design of the system.

multimedia courseware-assisted teaching is established by using image regional feature analysis [19, 20]. The difference factor under the constraint of the optimal utilization ratio of multimedia courseware for medical images is obtained. Through nonspatial data fusion cluster analysis and comprehensive semivariance feature estimation, the analytical model of optimal spatial attribute parameters is established, which improves the reliability of the evaluation of multimedia courseware for medical images [21, 22]. A feature matching model of medical image multimedia courseware-assisted teaching resource management is established, and the statistical feature quantity of medical image multimedia courseware-assisted teaching effect evaluation is obtained as follows:

$$Q = \frac{C_1 \sum_{i=1}^{k} \exp\left[-S_2 \left(V_i - \mu\right)^2\right]}{1 + \exp\left[-S_1 \sum_{i=1}^{k} w_i \left(T_i - V_i\right)\right]} + \frac{y_j^T S_b y_j}{\lambda_j}. \tag{2}$$

In formula (2), C_1 and S_1 are all multimedia feature classification sets of medical image multimedia courseware-assisted teaching resources management. Through subspace clustering, medical image multimedia courseware-assisted teaching resources are fused. The parameter constraint model is [0, 0.43, 0.15, 0.64, and 1], which indicates the recommendation degree of medical image multimedia courseware-assisted teaching information resources, and the semantic similarity is obtained as follows:

$$Z_2 = \sum_{w \in W} \widehat{q}^{w} \left(p_I - \gamma \widehat{\theta} - Kr\right). \tag{3}$$

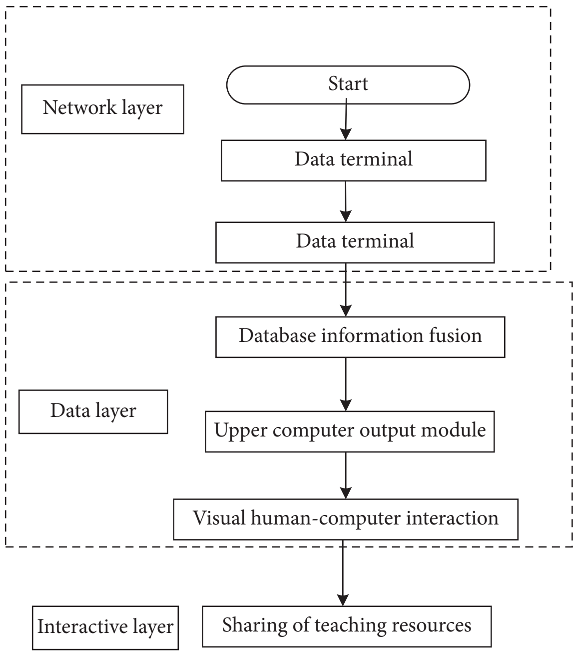

FIGURE 4: Implementation process of functional components of multilayer interaction.

TABLE 1: Big data statistical data set of medical imaging multimedia courseware-assisted teaching effect evaluation.

Sample group of medical multimedia courseware resources	Test sample sequence	Model parameter	Constraint factor
Test set 1	8560	5.409	0.922
Test set 2	5985	6.293	0.869
Test set 3	7999	2.964	0.629
Test set 4	3497	2.192	0.757
Test set 5	6983	1.455	0.697
Test set 6	4110	5.438	0.352
Test set 7	5484	8.611	0.015
Test set 8	5560	7.216	0.328
Test set 9	8902	1.212	0.260
Test set 10	3795	1.744	0.836
Test set 11	5374	6.497	0.737
Test set 12	9051	6.460	0.948
Test set 13	2425	4.410	0.718
Test set 14	6376	9.822	0.714

In formula (3), $\widehat{\theta}$ indicates the global equilibrium degree of medical image multimedia courseware-assisted teaching effect evaluation; α is a constant, and $\widehat{\theta}$ indicates the fuzziness of medical image multimedia courseware-assisted teaching resources. Based on the prediction of spatial attribute parameters, the classification big data mining model of medical image multimedia courseware-assisted teaching is constructed by using a deep learning algorithm, and the association rules and frequent item sets that can dynamically reflect the quality of medical image multimedia courseware-assisted teaching are mined so as to realize the quality detection of medical image multimedia courseware-assisted teaching [23].

4.2. Quantitative Evaluation of Medical Multimedia Courseware-Assisted Teaching Effect. Based on the method of spatial and attribute parameter prediction, a dynamic constraint parameter model of medical image multimedia courseware-assisted teaching effect evaluation is established. Combined with subspace fusion cluster analysis, the maximum tree bifurcation method is adopted to conduct data-driven and segmentation scale adaptive estimation in the process of medical image multimedia courseware-assisted teaching effect evaluation. According to the spatial characteristics and attribute characteristics, the estimated construction effect of medical image multimedia courseware-assisted teaching is obtained, $A = \{a_1, a_2, \ldots, a_n\}$ and $b = \{b_1, b_2, \ldots, b_m\}$. According to the above, the standard function of the teaching constraint index parameter is obtained as follows:

$$\begin{cases} \dot{x} = -\sigma x + \sigma y, \\ \dot{y} = -xz + rx - y, \\ \dot{z} = xy - bz. \end{cases} \tag{4}$$

In formula (4), x represents the lateral component of the constraint index parameters of medical image multimedia courseware, Y represents the central component of the constraint index parameters of medical image multimedia courseware, Z represents the three-dimensional characteristic quantity of the constraint index parameters of medical image multimedia courseware, and σ represents the fuzzy membership parameter. Based on the machine learning algorithm, data from multiple data sources are merged together to obtain the grouping detection model as follows:

$$d_i = \sqrt{x_i^2 + y_i^2 + z_i^2}. \tag{5}$$

In formula (5), x_i is the integration parameter of the i-th medical image multimedia courseware-assisted teaching distribution block, y_i is the auto-correlation characteristic matching coefficient of medical image multimedia courseware-assisted teaching, and z_i^2 is the fuzzy dynamic detection parameter. The entropy evaluation model of medical image multimedia courseware-assisted teaching effect evaluation is established, and the maximum information entropy distribution is as follows:

$$E_{\text{Snake}} = \sum_{0}^{N-1} \left[E_{\text{int}}(vi) + E_{ext}(vi) \right]. \tag{6}$$

In formula (6), $E_{\text{int}}(\text{vi})$ represents the self-adaptive estimation parameter value of multimedia courseware-assisted teaching effect construction of medical images, $E_{\text{ext}}(\text{vi})$ represents the local equation of multimedia courseware-assisted teaching images of medical images, and N represents the sample number of segmented patches. By using the method of fuzzy information fusion, the fuzzy clustering function of multimedia courseware-assisted teaching effect evaluation of medical images is expressed as follows:

$$\min \overrightarrow{y} = \overrightarrow{f}((\overrightarrow{x}) = (f_1(\overrightarrow{x}), f_2(\overrightarrow{x}), \ldots, f_m(\overrightarrow{x})). \tag{7}$$

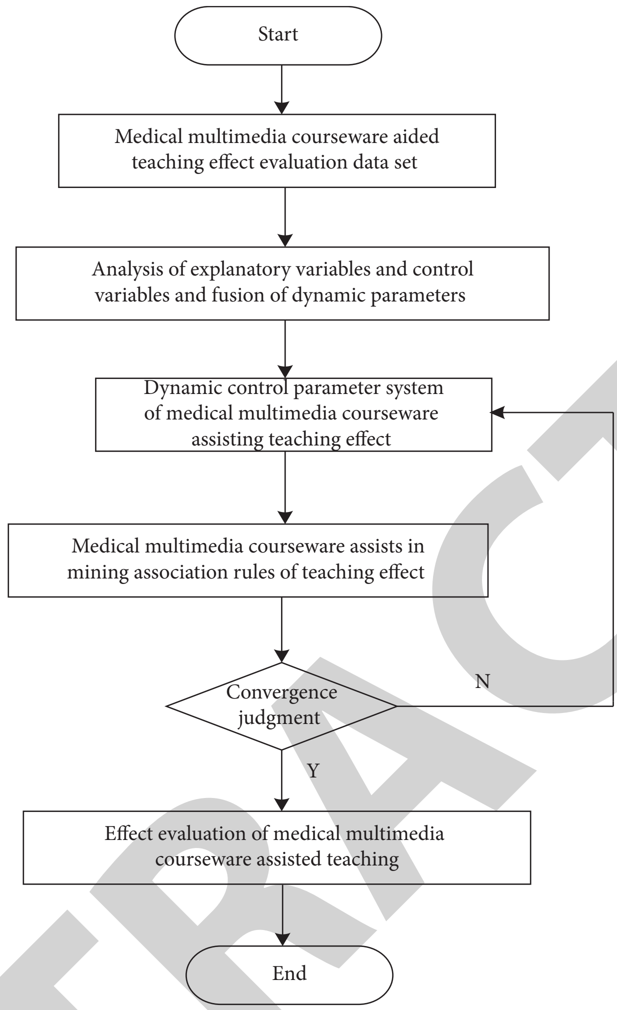

Figure 5: Implementation process of the improved algorithm.

In formula (7), $\overrightarrow{x} = (x_1, x_2, \ldots, x_n) \in X \subset \mathfrak{R}^n$ represents the abnormal error of elevation; X represents the level residual error of the utilization efficiency of multimedia courseware for medical images; $\overrightarrow{y} \in Y \subset \mathfrak{R}^m$ is the characteristic component representing the abnormal difference of medical image; Y represents the frequency quantization characteristic parameter value. Then, we calculate the variation function value of the medical image multimedia courseware-assisted teaching subblock, extract the statistical feature quantity of the medical image multimedia courseware-assisted teaching effect constraint index dataset by inverse feature analysis, and get the clustering model of medical image multimedia courseware-assisted teaching effect evaluation by fuzzy clustering maximum tree algorithm analysis. Under the optimized control rules, we establish the sparse scattered point parameter fusion model of medical image multimedia courseware-assisted teaching constraint index parameters, combining the analysis of generalized association rules and periodic association rules to realize the item set analysis of medical image multimedia courseware, and the statistical characteristic quantity of dynamic evaluation effectiveness is as follows:

$$E\left[N_{kl}^{*} N_{nm}\right] = \sigma^2 \delta_{\mathrm{km}} \delta_{\mathrm{ln}}. \tag{8}$$

In formula (8), σ is the root mean square error of minimum support, $\delta_{\mathrm{km}}$is the regression steady-state parameter of medical image multimedia courseware aided teaching evaluation, and it is the joint detection probability density. The transaction database is transformed into a transaction matrix, and the fuzzy retrieval and information clustering analysis of constraint index parameters of medical image multimedia courseware are carried out through the feature extraction results [24, 25]. To sum up, the adaptive improved machine learning model is adopted to realize the classified guidance and teaching evaluation of medical imaging multimedia courseware [26, 27]. The implementation process is shown in Figure 5.

According to Figure 5, after inputting the dataset of medical image multimedia courseware auxiliary teaching effect evaluation, the medical image multimedia courseware auxiliary teaching effect is finally obtained through convergence judgment, and the final evaluation result is output to complete the research of medical image multimedia

Table 2: Descriptive statistical analysis results of explanatory variables.

Explanatory variable	Equivocation	Value factor	Correlation	Statistical characteristic quantity
Rationality of course content design	0.039	0.159	0.336	0.8404
Classroom atmosphere	0.383	0.149	0.579	0.9557
Diversity of teaching methods	0.424	0.452	0.916	0.6674
Subject theoretical permeability	0.201	0.890	0.528	0.1089
Efficiency of classroom teaching feedback	0.438	0.651	0.655	0.2740

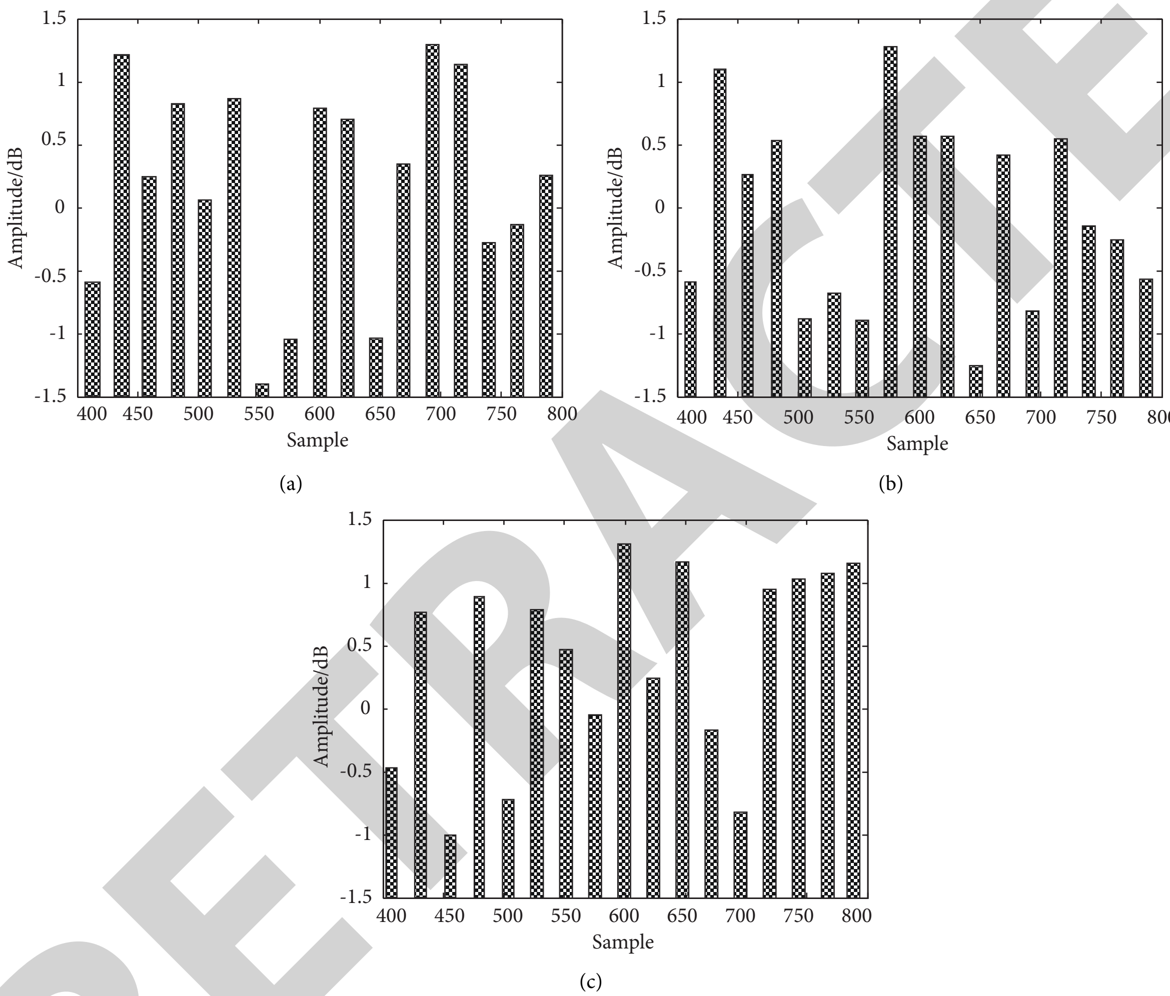

Figure 6: Time-domain distribution of constraint index parameters of medical image multimedia courseware-assisted teaching effect evaluation. (a) Test sample. (b) Training sample. (c) Statistical sequence sample of medical image multimedia courseware effect evaluation.

courseware auxiliary teaching effect evaluation based on the deep learning algorithm.

5. Simulation Test

In order to verify the classification guidance and teaching evaluation of medical image multimedia courseware, this paper analyzes and tests the parameters of medical image multimedia courseware with SPSS 22.0 Chinese version statistical analysis software and MATLAB simulation tools. First, the minimum confidence of medical image multimedia courseware classification is set at 43%, and the sample sequence size is 2400, and the rationality of course content design, classroom atmosphere, diversity of teaching methods, penetration of subject theory, and feedback benefit of classroom teaching are taken as explanatory variables. Table 2 shows the distribution of descriptive statistical analysis results of explanatory variables.

The low point of constraint dynamic frequency of medical multimedia courseware is 54 Hz, the sampling rate of association rules is 26 kHz, and the length of classification data of medical multimedia courseware is 12,000 cm. Thus, the distribution of big data statistical characteristics of medical multimedia courseware is shown in Figure 6.

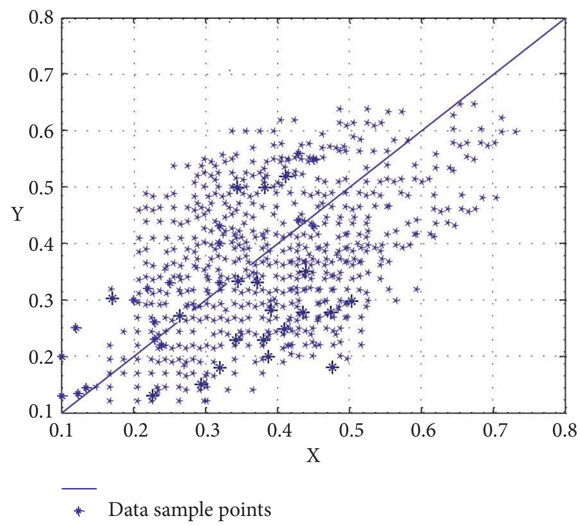

FIGURE 7: Cluster output of multimedia courseware of medical images for assisting teaching evaluation.

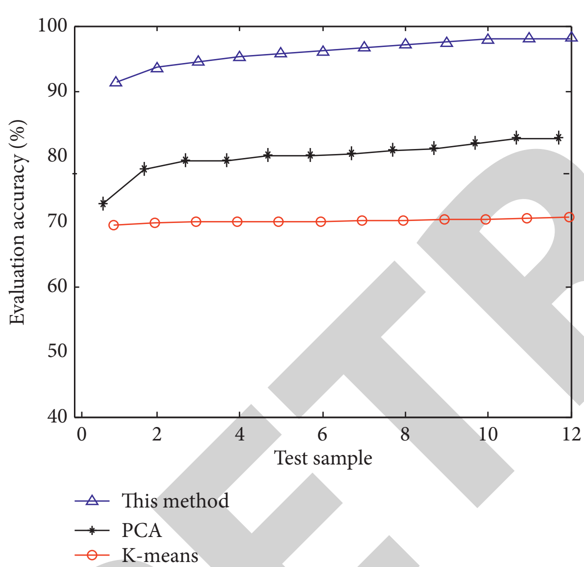

FIGURE 8: Comparative test of evaluation reliability.

Taking the data of Figure 7 as the research object, the multimedia courseware of medical images is used to assist in teaching and data clustering, and the output is shown in Figure 7.

According to the analysis of Figure 7, this method can effectively realize the dynamic evaluation of multimedia courseware for medical images, improve the clustering performance of constraint index parameters of multimedia courseware for medical images, and test the storage cost after the evaluation of talent cultivation quality, as shown in Figure 8.

According to the analysis of Figure 8, the method in this paper compares the reliability of medical image multimedia courseware-assisted teaching evaluation, and the reliability results are all above 90%, with good performance.

6. Conclusions

This paper presents a method of evaluating the effect of medical image multimedia courseware based on the deep learning algorithm to realize the quantitative evaluation of the teaching effect of medical image multimedia courseware and to improve the teaching quality of medical image courses. The simulation test shows the superior performance of this method in improving the evaluation ability of medical image multimedia courseware-assisted teaching, which is shown in the following aspects:

(1) This method has important significance in improving the quality of medical image multimedia courseware-assisted teaching

(2) The effect evaluation of medical image multimedia courseware based on the deep learning algorithm can achieve effective clustering output

(3) In this paper, the reliability of medical image multimedia courseware-assisted teaching evaluation was compared, and the results were above 90%

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

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Research Article

Application of Big Data Technology and Visual Neural Network in Emotional Expression Analysis of Oil Painting Theme Creation in Public Environment

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With the progress of science and technology and the arrival of the big data era, people increasingly rely on computers to deal with daily life and related affairs. In recent years, machine learning has become more and more popular and has achieved good results in some fields, which also makes machine learning widely used. Among them, visual neural network technology can more intelligently analyze the emotional expression of oil painting, which is one of the current research hotspots, involving machine vision, pattern recognition, image processing, artificial intelligence, and other fields. However, in the art field, oil painting is still very different from other images. At present, there is no deep learning algorithm to identify the application of emotional expression analysis in oil painting theme creation. This paper will start with the neural network algorithm and combine the big data recognition technology to analyze the emotional expression of the oil painting subject in the public environment and establish the emotional expression analysis model of oil painting creation based on big data and neural network. The experiment shows that the graphics synthesized by this model have high resolution and good definition, but the speed is slow in the process of experimental operation. It takes about one hour to complete a round of image optimization.

1. Introduction

With the rapid economic development of the times, people gradually pursue spiritual culture. In this new era, public art plays a role in improving people's spiritual culture and beautifying the city. As an art culture with a long history, oil painting is not only a way to improve the beautification of urban public environment but also the most effective way to spread culture. Since ancient times, artistic creation has always been a skill that human beings rely on. Excellent paintings reflect human imagination and creativity.

Oil painting originated in Europe in the 15th century and was invented by the Dutch. With the hiding power and transparency of pigments, it can fully express the painted objects, with rich colors and strong three-dimensional texture. For more than 500 years, oil painting has been favored by painters, especially Mona Lisa, the last judgment, Adam and Eve, and other works. Oil painting is a form of painting in which linseed oil, walnut oil, poppy oil, and other quick drying oils, as well as treated Matty resin or Dame resin, are mixed with various color powders to make oil paint and media, and painted on linen, wood, or cardboard. But the algorithm used in the process of painting has always been regarded as a black box model. As for people, painting has always been regarded as a talent. Oil painting requires not only complicated material preparation but also a solid painting foundation. For ordinary people, it is very difficult to complete a professional oil painting. People use computers to convert pictures into different styles. Professional image processing software such as Photoshop can render and adjust the color and curve of photos and render photos into oil painting style, but computers cannot independently create paintings of any style. Recently, the PRISMA laboratory development team from Moscow, Russia, developed a photo editor PRISMA, which combines ordinary photos with the styles of many oil painting artists' works through image stylization and turns them into an oil painting art photo with high perception, beautification, multistyle, etc.

Three scientists from the German Research Canter [1] for integrated neuroscience and theoretical physics published the latest research paper saying that computers can imitate world-famous painters to create oil paintings in 2015. The algorithm proposed by them simulates the processing method of human vision. The first step of creation is to have the feelings you want to express and have a strong desire to act. This is a very important step in the process of creation. How to produce the emotion you want to express? Some situations that we have experienced and felt personally or images that only exist in our minds can make us produce the emotions we want to express. It may be joyful or sad, soft or intense, which will inject emotion and soul into our works [2, 3].

Although the artistic neural network algorithm proposed by German scientists can enable computers to create exquisite works of art, the drawback is that it is a great test for both the computing speed and memory capacity of computers, generating a 512×512-pixel painting; in the case of CPU calculation, the calculation time is in hours, which requires at least 16 g of memory. In the case of CPU calculation, the calculation time is in minutes, which requires about 4 GB of video memory. Johnson et al. [4] of Stanford University made improvements to the algorithm, generating pictures and can shift videos style in 2016.

In recent years, machine learning has become more and more popular, especially deep learning has achieved good results in some fields, which also makes deep learning widely used. Deep learning is a branch of machine learning, which combines low-level features to form more abstract high-level features and simulates the mechanism of human brain to interpret data information. Deep learning can achieve good recognition rate in natural scenes, handwriting fonts, face recognition, and Imagenet image database. However, in the art field, there are great differences between artificial oil painting and image graphics in other fields [5]. At present, there is no deep learning algorithm to analyze the emotional expression in oil painting theme creation. Convolutional neural network is a kind of artificial neural network. Due to the use of local convolution and weight sharing, the number of weights can be greatly reduced, thus reducing the complexity of the entire network and improving the operation efficiency. Therefore, convolutional neural network has become a research hotspot of deep learning. Lee and others [6]improved the algorithm by additionally notifying texture transfer with edge direction information. Because only low-level image features at pixel level are used, these algorithms have great limitations in flexibility, effectiveness, diversity, and so on, so the universality of these algorithms is not strong. Despite these methods, and for specific task objectives, a large number of manual parameters are often required.

The historical inevitability of the application of contemporary emotional expression in oil painting creation adapts to and shows the state of personalized development, which is of great significance to the oil painting creation of future artists. At the same time, it also encourages painting creators to pursue their own emotional expression, give full play to their personal style, and respect the diversity of cultural development. This paper discusses the application of big data technology and visual neural network in the emotional expression analysis of oil painting theme creation in the public environment. The innovative application of these two methods realizes the logic part of TensorFlow framework, better determines the skills of creating oil paintings based on emotional expression, and contributes to better artistic creation. It also introduces the application of convolutional neural network in oil painting stylization and shows how to use the characteristics of high-performance convolutional neural network to transfer image styles between images.

2. Neural Network and Big Data Technology

2.1. Neural Networks and Deep Learning. Hinton published an article that opened the tide of in-depth learning in academia and industry in the 2006 Academic Journal Science. It is a widely parallel connected network composed of adaptive neurons. Its organization can simulate the response of biological neural system to real-world objects [7]. Neural network is the intersection of machine learning and biological science. It is a widely parallel connected network composed of adaptive neurons. Its organization can simulate the response of biological neural system to real world objects. The neuron model has laid the foundation for the development of neural network model. Figure 1 shows the earliest and simplest "M-P neuron model."

The weight of M-P network is fixed. For excitatory synapses, the weight is 1; for inhibitory synapses, the weight is -1. In the sequence of signal fault events, when a signal is in the conditional state of 1 to support the occurrence of fault events, the signal connection is excitable; on the contrary, if the state of 1 negates the occurrence of the fault event, the connection is inhibitive. In addition, the input and output of the network are binary variables, and the response function is a step function. Although M-P model is simple, it reflects the main characteristics of biological neurons and can complete any finite logical operations. Common activation functions include sigmoid function, tanh function, and ReLu function. The function diagram of three activation functions is shown in Figure 2.

2.2. Convolutional Neural Network. Convolutional neural networks have been studied for nearly 50 years, from the concept of receptive field in biological research in the 1960s to the establishment of the first receptive field-based model in the 1980s. In 1998, the lenet-5 model PW proposed by Lecun of New York University made a breakthrough in handwriting recognition, thus opening the door for convolutional neural network research. In recent years, the holding of the Olympic lmageNet competition in the field of image recognition has pushed the research of convolutional neural networks to a climax. Key universities and laboratories around the world and technology companies have used their trained models for the recognition of ImageNet image

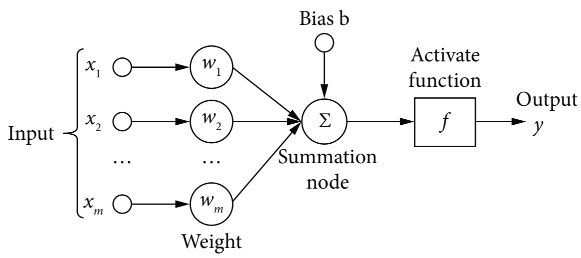

Figure 1: M-P neuron structure.

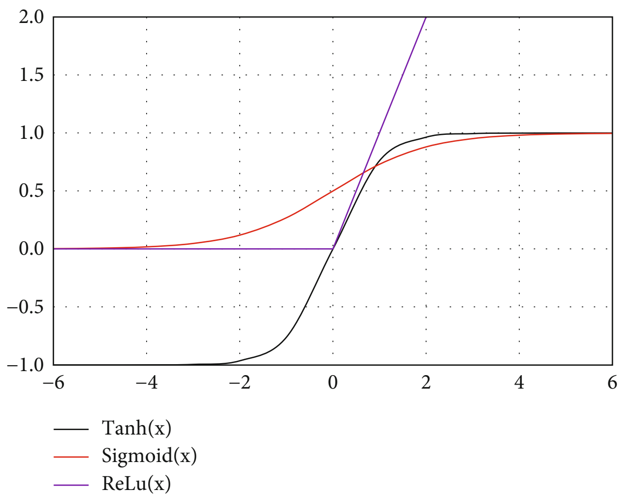

Figure 2: Function curve.

library. The champion in 2012 proposed the AlexNet foot model; various networks can be built through CNN, such as cifar10 for natural scenes, LeNet-5 for handwritten fonts as shown in Figure 3, AlexNet for ILSVRC dataset, deep VGG model, etc. These convolutional neural networks aim at different datasets or different objects, and their design network layers and initial design network parameters are different. So far, CNN's design ideas are basically towards deeper networks and more convolution computing [8]. Although the classification accuracy has been improved, it also puts forward higher requirements for the experimental environment. In most depth learning algorithms, the depth of the network is a very important parameter, and the depth convolution neural network is no exception. However, under the condition of relatively small datasets and limited experimental environment, there is no need for a network architecture such as GoogLeNet and deep residual learning, and better results cannot be achieved under such a network architecture. The use of which is briefly introduced below in the part of this article [9].

Convolutional neural network is widely used in image classification, semantic segmentation, feature extraction, style transfer, and so on [10]. For example, a convolutional neural network based on attention mechanism to solve the problem of image classification in complex scenes are proposed. This model is proficient in fine-grained classification and has better robustness [11–13]. The process of convolution is the process of feature extraction. Each convolution kernel represents a feature. If the result of a certain area in the image is larger than that of a convolution kernel, the area is more similar to that convolution kernel. The VGG16 model without full connection layer is selected for image stylization, which includes 13 convolution layers and 5 maximum pooling layers. The performance is improved by continuously deepening the network structure. VGG16 model is divided into five layers. In the first two layers, each layer is pooled after two convolutions, and the last three layers are pooled after three convolutions [14]. Each convolution is accompanied by an activation function. Here, more convolution kernels can make the decision function more discriminative. The overall convolution kernel size is 3×3. The effect of three convolution layers in series is not only equivalent to a 7×7 convolution layer, which can reduce the parameters of convolution layer, but also has more nonlinear transformations, so that CNN has a stronger ability to learn features. Here, pooling is the maximum pooling, and the size of the pooled core is 2×2. Maxpool is easier to capture changes in images and gradients, which brings greater local information differences and better describes the details of edges, textures, and other semantic information. This is especially reflected in network visualization, which visualizes the filter of vgg16 through the gradient rise in the input space. The model is public and can be downloaded in caffe framework [15–18]. The visual structure of each filter is shown in Figure 3. It can be seen that the convolution check color at the lower level has higher edge signal sensitivity, and the higher the convolution core, the more abstract and complex the content is. Image features are extracted by convolution neural network, and different features are extracted by different convolution kernels. A given input image is processed into a group of characteristic images at each processing stage in CNN. The bottom layer mainly reflects the bottom characteristics of pixel level, while the top layer mainly reflects the edge structure of the image [19].

2.2.1. Convolution Layer (Conv Layer). The traditional neural network adopts the fully connected working mode, which has a poor effect on large-scale digital images. Take a $100 * 100 * 3$ image as an example, each neuron needs to connect 30000 weights, and one layer of network connection will generate millions of weights. Therefore, the fully connected neural network is inefficient and will produce overfitting. Since the concept of receptive field is introduced into the convolutional neural network, in the model, we convert the receptive field into a convolution kernel model, and the convolution kernel parameters are shared. Each layer is composed of a group of convolution kernels, so the weight parameters are greatly reduced. Generally, convolutional neural network model is composed of convolution layer, pooling layer, and full connection layer.

Conv layer is an important part of constructing Conv neural network model [18]. The size of these filters is consistent in space, and the depth of the filter is the same as that of the input data. The VGG network used below is taken as an example. The Conv layer of the first layer of VGG network can be expressed as [64, 3, 3, 3], in which 64, 3, 3, and 3

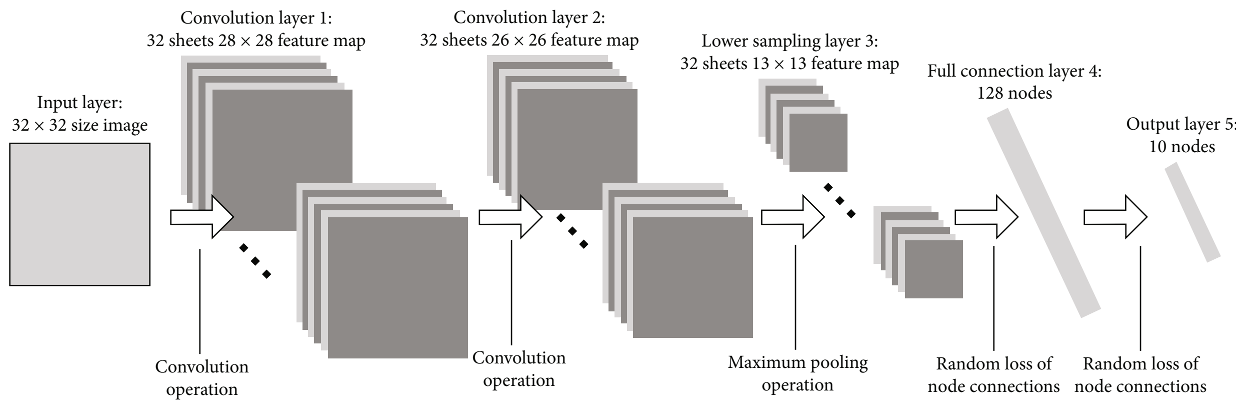

Figure 3: Schematic diagram of LeNet convolution network.

are called superparameters, which, respectively, represent the number, depth, length, and height of filter banks. In the training process of forward propagation, each group of filters slides up and down, left and right according to the specified step size on the input, then calculates at the sliding box. When the filter slides along the input data, a two-dimensional activation diagram will be generated. The diagram is input on filter and represents a certain feature of the image. For example, the shallow activation diagram is corner information, and the deep activation diagram is an organic combination of shallow layers, representing more complex information.

2.2.2. Pool Layer. At present, most convolutional neural networks have a pool layer embedded in the structure; the purpose of pooling layer is to improve the performance and robustness of the algorithm. It is generally divided into non-overlapping pooling and overlapping pooling. In this study, the pooling algorithm with overlap and maximum value is used to reduce over fitting. The pooling layer can adopt the maximum value or average value operation. It operates for each depth layer of input data, reducing the size of the data body. Taking VGG network as an example, the pooling layer of VGG network includes two super parameters, namely, space size $F = 2$ and step size $S = 2$. After pooling the input data, 75% of the information is lost, thus avoiding over fitting.

2.2.3. Full Connection Layer. In the fully connected layer of convolutional neural network, neurons are fully connected to all input data in the previous layer, which is the same as that of ordinary neural networks. The full connection layer is mainly used to map the previously learned distribution features into the sample space, thus playing the role of classification. However, due to the parameter redundancy of the full connection layer, some models have adopted other methods to replace the full connection layer to avoid parameter redundancy and have achieved good results.

2.2.4. Optimization Algorithm. In Conv neural networks, the initial parameters of Conv layer filters are randomly generated, and they will produce loss functions in the training process of forward propagation. The parameters of the filter to reduce the loss are optimized in back-propagation. This method of updating the filter parameters by back-propagation is called optimization algorithm. Common optimization methods include random gradient descent method [20], Adam, and L-BFGS. Choosing the appropriate optimization algorithm under specific conditions will have a great impact on the training results of the network. Next, we will briefly introduce Adam and L-BFGS algorithms.

Adam optimization algorithm is an adaptive learning rate optimization algorithm, which was first proposed at the ICLR conference in 2015 [21]. Adam algorithm can be understood as a learning rate adaptive optimizer with momentum method. It is an extension of the random gradient descent method and can replace the classical random gradient descent method to update the network weight more effectively. It estimates the first and second moments of the gradient of each parameter according to the objective function and uses the exponential moving average to calculate. The feature scaling of the gradient of each parameter is unchanged, to solve the problems of high noise and gradient dilution in the process of parameter space iteration.

L-BFGS algorithm [22] is one of the most effective quasi-Newton methods to solve unconstrained optimization problems, with good numerical results and theoretical convergence. This method approximates the Hesse matrix of the objective function by updating the symmetric matrix Bk, so that it satisfies the secant equation (quasi-Newton condition). It can be regarded as the conjugate gradient method with additional storage to accelerate the convergence rate, and it can also be regarded as the BFGS method with limited storage. It not only overcomes the difficulty of large amount of calculation of quasi-Newton method but also maintains good convergence. It can be predicted that by modifying the secant equation, we can not only maintain most of the excellent properties of the quasi-Newton method but also better approximate the second-order curvature information of the objective function.

2.2.5. Illustration2Vec. Illustration2vec, that is, the automatic description of illustrations or comics, was first proposed by Saito and Matsui [23] to find matching illustrations for text (as shown in Table 1). They extracted the semantic vector representation of illustrations by training convolutional

Table 1: Illustration2vec structure table.

Input $224 \times 224 \times 3$ RGB image
Conv1_1 + Maxpool
Conv2_1 + Maxpool
Conv3_1 + Conv3_2 + Maxpool
Conv4_1 + Conv4_2 + Maxpool
Conv5_1 + Conv5_2 + Maxpool
Sigmoid

neural network. The model structure of illustration2vec is similar to that of VGG, but it is a little shallower than the VGG structure introduced above, and it removes all the connection layers and replaces the SoftMax function with sigmoid function. In this paper, the focus is not to discuss how to automatically describe comics. Its model is trained and generated by comics, and its trained model is used for the realization of emotional expression.

2.2.6. VGGNet. The VGG model used in this application is VGG-19 model. The network structure of VGG is easy to understand, because the whole network structure of VGG maintains a very neat structure, and the whole network uses $3\times$ Conv kernel of 3 and 2×2. In VGG, the Conv layer is 2 in steps of $1\times$ the Conv of 2 uses the zero padding of 1, which is the same size as the input data volume. The pool layer is 2 with a core of size $2\times$ the maximum value of 2 pooled. Figure 4 shows the convolutional neural network model.

2.3. Big Data Technology. It is a dataset with huge data volume, high data quality, and various data types. Due to these characteristics, it is difficult to rely on traditional tools to capture, process, and manage these big data. Therefore, big data technology should be born. Big data technology integrates several different technical advantages, such as collection, data storage, retrieval, data access, mining, and use; it can realize the rapid processing, analysis, and transmission of huge datasets [24], such as intelligent data screening, analysis, and calculation, to quickly realize the analysis and utilization of huge datasets in a short time by relying on the power of machine intelligence. From the perspective of AI, the emergence of the advantages must be based on huge data. Technology provides important support and assistance for AI [25]. In particular, as the main research direction of knowledge representation, robotics, AI, vision, automatic reasoning, natural language processing, machine learning, etc., although from the perspective of research direction, these contents have their own particularity, and there are certain differences in research methods and main contents. However, all of them need the support of big data technology and need to go through data collation, data collection, algorithm training, algorithm design, and other related processes to achieve the research purpose. Big data technology architecture is shown in Figure 5.

Therefore, the core part of AI is big data technology. The application of big data technology in the field of AI is bound to provide a great auxiliary effect for the development of AI research activities [26]. Especially at the moment of advocating intelligent reform, with the increasing expansion of the application field of AI, the amount of data involved in AI research is gradually increasing, and the research difficulty is increasing. From this point of view, big data technology can exist as an important data processing means of AI. The integration of big data technology and AI can play a good auxiliary and supporting significance [27].

As a technical science, big data mainly studies the simulation of human intelligent activities by machines, so that computers can replace human beings in complex intellectual labor. In the early 1950s, Lebowski successfully used computers to create artificial intelligence artworks, such as waveforms, through repeated research. Harold Cohen developed the art creation software Aaron in 1973 and began to automatically create portraits and still life paintings with certain artistic styles. In addition, through the study of the elements of traditional Chinese ink painting, such as material, media, and artistic effect, as well as the complex relationship elements such as their interaction, the computer drawing system simulating Chinese ink painting has been constructed, and now, it has been able to successfully draw the effect of Chinese painting with ink charm. It is also a general trend that traditional easel oil painting creation is "artificial intelligence." This impact will affect the creation of easel oil painting as a "pure art" from the aspects of artistic creation, viewing, cultural value, and communication mode. Kurzweil of the United States is even more whimsical: robots will be comparable to human intelligence in 2045. They will acquire "personality" and create works of art "equal" to human intelligence.

3. Emotional Expression Analysis Model of Oil Painting Creation Based on Big Data and Neural Network

3.1. Feature Style Generation. Convolutional neural networks deal with visual information hierarchically in a feedforward manner. The unit of each layer is the set of image filters. Each image filter extracts a certain feature from the input image and inputs different filters to obtain different feature maps. After the convolution neural network is trained, the object information is more and more clear along the processing level. Along the processing level of the network, the input image pays more and more attention to the actual content of the image and its detailed pixel value. The information about the input image contained in each layer is visualized by reconstructing the image [28] from only the feature map in that layer. The stylization algorithm of convolutional neural network is a texture transmission algorithm, which constrains the texture synthesis method through the feature representation of the most advanced convolutional neural network. A new image is generated by performing a pre image search to match the feature representation of the example image. Therefore, this section will generate the texture feature style of art works from noisy images through Conv neural network, and Figure 6 shows the flow diagram.

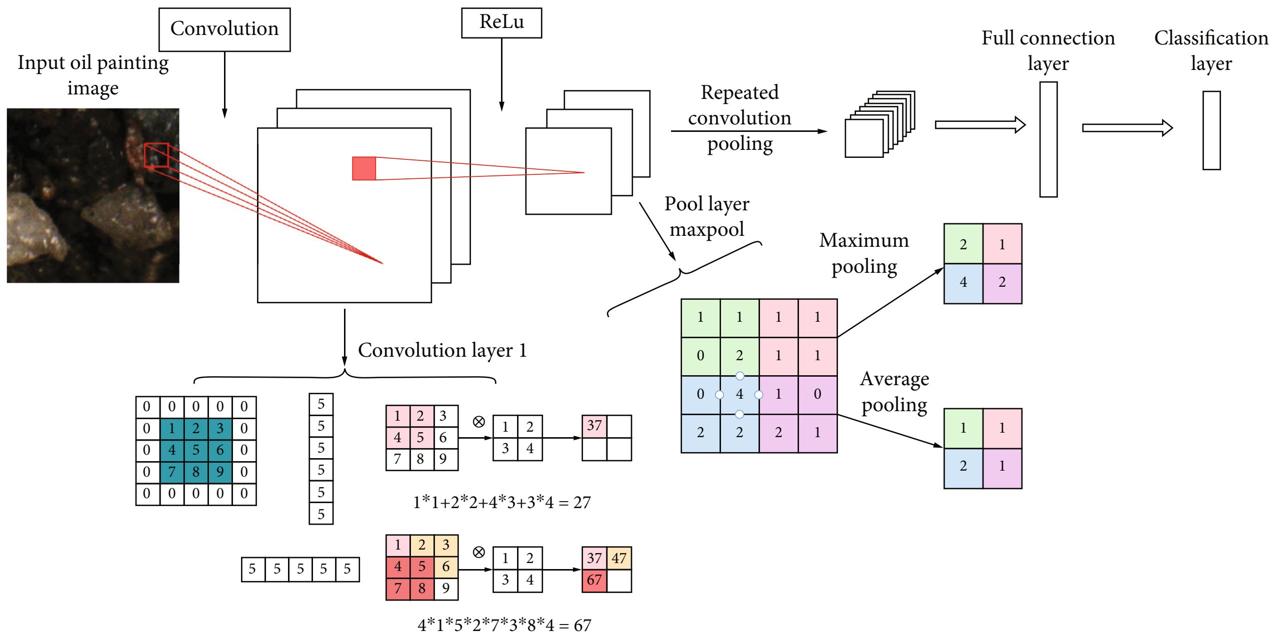

Figure 4: Convolutional neural network model.

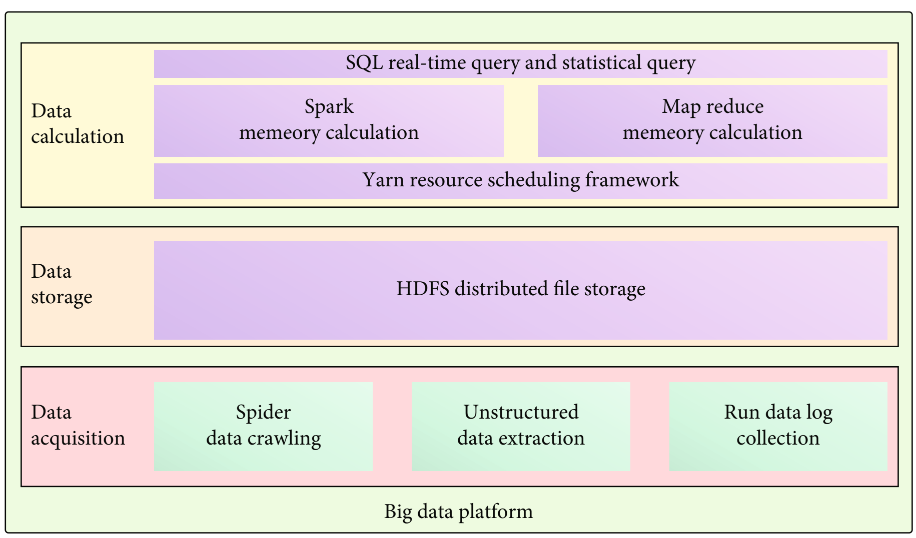

Figure 5: Big data technology architecture.

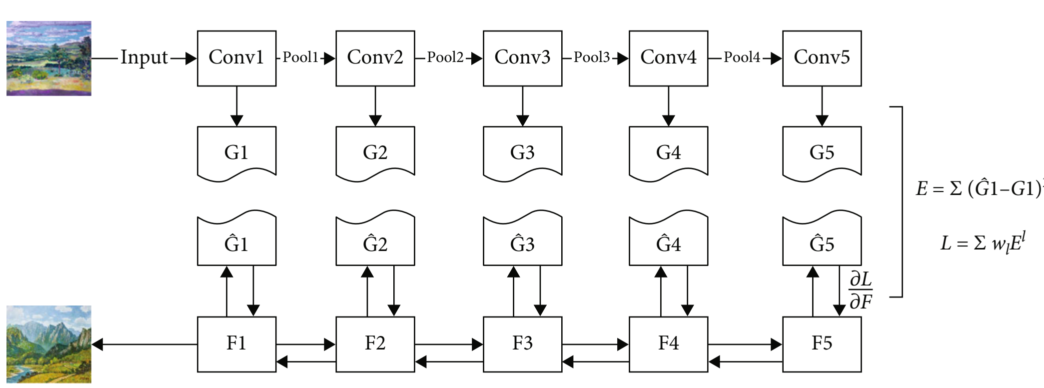

Figure 6: Flow chart of feature style generation.

The Conv kernel moves 2 horizontally and vertically in the image, so the pooled image is the hit of the input image, and overfitting is avoided. The excitation function of neurons is ReLu function. Relevant research shows that ReLu function has better effect in CNN operation than other traditional function and solves the ingenious problem of explosion. You can directly call the ReLu function in TensorFlow. The correlation degree of different filters can be expressed by Gram matrix G of Formula (1), where each element g_{ij} is the inner product of vectorized characteristic graphs i and j, as shown in Equation (2). The image is generated step by step through the loss of each layer, which can be expressed by normalization Formula (3). The total loss can be expressed by Equation (4).

$$G = \begin{bmatrix} g_{11} & g_{12} & \cdots & g_{1n} \\ g_{21} & g_{22} & \cdots & g_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ g_{n1} & g_{n2} & \cdots & g_{nn} \end{bmatrix}, \quad (1)$$

$$g_{ij} = \sum_k F_{ik} F_{jk}, \quad (2)$$

$$E = \frac{1}{4N^2 M^2} \sum_{i,j} \left(G_{ij} - A_{ij}\right)^2, \quad (3)$$

$$L_{\text{style}} = \sum_{l=0}^{L} w_l E_l. \quad (4)$$

After completing the theoretical analysis part, you also need to build code in TensorFlow to complete the specific operation process. TensorFlow adopts the operation mode of data flow graph, which is embodied in the fact that the process we become is only to build a data operation process, rather than to implement a specific operation. The specific operation can only be started in one session, and the running process will be completed in the CPU. The result of the operation will be retrieved after the calculation. The advantage of this is to avoid the waste of time and unit width caused by the frequent transmission of data between the CPU video memory and the computer memory [29].

3.2. Emotional Expression Analysis. A very important point in oil painting creation is emotion. It has not only become the engine of painting creation but also become a way to vent the author's inner spiritual world. Of course, creators living in different environments have different perceptions. Therefore, the methods, contents, themes, and forms of expression are also quite different. Each art master has formed a unique style by combining his own characteristics [30]. Da Vinci is good at setting off the emotions of characters with the help of composition, which makes his works full of creativity.

Emotion is the most common phenomenon in human life, and it also plays a unique charm in painting. But in today's painting creation, many painters only pay attention to form, thus ignoring the role of emotion. Kandinsky [31] believes that today's art pursues unremitting material and media, and works have gradually become commodities. The phenomenon that emotional and spiritual connotation are ignored in painting does exist; Langer [32] expounds the relationship between emotion and art. Domestic scholars have also made some research achievements. Lingli [33] discussed the influence and importance of emotion on oil painting creation and her understanding and analysis of emotion in oil painting creation. Bi [34] deeply explored the position of emotion in painting creation and said that the process of oil painting creation is the process of painting on the one hand, and the process of expressing the author's inner feelings on the other hand.

The style content of the composite image is different from the other two images that provide content and style, respectively. The image content and the wind cannot be completely separated. Generally, there is no image that completely matches the two constraints at the same time. We will optimize the generated image according to the loss function of the content and style. Each layer in the network defines a nonlinear filter bank, and its complexity increases with the position of the middle layer in the network. In order to analyze the emotional expression in oil painting, this paper also needs the forward propagation of content pictures through Conv neural network model. We can use the functions in the TensorFlow function library to optimize. In order to intuitively show the convergence process of style loss, content loss, noise picture pixel loss, and total loss in the training process, we use tensor board to visualize the decreasing trend of loss and summarize all loss variables through code. At present, the accuracy of emotional evaluation is evaluated from two aspects: first, people's subjective evaluation. Human beings have formed a unique evaluation of artistic beauty in the long-term practice process. The disadvantage of sample delivery is that it cannot form a unified standard. Second, judge the quality of generated pictures through quantitative indicators [35]. Picture loss is a good indicator. Usually, pictures with small loss have relatively evaluation of generated pictures.

4. Experimental Test and Analysis

4.1. Effect Analysis of Different Styles of Oil Painting. The convolutional neural network used in this algorithm can be well separated from the content and style representations, so the two representations can be processed independently to generate new perceptually meaningful images. The following are the oil painting renderings realized according to the coding. We combine different picture content expression forms with the style expression forms of several oil painting works. In order to ensure the accuracy of emotion analysis and training efficiency, the Conv neural network used in this algorithm can well separate the content and style representation. We combine different image content expression forms with the style expression forms of multiple oil painting works of art. Figure 7 shows the renderings of different images combined with various oil painting works.

One influencing factor of image stylization is the ratio of α and β. Figure 7 shows the content diagram composition of

Figure 7: Composition of oil painting styles with different emotional expressions.

Figure 8: Matching different content feature layer renderings.

Table 2: Comparison of three classification experimental results of the model on three datasets.

Group	Style 1		Style 2		Style 3		Style 4	
	Accuracy	Std.	Accuracy	Std.	Accuracy	Std.	Accuracy	Std.
Dataset 1	0.743	0.159	0.668	0.205	0.678	0.156	0.658	0.098
Dataset 2	0.752	0.063	0.691	0.096	0.682	0.063	0.659	0.069
Dataset 3	0.772	0.136	0.687	0.106	0.701	0.042	0.684	0.123

sand painting style, in which α and β is selected 1×10^{-2}, 1×10^{-4}, and 1×10^{-6}, respectively. From Figure 7, the ratio of α and β is reduced in turn, that is, the composite image on the left emphasizes the content, which can clearly identify the content, but the style effect of the image is not very good, and the style effect of the image on the right is obvious, but the displayed content is not easy to identify. Color plays a vital role in the rendering of emotion. For example, in the new year, the streets and alleys will be decorated with red decorations; Red Spring Festival couplets will also be pasted on the doors of every household, and a peaceful and lively atmosphere will spontaneously arise. Back to our creation, the same is true.

Figure 8 shows the matching different content feature layer renderings. It can be seen that the essence of artistic creation cannot be separated from "creation." From experience to conception and then to expression, it is an important stage in the process of artistic creation. Artistic creation is a unique and highly creative spiritual and practical activity of mankind. With the help of various media, through the unique form of artistic language, human beings creatively express their individual survival experience, aesthetic experience, ideas, and so on through artistic images, forming artistic works. It can be seen that every work of art has its unique creative process, and the finiteness and uniqueness of the soul make human art great. The finiteness of life is one of the driving forces of artistic creation and the vitality of artistic works. The unique life experience of artistic creation creates the uniqueness of artistic creation.

4.2. Analysis of Emotion Expression in Different Styles of Oil Painting. In order to verify the classification effect of the model, the model is compared with the baseline model selected in this chapter in two classification and three classification experiments on three datasets, and the accuracy of the model is counted. Among them, the second classification experiment classifies the emotional polarity of aspect words into positive and negative, and the third classification experiment classifies the emotional polarity of aspect words into positive, neutral, and negative. In the two classification experiments carried out on three datasets, the accuracy values obtained by different models are shown in Table 2.

It can be seen from Table 2 that the accuracy of this model in three datasets and three different oil painting styles is about 70%, and the values of std. (i.e., standard deviation) are all within a controllable range, which fully shows that the model established in this paper is suitable for emotional analysis tasks of different oil painting styles, because this model can model the forward and backward features of the text at the same time. However, the model does not take into account the emotional features, part of speech features, and the location information between words and aspects in the sentence, so the feature extraction ability is limited. Although the best classification effect is achieved in the baseline model, the model does not introduce emotional features and part of speech features, nor does it consider the impact of location information on the classification results. The model in this paper also needs to consider these factors and further strengthen the analytical ability of the model.

5. Discussion and Conclusion

With the advent of the era of big data, oil painting creation needs to keep pace with the times, and it is imperative to create momentum by combining neural network algorithm. Convolutional neural network and big data technology are introduced, and based on these two methods, an emotional expression analysis model of oil painting creation based on big data and neural network is established in this paper. The model is composed of feature style generation and emotion expression analysis, and the effectiveness of this model is verified by experiments. It is found that different styles of oil paintings express different emotions. Although the visual image with high perceptual quality is synthesized, the algorithm still has some technical limitations. The most obvious disadvantage is that the resolution of the synthesized image is low, the definition is greatly reduced, and the speed is slow during the experimental operation. It takes about one hour to complete a round of image optimization. For human society, all innovation must serve people. Whether art or technology, we need to pay attention to and take care of the needs of human beings at the material and spiritual levels, and take this as the bottom line for innovation. AI artistic creation will bring more opportunities for the growth and extension of on-board oil painting creation and exist as a branch of art, which will add more prosperity and splendor to human social life and spiritual world.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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Research Article

Green and Energy-Saving Ecological Reconstruction Design of Existing Buildings in Cities in Severe Cold Areas

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In order to improve the overall structural stability and thermal insulation capacity of existing buildings in severe cold areas, green energy-saving ecological transformation methods of existing buildings in severe cold areas are proposed. The concrete stress analysis method of the joints in the frame is used to calculate the bearing capacity and prestress of the beam-column joints. Based on the method of parameter analysis, the calculation model of shear capacity is established. The embedded anchoring method is adopted to realize the equal strength connection of beam-column joints. Increase the unbalanced moment between reinforcement and steel plate, and improve the stability and reliability of beam-column joint fixation. The overall structural optimization method of joint shear performance is adopted to reduce the distance between lap reinforcement and steel plate, so as to realize the green energy-saving ecological transformation design of existing urban buildings in severe cold areas. The test results show that the service stress and tensile resistance of the reconstructed existing building area are higher than 60, the tensile capacity is good, and the slip of the lap reinforcement is effectively controlled. At the same time, this method improves the stability of beam-column elements and the overall thermal insulation performance of existing buildings in cities in severe cold areas. The next research will focus on the transformation of other structures.

1. Introduction

In recent years, with China's great emphasis on the ecological environment, the concepts of low-carbon cities and green energy-saving buildings have been gradually popularized. With the constant improvement of China's green energy-saving construction, the growth of building energy consumption has been effectively restrained. However, there are still some problems, such as people's ignorance of building energy-saving ideas, imperfect building energy-saving renovation methods and technologies, lack of energy-saving ideas in building construction [1, 2], and inadequate supervision and management of energy-saving renovation.

At present, for residential units, there are often some problems, such as unreasonable layout of residential buildings, inefficient use of space, ventilation and lighting of residential buildings failing to meet the requirements of residents, wasting a lot of energy and so on. Therefore, the application of low-carbon concept and low-carbon technical measures in planning and architectural design to build energy-saving green communities and energy-saving buildings is not only of great significance to China's energy conservation and utilization [3–6], but also significantly improves the living environment of residents. By optimizing the fixed design of beam-column joints of existing buildings in cities in severe cold areas, the overall stability and stress reliability of the building structure are improved, and it is of great significance to study the green energy-saving ecological transformation method of existing buildings in cities in severe cold areas, which is of great concern to people.

China's research on the application of low-carbon energy-saving theory and space syntax in building energy-saving renovation is still insufficient, and the current research results in this area are also lacking, and have not formed a complete system. This study systematically sorts out the application theory of low-carbon energy conservation and the practice method of spatial syntax by analyzing the Reference, reports and excellent cases of the implementation and application of low-carbon energy conservation concepts at home and abroad, perfecting and enriching the energy conservation theory of existing residential areas and residential buildings, and supporting the construction of low-carbon energy-saving communities in China. In this study, the spatial syntax theory is applied to the quantitative and visual analysis of existing residential areas, which can more intuitively analyze the energy-saving transformation of residential areas and buildings. The comprehensive application of space syntax and low-carbon energy-saving theory will provide a new direction and path for the renovation of low-carbon energy-saving residential areas in the future. The design of green energy-saving ecological transformation of existing buildings in cold regions is based on the optimization design of mechanical parameters of beam-column joints of existing buildings in cold regions, and the optimization of green energy-saving ecological transformation of existing buildings in cold regions is realized by combining numerical simulation and mechanical analysis. At present, for the green and energy-saving ecological transformation methods of existing buildings in cities in severe cold areas, the anchor joint fixing method, the foundation pit fixing method, and the tensile steel bar strain stability fixing method are mainly adopted, and the double steel plate concrete composite wall design method is adopted to realize the stability control of beam-column joints of existing buildings in cities in severe cold areas.

Reference [7] proposed a three-dimensional virtual technology for energy-saving space design of green buildings. Use the three-dimensional virtual model of green building and Geographic Information System (GIS) technology to obtain the relevant information of green energy-saving building. It is imported into DeST-c software to simulate the heat balance of green buildings. Reference [8] by analyzing the advantages of BIM Technology and applying it to green buildings, simulates and analyzes the important evaluation parts of green buildings, such as indoor lighting, outdoor acoustic environment simulation, indoor acoustics and outdoor wind environment simulation, and optimizes them in time, so as to achieve the purpose of energy-saving and eco-friendly design of green buildings. Reference [9] discusses the theoretical research trends of Engineering Procurement Construction (EPC) mode, risk sharing, incentive mechanism and energy efficiency labeling system of energy-saving transformation of existing buildings abroad from the perspective of market operation of energy-saving transformation of existing buildings. This paper summarizes the practical characteristics of the operation of the foreign existing building energy-saving reconstruction market from four aspects: laws and regulations, information transmission mechanism, incentive policies, and financing environment. This paper combs the theoretical research results of the operation of China's existing building energy-saving reconstruction market from four aspects: government supervision, behavior strategy, income distribution and financing mode, and summarizes the practical work of the operation of China's existing building energy-saving reconstruction market. Based on the perspective of market governance, starting with the analysis of the particularity of the market governance of the green transformation of existing buildings, this paper demonstrates the theoretical value and practical urgency of the research on the optimization and operation of the market governance system of the green transformation of existing buildings. However, the overlapping intensity of this method in the green, energy-saving, and ecological transformation of existing buildings in cities in severe cold areas is not high. Reference [10] aimed at the typical residential space plane type of existing residential areas in the north, taking Taishan community in Dalian City, Liaoning Province as the research object, the grass hopper platform was used to conduct quantitative simulation analysis and Research on the impact of the target residential building shape, surrounding building types, building spacing and orientation parameters on the operating energy consumption and carbon reduction of existing residential areas. By analyzing 240 simulation cases constructed by parameter transformation, the operating energy consumption of typical residential types under the current envelope conditions under the real layout of existing residential areas in the north is obtained. According to the 50% energy-saving requirements in jgj26-2018 "design standard for energy efficiency of residential buildings in severe cold and cold regions," a series of passive energy-saving transformation means of external wall insulation and replacement of doors and windows for buildings in existing residential areas are simulated parametrically to quantitatively evaluate the energy-saving and carbon reduction effects after transformation. But this method costs a lot of money.

The vast majority of existing buildings belong to non-energy-saving high-energy buildings. In the energy-saving transformation of existing buildings, local practices basically focus on large-scale public buildings and government office buildings with high-energy consumption, as a breakthrough in energy-saving transformation. Therefore, this paper proposes a green and energy-saving ecological transformation method of existing buildings in cities in severe cold regions based on the overall structural optimization of node shear performance. Firstly, in assembling the integral shear wall structure, the concrete stress analysis method of the joints in the frame is adopted, the embedded anchorage method is adopted, and the prestressed reinforcement degree analysis and yield response analysis are combined to realize the equal strength connection of the beam-column joints of the existing urban buildings in severe cold areas. Then, the static monotonic tensile test method is adopted to increase the moment of force between steel bars and steel plates, improve the stability and reliability of the beam-column joints, and the overall structural optimization method of the shear performance of the joints is adopted to reduce the distance between the overlapping steel bars and steel plates. Finally, the experimental test shows the superior performance of this method in improving the green energy-saving ecological transformation ability of existing urban buildings in severe cold areas.

2. Theory of Parameter Analysis Method

Parameter analysis method is widely used in various reservoir parameters. Through cluster analysis and discriminant analysis, the types of flow units in the study area are reasonably divided, and the discriminant functions of various flow units are established to identify the unit types. These parameters mainly include porosity, permeability, median grain size, shale content, formation coefficient, net-gross ratio, saturation, conductivity coefficient, storage coefficient, pore throat radius, pore throat ratio, and cross-well flow capacity index.

2.1. IFCI Method of Inter-Well Fluidity Index. Cans identifies the flow unit by using the cross-well flow capacity index Interwell Flow Capacity Index (IFCI). IFCI is defined as the ratio of flow between two adjacent wells. The denominator is the flow rate of high permeability layer. The results show that if the two wells are located in the same flow unit, the ratio of formation coefficient of the two wells has a good correlation with its flow rate ratio. Otherwise, the correlation is poor. Therefore, the distribution range and connectivity of flow units can be judged.

2.2. Repeat the Formation Test Repeat Formation Tester (RFT) and Tracer Test Method. Identification of flow unit by repeated formation test and tracer test. The main principle is to identify the flow unit according to the measured pressure change and tracer concentration change.

2.3. Production Pressure Difference Method. Prediction of flow unit by production pressure difference. According to the flow of fluid in oil–water two-phase obeying Darcy's law, the calculation formula of production pressure difference of flow unit is established. This method can avoid the contradiction between resource waste caused by shut-in pressure measurement and less pressure measurement data by layers, and its accuracy depends on the accuracy of parameter selection and the reliability of flow unit division.

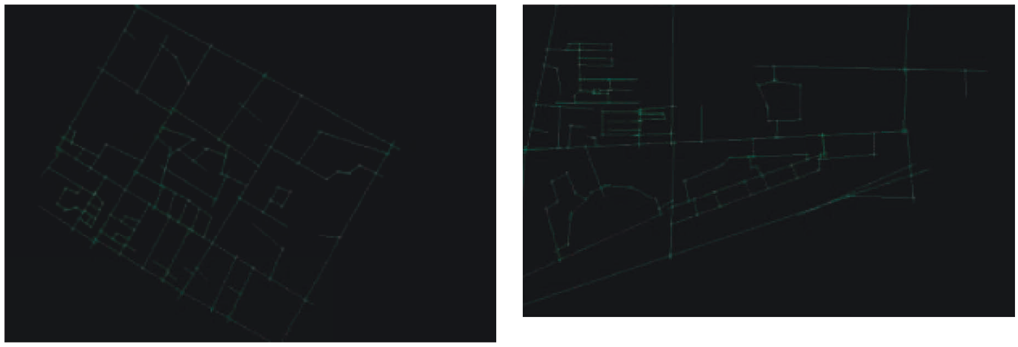
2.4. FIS Method of Inclusion Stratigraphy. Fluid Inclusion Stratigraphy (FIS) is used to identify oil–water interface and seepage barrier, and production logging and pressure data are used to identify flow units. It is worth noting that when the physical and chemical properties of fluid inclusions between adjacent wells are different, it can indicate the existence of barrier layer. However, when there is no difference in physical and chemical properties of fluid inclusions between adjacent wells, it cannot be concluded that the barrier layer does not exist.

3. Quantitative Analysis of Green Energy-Saving Transformation of Existing Urban Buildings in Severe Cold Areas

3.1. Existing Buildings in Cities in Severe Cold Areas. Based on the research and analysis of domestic and foreign cases, it is concluded that domestic green low-carbon energy-saving residential communities usually pay attention to the application of low-carbon energy-saving concept from the early planning and design stage. In the construction stage, domestic residential areas also adopt construction methods such as assembly to reduce energy consumption and waste of resources in the construction stage. Many technologies and methods are also used in the residential operation stage, which play a substantial role in the energy conservation and utilization of the whole residential area, but the public participation is not high and the enthusiasm is not strong. Compared with foreign low-carbon energy-saving communities, they have invested a lot of financial resources and manpower in the active energy-saving and passive energy-saving design of residential areas, and paid great attention to public participation and the cultivation of residents' low-carbon energy-saving concept in the whole process, which is very worthy of our reference [11–14]. Combined with the stress parameter analysis method of beam-column joints of existing buildings in cold regions, the connection model of concrete foundation and double steel plate composite wall joints of existing buildings in cold regions is established. Firstly, among the three most basic syntactic models, such as convex spatial model, visibility model, and linear element model, the most appropriate spatial syntactic model is selected according to different scales. In the scale range of residential area, the linear factor model is selected for analysis. In this study, the line segment model of linear elements is used for analysis, the axis map representing the street is drawn according to the syntax theory, and the spatial network indicators, such as traversal degree, integration degree, and understandability are analyzed through operation. In the spatial syntax Depthmap software, each line segment (each spatial element) will have a series of spatial network indicator data after calculation. According to the size of these data values, Arrange with color gradient, visualize it in a more intuitive way, compare and analyze it, and get the process diagram of axis model verification, as shown in Figure 1.

Verify through the node count in the software. If the value of node count is positive, it indicates that the drawing is correct, and the color of the line segment is green. If the value is negative, the model is wrong and the color of the line segment is red.

Using reinforced concrete raft as foundation, combining embedded anchoring and embedded anchoring methods, the anchoring connection module of beam-column joints of existing buildings in cities in severe cold areas is established. According to three anchoring forms, double steel plate concrete composite wall configuration method is adopted, and bolts on both sides of beam-column joints of existing buildings in cities in severe cold areas are used to achieve anchoring. Considering raft foundation, embedded steel



(a) (b)

Figure 1: Axis model verification process diagram. (a) Residential area 1. (b) Residential area 2.

plates of beam-column joints of existing buildings in cities in severe cold areas are perforated. The cracks of reinforced lap specimens are fixed by anchor bolts, and the ribbed steel bars are lapped in concrete by embedded anchorage. Through strain detection and mechanical parameter analysis of tensile steel bars and steel plates, the wall-reinforced concrete foundation parameters of beam-column joints of existing buildings in cities in severe cold areas are determined. Based on the code for design of building thermal insulation (GB 50011-2010), the thermal insulation design of beam-column units of existing buildings in cities in severe cold regions is carried out. In AISC N690-12, the tensile reinforcement is configured in combination with the technical standard requirements of cylindrical head welding nails for arc stud welding (GB/T 10433-2002).

3.2. Constitutive Relationship of Beam-Column Joint Materials of Existing Buildings in Severe Cold Areas. Through field investigation, case comparison and spatial syntax model analysis, this paper analyzes the constitutive relationship of beam-column joints of existing buildings in severe cold regions.

In order to comprehensively consider the green energy-saving design level of buildings in residential areas and the maintenance degree of green environment in residential areas, the building materials of residential buildings and the property management of residential areas are also analyzed. In the assembled integral shear wall structure of existing buildings in cities in severe cold areas, the concrete stress analysis method of the joints in the frame is adopted, and the spatial structure, planning layout and traffic flow lines of two existing residential areas are analyzed at the macro level. For the overall layout and traffic, through the axis model of two existing residential areas, it is analyzed according to two indicators: selectivity and integration. According to the axis model established by the urban road network, the roads represented by each axis have corresponding index values. The values are arranged according to the size, and the color is attached for visual analysis. In the model, the red, yellow and blue axes represent high, medium, and low index values in turn. Among them, the main syntactic index of axis: Choice〉 indicates the potential of axis to attract crossing traffic. Integration represents the traffic accessibility of the axis. In assembling the integral shear wall structure, the concrete stress analysis method of the joints in the frame is adopted to calculate the bearing capacity and prestress of the beam-column joints of the existing buildings in cities in severe cold areas, and the constitutive model of the materials of the beam-column joints of the existing buildings in cities in severe cold areas is constructed [15–17]. The embedded anchorage method is adopted, combined with the analysis of prestressing tendons and yield response, to realize the equal strength connection of the beam-column joints of the existing buildings in cities in severe cold areas. The bending stress model is as follows:

$$f_t = \frac{\Delta V_t}{V_{t1}} = \frac{V_{t1} - V_{u1}}{V_{t1}}. \tag{1}$$

In the above formula, V_{t1} represents the internal force of tensile reinforcement configuration of existing buildings in cold regions relative to the node performance, V_{u1} represents the standard anchorage length of reinforcement, and ΔV_t represents the distance between lap reinforcement and steel plate of existing buildings in cold regions. The static loading test method is adopted to analyze the correction factor of lap reinforcement diameter as follows [18]:

$$d_i = d_{ei} + d_{pti}, \tag{2}$$

where in d_{ei} is the hysteretic coefficient of the cross-section and steel plate of the existing building specimen in the cold area city, and d_{pti} represents the buckling relation of large local deformation. The template parameters on both sides of the existing building concrete pouring in the cold area city, and the stress parameters of the anchoring reinforcement are:

$$\begin{cases} b_{20}(t;\lambda) = \dfrac{1}{2}(1-\lambda t)(1-t)^3, \\ b_{21}(t;\lambda) = \dfrac{1}{2}\left[1 + (\lambda+3)t - 3(\lambda+1)t^2 + 4\lambda t^3 - 2\lambda t^4\right], \\ b_{22}(t;\lambda) = \dfrac{1}{2}(1-\lambda+\lambda t)t^3, \end{cases} \tag{3}$$

where in λ is the index of compression and tensile damage of existing buildings in cities in severe cold areas, and t is the volume stirrup ratio of energy-saving ecological renovation of existing buildings in cities in severe cold areas. Considering the size and loading capacity of the loading device, it is found that the index coefficient of tensile damage of beam-column joints of existing buildings in cities in severe cold areas satisfies u: $I \times IR^d \longrightarrow IR$, and the elastic modulus of concrete of existing buildings in cities in severe cold areas is:

$$k_z^g(t,\tau) = k_z(t,\tau) = z\left(t + \frac{\tau}{2}\right)z^*\left(t - \frac{\tau}{2}\right), \tag{4}$$

where in $s \geq 0$, $1/p = 1/p_1 + 1/p_2 = 1/p_3 + 1/p_4$. The index coefficients of compressive and tensile damage of existing building concrete in cities in severe cold areas are analyzed. When $\exists x_0 \in R_2$, the tensile damage index of concrete in steel tube:

$$i = \max_j \left\{ \frac{P(Y \mid \lambda_j)}{P(Y \mid \lambda_j) > P(Y \mid \lambda_T)} \right\}, \tag{5}$$

where in $P(Y|\lambda_j)$ is the biaxial compressive yield strength of existing urban buildings in severe cold areas, $P(Y|\lambda_j)$ is the uniaxial tensile stress of existing urban buildings in severe cold areas, and $P(Y|\lambda_T)$ is the initial elastic modulus. If $a > 1$, the constitutive relation model of beam-column joints of existing urban buildings in severe cold areas is established, and the constitutive relation analysis of beam-column joints of existing urban buildings in severe cold areas is realized under uniaxial stress.

4. Optimization of Green Energy-Saving Ecological Transformation of Existing Buildings in Cities in Severe Cold Areas

4.1. Analysis of Overall Structural Parameters of Shear Performance of Joints. On the basis of the above-mentioned constitutive relation model of beam-column joints of existing buildings in cities in severe cold areas, the overlapping force transmission analysis of beam-column joints of existing buildings in cities in severe cold areas is carried out by adopting the arrangement of overlapping steel bars, and the stress parameter analysis model of beam-column joints of existing buildings in cities in severe cold areas is established by analyzing the bearing capacity, stiffness, and other parameter information of beam-column joints of existing buildings in cities in severe cold areas. Steel plates are welded at the bottom of steel plates, Calculate the stress parameters of the anchorage zone between column and foundation, build the calculation model of shear bearing capacity, adopt the embedded anchorage method, and combine the analysis of prestressing tendons and yield response to obtain the longitudinal strength of the beam-column joints of existing urban buildings in severe cold areas, and establish the finite element model of the beam joints [19]. The compressive stress of existing urban building concrete in severe cold areas is as follows:

$$\varphi(a,t,s,b) = \sum_{x=(p/2)}^{(p/2)-1} \varphi_x(a,t,b)v^{-wx\beta}, x = -\frac{P}{2}, \cdots, \frac{P}{2} - 1, \tag{6}$$

where in P is the applied prestress, φ_x is the anchor parameter of the existing buildings in the cold region, v is the prestress, b is the structural fitting parameter, a is the yield response of ecological design, and t is the constitutive model parameter.

The calculation model of shear capacity includes the main influencing factors, such as beam geometric size, shear span ratio, stirrup ratio, axial prestress, concrete strength, load form, and so on. During the construction, 987 beams without web reinforcement were selected, including 531 beams with web reinforcement, 136 beams without web reinforcement, and 42 beams with web reinforcement under uniform load. Other prestress, bearing capacity, concrete strength, load, and other parameters are set in the test.

Therefore, combined with the finite element analysis of composite frame joints, the relationship between compressive stress and compressive strain is shown in Figure 2.

According to the relationship between compressive stress and compressive strain of green energy-saving ecological renovation of existing buildings in cities in severe cold areas shown in Figure 2, the finite element simulation method is adopted to test the lap joint force transmission between steel plates and steel bars. The solution domain is considered to be composed of many small interconnected subdomains called finite elements, and a suitable approximate solution is assumed for each element, so that the compressive stress satisfying conditions of green energy-saving ecological renovation of existing urban buildings in severe cold areas can be deduced and solved, and then the stress situation of tensile steel bars can be obtained. In the finite element analysis model of composite frame joints, the relationship between compressive stress and strain of roots is distributed, and the anchorage method of existing buildings in cities in severe cold areas is adopted to weld both ends of tensile steel bars on steel plates. The stress of tensile steel bars in different positions on green energy-saving ecological renovation of existing buildings in cities in severe cold areas is analyzed, and the results are as follows:

$$\begin{cases} x_i^{(k+1)} = \dfrac{1}{a_{ii}}\left(b_i - \displaystyle\sum_{j=1}^{i-1} a_{ij}x_j^{(k+1)} - \sum_{j=i+1}^{n} a_{ij}x_j^{(k)}\right), \\ a_{ij} \neq 0, i = 1, 2, \cdots, n, \end{cases} \tag{7}$$

where in a_{ii} is the stress–strain joint distribution characteristic of green energy-saving ecological transformation of existing buildings in cold regions, b_i is the deviation value of green energy-saving flow potential of existing buildings in cold regions, $x_j^{(k)}$ is the expansion angle of concrete, and $x_j^{(k+1)}$ is the strain corresponding to uniaxial compression of green energy-saving ecological transformation of existing buildings in cold regions. According to the analysis of the overall structural parameters of shear performance of beam-column joints of existing buildings in cold regions, the standard anchorage length of steel bars is calculated by the

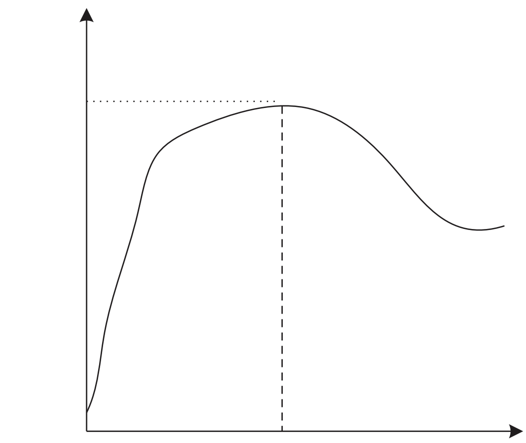


Figure 2: Relationship between compressive stress and compressive strain.

method, and the influence of anchorage length on the performance of beam-column joints of existing buildings in cold regions is analyzed.

4.2. Stress Optimization of Beam-Column Joints of Existing Buildings in Severe Cold Areas. By adopting the static monotonic tensile test method, the moment of force between steel bars and steel plates is increased, and the lap joint model of beam-column joints of existing buildings in cities in severe cold areas is constructed [20]. The index of lap joint position change is expressed as follows:

$$I_s = \frac{\mu_j A_j}{\sum W'} F, \tag{8}$$

where I_s is the vertical and horizontal spacing, μ_j is the distribution of compressive stress–strain relationship, A_j is stress–strain under uniaxial compression, W' is the parameter value of uniaxial tension descending section, F is the biaxial compressive yield strength.

When F is 0.1, the biaxial compressive yield strength obtained satisfies:

$$I_s = \frac{\lambda_n f_{vk} \left(nA_c + A_w\right)}{\omega \sum A_f}, \tag{9}$$

where λ_n is the uniaxial tensile strength of beam-column joints of existing buildings in cities in severe cold areas [21, 22], f_{vk} is the standard value of the parameter value of uniaxial tension descending section, ω is the deviation value of flow potential; A_c, A_w are the cross-section parameters and distribution area of concrete restrained by stirrups, and $\sum A_f$ is the stiffness recovery coefficient. N is the initial elastic modulus of steel [23, 24].

According to the supporting sequence of the bolt body, the concrete supporting column project is adopted to realize the analysis of the stress structure parameters of the beam-column joints of existing buildings in cities in severe cold areas. In the steel-inserted anchorage joints, the bearing capacity of the specimens is analyzed, and the specific operation process is shown in Figure 3.

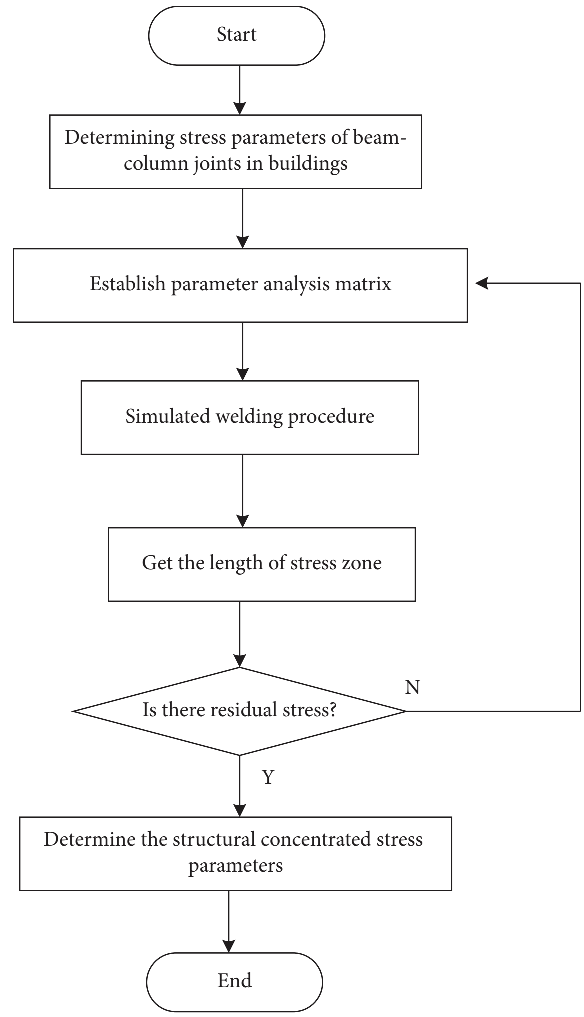


Figure 3: Stress structure parameter analysis process.

To sum up, to realize the equal strength connection of beam-column joints of existing buildings in cities in severe cold areas, the static monotonic tensile test method [25, 26] is adopted to realize the green energy-saving ecological transformation of existing buildings in cities in severe cold areas. The node optimization model is shown in Figure 4.

5. Test

In the experimental test of green energy-saving ecological transformation of existing buildings in cities in severe cold areas, the strength grade of steel bars is set to HRB400, and the ultimate strength detection model of beam-column joints of existing buildings in cities in severe cold areas is established by using I-beam, steel tube, and internal reinforcement design method. The yield prestress degree is 234.1 MPa and 232.0 MPa. See Table 1 for the distribution of performance evaluation index system of beam-column joints of existing buildings in severe cold areas.

According to the parameter evaluation index system in Table 1, pin holes with a length of 150 mm, a width of 200 mm and a depth of 150 mm are opened in the brick wall

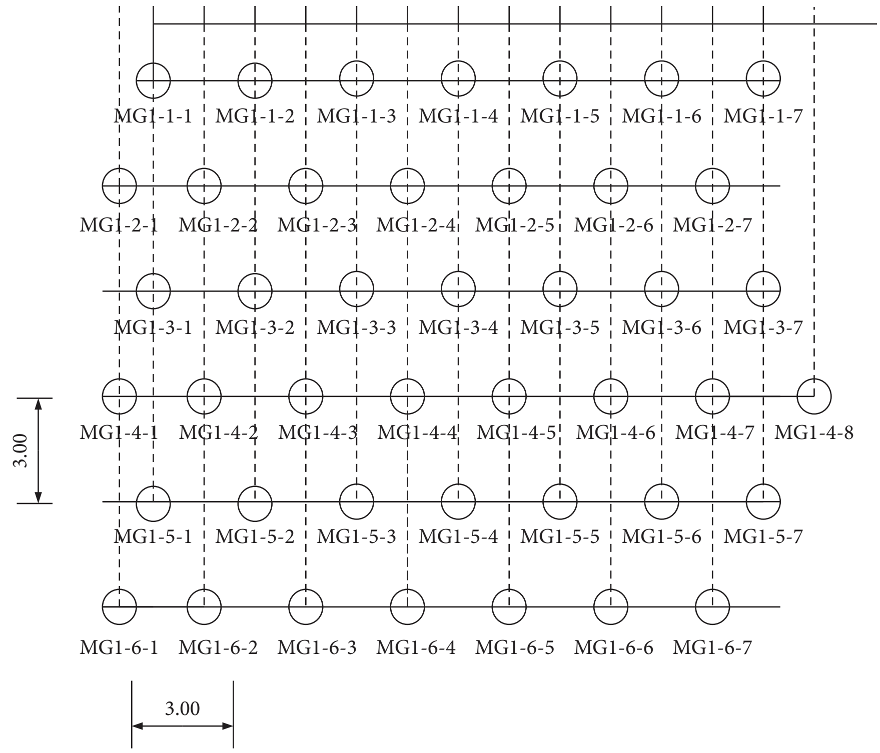


Figure 4: Distribution optimization of green energy-saving ecological transformation of existing buildings in cities in severe cold areas.

at the top of the horizontal post-pouring belt, with a spacing of 675 mm. The holes are equipped with 4q8 longitudinal reinforcement and 8@100 stirrups, which are poured together with the post-pouring belt, thus connecting the precast reinforced concrete slab with the plain brick wall. Two I-beams are embedded in the bottom of the precast reinforced concrete slab, which are used for positioning the precast wallboard and connected with the substructure. At the top of the precast reinforced concrete slab, a steel bar planting hole is drilled, which is located in the middle of the slab, and an 8-bar is implanted in the hole, with the implantation depth of 80 mmo. The stress analysis of energy-saving ecological transformation is carried out in the green plastic damage model of existing buildings in cities in severe cold areas is shown in Figure 5.

In Figure 5, the stress conditions of the proposed method, reference [9] method and reference [10] method are compared respectively.

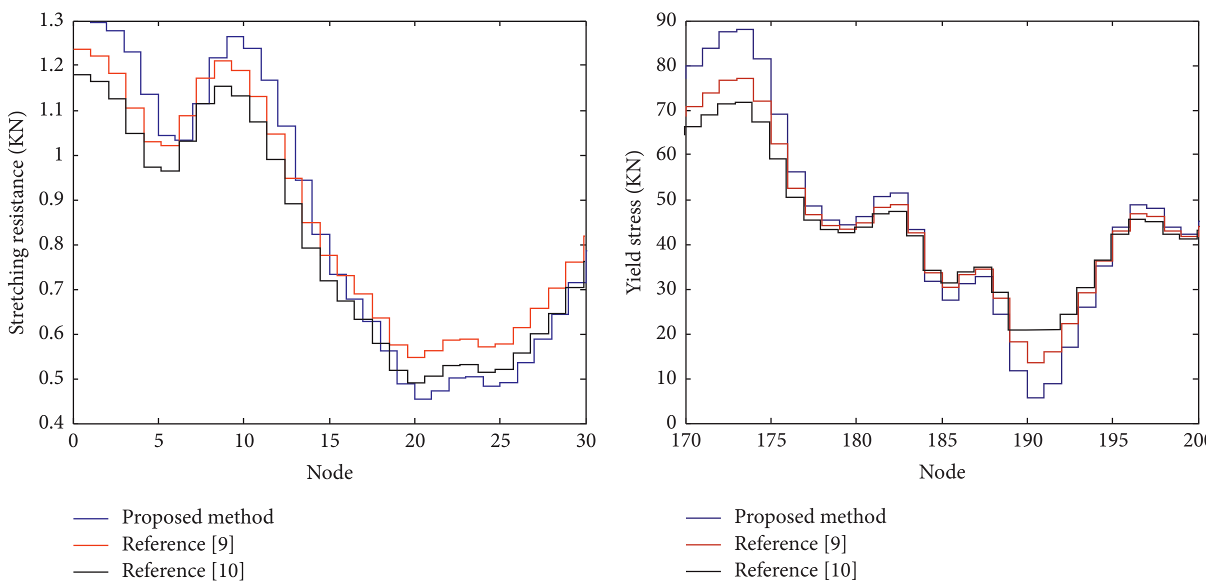
According to the stress analysis in Figure 5, the tensile resistance and yield stress of the proposed method are between 0.45~1.3 kN and 5~90 kN respectively. The tensile resistance and yield stress of reference [9] method and reference [10] method are between 0.57~1.23 kN and 12~78 kN, 0.5~1.19 kN and 21~72 kN, respectively. From the above data, it can be seen that the tensile resistance and yield stress expansibility of the proposed method are better. That is, the proposed method can effectively improve the bearing capacity of the reconstructed buildings by establishing the connection model between the concrete foundation of the beam-column joints and the double steel plate composite wall joints of the existing buildings in the severe cold areas, as well as the embedded anchoring and embedded anchoring methods.

The steel bars are planted on the brick wall at the post-cast strip. The depth of the holes for planting steel bars is 200 mm, and the spacing is 300 mm. An 8-screw with an implanted depth of 150 mm is arranged in the hole, which is anchored by pouring steel bar glue, and 180 mm is thrown out of the hole. Eight long-length steel bars are placed in the post-cast strip, and the long-length steel bars are tied together with the bolts implanted in the wall. At the same time, the hooks of the embedded steel bars at the bottom of the precast reinforced concrete slab hook the long-length steel bars. This test is loaded in the vertical and horizontal directions, and a jack is used to apply a constant vertical force of 30 t to the steel beam. The load is transmitted to the concrete loading beam at the top of the test body through the loading steel beam, and then to the specimen to ensure that the axial force is evenly transmitted to the specimen. Load horizontally with electrohydraulic servo actuator and adopt displacement control, and get the comparison of force characteristics of existing buildings in cities in severe cold areas after green energy-saving ecological transformation, as shown in Figure 6.

According to the analysis of Figure 6, in the 10 experiments of the proposed method, after applying a constant vertical force of 30t, the yield stress and tensile resistance always remained above 60, and fluctuated between 60 and 72, with small fluctuations. Therefore, the mechanical reliability of beam-column joint fixation of green building by this method is better. The main reason is that the embedded anchoring method is used in this paper to optimize the shear

Table 1: Performance evaluation index system of beam-column joints of existing buildings in cities in severe cold areas.

Limit strain index layer (weight of comprehensive thermal insulation capacity)	Level 3 indicators (weight of level 2 indicators)
Ultimate strain capacity (042)	Bearing capacity of steel structure (0.345) Bearing capacity at the limit point (0.4121) Linear arrangement (0.321 Building regularity (0.126) Integral shell structure (0.348)
Building materials (0.26)	Concrete (0.35) Constitutive model of prestressed reinforcement (0.123) Monotonic loading (0.343)
Proportional stress capacity requirement (0.32)	Peak load (0.55) Reverse reload depth (0.234)



(a) (b)

Figure 5: Stress analysis of energy-saving ecological transformation. (a) Stretching resistance. (b)Yield stress.

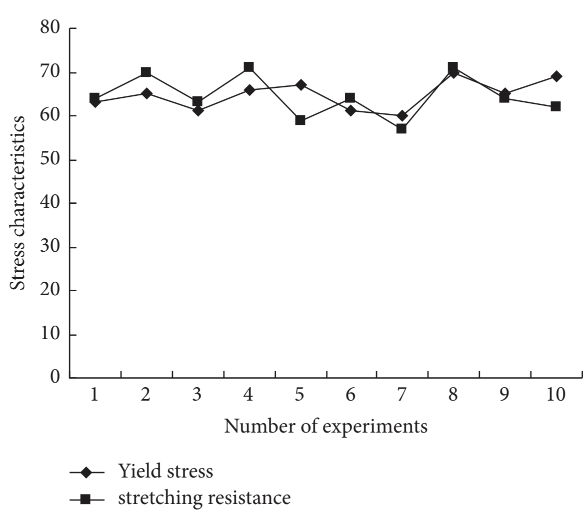
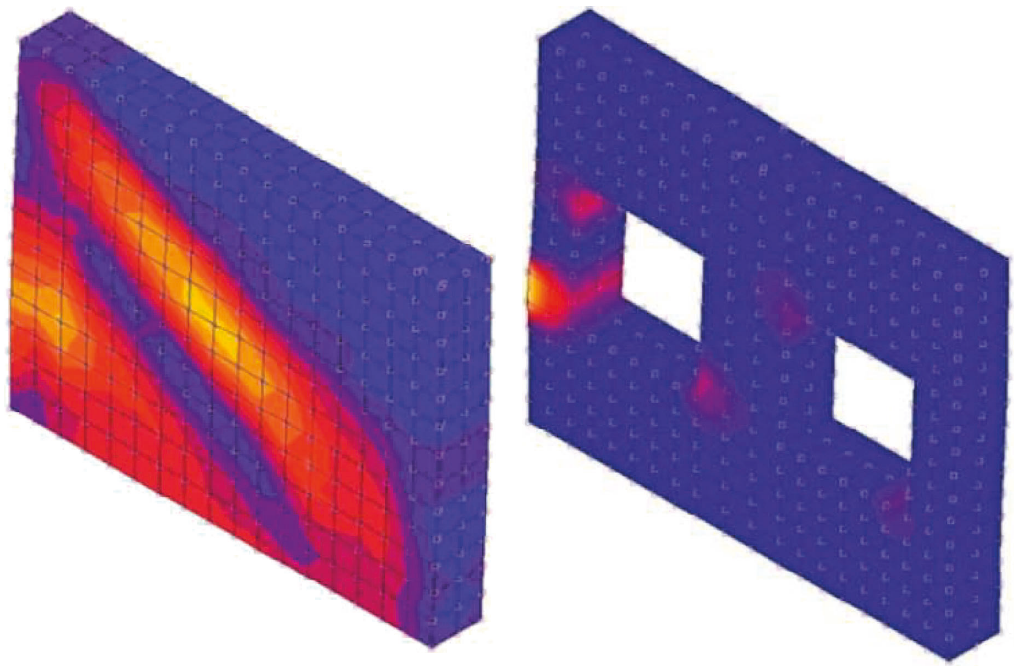


Figure 6: Comparison of stress characteristics of existing urban buildings after green energy-saving ecological transformation in severe cold areas.



(a) (b)

Figure 7: Test on the effect of green energy-saving ecological transformation of existing buildings in cities in severe cold areas. (a) Before transformation. (b) After transformation.

performance of existing buildings, combined with prestressed reinforcement analysis and yield response analysis.

The yield response of beam-column joints of green buildings is tested. The comparison of cloud pictures of green energy-saving ecological transformation of existing buildings in cities in severe cold areas is shown in Figure 7.

In Figure 7, the more red areas, the higher the heat dissipation capacity of the reconstructed building. That is, the more blue areas, the better the thermal insulation performance of the reconstructed building.

It can be seen from Figure 7 that after the green and energy-saving ecological transformation of existing buildings in cities in severe cold areas by this method, the blue areas have increased significantly. Therefore, this method not only improves the stability of beam-column elements of existing buildings in cities in severe cold areas, but also improves the thermal insulation performance of buildings.

6. Conclusions

This paper puts forward the green energy-saving and ecological transformation methods of existing buildings in cities in severe cold areas. The connection model between concrete foundation and double steel plate composite wall of beam-column joints of existing buildings in cities in severe cold areas is established, which improves the bearing capacity of buildings. Combined with embedded anchoring and embedded anchoring methods, the mechanical reliability of beam-column joint fixation is optimized. The embedded anchoring method improves the stability and thermal insulation performance of the building.

Since the weather environment in most cities in China is hot in summer and cold in winter, this study is only aimed at the reconstruction of existing buildings in cities in cold regions. Therefore, the next research will start from the energy-saving transformation of the building envelope, energy-saving transformation of existing buildings in hot summer and cold winter areas.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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Research Article

Emergency Decision-making Method of Unconventional Emergencies in Higher Education Based on Intensive Learning

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In order to improve the emergency decision-making and management ability of unconventional emergencies in Colleges and universities, an emergency decision-making method for unconventional emergencies in Colleges and Universities based on reinforcement learning is proposed. The function of the emergency decision-making model of unconventional emergencies in Colleges and universities is constructed, and the optimal control of the emergency decision-making process of unconventional emergencies in Colleges and universities is realized by using the queuing theory model. Based on the sub-sequence decomposition method, the reinforcement learning function is optimized. Combined with big data scheduling and the empirical mode decomposition method, the effective probability density function of emergency decision-making for unconventional emergencies in higher education is calculated, and the optimal solution vector analysis of emergency management and scheduling decision-making for unconventional emergencies in Colleges and universities is realized according to parameter estimation and quantitative optimization results. The test results show that this method has a good ability to optimize and schedule the emergency decision-making of unconventional emergencies in higher education, and has strong convergence. This method improves the emergency response-ability, and the time cost is short.

1. Introduction

The emergency response ability of unconventional emergencies in colleges and universities is the key to emergency response at the beginning, emergency treatment in the middle, and recovery afterward. In order to reduce the casualties and property losses of unconventional emergencies in colleges and universities, ensure the normal operation of colleges and universities, and effectively allocate emergency support resources [1], it is necessary to manage the emergency response ability of unconventional emergencies in colleges and universities. In order to effectively meet the emergency needs in the new situation and improve the scientific management of unconventional emergencies in colleges and universities, it is necessary to change the corresponding management concepts and methods, pay attention to the evaluation of existing emergency capabilities from the perspective of supply and demand, and realize quantitative management. Because non-quantitative management is highly subjective, random, and unreliable, managers often evaluate, make decisions and manage through experience, which easily leads to decision-making mistakes and hidden problems [2]. Compared with non-quantitative management, quantitative management can more effectively digitize the resources required by the emergency response capability, mine the information through mathematical tools, and obtain more objective quantitative results, which can be applied to the planning, organization, coordination, and control of the emergency response process of unconventional emergencies in higher education [3].

The structure of emergency capability of unconventional emergencies in colleges and universities refers to the composition and proportion of each element of the emergency capability of unconventional emergencies in colleges and universities [4]. The elements of emergency response capability of unconventional emergencies in colleges and universities and their proportional interaction effect determine the state of emergency response capability of unconventional emergencies in colleges and universities [5]. The influencing factors of emergency response ability of unconventional emergencies in colleges and universities mainly focus on personnel quality, resource support, cooperative response, management ability, and so on. However, different response processes for unconventional emergencies in higher education have different requirements for emergency response capabilities. It is necessary to allocate emergency resources in time according to specific scenarios and adjust the proportion of emergency response capability elements of unconventional emergencies in higher education to meet specific emergency needs. From the perspective of intensive learning and dynamic emergency management and dispatch, this article studies the demand structure and supply structure of the emergency capacity of unconventional emergencies in colleges and universities, to evaluate the matching degree between the emergency capacity building of unconventional emergencies in colleges and universities and the emergency demand, so as to put forward more targeted countermeasures to improve the emergency capacity. Yang Jin believes that because some factors of emergency management ability of unconventional emergencies in higher education are uncertain or difficult to quantify, the description of emergency management execution ability is fuzzy [6]. When evaluating the emergency management execution ability of higher education, a fuzzy comprehensive evaluation method can be used to make a general and general understanding of the situation of emergency management execution ability. For some evaluation indexes that cannot be quantitatively described, the qualitative prediction method is usually used, and it is judged by the knowledge and experience of experts. Yu Yanling believes that it is very important to conduct scientific and reasonable evaluations and build a complete evaluation index system. In order to ensure the scientificity and applicability of the established system, the selection of indexes in the evaluation index system should follow certain principles, and the determination of evaluation indexes should take into account various factors. The evaluation index system established according to the above rules can become a complete, objective, scientific, and reasonable evaluation index system, and the evaluation of the evaluation index can be more effective. There are also academic disputes about the understanding of emergency response capability. Dong Shuang believes that the emergency response ability of colleges and universities includes three aspects: early warning ability, crisis response ability, and crisis recovery ability. It is necessary to analyze the resources, skills, knowledge, and other elements of emergency response capability by investigating the capability composition and functions in different stages of crisis events. It is considered that the emergency management ability of colleges and universities in Yang Bin refers to the ability of college emergency management personnel to avoid emergencies and reduce the losses caused by emergencies by mastering certain ability elements, including resources, knowledge, and skills [7]. Liu Wei believes that the emergency management of colleges and universities should form a systematic process according to the process of unconventional emergencies in colleges and universities, the people involved, and the losses caused. In this system, from the prevention of the emergency management of unconventional emergencies in higher education, to the outbreak of emergencies, to the loss of people and property, to the rescue, recovery, reconstruction, and summary learning, the principles of the emergency management process of unconventional emergencies in higher education can be completely outlined [8].

In view of the above problems, this study proposes an emergency decision-making method for unconventional emergencies in higher education based on reinforcement learning. First, the model function of emergency decision-making for unconventional emergencies in higher education is constructed. Then, according to the results of parameter estimation and quantitative optimization, the optimal solution vector analysis of emergency management and scheduling decision of unconventional emergencies in higher education is realized. Finally, the experiment verifies the good effect of this method in improving the emergency response ability of unconventional emergencies in higher education.

2. Reinforcement Learning Theory

Reinforcement learning, also known as reinforcement learning, evaluation learning, or reinforcement learning, is one of the paradigms and methodologies of machine learning. It is used to describe and solve the problem that agents maximize returns or achieve specific goals through learning strategies in the process of interacting with the environment. The common model of reinforcement learning is the standard Markov decision process. According to the given conditions, reinforcement learning can be divided into model-based reinforcement learning and modeless reinforcement learning, as well as active reinforcement learning and passive reinforcement learning. The variants of reinforcement learning include reverse reinforcement learning, hierarchical reinforcement learning, and reinforcement learning of some observable systems. The algorithms used to solve reinforcement learning problems can be divided into two categories: strategy search algorithm and value function algorithm. A deep learning model can be used in reinforcement learning to form deep reinforcement learning. Inspired by behavioral psychology, reinforcement learning theory focuses on online learning and tries to keep a balance between exploration and utilization. Different from supervised learning and unsupervised learning, reinforcement learning does not require any data to be given in advance but obtains learning information and updates model parameters by receiving reward feedback from the environment. If an agent's behavior strategy leads to a positive reward reinforcement signal in the environment, then the agent's tendency to produce this behavior strategy will be strengthened in the future. The goal of Agent is to find the optimal strategy in each discrete state to maximize the expected discount reward. Reinforcement regards learning as a tentative evaluation process. The agent selects an action for the environment, and the environment changes its state after accepting the action. At the same time, a reinforcement signal is generated and fed back to the agent. The agent selects the next action according to the reinforcement signal and the current state of the environment. The principle of selection is to increase the probability of positive reinforcement. The selected action not only affects the immediate enhancement value but also affects the state of the next moment in the environment and the final enhancement value. The specific operation process is shown in Figure 1.

According to the reinforcement learning process shown in Figure 1, with the advantages of high sample utilization, small value function estimation and variance, and convenient falling into local optimization, this article studies the emergency decision-making method for unconventional emergencies in higher education.

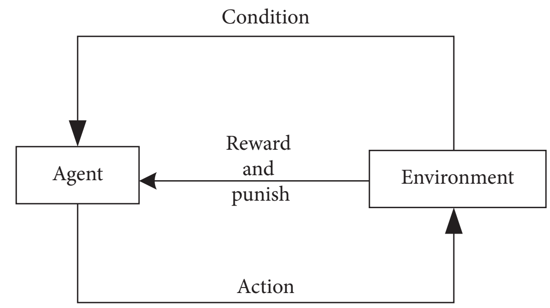

Figure 1: Reinforcement learning process.

3. Analysis of the Quantitative Model Framework of Emergency Response Capacity of Unconventional Emergencies in Colleges and Universities

3.1. Applicability Analysis of Quality Function Deployment Theory. The needs of emergency management in colleges and universities, that is, in the process of emergency management, the goal of achieving the ideal level of state control of emergencies in colleges and universities can also be called demand goals, such as short response time, small accident impact range and fast information reporting. In the process of emergency management, we can quantitatively analyze the degree of demand satisfaction, which is an analysis of the emergency management process [9–11].

The supply of emergency capacity in colleges and universities needs to meet the needs and objectives of emergency management. Meeting the needs and objectives of emergency management depends on the supply of emergency capability, which is provided by the emergency management department of colleges and universities. The emergency management department of colleges and universities is usually not a fixed department, but is composed of emergency managers from the principal's office, public security department, school hospital, student affairs office, and other departments. The supply of emergency capability is usually reflected in decision-making and command, resource guarantee, rehabilitation, reconstruction, etc., which has a certain structural relationship. It is necessary to clarify the key points of emergency capability construction [12, 13].

If the supply of emergency capability can guarantee the realization of the demand target in the emergency treatment process, the emergency can be controlled according to the demand target; If the supply of emergency capacity cannot guarantee the realization of the demand target in the process of emergency treatment, it is necessary to adjust the structure of relevant emergency capacity and improve the level of emergency capacity [14].

As the emergency management and emergency response capability of colleges and universities show the relationship between demand and supply, the theory of quality function deployment and its quality manifestation can be used for analysis. The overall framework of the quantitative model of emergency response capacity in colleges and universities established in this study refers to the method of quality function development and the principle of building house of quality, combines the specific demand and supply environment of emergency response capacity in colleges and universities, and takes the matching management of supply and demand as the guiding ideology [15, 16]. On the basis of analyzing the demand structure and importance of emergency response capacity, the relationship between supply elements of emergency response capacity, and the relationship between supply and demand of emergency response capacity, it evaluates the demand achievement and supply level of emergency response capacity in colleges and universities. The overall framework of the quantitative model of college emergency response capacity proposed in this study is shown in Figure 2.

3.2. University Education Unconventional Emergency Decision-Making Structure Model. The function of the emergency decision-making model for unconventional emergencies in higher education is constructed, and the queuing theory model is used to optimize the process of emergency decision-making for unconventional emergencies in higher education. The database of emergency decision-making for unconventional emergencies in higher education consists of four parts: database server, information management middle ware, data storage server, and browser [17]. When constructing the emergency decision-making model of unconventional emergencies in higher education, the simulation environment is preset, and the specific parameters are:

Virtual machine VM10.0

Processor AMD A4-4300 M 2.5 GHz × 1

Memory 3 GB

Graphics AMD

Hard disk 50 GB

Operating system ubuntu 15.04 64 bits

Kernel version 3.19.0-15-generic

Search engine toolkit Lucene2.4.3.

Based on the above parameters, in cloud storage, the implementation process of emergency decision-making for unconventional emergencies in university education is shown in Figure 3.

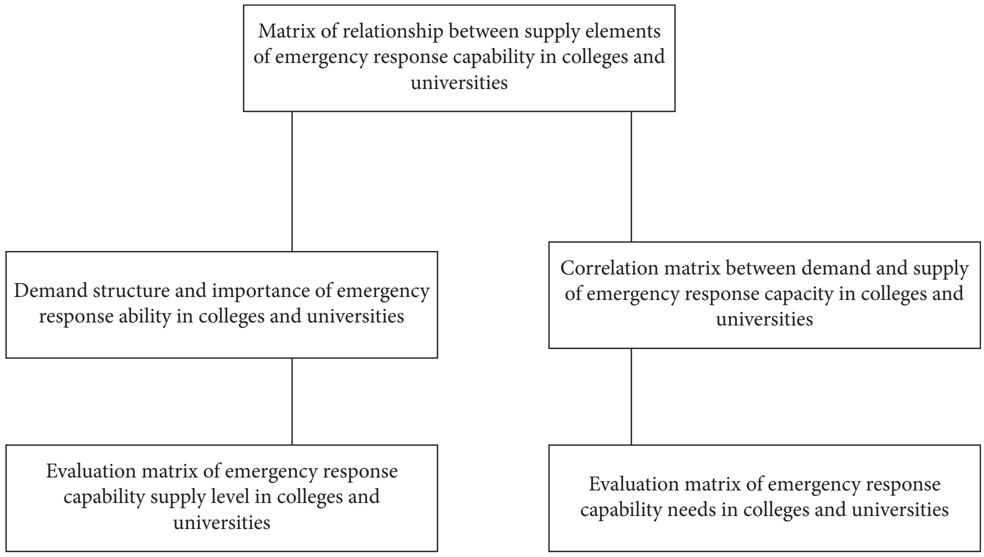

Figure 2: Overall framework of a quantitative model of emergency response capacity in colleges and universities.

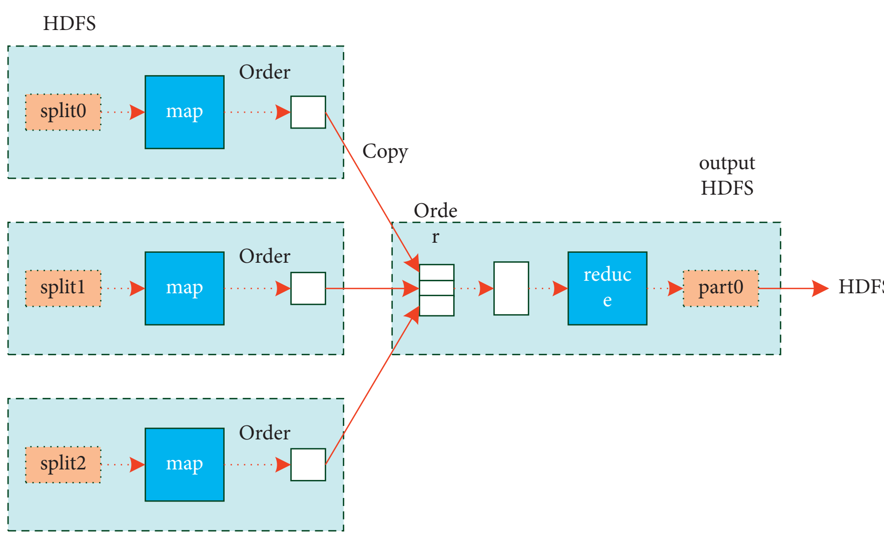

Figure 3: Execution process of emergency decision-making for unconventional emergencies in higher education.

In Figure 3, it is assumed that U_i is the autocorrelation data of the information interaction data set of the multi-feature cloud storage database for emergency decision-making of unconventional emergencies in higher education, and the related function data of each unstructured data set are independent of each other. Among them, the resource utilization rate of the whole emergency decision-making platform for unconventional emergencies in higher education is mentioned in the formula given below:

$$\lambda_{SRm} = \sum_{i=1}^{M} \lambda_i p_{im}, \tag{1}$$

where λ_i is the basic file block of emergency decision-making for unconventional emergencies in higher education, and p_{im} is the decision probability. Using the model of queuing theory, the specific characteristic values of emergency decision-making scheduling for unconventional emergencies in higher education are obtained. The demand factor values of emergency capability in higher education are mentioned in the formula given below:

$$I_{SRm} = \frac{L_{SRm}}{\rho_{SRm}} = \frac{\sum_{i=1}^{M} \lambda_i p_{im} \left(T_{\text{wait}} + T_{\text{service}}\right)}{\rho_{SRm}}, \tag{2}$$

where L_{SRm} is the emergency capability parameter of colleges and universities, ρ_{SRm} is a preliminary parameter for sorting, summarizing, analyzing and adjusting. p_{im} is the emergency dispatch factor of unconventional emergencies in colleges and universities, T_{wait} is the waiting time, and T_{service} is the service time of emergency dispatch of unconventional emergencies in colleges and universities. Assuming that the emergency decision of unconventional emergencies in colleges and universities adopts unstructured data sets for feature classification, The classified aggregated tag information conforms to the mixed distribution of distribution factors, and the auto-correlation quantum sequence of tag information of file blocks is obtained by numerical calculation, thus realizing the emergency dispatch of unconventional emergencies in higher education and the optimized access to the database. The elements obtained through various channels are preliminarily sorted out, summarized, analyzed and adjusted. In the emergency management of unconventional emergencies in higher education, the difference in meaning expression caused by the difference in conceptual categories and semantics should be avoided, and it should be adjusted to a structured language [18, 19].

3.3. Sub-Sequence Decomposition of Emergency Decision-Making for Unconventional Emergencies in Higher Education. On the basis of the overall design of the structural model of emergency decision-making for unconventional emergencies in higher education, the subsequence decomposition of emergency decision-making for unconventional emergencies in higher education is carried out. By analyzing the traditional methods, it can be seen that the existing emergency decision-making schemes for unconventional emergencies in higher education have the following shortcomings: (1) they can only be verified a limited number of times; (2) Most emergency decision-making schemes for unconventional emergencies in higher education are based on coding technology. In this study, the sub-sequence decomposition method of unconventional emergency decision-making in university education is used to logically encode and decrypt the cloud data of the receiving node of large-scale cloud dynamic data.

The solution principle of the subsequence decomposition method is as follows:

If the head of a continuous subsequence is negative (that is, the continuous subsequence starting from the starting point), the sum of the sequence obtained by dropping the head is larger. Therefore, whenever there is a header and a negative, set the sum to 0, which means that the cumulative sum is renewed. After updating the sum, the value of the maximum sum is also updated. The pseudocode is expressed as:

```
int sum = 0;
int res = -INF;
for (int i = 0; i < N; i++) {
sum + = nums [i];
res = math. max (res, sum);
if (sum <0)
sum = 0;
}
```

According to the solution process of the above sub-sequence decomposition method, the job execution information is obtained, and the new mapping formed in the multi-source nodes is obtained [20], as shown in the formula as follows:

$$x_n = [x(0), x(1), \ldots, x(N-1)]^T, \tag{3}$$

where $x(0), x(1), \ldots, x(N-1)$ represents the time series of emergency decision-making for unconventional emergencies in higher education. In the demand structure table of emergency capability in higher education, the tag information is related to S-Table. And $h(\cdot)$ is the broadcast data packet. Assuming that the emergency decision of unconventional emergencies in higher education has correctly received the broadcast information packets of $d\,(0 \le d \le n)$ original data streams, if the receiving node has received the membership samples of (g_1, Y_1), (g_2, Y_2), …, neighbor samples from the broadcast source, the retransmission packet X_1, X_2, …, X_d neighbor samples of the scheduling factor of unconventional emergencies in higher education is obtained. For simplicity, set the subsequence of emergency decision-making for unconventional emergencies in higher education that $W_c < \delta(t_c, t_a)$ has correctly received in the current window of the emergency decision-making process for unconventional emergencies in higher education, and the subsequence is X_{d+1}, that is, the lost data packet is $W_c < \delta(t_c, t_a)$, and the weighting coefficient, and there is a relationship of given as the formula given below:

$$\delta(t_c, t_a) = \frac{2^{-\lambda(t_c - t_a + T_d) - 1}}{2^{-\lambda T_d} - 1}, \tag{4}$$

where t_c is the time series of $A[n+1]$ tuples, and t_a is the data decision fusion granularity of the isolated core cluster of emergency decisions for unconventional emergencies in higher education. The realization steps of sub-sequence decomposition to obtain emergency decisions for unconventional emergencies are described as follows:

(1) according to S_k model M_k, calculate the predicted value of emergency decision of unconventional emergencies in higher education, search the hierarchical data structure tree composed of internal nodes of database access buffer through granularity decomposition of data information, and initialize the reinforcement learning parameters of emergency decision of unconventional emergencies in higher education;

(2) until the specified iteration number k is reached or the termination condition is met, the value of is updated to $\widehat{\theta}$, and the sub-sequence decomposition of the emergency decision of unconventional emergencies in higher education is carried out, and the decision criteria of whether the decomposition is accepted or not are obtained as shown in formula below:

$$\max_{a,\tau} \left| \int_0^T r(t) \frac{1}{\sqrt{a}} f^* \left(\frac{t-\tau}{a} \right) \mathrm{d}t \right| = \max_{a,\tau} \left| W_f r(a,\tau) \right| H_1 > \lambda \lambda < H_0. \tag{5}$$

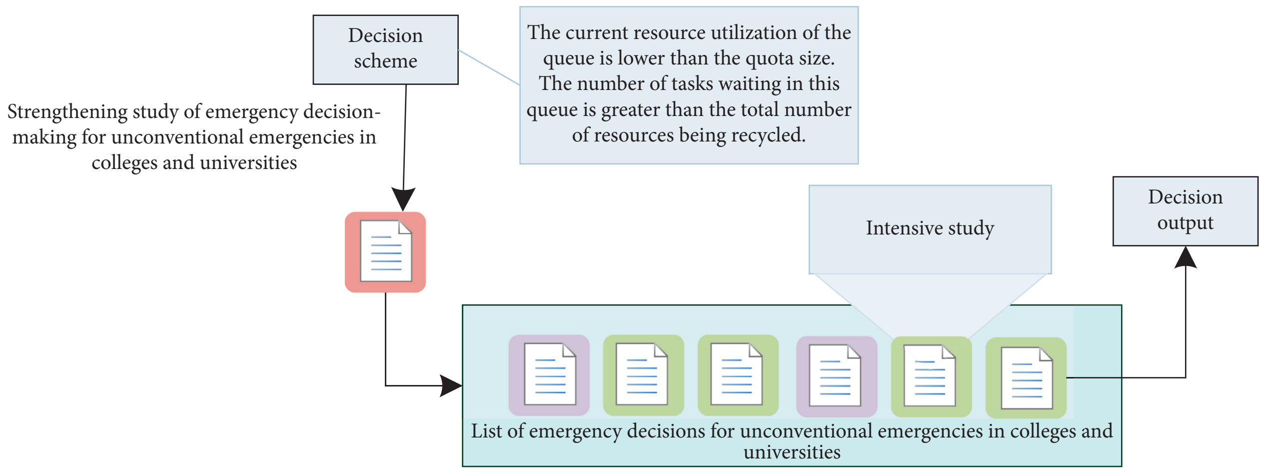

Figure 4: Sub-sequence decomposition of emergency decision-making for unconventional emergencies in higher education.

(3) When the data stream of emergency decision-making for unconventional emergencies in higher education is processed, the node DB_{ij} is locked and inserted into the node f through the < key, pointer > instruction, so as to realize the scheduling of emergency decision-making for unconventional emergencies in higher education. The execution time of emergency decision-making for unconventional emergencies in higher education is set to $(t_{\text{current}} + \phi_k/d_x/d_t)$.

To sum up, the subsequence decomposition process of emergency decision-making for unconventional emergencies in higher education in cloud storage systems is shown in Figure 4.

4. Improved Implementation of Algorithm

The intensive tracking learning and adaptive optimization control in the emergency decision-making process of unconventional emergencies in colleges and universities have been established, the effective probability density function of emergency decision-making for unconventional emergencies in higher education is calculated, and the optimal solution vector analysis of emergency management and scheduling decision-making for unconventional emergencies in higher education according to parameter estimation and quantitative optimization results is realized, which leads to the response of emergency decision-making for unconventional emergencies in higher education.

In order to overcome the disadvantages of traditional methods, this study proposes an emergency decision algorithm for unconventional emergencies in higher education based on subsequence fuzzy decision-making. Fuzzy decision is a decision with fuzzy elements (such as criteria and alternatives). Fuzzy decision-making method refers to the use of fuzzy mathematical methods to deal with some complex decision-making problems. This kind of problem generally has the characteristics of a large-scale system. The relationship between systems is very complex, and some variables cannot be accurately assigned. These variables belong to fuzzy factors and involve certain subjective factors, which makes the relationship between subsystems and variables unclear, so it must be handled with the help of sorting, fuzzy evaluation, and other methods. The implementation of this method mainly includes two aspects: function establishment and pattern recognition.

4.1. Create Function. The improved algorithm design is described as follows: In the construction of data temporal distribution, two points of database temporal attributes of emergency decision-making for unconventional emergencies in higher education are assumed to be n_1, n_2, and the distance between two points SD is defined as normal distribution, and the consistency index of emergency decision-making for unconventional emergencies in higher education is defined as $N = \Delta x^2$. In the interval $[-\Delta x/2, \Delta x/2]$, subsequence fuzzy decisions have complete consistency. Choose different file block sizes, and get the response time of emergency decision-making homework for unconventional emergencies in higher education as shown in the formula given below:

$$Y^* = GXN_0 + \frac{\tilde{x}(t)}{\tilde{x}(u)}, \tag{6}$$

where $\tilde{x}(t)$ is the coding vector of emergency decision-making for unconventional emergencies in higher education, N_0 is the sub-sequence fuzzy decision-making scale parameter of emergency decision-making for unconventional emergencies in higher education, and $\tilde{x}(u)$ is the reinforcement learning function. By using subspace fusion, the algorithm of emergency decision-making for unconventional emergencies in higher education is improved, and the attribute weight distribution of emergency decision-making for unconventional emergencies in higher education is as shown in the formula given below:

$$F = \begin{bmatrix} \omega^0 & \omega^0 & \omega^0 & \cdots & \omega^0 \\ \omega^0 & \omega & \omega^2 & \cdots & \omega^{k-1} \\ \omega^0 & \omega^2 & \omega^4 & \cdots & \omega^{2(k-1)} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \omega^0 & \omega^{k-1} & \omega^{2(k-1)} & \cdots & \omega^{(k-1)^2} \end{bmatrix} = \prod_{0 \le j < i \le k-1} \left(\omega^i - \omega^j\right), \tag{7}$$

where ω^i, ω^j are the weighted subsequences of emergency decision-making for unconventional emergencies in higher education. Assuming that the phase spectra of two sections of multi-queue management task data $x_1(t)$ and $x_2(t)$ are independent and autocorrelation, the correlation is analyzed by using the analysis method of the decision-making laboratory. By calculating the overall impact matrix of emergency capability supply, the reachable matrix is obtained, and the relationship between emergency capability supply elements is analyzed. The differential equation is expressed as shown in the formula given below:

$$\begin{cases} \dot{m}_i(t) = -a_i m_i(t) + b_i\left(p_i(t-\sigma), p_2(t-\sigma), \ldots, p_n(t-\sigma)\right), \\ \dot{p}_i(t) = -c_i p_i(t) + d_i m_i(t-\tau), \end{cases} \tag{8}$$

where a_i, b_i, c_i, and d_i are the emergency capability supply element, t is the decision time, τ is the delay, and $m_i(t)$ is the emergency capability supply parameter.

Formula (8) is the established fuzzy decision function.

4.2. Pattern Recognition. In the multi-source hierarchical data structure, intensive learning of emergency decision of unconventional emergencies in higher education is carried out, and the data classification attribute is $A = \{A_1, A_2, \ldots, A_m\}$. The information fusion center in the emergency management database of unconventional emergencies in higher education forms a relative index result $\widetilde{Q}$ and a slack query result $X_1 \oplus X_5$. In the application of XNCWBR, it is necessary to broadcast and retransmit the emergency management factor (E_i, E_j, d, t) of unconventional emergencies in higher education. The trust relationship of query structure is expressed as follows. According to the existing emergency management data packets X_1, X_2, X_3, X_8, X_7, X_9, X_{10} of unconventional emergencies in higher education and the received sub-sequence task modules of big data, the emergency decision of unconventional emergencies in higher education is made, and the distribution matrix of reinforcement learning state of emergency decision of unconventional emergencies in higher education is obtained (see Table 1).

4.3. Realize the Emergency Decision-Making of Unconventional Emergencies in Higher Education. Based on the algorithm improvement process of the above two parts, reinforcement learning algorithm is used to strengthen the emergency decision-making of unconventional emergencies in higher education, so as to realize the data scheduling in the cloud storage system. To sum up, the point cloud data analysis method, combined with big data scheduling and empirical mode decomposition, is used to establish intensive tracking learning and adaptive optimization control in the process of emergency decision-making of unconventional emergencies in higher education, and the effective probability density function of emergency decision-making of unconventional emergencies in higher education is calculated. According to the parameter estimation and quantitative optimization results, the optimal solution vector analysis of emergency management and scheduling decision-making of unconventional emergencies in higher education is realized.

Table 1: Emergency decision-making of unconventional emergencies in higher education strengthens learning state response.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
R_1	Y	X	X	Y	Y	X	X	Y	X	Y
R_2	X	Y	X	Y	Y	X	X	X	Y	Y
R_3	X	X	Y	Y	Y	X	X	X	X	X
R_4	Y	X	Y	Y	X	Y	X	Y	Y	Y
R_5	X	Y	X	Y	Y	X	X	X	X	Y

5. Simulation Experiment

According to the idea of matching supply and demand, the supply of emergency capacity for unconventional emergencies in higher education is the core content of quantitative management of emergencies in higher education, and the basis for meeting the demand of emergency capacity for unconventional emergencies in higher education. In the experiment, through data analysis and simulation, we will study the composition of the supply of emergency capacity for unconventional emergencies in colleges and universities and the relationship between them. In the description of the satisfaction degree of emergency capacity supply elements to the demand of emergency capacity, rr can be used to indicate the degree of influence of the j-th emergency capacity supply element on the ith emergency capacity demand element, that is, the degree of correlation, which usually takes the values of 0, 1, 3 and 9, respectively, indicating strong correlation, medium correlation, weak correlation, and irrelevance. See Table 2 for the distribution of the weight factors of the importance of emergency demand objectives in colleges and universities.

According to the parameters and demand capacity allocation in Table 3, strengthen tracking learning and adaptive optimization control in the process of emergency decision-making for unconventional emergencies in higher education are established, and the effective probability density of emergency decision-making for unconventional emergencies in higher education is calculated. The calculation results of demand importance, target value, and improvement ratio are shown in Table 3.

The importance of the supply elements of the emergency response capability for unconventional emergencies in colleges and universities needs to be transformed by "demand-supply," so as to find out the key emergency response capability. Convert the degree of demand achievement in the

Table 2: Distribution of weight factors of the importance of emergency demand objectives in colleges and universities.

Bound variable	Weight factor
Counselors found the accident at the first time.	0.69
Personnel are sent to hospital for rescue in time.	0.93
Protection of the scene is complete.	0.75
Accident information is reported in time.	0.06
Relevant information of the deceased is collected comprehensively.	0.23
Prevent information diffusion	0.27
Accurate event characterization	0.33
Emergency plan starts quickly.	0.10
Effective leadership decision-making	0.17
Reasonable allocation of emergency resources	0.85
Family reception in place	0.57
Network public opinion guidance	0.24
Prevent mass incidents	0.24
Prevent derivative events	0.98
Low social influence	0.24
Authoritative information release	0.08
Information transmission is smooth.	0.79
End the accident as soon as possible.	0.84
Reasonable compensation or assistance compensation to family members	0.96
Restore normal teaching order on campus on time.	0.06
Timely psychological intervention for students.	0.79

Table 3: Calculation results of emergency decision parameters for unconventional emergencies in higher education.

Ability requirement	Importance of demand	Target value	Improvement ratio/%
Counselors found the accident at the first time.	0.38	0.64	91.47
Personnel are sent to hospital for rescue in time.	0.22	0.90	18.31
Protection of the scene is complete.	0.56	0.96	65.72
Accident information is reported in time.	0.64	0.16	69.70
Relevant information of the deceased is collected comprehensively.	0.57	0.86	92.48
Prevent information diffusion	0.35	0.00	24.26
Accurate event characterization	0.27	0.87	3.19
Emergency plan starts quickly.	0.40	0.96	68.58
Effective leadership decision-making	0.35	0.86	10.43
Reasonable allocation of emergency resources	0.62	0.11	18.22
Family reception in place	0.05	0.29	8.35
Network public opinion guidance	0.91	0.14	12.90
Prevent mass incidents	0.46	0.33	68.15
Prevent derivative events	0.60	0.58	10.16
Low social influence	0.22	0.59	11.16
Authoritative information release	0.43	0.39	0.69
Information transmission is smooth.	0.54	0.98	56.26
End the accident as soon as possible.	0.72	0.96	7.90
Reasonable compensation or assistance compensation to family members	0.89	0.74	89.98
Restore normal teaching order on campus on time.	0.92	0.98	99.90
Timely psychological intervention for students.	0.17	0.90	29.69

supply level of emergency capacity, get the promotion ratio, build and develop the emergency capacity level pertinently, and get the convergence curve of emergency decision as shown in Figure 5, and the cost of decision time as shown in Figure 6.

Figure 5 shows that before the improvement, the emergency decision fluctuated greatly and the convergence was poor. The oscillation range was mainly divided into three parts: 0~10, 5~6, and 0~1. Using this method to deal with emergencies in Colleges and universities can quickly converge to the minimum oscillation range, which is mainly divided into two parts: 5~6 and 0~1. Therefore, the proposed method has good convergence.

Figure 6 shows that using this method to make emergency decisions for unconventional emergencies in colleges and universities has better optimization scheduling ability, stronger convergence, improved emergency response ability of unconventional emergencies in colleges and universities, and shorter time cost. The data packet loss rate is lower than 4, which is lower than 5 and 7 in reference [4] and reference [5], which verifies that the proposed method has a better decision-making effect.

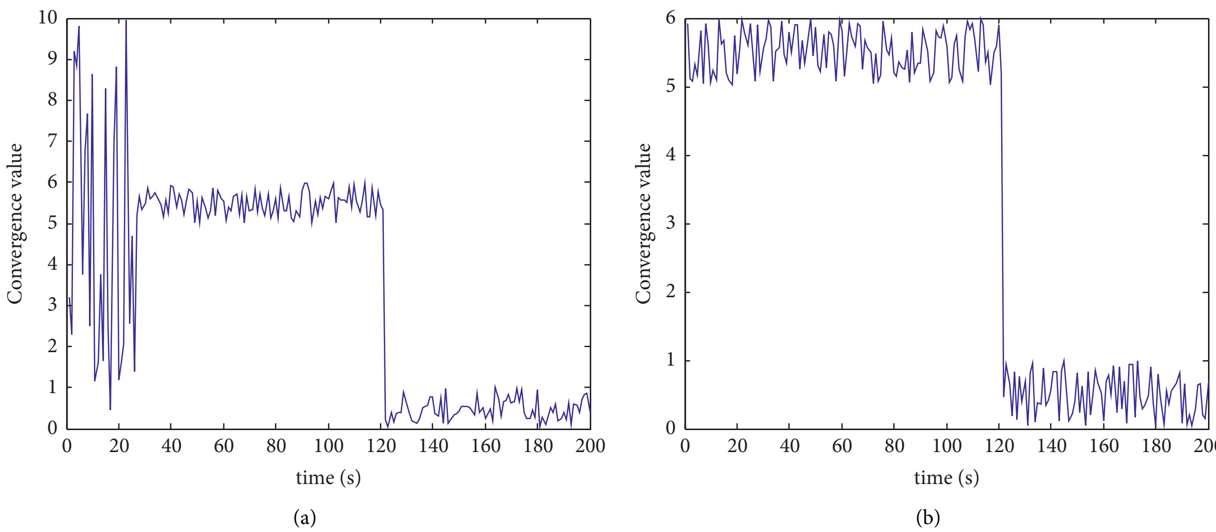

FIGURE 5: Convergence curve of emergency decision (a) before improvement (b) after improvement.

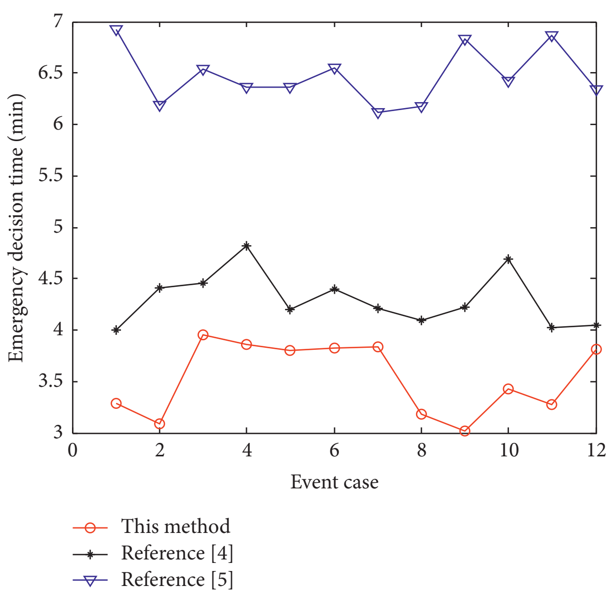

FIGURE 6: Time expenditure of emergency response to unconventional emergencies in higher education.

In order to further test the decision-making performance of the proposed method, this method is run in a university from June 1 to June 12, 2021 to generate Unconventional Emergency Decision-making schemes in this time period. The generation of the decision-making scheme of the system on the 12th day of operation is shown in Table 4.

Table 4 test results show that this method can be used to generate unconventional emergency decision-making schemes with a low failure rate. When the failure rate is less than 0.003% and the number of concurrent users is 385, the response time generated by the unconventional emergency decision scheme is less than 500 ms. According to the test results in Table 4, this method has ideal operation performance.

6. Discuss

The process management of emergency response in colleges and universities is helpful to find out the weak links in the management process. Instead of just judging by the results, it is necessary to objectively evaluate the situation of each stage in the process of emergency response. Analyze and comprehensively evaluate the disposal process of emergency management. For example, the research of this study is to achieve the goal based on the demand in the process of emergency handling, and then comprehensively evaluate the quantitative score of handling and the emergency capability supply structure that matches it after the structural transformation. To establish the concept of emergency process management, colleges and universities need to pay attention to the record of the emergency management process, form the system of database construction, and experience the exchange of emergency treatment process, so as to carry out emergency personnel training more pertinently and continuously improve the management level of emergency treatment process.

In the information age, the implementation of quantitative management is an important symbol of the contemporary management level. The essence of quantitative management is the refined utilization of resources, and it is an important concept for the management effectiveness of enterprises, units, and organizations. In essence, the process of quantitative management of emergencies in colleges and universities is based on the quantitative evaluation of the objectives of emergency needs, and the structure of the supply elements of emergency capabilities, their importance, the upgrading objectives, and supply status of emergency capabilities are obtained, so as to improve and upgrade the important emergency capabilities to better meet the needs. In addition, the quantification of the emergency response ability of colleges and universities is conducive to the realization of digitalization and indexing with the help of computer programming, and it is convenient to fully tap and

Table 4: Generation of decision schemes.

Date	Number of decision schemes generated/piece	Successfully generated quantity/piece	Failed generation quantity/piece	Maximum concurrent users/	Maximum response time/ms
June 1st	125814	125811	3	385	436
June 2nd	214581	214579	2	289	341
June 3rd	185161	185159	2	348	285
June 4th	194513	194512	1	297	364
June 5th	234568	234565	3	264	294
June 6th	187415	187413	2	285	345
June 7th	195462	195461	1	316	294
June 8th	224687	224685	2	352	258
June 9th	269784	269783	1	348	378
June 10th	216485	216483	2	296	465
June 11th	198541	198538	3	348	418
June 12th	132548	132547	1	297	395

utilize valuable information in the data. To strengthen the concept of quantitative management in colleges and universities, we should carry out key activities such as safety culture education, case quantitative analysis, personnel training, assessment, etc., so that the quantitative thinking mode can go deep into all levels and all kinds of emergency personnel and form a benign normative thinking.

7. Conclusions

In view of the long response time of traditional emergency decision-making methods, this study proposes an emergency decision-making method for unconventional emergencies in higher education based on reinforcement learning. Based on the big data distribution structure model, node resources are allocated through multi-queue decision fusion. The sub-sequence decomposition method is used to logically encode the receiving nodes of large-scale cloud dynamic data, decrypt the data, and obtain job execution information. Fuzzy decision-making method is used to improve the emergency decision-making algorithm for unconventional emergencies in higher education. The simulation results show that the algorithm has good decision fusion performance of big data subsequence. This method improves the response-ability of state characteristics in the process of data resource scheduling and mining and reduces the packet loss rate in the process of big data transmission and storage.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

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Research Article

Analysis of the Effect of the Integration Development of Sports Economy and Health Industry in the Context of Public Health Based on Big Data Analysis Technology

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In order to guide and meet people's health needs, various resources are flowing to the health sector, and the regional health economy is bound to develop rapidly, which increases the possibility of integrating and developing the sports economy and health industry in the context of the public health sector. As the health of the population improves, life expectancy increases, science and technology develops, and lifestyles change, the health economy sector is becoming increasingly active and both sport and healthcare will contribute to the development of the regional health economy. Big data, as a new management mindset and technical tool, brings new opportunities and challenges to the integrated development of sports economy and health industry. Based on the basic characteristics of big data, this paper provides a strategy for the development of the sports and health integration industry by using research methods such as grey correlation analysis, expert interviews, and agglomeration measures, starting from the problems faced by the integration development of China's sports industry to guarantee the construction of conditions. The experiment is analysed through the big data presentation of the health industry and the big data modelling ideas of grey correlation analysis, which provides new ideas to expand the application research of grey correlation analysis in the field of integration development.

1. Introduction

With the introduction of the Health China 2030 Plan, health economy has become a high-frequency term, and in 2011, the size of China's health economy exceeded 500 billion yuan [1]. The health economy is a collection of industrial activities such as production of products, provision of services, and dissemination of information on a large scale for the purpose of maintaining health, repairing health, and promoting health [2]. The health economy mainly aims to meet people's needs for health care to the maximum extent possible through the effective use of social resources and ultimately to promote and improve people's health. Therefore, health-related industrial activities are all related to the health economy. As an industry closely related to people's health, the sports industry has obvious health-related attributes. In recent years, the sports industry has gradually become a strategic emerging industry in China, playing an increasingly important role in the country's economic, scientific, and technological as well as humanistic development [3].

For the sports economy in public health to play a greater role in its implementation, it must integrate with other health industries and take the path of integrated development of the sports industry. But there are still many difficulties in how to better integrate with other industries and how to overcome them is the key. From a macro point of view, the prospect of integrating the sports industry and the health industry is indicated and planned as an important development path for the deep integration of national fitness and national health. At present, China's economy presents a new normal of transition from high-speed growth to high-quality development [4], and the population structure is moving from adult to elderly, with the Lewis inflection point [5]. In the context of the health concept and the construction of a strong sports nation, as a happiness industry that promotes people's well-being and enhances their growing aspirations for a better life, high quality has become the new connotation of the integration and development of the sports and health industries in the new era. How to improve the quality and efficiency of the integration of the two has important practical significance for improving the physical quality of China's nationals, adjusting the economic structure, and ensuring healthy economic development.

The sports industry is usually divided into four categories: sports goods manufacturing, professional sports, sports fitness, and leisure industry and related supporting services [6], which is a general term for a series of related economic activities centred on sports activities [7]. The sports industry is a collection of production activities that provide various sports products to the society with the ultimate goal of enhancing people's physical fitness and satisfaction and happiness in life, with the service industry as the main industry structure and the manufacturing industry as a supplement. There are two mainstream definitions of the health industry in the academic community. One is to divide the health industry into health manufacturing and health services according to the attributes of the products provided. The second is to divide the health industry into medical intervention health services and nonmedical intervention health services according to the mode and manner of service provision.

Industrial integration refers to the dynamic development process in which different industries or different sectors within the same industry interpenetrate and intersect with each other and eventually become one, gradually forming a new industry [8], including the comprehensive integration of technology, products, markets, talents, resources, and other aspects. Both the sports industry and the health industry have a wide range of people, comprehensive services, integration, and absolute positive externalities, and the industry involves a wide range of areas. Therefore, the high-quality integrated development of the sports industry and the health industry refers to a new model driven by new technologies, guided by meeting the people's growing need for a better life, based on the deep integration of national fitness and national health, and aiming at responding to the trend of people's consumption upgrade. Deep cross-fertilisation, interpenetration, and complementary advantages are carried out on the supply side of manufacturing and service industries to provide high-quality, high-efficiency, multilevel, and diversified products and services.

Since the 21st century, the progress of modern civilization has brought about an increase in the proportion of people with various chronic diseases and subhealth and an imbalance between health and income development, with rising living standards and declining health. While sport brings pleasure to people, it also promotes the development of a full cycle of health awareness, giving society a positive, stable, and orderly new look [9]. With the cross-border integration and interpenetration of industries as a new paradigm for high-quality economic development [10], the integration of sports and health industries will have more room for development and stronger market vitality. The national demand for health is growing at a high rate [11], and the content of sports and health consumption based on health care and recreation is in line with the people's goal of a green and healthy life. People are more willing to reduce their investment in mid-range disease treatment and gradually shift to the front-end national fitness and back-end rehabilitation and physiotherapy.

Technological advances and innovations often occur at the intersection of industries and change the products and market demand of the original industries, promoting deeper integration between industries. At this stage, as China's new infrastructure projects continue to be implemented, technologies such as 5G, big data, and the internet are moving into a new phase of development, bringing new opportunities for high-quality integration between the sports economy and the health industry, becoming the glue that holds the two together effectively. Promoting more specialisation and refinement of sports services and health services, new industries such as health data monitoring, smart venues, and intelligent health manufacturing have been derived, accelerating the interconnection of industry-wide ecology. At the same time, new technologies can further satisfy the public with diversified consumption demands, providing sports and health products of various types and rich content and forms. For example, in the field of exercise and health promotion, fitness centres can provide a variety of services that integrate sport and health for gym goers through new technologies. Related equipment manufacturers can also apply big data technology to smart wearable devices to form health interactions.

The rapid development of science and technology, such as the Internet, Internet of Things, cloud computing, and e-commerce, has given rise to huge amounts of semistructured and unstructured data in all areas of the economy and society, prompting huge challenges and new opportunities in the way of thinking and decision-making in modern management decision-making, while analysing and tapping the potential value of big data has become an important feature of modern management decision-making. On the other hand, as China's economy and society continue to progress and people's living standards continue to improve, the development of the big health industry has been brought to a strategic level by party committees and government departments at all levels. The new technologies introduced in the development of the industry have made the data of the big health industry gradually take on the characteristics of big data such as massive, multisource, heterogeneous, and low-density value.

Grey correlation analysis is an important element of grey system theory and has been widely cited by scholars in various research fields, such as the selection of regional strategic emerging industries [12], innovation efficiency analysis of high-tech industries [13], and the preferential selection of black-start schemes for power systems [14]. However, the application object of grey correlation analysis is the problem of information-poor uncertainty with little data, and its application area is "modelling of small sample data where some information is known and some information is unknown". On the other hand, the era of big data has greatly increased the availability of all data or information in the field under study, which has also led to a crisis in the application of grey correlation analysis methods. The object of study of grey system theory should involve only poor information and not less data, i.e., the amount of data and poor information do not have a sufficiently necessary relationship, thus providing a theoretical basis for big data modelling of grey correlation analysis.

Some scholars initially explored the application research of grey correlation analysis in the era of big data, for example, Xu Lei studied the evaluation of efficient financial budget performance in the era of big data based on the improved model of grey correlation analysis [15]. Li et al. conducted a comprehensive assessment of electricity quality based on entropy power and grey correlation model and using electric power big data [16]. These two studies cover relevant aspects of big data but do not delve into big data modelling for grey correlation analysis, and they cover types of structured data without exploring modelling of semistructured and unstructured data. In view of the unique advantages and roles of grey correlation analysis methods in studying relevant factors of industrial development such as influencing factors, correlating factors, and controlling factors, exploring the integration development of sports economy and health industry is a positive contribution to the further development and improvement of grey system theory and so on. Based on the basic characteristics of big data and through the use of research methods such as grey correlation analysis, expert interviews, and agglomeration measurement, this paper proposes strategies for the development of the integrated sports and health industry from the perspective of the problems faced by the integrated development of China's sports industry, for the construction of guarantee conditions, the construction of incubation platforms, and the synergy between supply and demand.

2. Big Data Characteristics of the Sports Economy and Health Industry

The sports and health convergence industry is a general term for the industry that provides industrial, academic, and research products and related health services for the purpose of maintaining, improving, promoting, and managing health and preventing diseases [17]. Big data has 4 V characteristics, namely volume, variety, value, and velocity [18]. With the development of the Internet, the Internet of Things, cloud computing, and e-commerce, the data of the health industry has gradually acquired the four basic characteristics of big data. The path of high-quality integration and development of sports industry and health industry is shown in Figure 1.

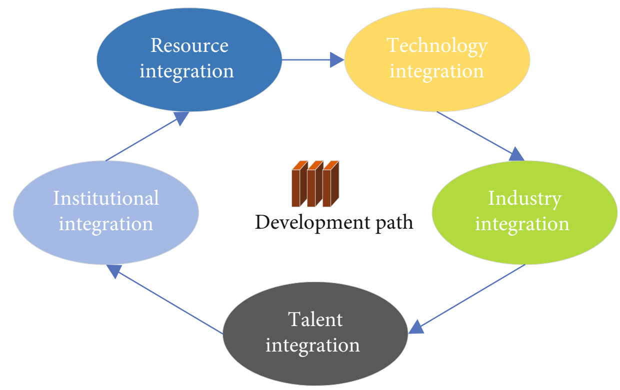


Figure 1: The path to high-quality integration of the sports economy and the health industry.

2.1. The Massive Characteristics of Health Industry Data. The massive characteristics of health industry data are mainly manifested by the large amount of data and the rapid growth rate. With the rapid development of the Internet and the Internet of Things and the widespread use of barcode technology, data such as production and sales volume of big health products are constantly stored and used by manufacturers, intermediaries, logisticians, and sellers, prompting the rapid growth of data volume. Technologies such as telemedicine and wearable devices have enabled hospitals and health authorities to network the collection and use of data information such as patient signs, leading to a dramatic increase in data volumes. The characteristics of big data in the big health industry are (1) firstly, massive data can be obtained from the long time monitoring of the target objects; (2) massive data generated from the huge target groups; and (3) massive data derived from the many index attributes of the research objects.

The health management, medical rehabilitation, elderly care, and health and fitness industries are mainly for the general public, which inevitably involves a huge number of people. In 2016, China's elderly population aged 60 or above exceeded 230 million [19], and the number of people who choose elderly care institutions and smart home care is huge, thus generating a huge amount of data on elderly health. Currently, the number of people who are concerned about health and wellness is getting larger and younger, and the number of monthly active users of health and wellness through the Internet alone is over 10 million, which generates a huge amount of user data every day. In addition, the latest data from the State Food and Drug Administration shows that the number of health food products in China has reached 19,670.

The above facts indicate that the massive amount of data in the big health industry will be a primary feature of future activities such as industry management and decision-making. According to some sources, the health industry is expected to grow at an annual rate of 15% to 20% in the next 10 years, and the amount of data generated will grow exponentially.

2.2. Multiple Sources and Heterogeneous Characteristics of Health Industry Data. Big data comes from a wide range of sources, and its composition is diverse. The sources of data in the health industry include physiological, psychological, pathological, and therapeutic data collected by medical smart sensors and therapeutic devices; physical data on temperature, blood pressure, and heartbeat collected by smart wearable devices; data on temperature, humidity, wind direction, and pests from the health farming industry; and

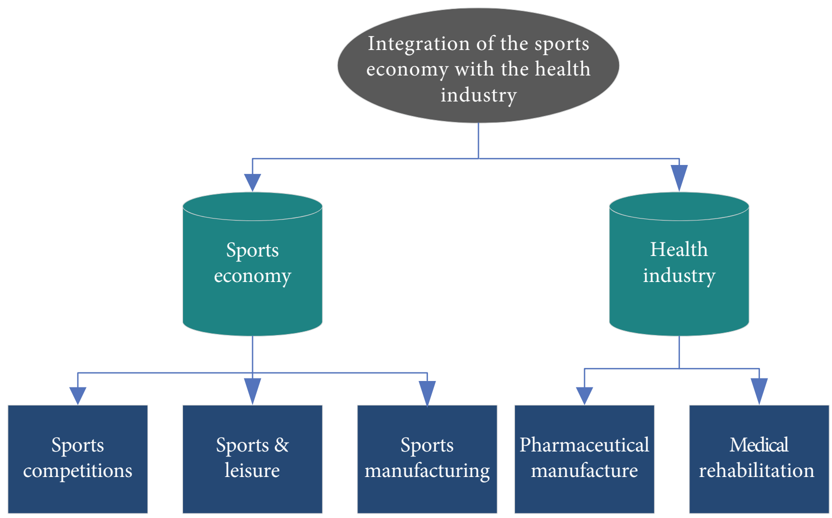


Figure 2: Space for the integration of sports economy and health industry sectors.

health products reflected in the media, markets, documents, and announcements.

The heterogeneity of data in the health industry is reflected in the media, marketing, documentation, and announcements. The heterogeneous nature of health data is reflected in the fact that information on health products in terms of form, quality, price, and geographical location can be stored in various forms such as text, images, videos, and websites. In addition to immediate information such as service price, service experience, body language, and quality satisfaction, the health service industry also has later information such as consumer credibility and audience reputation. It is clear that the diverse sources and heterogeneous storage methods of data in the health industry lead to great difficulties in processing the data.

2.3. The Low-Density Value Characteristics of Health Industry Data. There is no positive relationship between the value content of data and the total amount of data, which shows that only a small amount of data in the massive data can provide real value for managers' decision-making. As a result, it is more difficult for managers to obtain valuable information, and the amount of valuable information is diluted, so the massive data has obvious characteristics of low value density. The large amount of data obtained for infectious disease surveillance has little sensitive information and requires dynamic and continuous monitoring to capture abnormal information or discover its epidemiological pattern in such a huge amount of data. Inevitably, data bias and data errors occur during the management process of collection, storage, and replication. As a result, the large amount of daily information that the health industry obtains about its targets will inevitably lead to data bias and data redundancy, which will inevitably dilute the small amount of valuable information.

By forming a value chain with the main objective of jointly promoting the physical, mental, and emotional health and happiness of the masses as a link, promoting the integration of the cross and overlapping parts of the two industries, and extending and expanding the industrial space [20], the sports economy, which focuses on enhancing people's physical fitness and mental pleasure, and the health industry, which focuses on disease recovery and treatment, can be endogenously driven by the development of their respective advantageous industries. The development of in-depth integration within the industry to meet the diversified and differentiated health needs of consumers is shown in Figure 2.

3. Research Methodology

3.1. Grey Correlation Analysis. With the increasing penetration of big data into most industries in modern economic systems and most business functional areas in modern management activities, big data has become an important production factor and decision basis in modern production and management activities and has brought a crisis to the applied research of grey correlation analysis [21]. Big data modelling differs from traditional data modelling in its characteristics such as massive, multisource, heterogeneous, and low-density values, which bring significant challenges for grey correlation analysis models in terms of numerical adoption and computational accuracy.

In the study of grey correlation analysis, the main work is to establish grey correlation algorithm, and the algorithm model is mainly based on the following perspectives: reflecting the similarity of development process or magnitude between two series, reflecting the similarity of development trend or curve shape of two series, or considering the similarity and similarity of two series curves at the same time [22]. It is clear that the similarity or similarity features between the reference and comparison series of grey correlation coefficients and grey correlation modelling are easily cancelled out in the process of synthesis or merging when large amounts of data are used. In studying the process of model building between or within sequences, special attention should be paid to their differences from traditional data sequences.

In the healthcare industry, data can be broadly classified into four categories: data generated during patient visits, data from testing centres, data from pharmaceutical companies and gene sequencing, and data from smart wearable devices. Each type of data may differ in terms of the type or amount of data, and the sequence of data generated by each type of data may also differ to a certain extent. For the convenience of subsequent research, we establish a standard big data sequence form for the medical industry as follows.

$$Y_i = (t_1, t_2, \cdots; p_1, p_2, \cdots; v_1, v_2, \cdots; a_1, a_2, \cdots;)(i = 1, 2, 3 \cdots), \tag{1}$$

where t is text data, p is image data, and a is audio data.

In this way, a number of large data series of the above types can form a system of medical health conditions for a patient. Based on the acquired data series, the management decision-maker can analyse the health status of the person and the factors influencing it.

In the process of studying big data sequences, the sequences differ from traditional data sequences in that they have a complex and diverse composition of elements, containing both numerical structured data and semistructured data such as web pages and unstructured data such as images, videos, audio, and location. As a result, big data sequences will cause a crisis in the application of grey correlation models.

In order to enable the big data sequences to be used effectively in constructing grey correlation analysis models, the big data sequences need to be. The data series should be preprocessed.

Assume that the big data sequences

$$X_1 = (t_1, t_2, \cdots; p_1, p_2, \cdots; v_1, v_2, \cdots; a_1, a_2, \cdots;)(i = 1, 2, 3 \cdots). \tag{2}$$

Dimensionless processing of data allows for the transformation of heterogeneous data into homogeneous data. After dimensionless processing large data series can be obtained as

$$X_1 = \left(x_1^{t_1}, x_1^{t_2}, \cdots; x_2^{p_1}, x_2^{p_2}, \cdots; x_3^{v_1}, x_3^{v_2}, \cdots; x_4^{a_1}, x_4^{a_2}, \cdots;\right) \cdot (i = 1, 2, 3 \cdots). \tag{3}$$

Through big data preprocessing, a grey correlation analysis model of big data can be attempted to be established. Referring to the traditional correlation model of grey correlation analysis theory, the grey correlation model between two data series in the big data environment can be constructed as follows.

$$\begin{aligned}\gamma(x_1(k), x_2(k)) &= \frac{\text{minmin}|x_1(k) - x_2(k)| + \xi\,\text{maxmax}|x_1(k) - x_2(k)|}{|x_1(k) - x_2(k)| + \xi\,\text{minmin}|x_1(k) - x_2(k)|}, \\ \gamma(X_1, X_2) &= \frac{1}{n}\sum_{n}^{k} \gamma(x_1(k), x_2(k)).\end{aligned} \tag{4}$$

Table 1: Total output and value added of the sports economy in China in 2020.

Sports industry category	Total output	Value added
Sports management	287.1	143.8
Sports competition	176.8	65.5
Physical fitness	368.6	175.6
Gym	523.5	256.3
Sports intermediary	156.3	114.2
Sports training	296.8	230.5
Sports media	145.2	144.3
Sports-related services	532.2	178.5
Sporting goods	852.3	368.3
Sports facilities	263.5	127.8

Then, $\gamma(X_1, X_2)$ is called the grey correlation between X_1 and X_2, where k is the kth element in the sequence and ξ is the discrimination factor.

To treat the elements of a large data sequence as a nonnumerical sequence of the same structural type or to adjust only the positions of the data elements, then an appropriate multidimensional coordinate system can be considered to represent the data sequence, and then, a grey correlation model can be built with information on the possible positions of the coordinate system graphs, information on the possible composition of the angles, etc.

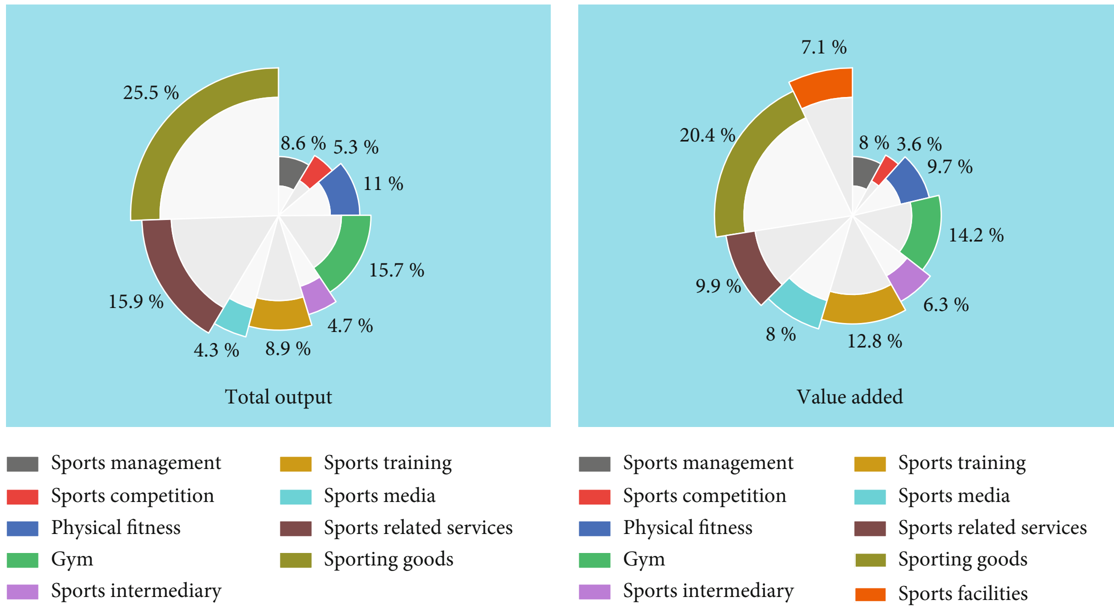
3.2. Expert Interview Method. Interviews and surveys will be conducted with experts, scholars, and relevant leaders in sports economy. A number of small symposiums will also be held to discuss the relevant issues of this paper and to consult with experts.

3.3. EG Index Measurement Method. Current methods of measuring industrial agglomeration include information entropy, industry concentration, locational Gini coefficient, spatial separation index, locational quotient, and kernel density estimation. In this paper, we adopt the EG index measurement method, and the specific steps are as follows:

Step 1. Calculation of locational Gini coefficient.

$$G_i = \sum_{R}^{r=1} \left(X_r^i - X_r\right)^2, \tag{5}$$

where R is the number of cities, X_r^i is the size of industry i in city r as a proportion of the size of that industry in all cities, and X_r is the size of all industries in city r as a proportion of the size of all industries in all cities. Clearly, indicator G_i reflects the degree of deviation of the geographical distribution of industry i relative to the geographical distribution of all industries. Under the condition of random distribution, the expected value of G_i is



(a) Total output (b) Value added

Figure 3: Comparison of data on total output and value added in China's sports economy in 2020: (a) total output and (b) value added.

$$E(G_i) = \left(1 - \sum_{R}^{r=1} X_R^2\right) H_i. \tag{6}$$

Step 2. Herfindahl index calculation.

Calculating the industry EG index requires first calculating the Herfindahl index H for that industry, and China does not keep statistics on the size of individual firms in an industry. Therefore, we use the estimation method of Yang Hongjiao [23], assuming that in each province, all enterprises within an industry have the same size, with the following estimation formula.

$$H_i = \sum_{P}^{i=1} \frac{\left(X_p^i\right)^2}{C_p^i}, \tag{7}$$

where P denotes the category of province, X_p^i is the size of industry i in province P as a proportion of the size of that industry in all provinces, and C_p^i is the number of enterprises in industry i in province P. This method is the most accurate estimate given the availability of data.

Step 3. EG index calculation.

If firms choose their location randomly and the location choices are relatively independent, then the expected value of γ is zero. In this case, the advantages of nature, institutions, etc., have no influence on the location choice of enterprises. If the γ value of a neighbouring industry is greater than zero, the industry is spatially clustered and vice versa. The larger the γ value, the higher the concentration

Table 2: Survey of sports economy income in Beijing and Shanghai, 2020–2021.

Projects	2020 Beijing	2020 Shanghai	2021 Beijing	2021 Shanghai
Sports management	32.3	31.4	27.8	26.3
Sports competition	89.2	35.7	70.6	23.4
Physical fitness	33.9	45.7	34.7	40.4
Gym	37.1	18.2	28.9	15.6
Sports intermediary	36.3	15.2	26.3	16.8
Sports training	17.6	17.3	19.8	12.5
Sports media	69.9	60.5	62.5	31.1
Sports-related services	85.3	59.9	75.6	41.8
Sporting goods	68.4	70.5	65.9	56.4
Sports facilities	26.8	35.7	19.8	15.5

$$\gamma_i = \frac{G_i - \left(1 - \sum_R^{r=1} X_r^2\right) H_i}{\left(1 - \sum_R^{r=1} X_r^2\right)\left(1 - H_i\right)}. \tag{8}$$

4. Analysis of Integration Development

4.1. Development of the Sports Economy. The current structure of China's sports economy is still unreasonable. In the USA, the flow of people, logistics, and services driven by professional sports competitions as the core has contributed to the economy of each state in the USA far more than one can imagine, and the impact of the sports economy on the economy of each state is very important and has now become one of the top ten industries in the USA [24]. As a result, state and local governments in the USA are spending considerable efforts to host sporting events and recruit

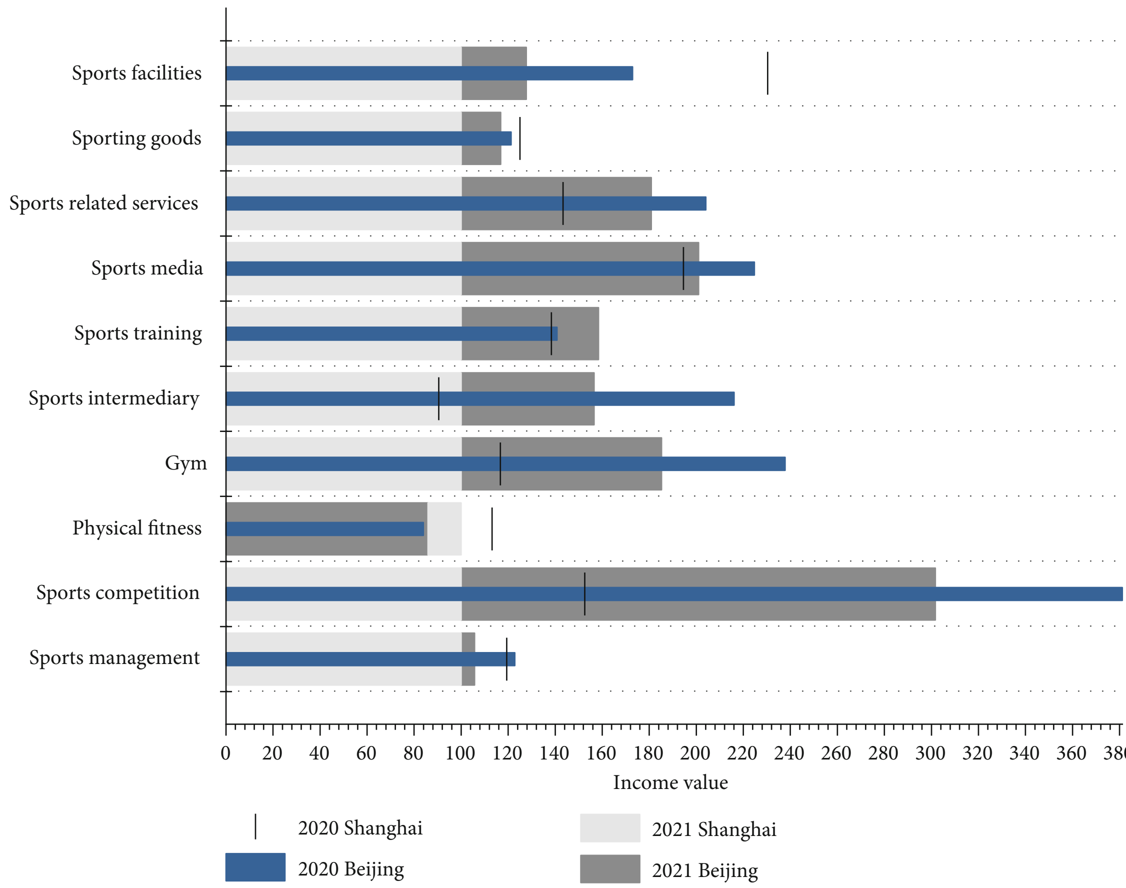


Figure 4: Sports economy data for 2020 compared to 2021.

related businesses [25]. Information on the total output and value added of China's sports economy in 2020 is given in Table 1.

A visual comparison of the total output and value added data for China's sports economy in 2020 is shown in Figure 3.

Figure 3 shows that the overall pattern of the sports economy in China has been formed, based on the manufacturing and sales of sports goods, driven by the sports competition and performance industry and the sports fitness and leisure industry, and the rapid development of sports venues, sports training, sports intermediation, and sports media. In the future, under the sustained effect of various policies, all relevant sectors of the sports economy will certainly usher in a period of rapid development. However, there are also problems such as the low total volume and the unreasonable internal structure of the sports economy, such as the high proportion of production and sales industries such as sports-related industries and the low proportion of sports services such as the sports industry.

In 2020, the total output of the sports economy in Beijing and Shanghai will be RMB 115.46 billion and RMB 104.59 billion, respectively, but the total output of three indicators representing the sports-based industry, namely sports competition and performance activities, sports fitness and leisure activities, and sports training and education, will be relatively low, as shown in Table 2.

A comparison of these sports economy figures for 2020 and 2021 is shown in Figure 4.

Figure 4 shows that the degree of agglomeration in the development of the sports economy is not yet high. Guided by the concept of fitness for all to health for all, the demand for health products will continue to increase for everyone as they grow older. In order to maximise the health needs of society at large, both developed and developing countries will continue to optimise the allocation of social resources, and health-related industries are bound to become areas where various resources are constantly concentrated, thus forming different degrees of agglomeration. A number of sports services and sports goods industry clusters have been formed in China, and industrial agglomeration has become a more important development model for the sports economy. In this situation, it has become inevitable to strengthen the management of the sports economy and realise the transformation of the sports economy development mechanism from management to governance, from control to performance, and from individual to synergy and the development of sports economy clustering.

The National Sports Administration has adjusted the caliber of sports economy statistics in 2021, but most provinces and municipalities have not yet done so. For the sake of consistency in the caliber of statistics and comparability of data, our collection of industry data started in 2018. For the purpose of analysis, based on the results of the expert

Table 3: 2018–2021 EG index for the sports economy in the five regions.

Province	2018	2019	2020	2021
Beijing	0.018	0.016	0.015	0.013
Shanghai	0.015	0.014	0.013	0.014
Hebei	0.003	0.004	0.003	0.004
Tianjin	0.002	0.003	0.002	0.002
Shanxi	0.002	0.001	0.001	0.002

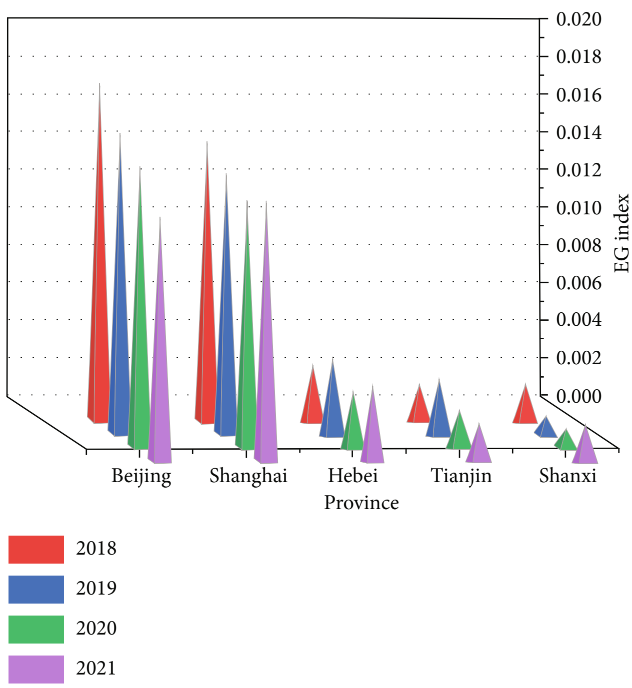


Figure 5: Comparison of the EG index for the sports economy, 2018–2021.

interviews and the availability of data, the indicator of the number of employed persons in China's sports economy from 2018–2021 is selected for analysis in this paper. In this paper, industry employment wages are used to indicate the size of the industry, and the data source required for the calculation of the EG index is the number of employment wages by industry in each province and municipality, with a geographical scope of 31 provinces, municipalities, and autonomous regions. The number of fixed asset inputs by industry for the number of enterprises by industry in each province required to calculate the industry Herfindahl index is shown in Table 3.

The comparative effect of these five localities for the 2018–2021 sports economy EG index is shown in Figure 5.

Five provinces with a low EG industry index were also selected, and their specific data information is shown in Table 4.

A comparison of the data for these five provinces with low EG industry indices are shown in Figure 6.

From the calculation results in the table, it can be seen that, firstly, the degree of agglomeration of the sports economy in all Chinese provinces and cities is at a low level, with EG values generally less than 0.02. Secondly, from the perspective of each province and city, the degree of agglomeration of the sports economy is higher in Beijing and Shanghai, while the figures for other provinces are generally lower. Third, from the data of each province, the agglomeration development of the sports economy in each province of China shows a decreasing trend from 2018 to 2021. From the data calculated in this study, the sports economy has the highest degree of agglomeration, which also indicates that the development of China's sports economy has not been satisfactory compared to other industries in the past few years, and its concentrated development is obviously lagging behind that of other industries.

Table 4: Data for the five provinces with a lower EG index for the sports economy, 2018–2021.

Province	2018	2019	2020	2021
Gansu	0.00027	0.00025	0.00023	0.00021
Qinghai	0.00018	0.00016	0.00015	0.00013
Ningxia	0.00025	0.00024	0.00021	0.00019
Xinjiang	0.00035	0.00037	0.00036	0.00032
Xizang	0.00018	0.00015	0.00013	0.00014

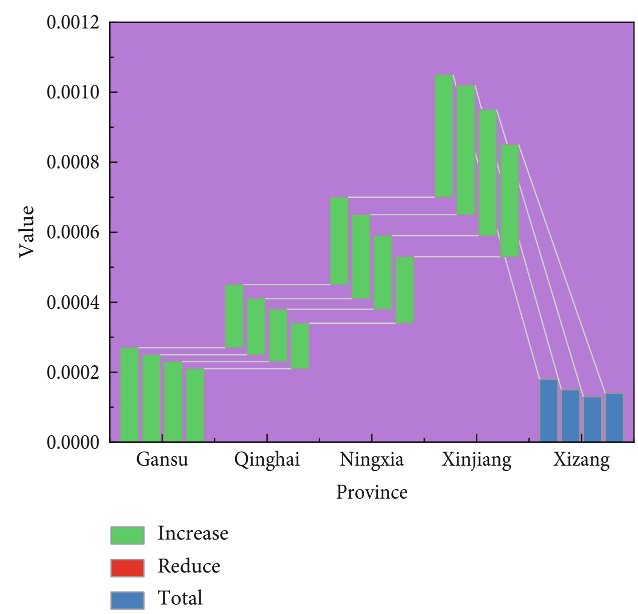
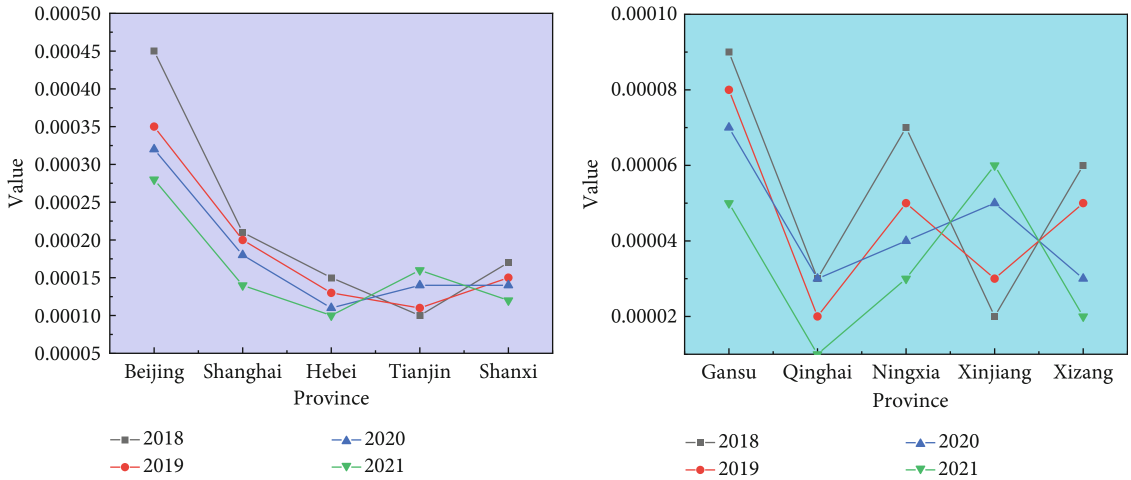


Figure 6: Comparison of data from the five provinces with lower EG index for sports economy, 2018–2021.

Table 5: Health industry EG index by province in China, 2018–2021.

Province	2018	2019	2020	2021
Beijing	0.00045	0.00035	0.00032	0.00028
Shanghai	0.00021	0.00020	0.00018	0.00014
Hebei	0.00015	0.00013	0.00011	0.00010
Tianjin	0.00010	0.00011	0.00014	0.00016
Shanxi	0.00017	0.00015	0.00014	0.00012



(a) Higher index

(b) Lower index

Figure 7: Comparison of lower health industry EG indices in five Chinese provinces: (a) higher index and (b) lower index.

4.2. Development of the Health Industry. The current new medical model is able to cover a wide range of aspects and stages of healthy life. The characteristics of economic development have made the traditional mechanistic and biomedical models unable to adapt to the state of human health and are not meeting the quest for healthy conditions. This model is based on genetic, lifestyle, social, environmental, and psychological interventions, combining environmental, biological, psychological, social, and rehabilitation knowledge. With the emergence of this new medical model, more related industries will converge in the direction of health and the range of services will continue to expand. The sports economy, led by the concept of health, will not only expand in scale but will also become more prominent in its integration with the new medical model, with many industries converging and a huge industrial cluster about to be formed.

The position and role of the sports economy in the development of China's national economy has been increasing in recent years. The development of the sports economy has contributed to a new understanding of the goals, functions, and commercial attributes of sport in the academic world and has given rise to many new forms of sport and related industries, such as the health sports economy. The health industry EG index 2018–2021 is given in Table 5 for each province in China.

A comparison of the health industry EG indices for the five provinces in China for 2018–2021 is shown in Figure 7(a). The lower health industry EG index data for the five Chinese provinces for 2018–2021 is given in Table 6.

A comparison of the lower health industry EG indices for the five Chinese provinces from 2018 to 2021 is shown in Figure 7(b).

4.3. Integration of the Sports Economy and the Health Industry. The health industry and the sports economy both show the characteristics of convergence of value chains and cross-fertilisation of industries in the industrial chain, for example, sports and fitness services are an important part of the sports economy as well as an important service product of the health industry. Therefore, the sports economy and the health industry, with the ultimate goal of promoting the physical and mental health and pleasure of people, have a strong combination in the areas of disease and injury prevention and rehabilitation from the point of view of the continuity of the industrial chain and have formed a connection point between the two industrial value chains, the structure of which is shown in Figure 8.

Table 6: Lower health industry EG index for five provinces in China, 2018–2021.

Province	2018	2019	2020	2021
Gansu	0.00009	0.00008	0.00007	0.00005
Qinghai	0.00003	0.00002	0.00003	0.00001
Ningxia	0.00007	0.00005	0.00004	0.00003
Xinjiang	0.00002	0.00003	0.00005	0.00006
Xizang	0.00006	0.00005	0.00003	0.00002

At this linking point, there is a greater possibility for the sports economy to integrate with the health industry to develop new products, such as the integration of sport and health care, sport and physical function rehabilitation, sport and healthy ageing, sport and health advice, sport and nutrition, sport and health education, and many other aspects.

In summary, in terms of space, the products offered by the health industry cover a larger area than the sports economy, while in terms of time, the products offered by the sports economy are more advanced; compared to health issues, the products offered by the sports economy are more preventive; the sports economy highlights the function of enhancing human physical quality and mental pleasure at the front end of the value chain, while the health industry shows the function of treatment and rehabilitation at the back end of the value chain. The two are fused at the point of connection to form a sports-medicine fusion industry, which is more complementary in terms of health services.

The development of the sports-health integration industry should not only strengthen the synergy of all related

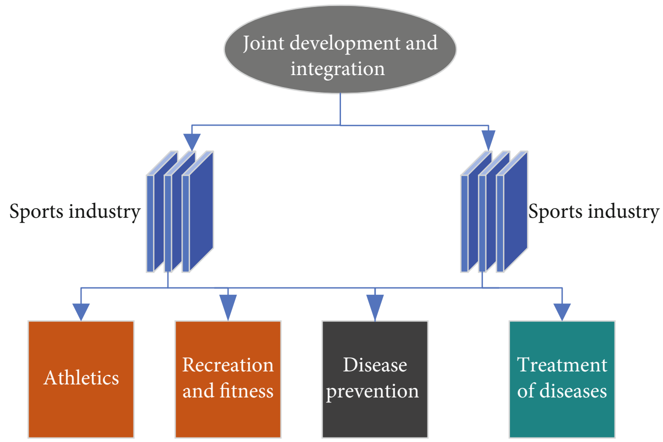


Figure 8: Structure of the integration of the sports economy and the health industry.

industries within the sports economy but also achieve cross-industry synergy between industries, which requires that the theory of industrial synergy should be fully applied to promote the integration of China's sports economy and health industry. The key point is that the integration industry should take health and longevity as the ultimate goal, with the main functions including health maintenance for healthy people, health recovery for subhealthy people, and health repair for sick people, to create an industry chain covering the whole population and the whole life cycle, and the focus should be on the provision of integrated health services in the industrial scope.

Therefore, the guarantee system for the synergistic clustering of the physical and medical integration industry should be more complex than that of a single industry and should be a synergistic guarantee of good cooperation between the various guarantee systems. The construction of conditions for integration development needs to meet the following four points: (1) optimise top-level design and realise collaborative governance of government departments, (2) establish and improve relevant regulations and improve supervision and management mechanisms, (3) implement inclined monetary and financial policies and use credit leverage to support the development of the integrative health industry, and (4) develop human capital for the development of the integrative health industry.

5. Conclusion

With the improvement of national health level and the extension of life expectancy per capita, the development of science and technology, and the change of lifestyle, the field of health economy is increasingly active, and both sports and medical care will play a role in promoting the development of regional health economy. The development of the sports and medical integration industry is still at the beginning stage, and the characteristics of agglomeration development are not yet obvious. This paper explores the big data modelling problem of grey correlation analysis using health industry data as an example, giving preprocessing methods and grey correlation modelling ideas for big data modelling. It also uses expert interviews and agglomeration measures to conduct research to achieve the collaborative agglomeration development of the health care integration industry in terms of guaranteeing the construction of conditions and analyses the specific strategies for integration development. The method proposed in this paper is a summary and sublimation of the theory of industrial agglomeration and cluster evolution, which is of great significance as a guide to the convergence development of related industries in China.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

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Research Article

Machine Learning-Based Psychology Evaluation of College Students for Building Innovative Health Service System

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Leadership psychology among college students is a multidimensional concept that primarily encompasses practical ability, teamwork ability, political literacy, emotional intelligence, etc. At present, a common problem among the surveyed college students is their leadership ability is not strong. Reasons include the lack of leadership-related knowledge and leadership awareness among college students as well as the fact that the public, particularly college educators, do not give leadership training a sufficient attention. Leadership psychology is a primary factor influencing the development of college students. It is necessary to strengthen college students' leadership education. This work extracts the key factors that influence the leadership of college students by analyzing their big behavior data. The extracted factors include the theoretical knowledge of leadership, practical ability, leadership psychology, home education, and exercise. To evaluate the degrees of these factors influencing the students' leadership, we develop an advanced multicriteria decision-making framework based on the ENtropy theory and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), called EN-TOPSIS. In EN-TOPSIS, an entropy method is used to determine the criteria weights rather than using the subjective weighting method. Three groups of college students are surveyed and evaluated based on the five factors. Each group contains ten students. The evaluation results show that the leadership of the students is mainly influenced by their practical ability and leadership psychology. The students with the highest evaluation score are recognized as having high levels of leadership.

1. Introduction

College students' leadership is a multidimensional concept, which mainly includes practical ability, teamwork ability, political literacy, emotional intelligence, self-management, and leadership psychology [1]. At present, a common problem among the surveyed college students is their leadership psychology is not strong. Reasons include the lack of leadership-related knowledge and leadership psychology of college students. And the fact that the public, especially college educators, do not pay enough attention to leadership psychology training. Leadership psychology is a primary factor influencing the development of college students. It is necessary to strengthen college students' leadership education. In the past few years, more and more attention has been paid to the leadership problems on college students [2]. The leadership problems of students have been reported all over the world, and the leadership of college students is not in a well condition. College leadership is a serious problem and will affect their study experience in college. Leadership problems can even affect students' legal behaviors and their future life.

In this paper, we will investigate using multicriteria decision-making (MCDM) technologies to evaluate which leadership elements can affect students' leadership with legal constraints. MCDM refers to the decision making in the set of conflicting and noncommensurable schemes [3]. Multiple criteria should be considered when making decisions, which is one of the important contents in the field of decision analysis. Noncommensurable between objectives and inconsistency of measurement categories, that is, there is no unified measurement standard or unit of measurement for each objective, so it is difficult to compare. According to whether the decision-making scheme is finite or infinite, MCDM is divided into multiple objectives and multiple attribute decision making [4]. Multiobjective decision-making is a MCDM problem that has nondiscrete decision variables and unconstrained decision schemes [5].

TOPSIS is a ranking method based on the proximity between the idealized target and the evaluation objects [6]. It is a distance-based evaluation method. Its primary idea is to calculate the distance between the positive and negative ideal solutions and the evaluating samples and calculate the relative closeness to the ideal solutions. If a sample is close to the negative ideal solution, then it is farther away from the positive ideal solution. The pros and cons of each alternative can be evaluated. TOPSIS is one of the most effective ranking methods for MCDM with limited alternatives and criteria. TOPSIS reduces the influence of different criterion dimensions after deal with the original normalized data. It can use the information of the source data. Therefore, it can completely indicate the gap between alternatives by considering the actual situation. It has the advantages of reliability, intuition, and authenticity. In addition, it does not have specific requirements for sample data.

Compared with the single index mutual analysis method, TOPSIS method can centrally reflect, analyze, and evaluate the overall situation. It has universal applicability. For example, it can be used to evaluate health quality, planned immunization work quality, and medical quality [7]. It can evaluate the setting of professional courses, customer satisfaction, software project risk assessment, and real estate investment site selection. It has been widely and systematically used to evaluate the economic benefits of enterprises, the macroeconomic benefits between cities, the competitiveness of regional science and technology [8], and the well-off society in rural areas. However, there are still various problems of TOPSIS for decision making. For example, the weight information should be given in advance, so the result is subjective. In addition, this method has the reverse order problems due to the occurrence of the new criteria or alternatives in application, which needs to be analyzed and studied more specifically and deeply [9].

This work extracts the key factors that influence the leadership of college students by analyzing the big behavior data of college students. The extracted factors include the theoretical knowledge of leadership, practical ability, leadership psychology, home education, and exercise. To evaluate the degrees of these factors influencing the students' leadership, we develop an advanced MCDM framework based on the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), called EN-TOPSIS. In EN-TOPSIS. The principal contributions of EN-TOPSIS are as follows:

(1) *Use an Entropy Method to Determine the Criteria Weights Rather than Using the Subjective Weighting Method*. Therefore, EN-TOPSIS can analyze and research problems more objectively

(2) *Survey and Evaluate Three Groups of College Students Based on the Five Factors*. Each group contains ten students. The evaluation results show that the leadership of the students is mainly influenced by their practical ability and leadership psychology. The students with the highest evaluation score are recognized as having high levels of leadership

The remaining paper is arranged as follows: Section 2 introduces the related work about the MCDM technologies and their application in leadership evaluation. Section 3 presents the technical details of EN-TOPSIS. Section 4 shows an experiment to use the proposed EN-TOPSIS to evaluate leadership of college students. Section 5 concludes this work and describes future research directions.

2. Related Work

Vafaei et al. [10] proposed that in MCDM, standardization must change criteria values into a universal scale to rate and rank alternatives. The authors' research contribution is to assess the assessment methods for standardization techniques and the proposed assessment process is the best normalization technique used in TOPSIS to obtain a more robust assessment and selection. A work by Muhsen et al. [11] uses load management to save energy and focuses on a multiobjective optimized differential evolution (MODE) algorithm to obtain an optimal set of user load management by simultaneously minimizing energy costs and user inconvenience. The optimal set of solutions obtained is ranked from the most outstanding to the worst using the MCDM method, which uses a mixture of the Analytic Hierarchy Process (AHP) with the TOPSIS to ensure that energy costs and peak consumption are saved while maintaining an adequate range of customer nuisance. In the work of Dutta et al. [12], an algorithm is designed to find a set of criteria by which the rank of another alternative can be obtained by changing the criteria of one alternative. The behavior of the closeness coefficients of the alternates when the criterion scores are changed is investigated and two algorithms are provided to identify high and low order realizable alternatives. Subsequently, the rank inversion of a couple of alternates is described and the concept of rank-sensitive intervals is introduced. Finally, the validity of the model is verified using university rankings as an example. The purpose of the work of Akram et al. [13] is to extend the TOPSIS method to a multiobjective clustering resolution problem based on Pythagorean fuzzy data. A Pythagorean fuzzy decision matrix is used for information evaluation. The alternatives are ranked using a modified closeness index to determine the optimal alternative.

In the work of Chauhan et al. [14], the fuzzy TOPSIS method was used to pick out the risks connecting the agricultural sector in India based on a review of the literature, and an analysis of the constitution makers' works on mental work stress and pressure where all identified risk factors are ranked according to actual local preferences. QFD techniques were then applied to propose design parameters to minimize farmers' work stress. The work of Liu et al. [15] evaluates the emergency response capability of university students based on the TOPSIS creative algorithm questionnaire. First, the survey method was used to evaluate the current cases of university students' response capability towards emergencies. The TOPSIS-based evaluation algorithm was developed to assess the crisis response capability of university students. The reasons for the shortage of students' emergency response capability were studied based by the reviews results. At the same time, the development countermeasures for the cultivation of college students' crisis response skill are proposed. A study by Omid et al. [16] investigated the impact of security climate and psychosocial safety climate elements on the safety performance of employees in the process industry. The collected data perform average analysis of the MCDM approach. Scenarios were also ranked using the TOPSIS. The results indicate that safety professionals need to consider the climate factors of psychosocial safety to improve the performance in facilities in high hazard processes. The work of Han et al. [17] proposes a vague approach to the clinical diagnosis of yin and yang bipolar disorder based on a group decision-making process incorporating multiple criteria. It introduces a group decision-making process based on multiple criteria for the diagnosis of bipolar disorder. The complexity of bipolar disorder is described by examining the interrelationships between symptoms.

The paper by Dandage et al. [18] uses the TOPSIS method to collect TOPSIS data to rank the main danger types in international projects. The results show that the TOPSIS method ranks political risk, technical risk, and design-related risk as the first three risk types in international projects. This work offers an overview of the risk types in international projects, and the results of their ranking show that it can help in developing strategies to deal with the risks appropriately. In the paper of Mo et al. [19], a risk assessment system is proposed. The system is designed to model many trial risks based on qualitative information in judicial databases. An extension technique has been introduced into the system to accommodate this complexity. The work of Radovanović et al. [20] performed an adaptation of the commonly used decision-making method which is the TOPSIS method to generate utility scores in the absence of differential impact. The results show the validity of the solution solutions shown on the synthetic dataset, as well as on the sample dataset on criminal justice.

EN-TOPSIS is an advanced MCDM framework based on TOPSIS, which can analyze and research problems more objectively. What makes EN-TOPSIS special compared to common evaluation methods is that EN-TOPSIS uses an entropy method to determine standard weights instead of subjective weighting methods. Therefore, EN-TOPSIS can make more reasonable decisions and can effectively solve the problem of reverse order.

3. EN-TOPSIS: An Efficient TOPSIS for Evaluating Legal Consciousness Based on Leadership Psychology of Students

Multiattribute decision analysis is used to establish an evaluation index system, determine a set of alternatives, and collect data based on the principles of problem completeness, scientificity, data availability, and operability. The objective data is then processed through the selected method. By integrating schemas, the intuitive reflection of each alternative is obtained. It can help decision makers to make accurate decisions.

For a problem, decision makers need to comprehensively consider from multiple aspects. They should summarize and merge all aspects to form a set of criteria, denoted as $C = \{c^1, c^2, \cdots c^m\}$, where m is the criterion number. The set of decision options or alternatives is denoted as $A = \{a^1, a^2, \cdots a^n\}$, where n is the alternative number. Therefore, a decision matrix of $m \times n$ is composed of the criteria and the alternatives.

After the decision matrix is constructed, the natural attribute value needs to be processed, and the natural attribute value t_j^i is changed to the corresponding preference representation value v_j^i, denoted as $v(a^i) = (v_1^i, \cdots v_m^i)$. The most common transformations include the transformation of fuzzy language into numbers and the standardization of numerical values in different dimensions.

Weights are then assigned to all criteria. The more important criteria have greater weights, the weight vector of the criterion set can be recorded as $w = (w_1, \cdots w_j, \cdots w_m)$ and requires $\sum_{j=1}^{m} w_j = 1$. Finally, a mapping function G is constructed, and the weight and preference representation vectors are integrated into the evaluation result value of the alternative a^i. Generally, the most used mapping function G is the weighting function.

The TOPSIS method, called EN-TOPSIS, is a sorting algorithm that approximates the ideal solution. It calculates the distance between the current evaluation object with the ideal and anti-ideal points, respectively. The closer to the positive point and the farther from the negative point, the better the performance. The calculation steps of TOPSIS are as follows:

(1) *Data Normalization*. Since the dimensions of different criteria may be different, to eliminate the influence of different dimensions on the results, it is necessary to standardize the data first. The standardization generally includes vector normalization, sum normalization, and maximum and minimum normalization, where vector normalization is performed

$$v_j^i = \frac{t_j^i}{\sqrt{\sum_{i=1}^{n} \left(t_j^i\right)^2}}, \tag{1}$$

where t_j^i is the natural attribute value of the alternative i under the criterion j, and n is the alternative number.

(2) *Find the Ideal Point a^+ and the Anti-Ideal Point a^-*. For the benefit criteria, the ideal point a^+ is the maximum value among all alternatives with respect to criterion j, and the anti-ideal point a^- is the minimum value among all alternatives under criterion j, denoted by

Table 1: Decision matrix.

Alternatives		a1	a2	a3	a4	a5	a6	a7	a8	a9	a10
	c1	8	4	5	4	6	8	6	7	6	9
	c2	4	4	10	6	4	6	9	6	8	3
Group 1	c3	6	8	6	4	2	6	4	6	8	4
	c4	8	8	10	2	4	6	2	4	4	8
	c5	2	10	8	4	6	6	4	2	2	2
	c1	8	8	6	4	6	8	6	6	2	2
	c2	6	2	10	6	2	6	8	8	4	10
Group 2	c3	10	8	6	4	2	8	6	6	8	8
	c4	8	2	8	2	4	6	4	6	10	4
	c5	6	4	8	2	6	8	2	2	2	4
	c1	6	10	6	4	8	10	6	6	8	6
	c2	4	2	8	6	2	6	8	6	6	8
Group 3	c3	8	6	6	4	4	8	4	4	4	6
	c4	6	4	8	2	2	6	2	6	4	4
	c5	4	4	10	7	5	8	7	6	2	5

$$v_j(a^+) = \max_{i=1}^{n} v_j^i, \tag{2}$$

$$v_j(a^-) = \min_{i=1}^{n} v_j^i. \tag{3}$$

As for the cost criteria, the values of the anti-ideal and ideal points are just opposite to the benefit criteria.

(3) *Calculate the Distance Between the Anti-Ideal and the Ideal Points of the Alternative a^i Under the Index j*. When calculating the distance, we used a normalization factor θ_j^+ and the anti-ideal point normalization factor θ_j^-, then the distances are calculated by

$$\boldsymbol{d}_j^+\left(\boldsymbol{a}^i\right) = \frac{\left|\boldsymbol{t}_j(\boldsymbol{a}^+) - \boldsymbol{t}_j\left(\boldsymbol{a}^i\right)\right|}{\boldsymbol{\theta}_j^+}, \tag{4}$$

$$\boldsymbol{d}_j^-\left(\boldsymbol{a}^i\right) = \frac{\left|\boldsymbol{t}_j(\boldsymbol{a}^-) - \boldsymbol{t}_j\left(\boldsymbol{a}^i\right)\right|}{\boldsymbol{\theta}_j^-}, \tag{5}$$

where $\theta_j^+ = \max\{\max\{|t_j(a^+) - t_j(a^i)|: i = 1, 2, \cdots, n\}, |t_j(a^+) - t(a^-)|\}$ and $\theta_j^- = \max\{\max\{|t_j(a^-) - t_j(a^i)|: i = 1, 2, \cdots, n\}, |t_j(a^+) - t_j(a^-)|\}$.

The monotonic and nonmonotonic criteria are uniformly processed. The monotonic criterion is a criterion for evaluating both single winner and multiple winners scored election systems. A scored system of voting is monotonic when neither preventing the election of an applicant by ranking them higher on some voter rolls nor electing an unaccountable applicant by scoring them lower on some voter rolls is feasible. This is a form of preference expression for each indicator. Through such processing, the objective value becomes the preference value of the decision maker.

Table 2: The setting of ideal point and anti-ideal point.

	c1	c2	c3	c4	c5
Group 1					
Ideal point	9	10	8	10	10
Anti-ideal point	4	3	2	2	2
Group 2					
Ideal point	8	10	10	10	8
Anti-ideal point	2	2	2	2	2
Group 3					
Ideal point	10	8	8	8	10
Anti-ideal point	4	2	4	2	2

(4) *Determine Weights for Criteria*. When the mutual importance between the criteria is not clear, the entropy method can be used for weighting. Since the entropy method is very mature, this article will not go into details. When the mutual importance of the criteria weights is clear, but the specific weights are unknown, the following two methods can be used.

At first, the weights of criteria are calculated based on the data envelopment method. Based on the observation data, the decision-making unit is evaluated by the change weight, so that the weight of the index is changed when this method is used. That is, under different alternatives, the weights are different, and the optimization model is shown as

$$\mathrm{Max}\frac{\boldsymbol{D}\left(\boldsymbol{a}^i\right)^-}{\boldsymbol{D}\left(\boldsymbol{a}^i\right)^- + \boldsymbol{D}\left(\boldsymbol{a}^i\right)^+}. \tag{6}$$

If the rank of alternative i under qualitative criterion j is s_u, the optimization model is calculated by

Table 3: Evaluation scores and ranking results for Group 1.

	$h = 0.1$		$h = 0.8$		$h = 1$		$h = 2$	
	Marks	Ranks	Marks	Ranks	Marks	Ranks	Marks	Ranks
a1	0.7824	3	0.7768	2	0.7195	4	0.7376	4
a2	0.4722	8	0.4394	6	0.4843	6	0.4415	8
a3	0.7519	4	0.7605	3	0.6157	5	0.7224	5
a4	0.4236	9	0.3242	9	0.3250	9	0.3503	9
a5	0.3478	10	0.2898	10	0.2867	10	0.3490	10
a6	0.7501	5	0.7172	5	0.7831	2	0.7388	3
a7	0.5382	7	0.4288	7	0.4775	7	0.4925	7
a8	0.5727	6	0.4039	8	0.4382	8	0.5620	6
a9	0.8001	2	0.7321	4	0.7459	3	0.7450	2
a10	0.8235	1	0. 8647	1	0.8928	1	0.8399	1

$$\frac{u-1}{t} \leq d_j^0\left(a^i\right)^+ \leq \frac{s}{t}, \quad (7)$$

$$\frac{t-u+1}{t} \leq d_j^0\left(a^i\right)^- \leq \frac{t-u}{t}, \quad (8)$$

$$w_i - w_j = t, \quad (9)$$

$$\sum_{j=1}^{q} w_j = 1, \quad (10)$$

where t is a constant, indicating how much the criterion i is more important than the criterion j. This optimization model is solved for each alternative to get different weights.

(5) *Fix Weights for All Alternatives*. It is practical to change the weights under different alternatives, but it increases the amount of calculation. To uniformly weight the criteria, the optimization model is shown as

$$\text{Max} \sum_{i=1}^{n} \frac{D\left(a^i\right)^-}{D(a^i)^- + D(a^i)^+}, \quad (11)$$

$$\forall a^i \in A, \frac{u-1}{t} \leq d_j^0\left(a^i\right)^+ \leq \frac{u}{t}, \quad (12)$$

$$\frac{u-t+1}{u} \leq d_j^0\left(a^i\right)^- \leq \frac{u-t}{t}. \quad (13)$$

(6) *Calculate the Distance Between Each Alternative with the Ideal and the Anti-Ideal Points, Respectively.*

$$D\left(a^i\right)^+ = \left\{\sum_{j=1}^{m} w_j d_j^+\left(a^i\right)^h\right\}^{1/h}, \quad (14)$$

$$D\left(a^i\right)^- = \left\{\sum_{j=1}^{m} w_j d_j^-\left(a^i\right)^h\right\}^{1/h}. \quad (15)$$

(7) *Calculate the Closeness of Alternatives to the Ideal Point*

$$D\left(a^i\right) = \frac{D\left(a^i\right)^-}{D(a^i)^- + D(a^i)^+}. \quad (16)$$

The larger the value of $D(a^i)$, the better the solution.

4. Experiment

4.1. Evaluation Settings. We use an example to describe the process of using TOPSIS for decision making. Three groups of students are surveyed. Each group contains ten students. They are evaluated in terms of five criteria: the theoretical knowledge of leadership (c1), practical ability (c2), leadership psychology (c3), home education (c4), and exercise (c5). Each criterion is ranked by using the scores in references [1, 8]. Table 1 shows the different scores of each member of the 3 groups of students under the 5 criteria. a1 to a10 represent 10 students.

4.2. Analysis of Results. The research team believes that the relative importance among the 5 criteria is clear. Table 2 shows that the ideal points of c1~c5 of Group 1 are 9, 10, 8, 10, and 10, respectively. The anti-ideal points are 4, 3, 2, 2, and 2, respectively. The ideal point consists of all possible best criteria values, while the anti-ideal point consists of all possible worst criteria values. The ideal points of c1~c5 of Group 2 are 8, 10, 10, 10, and 8, respectively. The anti-ideal points are 2, 2, 2, 2, and 2, respectively. For Group 3, the ideal points for criteria c1~c5 are 10, 8, 8, 8, and 10, respectively. The anti-ideal points are 4, 2, 4, 2, and 2, respectively.

Based on the proposed TOPSIS algorithm, the evaluation scores and ranking results are shown in Tables 3–5 for

Table 4: Evaluation scores and ranking results for Group 2.

	$h = 0.1$		$h = 0.8$		$h = 1$		$h = 2$	
	Marks	Ranks	Marks	Ranks	Marks	Ranks	Marks	Ranks
a1	0. 8593	1	0.8283	1	0.8688	1	0.8027	1
a2	0.4673	7	0.4653	7	0.4743	6	0.4295	6
a3	0.6765	5	0.6786	5	0.6367	5	0.6729	5
a4	0.3216	9	0.3126	9	0.3208	9	0.3433	9
a5	0.2254	10	0.2218	10	0.2724	10	0.2372	10
a6	0.7128	4	0.7819	2	0.7792	2	0.7321	2
a7	0.4189	8	0.4272	8	0.4549	8	0.4017	8
a8	0.4786	6	0.5148	6	0.4687	7	0.4185	7
a9	0.7864	2	0.7054	3	0.7195	4	0.7155	3
a10	0.7605	3	0.7001	4	0.7238	3	0.7010	4

Table 5: Evaluation scores and ranking results for Group 3.

	$h = 0.1$		$h = 0.8$		$h = 1$		$h = 2$	
	Marks	Ranks	Marks	Ranks	Marks	Ranks	Marks	Ranks
a1	0.7864	2	0.7054	3	0.7195	4	0.7155	3
a2	0.4673	7	0.4653	7	0.4743	6	0.4295	6
a3	0. 8593	1	0.8283	1	0.8688	1	0.8027	1
a4	0.3216	9	0.3126	9	0.3208	9	0.3433	9
a5	0.2254	10	0.2218	10	0.2724	10	0.2372	10
a6	0.7128	4	0.7819	2	0.7792	2	0.7321	2
a7	0.4189	8	0.4272	8	0.4549	8	0.4017	8
a8	0.4786	6	0.5148	6	0.4687	7	0.4185	7
a9	0.6765	5	0.6783	5	0.6367	5	0.6729	5
a10	0.7605	3	0.7001	4	0.7238	3	0.7010	4

Group 1, Group 2 and Group 3, respectively. In Tables 3–5, marks represent the evaluation scores, and ranks represent the ranking of the evaluation scores from high to low.

From Tables 3–5, we can see that the ranking results are similar regardless of the value of h. In Group 1, student a9 has the most serious problem based on the mental factors of their theoretical knowledge of leadership, practical ability, leadership psychology, home education, and exercise. In Group 2, student a1 has the most serious problem among all the 10 students. In Group 3, student a3 has serious leadership problem in terms of the five leadership investigating factors. Overall, the practical ability and leadership psychology of the students are mainly influenced by their leadership.

5. Conclusion

In this work, we first determined the key factors that influence the leadership psychology of college students by analyzing the big behavior data of college students. The extracted factors include the theoretical knowledge of leadership, practical ability, leadership psychology, home education, and exercise. To evaluate the degrees of these factors influencing the students' leadership, we developed an advanced MCDM framework called EN-TOPSIS. In EN-TOPSIS, an entropy method was used to determine the criteria weights rather than using the subjective weighting method. Three groups of college students were surveyed and evaluated based on the five factors. Each group contained ten students. The experiment evaluation performance shows that the leadership of the students is mainly influenced by their practical ability and leadership psychology. The students with the highest evaluation score were recognized as having high levels of leadership. However, EN-TOPSIS requires a lot of preprocessing work, and the weight update process is complicated. In the future, more deep learning-based methods can be introduced to evaluate scores. Evaluation methods based on deep learning can make evaluation more intelligent and accurate.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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Research Article

Modeling and Analysis of the Influence of Cultural Differences on English Learning from the Perspective of the Cultural Community

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A model of the influence of cultural differences on English learning from the perspective of the linguistic and cultural community based on data feature decomposition and fusion clustering is proposed. The new knowledge and the old knowledge are connected through the optimal control of the learning model. By decomposing relevant data through data features and fusion clustering algorithm, the impact of cultural differences on English learning can be modeled and analyzed from the perspective of language and cultural community. The simulation results show that the data fusion performance of the impact model of this method on English learning is good, and the quantitative analysis results are accurate and reliable. According to the results of visual data, targeted interventions were carried out for teachers, learners, and teaching managers.

1. Introduction

Teachers have always played an important role in the process of English teaching and in the establishment of English language and cultural status. In this process, higher requirements are put forward for teachers' teaching skills and academic abilities, so teachers need to constantly improve their teaching quality [1–3]. In college English teaching, the spread of English language and culture has always been in a one-way state, with teachers transmitting relevant knowledge to students, while two-way interactive communication has always been absent. If this situation wants to be changed, first, the current situation of college English language and culture learning should be understood, and both teachers and students should pay attention to the importance of establishing the status of English language and culture. Teachers and students need to increase interactive teaching links, so that students can better understand English language and culture through practice, and teachers also need to improve the teaching content and process, so as to speed up the establishment of English language [4–6]. Studying the influence of cultural differences on English learning from the perspective of language and cultural community is of great significance to improving English learning and education quality.

Among the traditional methods, there are mainly parametric methods based on ambiguity detection and feature vector fusion and the influence of cultural differences on English learning from the community perspective [7, 8]. Reference [9] proposes a model to guide English learning interest based on multivariate quantitative recursive analysis. By using descriptive statistical analysis, the constraint parameters of guiding English learning interest are constructed. And the guiding model of English learning interest in microclasses is transformed into a multiple linear regression model. Construct each explanatory variable for robust regression analysis. The model analyzes the correlation between the guidance of English learning interest and the learning quality, and evaluates the students' English learning interest and predicts the quality of English learning by means of multivariate quantitative recursive analysis. In this method, the guiding role of English learning interest in the microclassroom model is simulated. The results of quantitative analysis are accurate, the evaluation of English learning interest is reliable, and the effect of improving English learning quality is obvious. However, this method is computationally expensive. Reference [10] uses multilevel modeling to investigate the development of oral English complexity of Chinese learners in one academic year. And learners' individual development trajectory and group development trend are simulated. It is found that the development process of individual learners' oral complexity in different dimensions is different. At the group level, the unit length of learners increased significantly; the master — slave relationship increased weakly, and the length of phrases decreased slightly. The study further uses change point analysis and semistructured interviews to explore the development trend and reasons of learners' complexity in high-growth group and low-growth group. The results show that under the influence of different learning motivation and emotion, the complexity development of the high-growth group shows an upward trend after the change point and that of the low-growth group shows a downward trend. This method shows that the multilevel modeling method can deepen the understanding of the oral development process and the research results are helpful for teachers to better design oral teaching tasks.

In view of the above problems, this paper proposes a model of the impact of cultural differences on English learning from the perspective of language and culture community, based on data feature decomposition and fusion clustering. Using the differential semantic feature detection method, the index parameter distribution model of the impact of cultural differences on English learning from the perspective of language and cultural community is constructed. The relevant data collected on the English learning platform, including learners' learning logs and learning achievements, are used to realize the modeling and quantitative analysis of the impact of cultural differences on English learning from the perspective of language and cultural community. The experimental results show that this method is superior in improving the modeling ability of the influence of cultural differences on English learning.

2. Clustering Algorithm Theory

Any clustering algorithm has certain assumptions about the data set itself. If the distribution of the data set itself does not conform to the preassumption, the result of the algorithm will be meaningless, even it can be said that the result just gives a wrong distribution or imposes a fictitious distribution on the data set. Clustering combines the results obtained by different algorithms or using different parameters in the same algorithm, so as to obtain better results than a single algorithm.

In clustering fusion, multiple cluster members of the data set are generated first, and then, the clustering results of these cluster members are merged by consensus function. We select different initial points randomly and run the k -means algorithm several times, so as to generate the required cluster members. We use random sampling method to generate data subsets and then use k-means algorithm to generate clusters for each data subset, so as to get cluster members. Random projection is used to project high-dimensional data into low-dimensional space, and several data subsets are obtained by multiple projections. Then, the EM clustering algorithm is used to cluster each projection subset, so as to obtain cluster members. By selecting different algorithms, selecting different initial values for an algorithm, selecting different subsets of objects, selecting different subsets of features, and projecting them into the data subspace, cluster members are generated. The algorithm is used to measure the similarity between data points. Points larger than 0.5 in the matrix are considered to belong to the same class in the final clustering results.

The clustering fusion algorithm has excellent average performance in various fields and experiments and can adapt to most fields and experiments. Moreover, the noise data and abnormal data have little impact on the results of clustering fusion. Therefore, the clustering algorithm has the advantages of robustness, adaptability, and stability. Therefore, the learning model constructed by clustering fusion algorithm is applied in this paper, which provides a basis for subsequent relevant data analysis.

3. Influence of Cultural Differences on Parameter Distribution and Information Preprocessing

3.1. Influence Parameter Distribution and Information Preprocessing. The data of the process model of the influence of cultural differences on English learning mainly come from the following: (1) Learners make records through platforms, mobile terminals, software, etc. These data can reflect the interaction process between learners and platforms and can be used to analyze learners' learning behavior. (2) Curriculum, learning data, and data related to learners' learning. Managers can analyze these two kinds of data to provide feedback for teachers' teaching and students' learning.

These two kinds of data are analyzed by means of conceptual cognition, social network analysis, influence, and success or failure signals, followed by data tracking and prediction to form technical, social, and teaching individualization or adaptation. Learning analysis and process model are used to provide theoretical basis for junior high school English personalized learning instructional design supported by network teaching platform [11].

A feature matching model of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is constructed by combining semantic feature analysis and fusion scheduling method, which makes it the rough set feature quantity of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities [12–14]. The specific construction process is sh`own in Figure 1.

According to the information fusion matching results of feature layers, a deep hash coding algorithm is adopted [15, 16]. In this paper, the depth feature detection is carried out on the index parameters of the influence of cultural differences on English learning from the perspective of linguistic

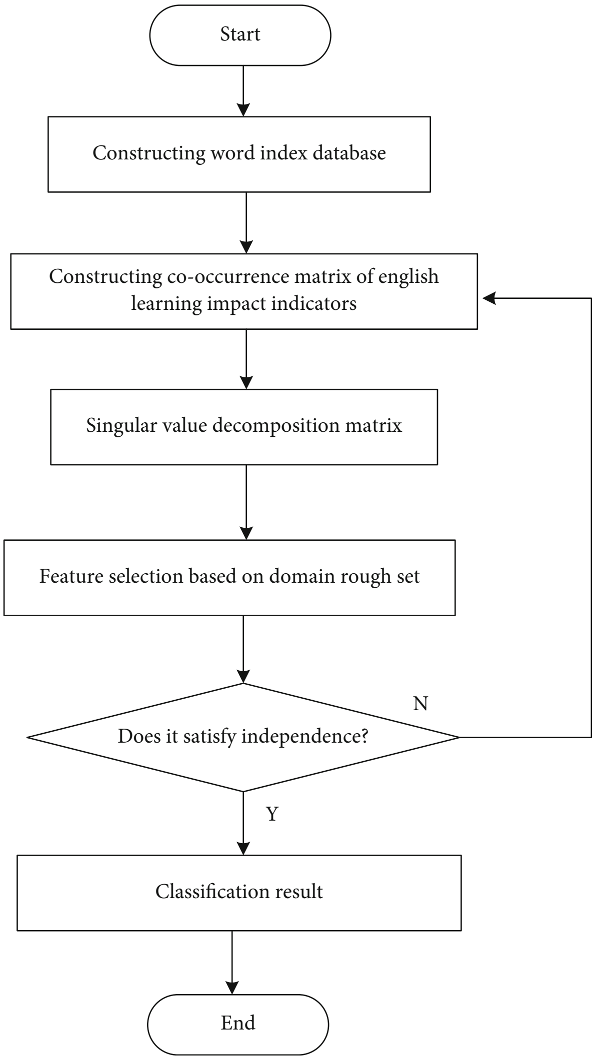


Figure 1: The process of feature matching model construction.

and cultural communities. Moreover, the gradient values of the index parameters of the influence of cultural differences on English learning from the perspective of each linguistic and cultural communities are calculated. Using the inherent sparseness of data, the convergence value of depth hash coding is obtained as follows:

$$P\left(\lim_{T\longrightarrow\infty} \overline{x_T} = K\right) = 1, \tag{1}$$

wherein $\overline{x_T}$ represents the correlation parameter between cultural differences and English learning correlation feature set from the perspective of linguistic and cultural communities. k is the scale of random features. Additionally, $Q(x_i, y_i)$ is the frame sequence moment of the index parameters of cultural differences' influence on English learning from the perspective of linguistic and cultural communities. According to the parameter fusion results of the index parameters of cultural differences' influence on English learning from the perspective of linguistic and cultural communities [17–19], the joint feature distribution set of the index parameters of cultural differences' influence on English learning from the perspective of linguistic and cultural communities is expressed as follows:

$$F(t) = X_p(u - v \sin a) = \frac{3}{(N+1)^2} x(N+1)x^3(N+1-\tau), \tag{2}$$

wherein X_p is the source information of semantic distribution of index parameters of cultural differences on English learning from the perspective of linguistic and cultural communities. u is the joint distribution feature quantity of index parameters of cultural differences on English learning from the perspective of linguistic and cultural communities. Moreover, v is the basis function of sparse representation classification model. We suppose $i = 1$. Read in the related features of cultural differences and English learning from the perspective of linguistic and cultural communities in the first frame and combine the coding of related features of cultural differences and English learning from the perspective of linguistic and cultural communities to obtain the output fuzzy feature code element sequence as follows:

$$\begin{cases} p_{th}^{(b_{\text{int}})} = C_t \sum_{x_i\in w} k(\|x_i\|)\delta(h(x_i) - b_{\text{int}}), \\ p_{te}^{(b_{ine})} = C_e \sum_{x_i\in w} k\left(\|x_i\|^2\right) his_{x_i}\delta\left(v_{x_i} - b_{ine}\right), \end{cases} \tag{3}$$

wherein $C_t = C_e = \left(1/\sum_{x_i\in w} k\left(\|x_i\|^2\right)\right)$ represents the depth information parameter of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities. $b_{\text{ine}} \in [1, M]$ is the attribute category of linguistic and cultural communities. $h(x_i)$ is the greedy function of mixed structure. b_{int} is the symbol transmission speed of characteristic frames from the perspective of linguistic and cultural communities. b_{ine} is the frame conversion rate. $\|x_i\|$ is the distance between clusters of sparse features, which represents a European distance.

The feature distribution quantity u in the joint feature distribution set obtained by formula (2) can determine the distribution of parameters. The larger the u is, the more obvious the distribution of joint features is. Therefore, the influence of cultural differences on the distribution of English learning parameters can be judged.

The new and old knowledge will be connected to form new knowledge experience, and the relevant data collected on the English learning platform. Learners' learning logs and learners' learning achievements will be analyzed in summary, so as to realize the integration of the indicators and parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities.

3.2. Information Characteristic Analysis of Influencing Index Parameters. The collected characteristic information of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is restructured, the feature distribution set is extracted, and the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is realized by using the support vector machine algorithm. The specific process is shown in Figure 2.

According to the depth feature weighting training [20–22], the weighted aggregate output function of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is obtained as follows:

$$E_{Snake} = \sum_{0}^{N-1} [E_{\mathrm{int}}(vi) + E_{\mathrm{ext}}(vi)] \tag{4}$$

wherein V_i is the morphological function of weighted aggregation of indicators and parameters of cultural differences' influence on English learning from the perspective of linguistic and cultural communities. $i = 0, 1, \cdots N-1$ is the collection of characteristic points of cultural differences' influence on English learning, and $E_{\mathrm{ext}}(vi)$ is the sparse scattered point set of cultural differences' influence on English learning. The aggregated output of sparse expression characteristic distribution of cultural differences' influence on English learning is G [23, 24], as shown below:

$$G_t = AF_{t-1} + t, \tag{5}$$

wherein $F_t = [x_t, y_t]^T$ is the correlation characteristic value of the T-frame of the teaching resources of the correlation between cultural differences and English learning from the perspective of linguistic and cultural communities and A is the output amplitude. The semantic correlation distribution model of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is constructed. In addition, the distribution of output search trajectories is obtained, as shown below:

$$\mathrm{trace}\left(x, y, \sigma^{(n)}\right) > \mathrm{trace}\left(x, y, \sigma^{(1)}\right) \quad l \in \{n-1, n+1\}, \tag{6}$$

wherein trace(.) represents the fusion parameter of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural community. Furthermore, the iterative function of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is obtained as follows:

$$X_t = AX_{t-1} + t, \tag{7}$$

wherein $X = [x_t, y_t]^T$ is the frame distribution set of training characteristics from the perspective of linguistic and cultural community. The output clustering matrix of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is obtained as follows [25–27]:

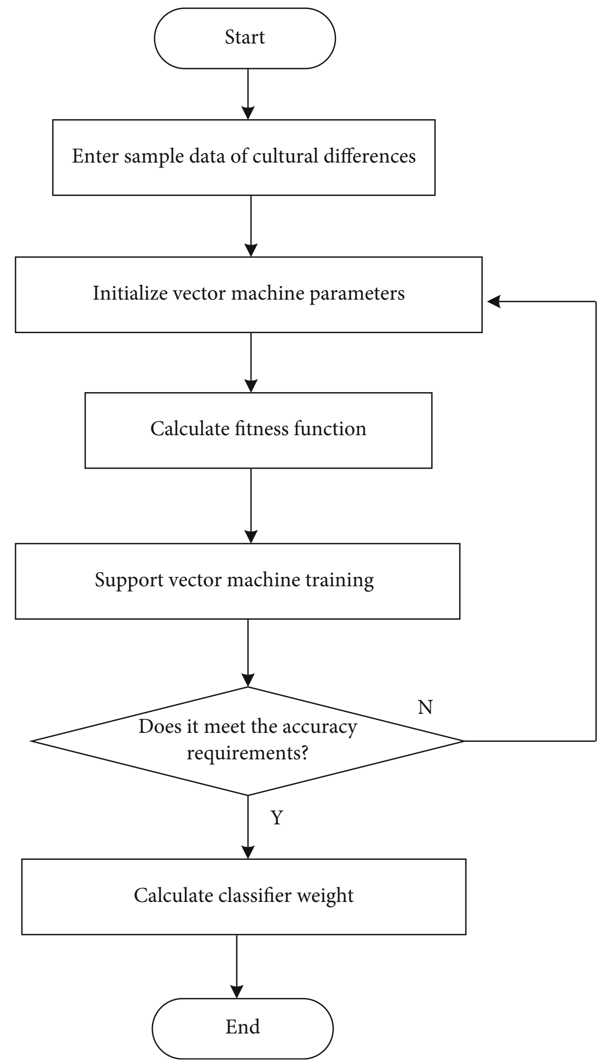


Figure 2: The process of extracting feature information.

$$H = \begin{bmatrix} L_{xx}(x,\sigma) & L_{xy}(x,\sigma) \\ L_{xy}(x,\sigma) & L_{yy}(x,\sigma) \end{bmatrix}, \tag{8}$$

wherein $Lxx(x, \sigma)$ is the characteristic matching coefficient of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities. Moreover, Lxy and Lyy are the characteristic components of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities in different aggregation directions.

4. Modeling and Optimizing

4.1. Data Feature Decomposition and Fusion Clustering Algorithm. The index parameter distribution model of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities is constructed by using the differential semantic feature detection method. Under constructivism, the deep learning model of the influence of cultural differences on English learning, from the perspective of linguistic and cultural communities, is established by using the methods of knowledge ontology structure reconstruction and semantic feature fusion cluster analysis. And the collected correlation between cultural differences and English learning from the perspective of linguistic and cultural community is decomposed by sparsity features. The specific process is shown in Figure 3.

According to the hash coding results of the index parameters of cultural differences on English learning from the perspective of linguistic and cultural community, information reorganization is realized. In addition, the coding model of support vector machine is constructed according to the information reorganization structure. By using cluster analysis method, it is found that the cluster centers of the index parameters of cultural differences on English learning from the perspective of linguistic and cultural communities are M_i and M_j, and the structural sparseness of data is represented by complexity. The reliability matching degree of cultural differences on English learning index parameters from the perspective of linguistic and cultural communities is $\mathrm{Clustdist}(M_i, M_j)$, and the corner information of cultural differences on English learning index parameters from the perspective of linguistic and cultural communities is extracted. The hierarchical alignment mechanism from coarse to fine is expressed as follows:

$$R_1(k) = R_2(k) \exp\left(-j\omega_0 T_p/2\right), \quad k = 0, 1, \cdots, (N-3)/2, \tag{9}$$

$$R_2(k) = A_k \exp\left(j\varphi_k\right), \quad k = 0, 1, \cdots, (N-3)/2, \tag{10}$$

wherein $R_2(k)$ is the correlation characteristic component between cultural differences and English learning from the perspective of linguistic and cultural community. T_p is the collection time interval of Gaussian mixture sparse characteristic distribution. $\omega_0 T$ is the joint component, A_k is the kernel matrix of Mahalanobis distance. ω_0 is the distance measurement parameter, and N is the weighting coefficient. Based on the semantic information detection results of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities and the analysis results of the moment invariants of the correlation between cultural differences and English learning from the perspective of multiview attribute coding linguistic and cultural communities, the generalization model parameters of the vector machine regression model are as follows:

$$\begin{aligned} \varphi(X_k, t_i) = G(\|X_k, t_i\|) &= \exp\left(-\frac{1}{2\sigma_i^2}\|X_k, t_i\|^2\right) \\ &= \exp\left(-\frac{1}{2\sigma_i^2}\sum_{m-1}^{M}(x_{km} - t_{im})^2\right) \end{aligned} \tag{11}$$

wherein $t_i = [t_{i1}, t_{i2}, \cdots, t_{iM}]$ is the discrete sequence of the

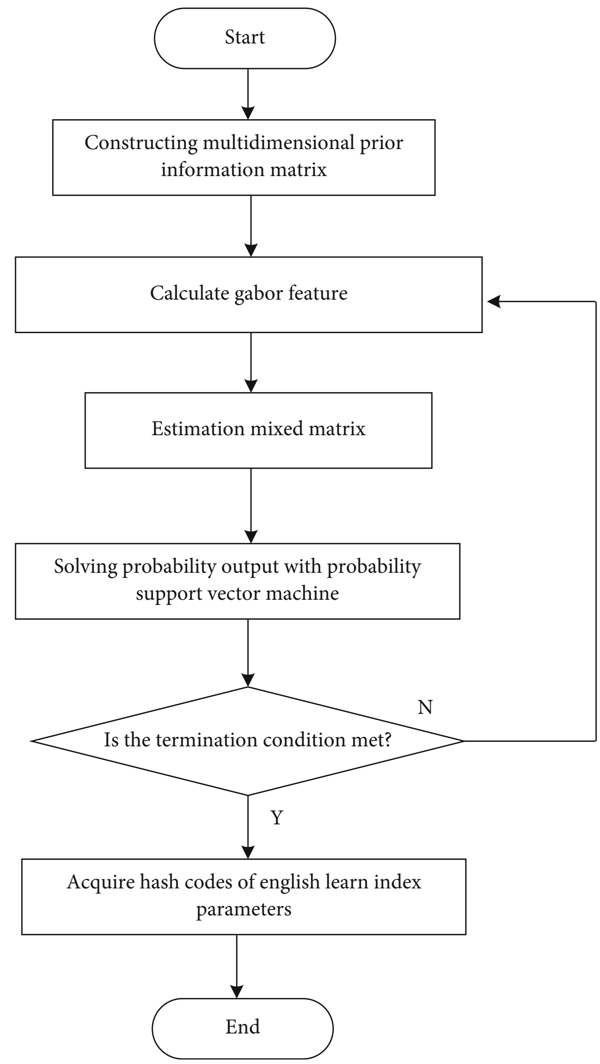


Figure 3: The process of decomposition of correlation characteristics.

index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural community and σ_i is the iterative function of maximum likelihood estimation. The new curriculum standard requires a diversified evaluation system to promote students' all-round development. Different students have different interests and different learning styles. In teaching evaluation, students should not only be evaluated by a single examination method. Through the investigation of students' personalized contact opportunities and understanding methods, personalized learning in teaching is expected to be better understood.

4.2. Model Optimization Design. In the modeling of influence relationship, by controlling the distribution resources of cultural differences, the resources are selected and developed in the form of combining original resources with generative resources. We include answering materials, teachers' answers to common problems, students' discussion and sharing of personality problems, teachers' evaluation and summary of personality problems, and evaluation forms. Q&A material is a summary of the problems that teachers have with students after they preview. For the common problems of class students, teachers will focus on answering them in class. For the individual problems, teachers will discuss them in groups, and then, teachers will evaluate and summarize the results of students' discussions. Students will evaluate themselves and their classmates according to the contents in the evaluation form, extracting the frame recombination sequence of the correlation features between cultural differences and English learning from the perspective of linguistic and cultural community, and obtaining the robust multimodal multivariate sparse features, which are expressed as follows:

$$r_1(n) = r_2(n) \exp\left(-j\omega_0 T_p/2\right), \quad n = 0, 1, \cdots, (N-3)/2, \tag{12}$$

$$r_2(n) = A \exp\left[j(\omega_0 nT + \theta)\right], \quad n = 0, 1, \cdots, (N-3)/2, \tag{13}$$

wherein N is the sampling length of the correlation features between cultural differences and English learning from the perspective of linguistic and cultural community, ω_0 is the symbol distribution interval of the evaluation feature sequence of students' discussion and sharing of personality problems and teachers' discussion of personality problems, and T is the maximum sampling length.

By analyzing the column vectors in the dictionary, this paper constructs an average segmentation model of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities, which is expressed as follows:

$$\overline{x_T} = \frac{1}{T}\sum_{i=1}^{T} x_i, \tag{14}$$

wherein $x_1, x_2, x_3 \cdots x_T$ is the feedback sequence of formative evaluation from the perspective of linguistic and cultural community and $_T$ is the time delay parameter of linguistic and cultural community perspectives in series.

We construct a recombination model of the index parameters of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities and obtain the joint measurement component of N_l, and the calculation formula is shown as follows:

$$N_l = \begin{cases} 1 & l = 0, L, \\ \left[2\pi \cdot \dfrac{D}{2} \cdot \sin \eta / l_{triangle}\right] & 1, \end{cases} \tag{15}$$

wherein $l_{triangle} = \pi \cdot D/2L$ represents the Retinex corner parameter value of the index parameter of the influence of cultural differences on English learning from the perspective of linguistic and cultural community. Moreover, $k = 1, 2, .. \cdots, n, zk \in w^s, ak \in \{1, 2, \cdots, R\}$ is the Gaussian mixture sparse feature quantity. We establish a feature channel for quick retrieval of the index parameter information of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities. According to the distributed fusion of edge features and frame sequence reorganization of the index parameter information of the influence of cultural differences on English learning from the perspective of linguistic and cultural communities, the comprehensive feature parameter is as follows: the test output result of the index parameter of the influence of cultural differences on English learning from the perspective of multilingual cultural community is shown as follows:

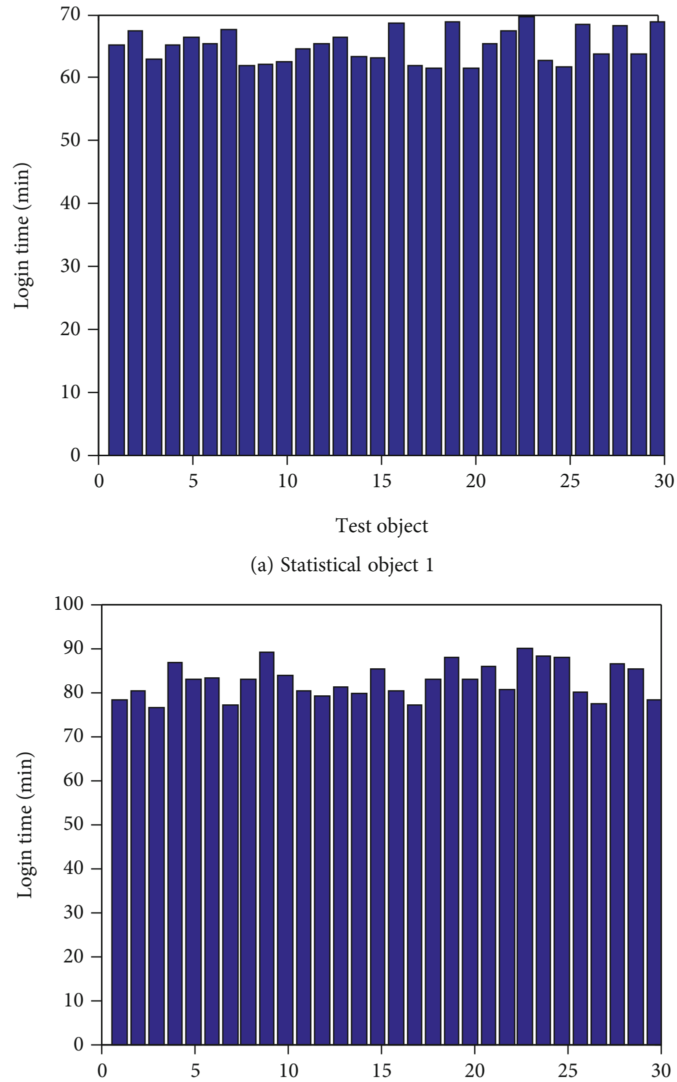
$$\dot{\sigma_i} = \begin{cases} \mu \sin \dfrac{\pi e}{2\mu}, |e_i| < \mu \\ \mu, |e_i| \geq \mu - \mu, |e_i| \leq -\mu \end{cases}, \tag{16}$$

wherein σ_x, σ_θ and e_i represent the fitness parameter of the index parameter fusion of cultural differences on English learning from the perspective of linguistic and cultural community and represent the minimum augmented Lagrange function. Thus, we realize the fusion of the index parameters of cultural differences on English learning from the perspective of linguistic and cultural communities. Relevant data collected on the English learning platform, including learners' learning logs and learning achievements, are decomposed by data features and fused clustering algorithm to realize the cultural differences on the perspective of linguistic and cultural communities.

5. Simulation and Test

A total of 60 students in two grade experimental classes with 30 students in each class were selected as test subjects. The simulation experiment is carried out in the MATLAB environment with the computer operating system of Windows 10 and the memory of 4 G. In the experimental study, the personal characteristics of students are mainly the time data of students' landing on the platform. The learning time recorded by the "ability sky" platform mainly refers to the online time of students. By recording the login time of students on the platform, teachers can know whether the learning time of students meets the actual needs. According to the test and analysis of MATLAB platform, the data table of students' login time is derived, and the students are numbered in turn. The details of the learning time of 60 students on the platform are shown in Figure 4.

According to Figure 4, more than 95% of students are satisfied with the teaching resources and teaching environment arranged by teachers and are willing to use the "Ability Sky" platform to help them complete their courses. The "Ability Sky" platform can help them acquire, internalize, and consolidate their current knowledge; enhance their interest in English learning and learning efficiency with the help of the "Ability Sky" teaching platform; promote personalized learning; and help students learn a lot through teachers' analysis and feedback of personalized data. From the students' attitude towards the implementation of



(a) Statistical object 1

(b) Statistical object 2

Figure 4: Time chart of students' landing study.

teaching, it can be seen that the junior high school English learning through the "Ability Sky" teaching platform is helpful to their individualized learning.

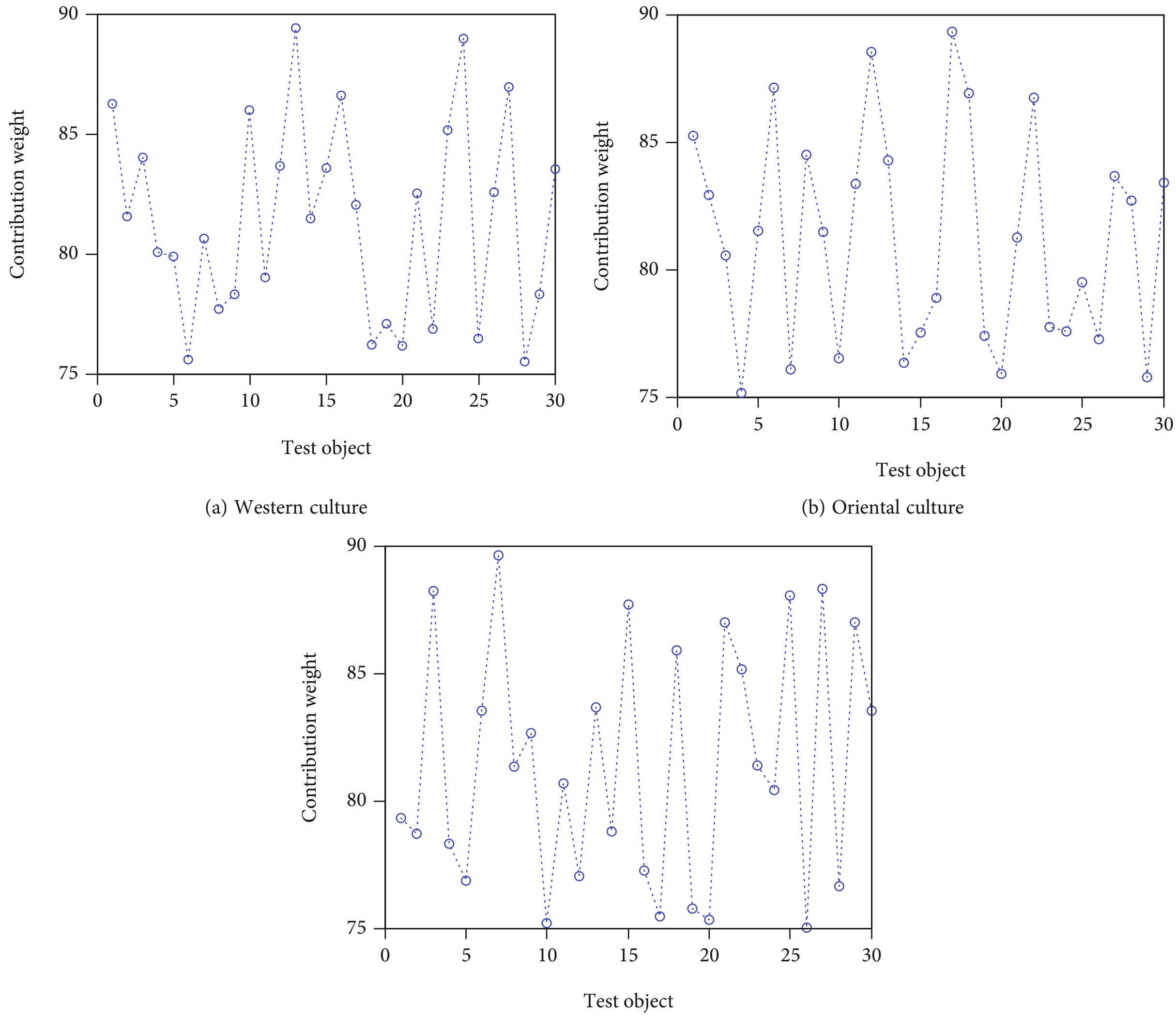
Students' personalized learning methods based on online teaching platform can analyze the contribution level of cultural differences to English learning, as shown in Figure 5.

It can be seen from Figure 5 the western culture. The Eastern culture or African culture, the personalized learning method of students using the online teaching platform, has a contribution weight of more than 75 to English learning up to 90. The contribution of this method to Oriental culture and African culture is particularly obvious, with an average value of about 85.

At different levels of differences, the accuracy of the evaluation of the influence of different cultural differences on English learning is tested, and the comparison results are shown in Figure 6.

It can be seen from the image comparison results in Figure 6 that the accuracy of the methods in this paper is above 90%, up to 100%, and the average value is about 95%. Compared with the two methods, the accuracy of the linear equalization algorithm is 70% ~90%, and the average accuracy is about 85%. The evaluation accuracy of analytical regression calculation is the lowest, ranging from 60% to 70%, and the average accuracy is 65%. By comparing the three methods, we can see that the accuracy of this method is the highest, which proves that the accuracy of this method is higher.

Based on the analysis of students' achievement, English learning attitude, and English learning strategies and questionnaires, it can be seen that the individualized learning of junior high school English supported by the network teaching platform has not greatly improved students' English achievement. However, through the comparison before and



(a) Western culture

(b) Oriental culture

(c) African culture

Figure 5: The influence of difference contribution level.

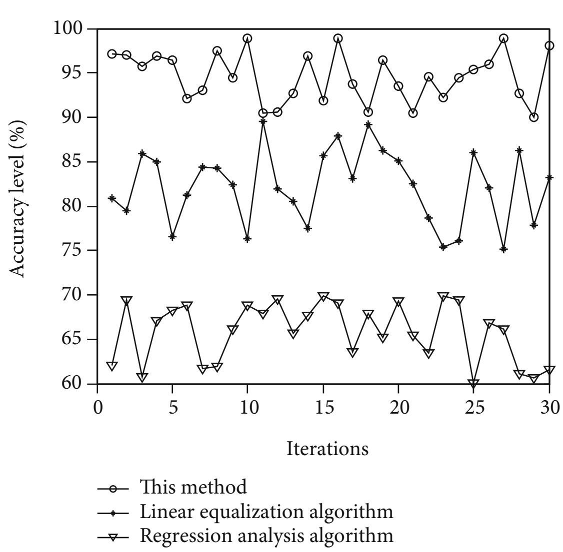


Figure 6: Comparative test on the accuracy of evaluation.

after the experiment, the individualized learning of junior high school English supported by the network teaching platform has greatly improved students' attitude towards English learning and learning strategies. Compared with before the experiment, students prefer learning English subjects. Through the questionnaire, it can be seen that the overwhelming majority of students like individualized learning of junior high school English supported by online teaching platform not only pays attention to their learning style but also effectively combines their interests with English learning. The personalized learning of junior high school English supported by the network platform enriches the traditional evaluation methods and objectively evaluates individual learning through personalized data. In addition, students can objectively understand their own learning situation through the learning process data recorded on the platform and the analysis results of the data and students can find their own shortcomings in learning and adjust their learning methods in time according to the feedback of personalized data.

6. Conclusions

This paper presents a model of the influence of cultural differences on English learning from the perspective of language and culture community based on data feature decomposition and fusion clustering. Relevant data are collected on the English learning platform, including learners' learning logs and learning achievements. From the perspective of language and cultural community, the quantitative analysis of the impact of cultural differences on English learning is realized. According to the analysis results of the simulation test, the personalized learning of junior high school English supported by the network teaching platform has greatly improved students' attitudes and learning strategies towards English learning. The model of the influence of cultural differences on English learning from the perspective of language and culture community established by this method has good data fusion performance, and the quantitative analysis results are accurate and reliable. It is hoped that in the future research, this method can be applied to the teaching of other subjects to cultivate excellent students with all-round development.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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Research Article

Design and Application of Sports-Oriented Public Health Big Data Analysis Platform

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People's pursuit of public health continues to improve with the rapid economic development. Physical activity is an important way to achieve public health. Excessive physical activity intensity and uncomfortable forms of physical activity can affect people's physical and mental health. Reasonable physical activity intensity and reasonable physical activity form will be beneficial to public health. People need to choose the corresponding sports mode according to physical function parameters and mental health parameters. However, it is difficult to understand the relationship between physical activity patterns and public health-related parameters, which limits people to establish reasonable exercise patterns. This research uses big data technology to design an intelligent sports-oriented public health data analysis scheme. It mainly uses MLCNN method and LSTM method to extract physical function parameter features, mental health parameter features, and sports parameter features. The research results show that the MLCNN method and LSTM can accurately extract and predict the parametric features related to sports and public health. The largest relative mean error is only 2.52%, which is the predicted value of the physical performance parameter characteristics. The smallest prediction error is also 2.27%, and this part of the relative error comes from the prediction of sports parameters.

1. Introduction

The improvement of economic level has brought people a higher quality of life and happiness. In the era of sufficient material life, people also began to pay more attention to their health [1, 2]. People often use sports to achieve fitness goals. Public health has become a trend in today's society, which is why people continue to pay attention to physical and mental health. There are also many forms of physical exercise, and different groups of people will have different suitable sports [3, 4]. Appropriate physical activity will promote physical health, but excessive or inappropriate forms of physical activity are not only harmful to physical health; it may also cause loss of physical function [5, 6]. Therefore, reasonable sports forms and reasonable sports methods can improve people's pursuit of health. This requires people to pay more attention to the relationship between physical function and physical health, so that it can find suitable forms of sports and methods of sports [7, 8]. For young people, intense physical activity may promote the body's metabolism, which will also cultivate a positive and optimistic attitude in young people. Long-term nonparticipation in sports can easily lead to the decline of physical function and unhealthy mental state. For the elderly, appropriate physical activity will promote physical health, and it will make the elderly maintain a better mental attitude and physical function [9, 10]. However, excessive physical exercise and intense physical activity are not good for the body of the elderly. This requires the elderly to choose appropriate sports according to their physical indicators [11, 12], so as to achieve the goal of pursuing physical health. It can be seen that different groups have different requirements for sports and the intensity of sports.

Different groups choose appropriate sports and exercise intensity, which requires people to understand the relevant indicators of physical function and the relationship between sports and the body [13, 14]. It is difficult to understand the quantitative relationship between physical activity intensity and physical performance. Despite the rapid development of the Internet with technology and high technology, data on the relationship between physical function and physical activity are relatively scarce [12, 15]. If people can choose the relevant physical activity according to the characteristics of the body's heart rate, pulse, and fitness level, it will achieve the purpose of physical health [16, 17]. When people have a healthy body and a healthy mind, they will not only have more expectations and enthusiasm for life but also create higher goals in life. Public health mainly includes physical health and mental health. Big data technology can better establish the mapping relationship between research objects for different characteristics [18, 19]. Therefore, it is a new direction for big data technology to solve the relationship between physical exercise and physical function, mental health, and other aspects. There is a complex relationship between sports and public health-related parameters, which is a nonlinear relationship that cannot be solved by artificial means through experiments or formula methods. Big data technology can efficiently extract the characteristics between sports and public health and establish a quantitative relationship between the two.

Big data technology has shown powerful advantages in dealing with huge amounts of data, it will extract the characteristics of huge amounts of data, and it can establish connections between data [20, 21]. If big data technology is applied to sports-oriented public health, it will extract physical function indicators and characteristics of mental health, and it will also establish the relationship between physical and mental health and physical activity intensity and physical activity form [22, 23]. Big data technology can solve some problems that traditional manual methods and empirical methods cannot solve [24, 25]. It is difficult for people to deal with huge amounts of data, and there is also a relatively complex nonlinear relationship between big data, which requires big data technology to use the distribution of weights and biases to establish nonlinear relationships between research objects. In life and production, there are often complex nonlinear relationships between the characteristics of research objects. These relationships are difficult to establish through empirical formulas, and big data technology is used for processing and prediction [26, 27]. So far, big data technology has more mature algorithms for feature extraction and feature prediction [28, 29]. This provides more convenience for the application of big data technology in various life and production fields.

This study uses big data technology to establish the relationship between sports characteristics and physical and mental health characteristics, and it also designs an intelligent public health big data platform. This study mainly designs a multipath convolutional neural network (MPCNN) and LSTM neural network to extract features related to public health and sports. First, this study introduces the relationship between physical activity and physical and mental health in Section 1; it also introduces the relevant research background of big data technology. Section 2 describes the current state of research in public health and sports. The platform for the relationship between intelligent physical activity and physical and mental health designed in this study using MPCNN and LSTM is introduced in Section 3. Section 4 highlights the reliability of MPCNN and LSTM methods in predicting and extracting features related to sports and public health. This study summarizes and analyzes the application value and reliability of big data technology in sports-oriented public health platform in Section 5.

2. Related Work

Although physical exercise can promote the development of physical and mental health, it puts forward requirements for the intensity of physical exercise and the way of physical exercise. Different groups of people are suitable for different sports intensities and different forms of sports. This requires the selection of relevant sports forms according to one's own physical function and mental state. Many researchers have studied the relationship between physical activity and public health. Yuan [30] has found that physical activity improves fitness and also improves mental health in college students. However, it was also found that the current college sports facilities that are not complete can hinder the development of college students' physical and mental health through sports. This study uses literature survey method, Delphi method, and factor analysis method to study the relationship between physical and mental health and physical activity of college students. The results of the study found that factors such as study pressure and family will affect the physical and mental health of students, which requires reasonable physical exercise to improve physical and mental health. Liu et al. [31] mainly explore the relationship between urban public settings and public health. The shortage of urban public sports facilities has limited the healthy development of public sports. However, little research has been conducted to comprehensively assess the relationship between urban physical activity and public health. This study uses multisource urban data and GIS network analysis method to quantitatively analyze the relationship between urban sports and public health. The results of the study found that reasonable urban sports facilities will also promote the development of public health, which will promote people's pursuit of physical and mental health. The multisource data model proposed in this study also has certain value for studying public health. Schneider et al. [32] mainly analyze climate change and the relationship between physical activity and public health. They mainly explore the impact of extreme weather, ultraviolet rays, allergens, and other factors on public physical and mental health. They use the sport, club, and climate change model (SC3 model) to develop a conceptual model to study the relationship between climate change and physical and mental health risks. These public health assessments mainly include early warning systems and coordinated assessment systems. The results show that the SC3 model can predict the risk relationship between climate change and physical and mental health, which has an important role for people to improve physical and mental health and reduce the impact of climate on physical and mental health. Liu and Zhang [33] also believe that reasonable sports facilities will improve people's well-being; it will also improve people's physical and mental health. However, the layout of sports facilities is unreasonable and the gap between urban and rural areas is large. This study uses big data technology and visual methods to study the layout of urban public health-related sports facilities. This approach primarily quantifies issues such as diversity and coordination in sports settings. The research results show that the space utilization rate of sports facilities designed by this big data method is improved by 15.32%. This method can maximize the utilization rate of the city, and it can also improve people's pursuit of health. Baghapour et al. [34] study mainly analyzed the relationship between swimming and public health. This study uses the multicriteria decision-making method and fuzzy OWA method in big data technology to analyze the relationship between the environment and health of swimming pool construction. Swimming is also a form of physical activity that improves health. The results of the study found that the expansion index would be useful for studying the qualitative relationship between swimming exercise and health. From the above review, it can be seen that few researchers use big data technology to analyze the characteristics of public health or sports. This study will use big data technology to quantitatively analyze the correlation between sports and public health.

3. Analysis and Application of Big Data Technology in Sports-Oriented Public Health Platform

3.1. The Importance of Big Data Technology for Public Health Analysis. There is a strong correlation between physical function parameters and mental health and the intensity of physical activity and the way of physical activity. However, it is difficult for people to quantitatively analyze the relationship between physical function parameters and sports characteristics, which limits people's pursuit of public health. This study uses MLCNN and LSTM methods to build an intelligent sports-oriented public health data analysis platform. The MLCNN method can extract features such as physical function parameters and mental health indicators related to public health, which can establish a nonlinear relationship between public health-related features and sports features. LSTM methods can extract temporal features related to public health. The MLCNN method and the LSTM method can jointly extract the spatial and temporal features related to public health. Most traditional methods have difficulty considering the relationship between public health-related characteristics and time. The hybrid MLCNN-LSTM method can comprehensively consider various nonlinear relationships of features. This allows for a more precise understanding of the relationship between public health characteristics and sports parameters.

3.2. Application of MLCNN Algorithm and LSTM Algorithm in Sports-Oriented Public Health Data Analysis. This research intends to use MLCNN method and LSTM algorithm to realize the intelligent analysis platform of sports and public health-related parameters. If this kind of intelligent public health data analysis platform is established and trained, people can carry out relevant sports activities according to their physical function parameters and mental health indicators. This can better guide people to pursue physical and mental health. This study mainly studies three characteristics of public health physical function parameters, mental health indicators, and sports parameters. In this study, a large number of datasets collected will be classified according to different weights. Figure 1 shows the workflow of the MLCNN method and the LSTM algorithm in extracting and predicting features related to public health and sports parameters. First, this intelligent platform divides the vast datasets it collects into three broad categories. These three types of data represent the characteristics of physical function parameters, the characteristics of mental health indicators, and the characteristics of sports parameters. After the data of these three features is processed, it will be input to the input layer of MLCNN for feature extraction process. The MLCNN method will contain multiple input layers, which can extract public health-related features at different scales. Then, these extracted features are again input to the input layer of LSTM for the extraction process of common health time-related features. For the MLCNN-LSTM algorithm, convolution operations and an iterative process are required in the training phase. However, the convolution operation is not performed in the test phase; it is only a matrix operation with weights and biases.

3.3. Basic Principles and Network Design of MLCNN and LSTM Algorithm. The working principle of MLCNN method and CNN method is similar. CNN methods utilize convolutional layers, pooling layers, and activation functions for feature extraction and transformation of nonlinear relationships. The MLCNN algorithm consists of three paths. It mainly consists of two paths that do not contain pooling layers. It only contains convolutional layers. The other path consists of pooling layers and convolutional layers. The pooling layer designed in this study adopts the method of maximum pooling layer. Compared with the single-path CNNF method, the MLCNN method can extract more features, and it can also extract features of different scales. This is beneficial to the data analysis of sports-oriented public health platforms, because the data related to public health is relatively complex. Figure 2 shows the working path of the MLCNN method. The pooling layer can reduce the operation parameters of the deep learning framework, and it can also extract relevant features from different angles and paths. It can be seen from Figure 2 that the MLCNN algorithm contains three paths, which include two single CNN algorithm paths and a neural network path with a maximum pooling layer. The three paths will be concatenated through a fully connected layer. In this study, the MLCNN method is similar to the CNN method and it also contains more parameters. The number of filters, sliding step size, and learning rate of the MLCNN method designed in this study are 256, 1, and 0.0001, respectively.

A sports-oriented public health data analysis platform will also involve time-related features. If the temporal features of public health-related features are not extracted, this will ignore the data analysis of time for public health. The LSTM method can memorize some historical information data, but it does not memorize all temporal features. If the LSTM algorithm memorizes the state data at all times, it will cause the data complexity and reduce the training speed of

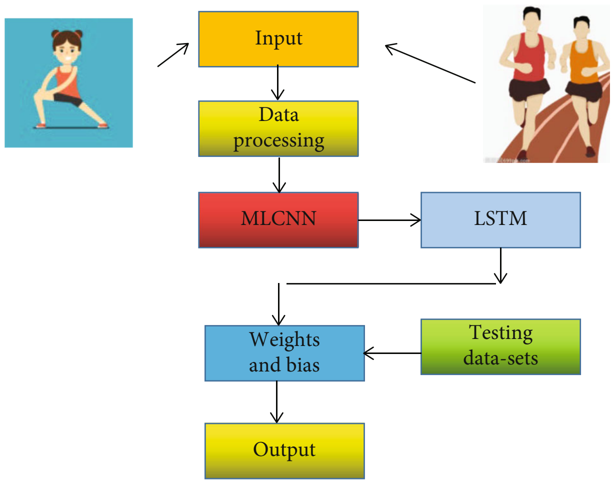

Figure 1: Application of MLCNN algorithm and LSTM algorithm in extracting spatiotemporal features of public health.

the deep learning framework. The LSTM algorithm can selectively filter and select the information data at all times, and it will leave the historical data with greater influence according to the distribution of weights. This is due to the specific gate structure of LSTM. Figure 3 shows the working scheme of the LSTM method for selecting information. It can be seen from Figure 3 that the output layer of the LSTM method is connected to the forgetting layer and the input layer of the next LSTM layer. The LSTM algorithm contains three neural network layers.

3.4. Mathematical Theory and Mathematical Principles of MLCNN Algorithm and LSTM Algorithm. This study uses the MLCNN-LSTM algorithm to extract the features related to sports and public health, which mainly involve physical function parameter features, mental health parameter features, and sports parameter features. The MLCNN method can be extracted from multiple angles and dimensions and public health-related characteristics. The detailed calculation process is as follows.

Both MLCNN and CNN methods involve convolution operations in both intelligent algorithms. The convolution operation will calculate the relationship between the data of the input feature and the convolution operator. Expression (1) and Expression (2) show the two steps of the convolution operation process. Expression (1) computes the integral operation of convolution. Expression (2) shows the sum operation of the convolution operation. Expression (3) shows the overall calculation process of the convolution operation.

$$\int_{-\infty}^{\infty} f(\tau)g(x-\tau)d\tau, \tag{1}$$

$$\int_{0}^{\tau} f(x)g(\tau-x)dx, \tag{2}$$

$$(f * g)(x) = \int_{-\infty}^{\infty} f(t)g(x-t)dt. \tag{3}$$

Expression (4) shows the convolution calculation process of MLCNN, which also reflects the calculation process between weights and biases and parameters. Expression (5) shows the derivation process of MLCNN. Weights are related operations according to the gradient descent method, and derivation is a basis of gradient descent.

$$x_j^\ell = f\left(\sum_{i\in M} x_i^{\ell-1} * k_{ij}^\ell + b_j^\ell\right), \tag{4}$$

$$\frac{\partial J}{\partial b_j^l} = \sum_{uv}\left(\delta_j^l\right) = \frac{\partial J}{\partial z_j^l} * \frac{\partial z_j^l}{\partial b_j^l}. \tag{5}$$

Expression (6) shows the derivation process of the bias. The distribution of bias and weight is a manifestation of the nonlinear relationship, which is also a basic algorithm of gradient descent. Expression (7) shows the calculation rule of the size of the output feature, which mainly involves parameters such as filter and sliding step size.

$$\frac{\partial E}{\partial k_{ij}^l} = \sum_{uv}\left(\delta_j^l\right)\left(P_I^{\ell-1}\right)_{uv}, \tag{6}$$

$$w' = \frac{(w+2p-k)}{s} + 1. \tag{7}$$

The optimal weight distribution and optimal bias distribution are done using the gradient descent method. The gradient descent method will iterate to find the region of the global minimum. Expression (8) shows the calculation rules of the gradient descent method. Whether it is MLCNN or LSTM algorithm, it will involve the gradient descent method.

$$d_j^\ell = \mathrm{down}\left(x_j^{\ell-1}\right). \tag{8}$$

Expression (9) shows the calculation method of the forget gate of the LSTM neural network. The forget gate will select and filter the historical information according to the size of the weight and the influence on the current state information.

$$f_t = \sigma\left(w_f \cdot [h_{t-1}, P_t] + b_f\right). \tag{9}$$

Expression (10) shows the calculation rule of the input gate of the LSTM algorithm. The input gate will control the input of historical information and current information, and the information will be used as new input data through the input gate. Expression (11) and Expression (12) show the update gate and output gate rules of the LSTM algorithm. The update gate is responsible for updating the values of the weights. The output gate complex selectively feeds data into the next layer of the neural network.

$$i_t = \sigma(\omega_i \cdot [h_{i-1}, P_t] + b_i), \tag{10}$$

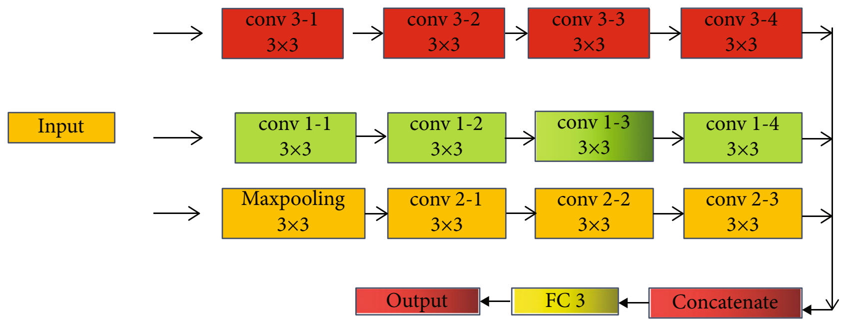

Figure 2: Design path and working principle of the MLCNN method.

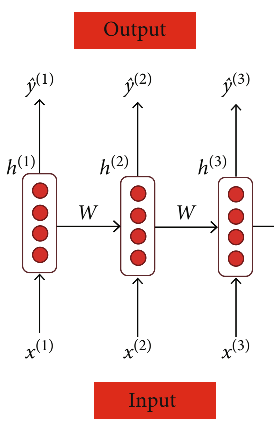

Figure 3: Working scheme of the LSTM method for selecting information.

$$\vec{C}_t = f_t \times \vec{C}_{t-1} + i_t \times \vec{C}_t, \tag{11}$$

$$O_t = \sigma\left(w_o \cdot \left[\vec{h}_{t-1}, P_t\right] + b_o\right). \tag{12}$$

4. Result Analysis and Discussion

This study uses big data technology to build a special data analysis platform related to sports and public health, which is a method for quantitative data analysis. The task of feature extraction with big data technology requires a large amount of data as data support, and a large amount of data is also the basis for big data technology to learn data correlation. MLCNN and LSTM methods can find and build nonlinear relationships from a large amount of sports and public health-related data. At the same time, the more feature types the dataset contains, the more knowledge about sports and public health can be learned by big data technology. If the dataset is too small, this will not only reduce the generalization ability of MLCNN and LSTM algorithms in sports and public health applications but also easily cause overfitting. If the number of datasets is too large, this will result in wasted data and increased training time. This study selected the data related to sports and public health in Beijing. Beijing's sports and public health data will contain more features than other provinces, because Beijing's medical level and urban facilities are more developed. Datasets about people are also easy to collect.

Both the CNN method and the MLCNN method can complete the feature extraction of parameters related to sports and public health. CNN and MLCNN methods have different performances on different datasets. This study first compares the performance of CNN-LSTM and MLCNN-LSTM methods in extracting sports and public health-related parameters. First, this study analyzes the performance of two big data techniques in public health forecasting using a global measure of mean relative error. Figure 4 shows the average relative error of the CNN-LSTM algorithm in predicting three parametric features of sports and public health. It can be seen from Figure 4 that the CNN-LSTM method can also accurately extract the characteristics of physical function parameters, mental health characteristics, and sports parameters. The prediction errors of the three different characteristics are all within 3%. The error has already met the error range of people's prediction of sports and public health-related characteristics. The prediction error of the physical function parameter feature is only 2.89%, which is the largest part of the feature. The relationship between physical function and physical activity was more complex than the other two health characteristics, which led to larger prediction errors. The prediction error for features related to mental health parameters was only 2.55%. Through the above analysis, it can be found that the CNN-LSTM method can analyze the relevant data of public health.

This study also compares the differences between the CNN-LSTM method and the MLCNN-LSTM method in extracting and predicting sports and public health-related features. Figure 5 shows the average relative error distributions for the three characteristics of sports and public health. In Figure 5, every two histograms represent a feature related to sports and public health; from left to right are physical function parameter features, mental health parameter features, and sports parameter features. The left side represents the relative mean prediction error using the CNN-LSTM method. It can be clearly seen from Figure 5 that the error range of the three characteristic parameters of sports and public health has been reduced. For the features of physical function parameters, the average relative error was reduced from 2.89% to 2.52%, and this part of the error was reduced by 0.37%. This relative percentage was relatively large

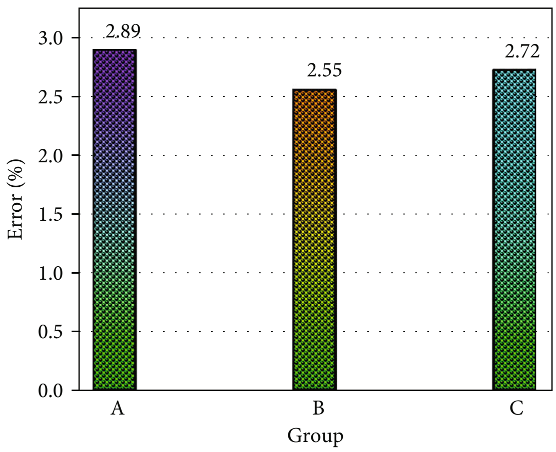

Figure 4: Prediction errors of public health and sports features using the CNN-LSTM method.

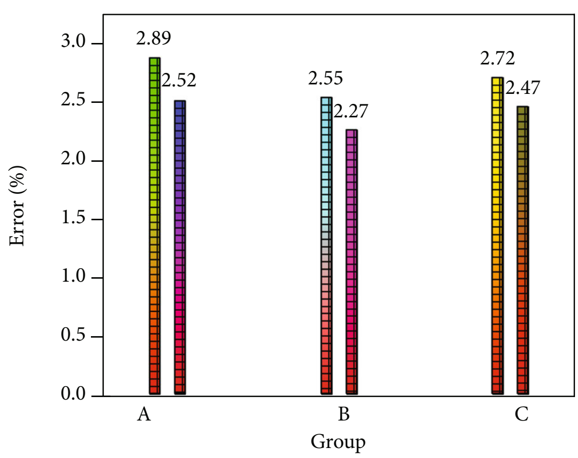

Figure 5: Prediction errors of public health and sports features using the MLCNN-LSTM method.

despite the low level of reduction in the physical performance parameter characteristics. The magnitude of the reduction in this part of the error is extremely beneficial to the discovery of physical function and the intensity and type of physical activity. For the mental health parameter features, the average relative error of this part was reduced from 2.55% to 2.27%. This part of the error reduction range is 0.28%. The average relative error of sports parameter features was reduced from 2.72% to 2.47%. It can be found through the above research that the MLCNN-LSTM method is more suitable for data analysis of sports and public health. The MLCNN method can extract relevant features of public health and sports from multiple perspectives and multiple paths. CNN methods only extract public health features from one path, which leads to large prediction errors.

From the Figures 4 and 5, it can be confirmed that the MLCNN-LSTM method used in this study has higher accuracy. The relative mean error is correlated from the perspective of global prediction accuracy, and this study also analyzes the local prediction accuracy of each feature individually. First, this study selected 35 groups of different physical function parameters for error analysis. Figure 6 shows the prediction error distribution of the physical function parameter features. In Figure 6, the abscissa represents a straight line with a prediction error of 2%. The upper part of the abscissa represents that the prediction error of physical function parameters is more than 2%. The lower part of the abscissa represents that the prediction error of physical function parameter characteristics is less than 2%. It can be seen from Figure 6 that the characteristics of 35 different groups of physical function parameters are all distributed below 3%. Half of the physical function parameter features are distributed below 2%. Only one in seven data points had a forecast error of more than 3.5%, but the distribution of these data points was also within a reasonable margin of error. It can be seen from Figure 6 that the prediction error range of physical function parameter features is between 0 and 3.5%. The reason for the large error range in this part may be that the dataset of physical function parameters has relatively large fluctuations. Overall, the MLCNN-LSTM method can also accurately predict different physical function parameters. Not only does it have superior performance in global body function parameter features; it also has high accuracy for each body function parameter indicator. This can be very helpful to people to discover the relationship between bodily function and public health.

This study also selected 35 different groups of mental health parameters for local predictive analysis. Mental health parameters vary greatly. For different groups of people, mental health status also affects the intensity and type of physical activity. Physical activity can promote the development of mental health. Therefore, it is also an advantageous way for people to understand the relationship between mental health parameters and physical exercise parameters. Figure 7 shows the change trend of the prediction curve of mental health parameter characteristics. In Figure 7, the blue curve represents the predicted value distribution of the mental health parameter feature, and the yellow curve represents the actual value distribution of the mental health parameter feature. It is used to verify the performance and reliability of the MLCNN-LSTM method. It can be seen from Figure 7 that the data of the mental health parameter characteristics fluctuates greatly. However, the predicted values of the mental health parameter characteristics are in good agreement with the actual data values. The MLCNN-LSTM method can not only predict the value of the parameters of mental health, but it can also predict the trend of the parameters of mental health. Whether it is the peaks and troughs of mental health parameters, this intelligent algorithm can accurately predict. It can be seen from the above analysis and research that this method can also help people to establish the relationship between mental health parameters and physical activity.

The data analysis of sports and public health involved in this study mainly includes three characteristics: physical function parameters, mental health parameters, and sports parameters. Similarly, this study also selected 35 sets of data for local predictive analysis of sports parameters. If the MLCNN-LSTM algorithm can accurately predict the

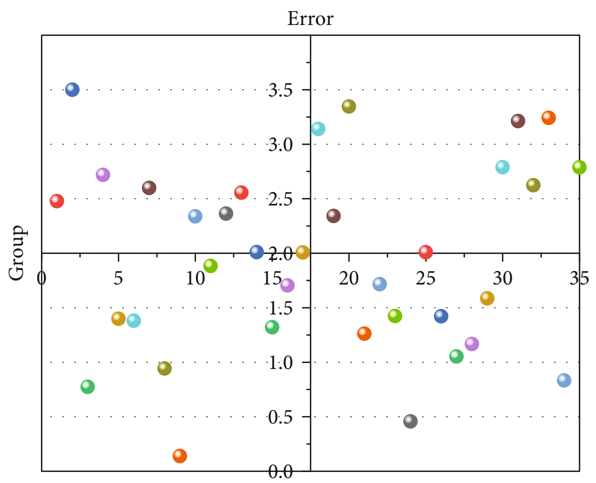

Figure 6: Prediction error distribution of physical function parameter features.

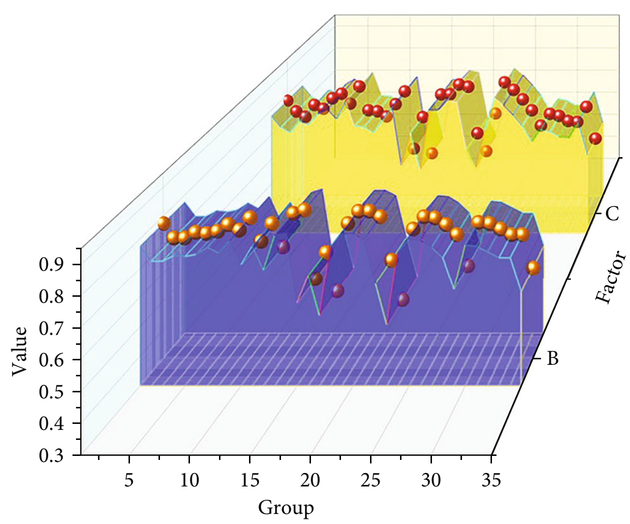

Figure 7: Predictive trends of mental health parameter characteristics.

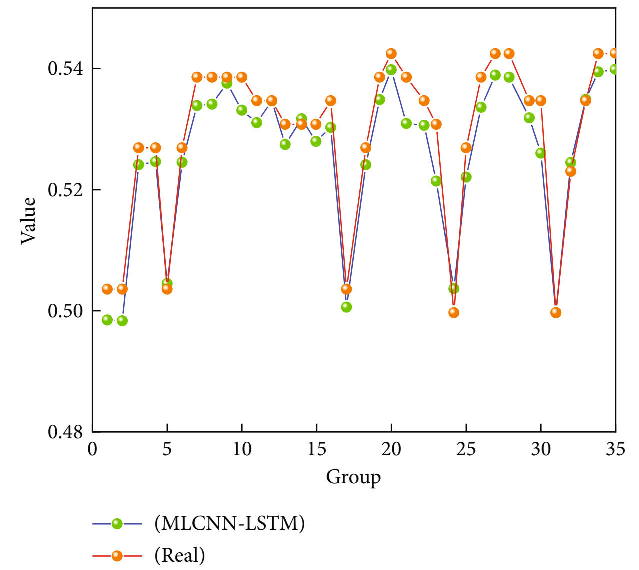

Figure 8: The changing trend of sports parameter characteristics.

characteristics of sports parameters, it can successfully help different groups to choose appropriate sports forms and sports intensity, which can really help people to achieve the goal of pursuing public health. Figure 8 shows the prediction of sports parameter features for 35 different groups of population data. It can be seen from Figure 8 that the MLCNN-LSTM algorithm has high accuracy in predicting 35 different sets of sports parameters. Similar to the characteristics of mental health parameters, the characteristics of sports parameters also have relatively large fluctuations, and there are many peaks and troughs. It can be seen from Figure 8 that the characteristic data of sports parameters has a small prediction error at the trough, but there is a relatively large prediction error at the peak of the sports characteristic data. However, this part of the error is also acceptable for public health research. Although the trend of peaks and troughs is detrimental to the performance of MLCNN-LSTM, it can improve the generalization ability of this intelligent algorithm. The reason for the large difference between the peaks and troughs of sports-related parameters may be the large gap between the eigenvalues of the sports intensity and the sports form, which will lead to a large difference in the weight distribution in the data processing stage. Overall, the MLCNN-LSTM method can meet people's needs for data analysis of sports parameters.

5. Conclusions

With the continuous improvement of the quality of life, people begin to pursue physical health. They also realize the importance of physical and mental health for life and productive activities. Physical activity is an important way to improve physical and mental health. However, excessive physical activity intensity or uncomfortable forms of physical activity are detrimental to public health. Only when people choose the appropriate form of physical activity according to their physical function parameters and mental health parameters can they be beneficial to the realization of public health purposes. However, it is difficult to understand the relationship between public health parameters and sports parameters, which can limit the development of public health goals. With the development of big data technology, it provides possibilities and support for sports-oriented public health data analysis. The parameters involved in sports and public health are relatively complex, and the amount of data on the characteristics of this research object is also relatively large. Big data technology can successfully process the data and features contained in sports parameters.

This research uses the MLCNN algorithm and LSTM algorithm in big data technology to design an intelligent sports and public health data analysis scheme. These two algorithms can fully extract the features of physical function parameters, mental health parameters, and sports parameters, and it can also help people establish the relationship between sports and public health. First, this study compares the differences between the CNN-LSTM algorithm and the MLCNN-LSTM algorithm in predicting public health and sports characteristics. Through research, it can be found that the MLCNN-LSTM algorithm has higher accuracy than the CNN-LSTM algorithm. For the features of physical function parameters, the average relative error was reduced from 2.89% to 2.52%. For the mental health parameter feature, the mean relative error was reduced from 2.55% to 2.27%. The prediction error of sports parameter features has also been greatly reduced. The characteristics of physical function parameters and mental health parameters are two important characteristics related to public health. The prediction error of physical function parameter features is reduced by 0.37%. Compared with the CNN-LSTM algorithm, the prediction error of mental health parameter features is reduced by 0.28%. In general, the MLCNN-LSTM method is suitable for building a sports-oriented public health data analysis platform. The sports-oriented public health data analysis platform designed in this study can maintain stability and reliability once it is trained. People can understand the appropriate form and intensity of physical activity according to their own body index parameters. This has relatively high practical value.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no financial or nonfinancial competing interests.

Acknowledgments

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Retraction

Retracted: Evaluation Model of Music Therapy's Auxiliary Effect on Mental Health Based on Artificial Intelligence Technology

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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Research Article

Evaluation Model of Music Therapy's Auxiliary Effect on Mental Health Based on Artificial Intelligence Technology

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The reason why music can affect people's emotional experience is that the stimulation can be transmitted to the brain through hearing, such as the thalamus and lenticular nucleus. Music therapy has a positive auxiliary treatment effect on mental health. Therefore, an evaluation model of the auxiliary effect of music therapy on mental health based on artificial intelligence technology is proposed. We construct the constraint index parameters for the evaluation of music therapy's auxiliary effect on mental health, take parent pressure, self-pressure, teacher pressure, and social pressure as the questionnaire object parameters, take class type as the independent variable, carry out an independent sample t-test, and construct an adaptive information extraction model for the evaluation of music therapy's auxiliary effect on mental health. Paired sample t-test is used to analyze whether there is a difference between the experimental group and the control group on the learning stress scale. According to the analysis of the difference between the experimental group and the control group, combined with the difference test analysis of the data of the stress release of music therapy on mental health, the quantitative evaluation of the auxiliary effect of music therapy on mental health is realized through artificial intelligence optimization control. The experimental results show that the accuracy and reliability of this method to analyze the auxiliary effect of music therapy on mental health are high. There are obvious changes in the data of students' self-pressure, and the difference between the average value and standard deviation of the data before and after the course is obvious. From the perspective of the effectiveness of the course, the students in the class who implement the four relaxation experience courses in the course are under the pressure of parents, self-pressure, teacher pressure, and social pressure. There are obvious changes in the five aspects of learning pressure compared with that before the implementation of the course. After the course experience, the pressure value of most students decreases, and the course intervention effect is obvious.

1. Introduction

Music therapy integrates music, medicine, and psychology and is an interdisciplinary subject. From the perspective of music therapy, the sensory stimulation brought by music can trigger multiple sensory experiences. Different music can make people produce corresponding physiological reactions and cause corresponding emotional experiences. Studies have found that the reason why music can affect people's emotional experience is that music can transmit stimuli to the brain through hearing, such as the thalamus and lenticular nucleus [1, 2]. These brain regions contain dopaminergic neurons, and the dopamine secreted by them is an important neurotransmitter in the brain. Music stimulates the secretion of dopamine and participates in many physiological activities such as people's movement, cognition, emotion, positive reinforcement, and endocrine regulation.

At present, the application of music therapy in schools is gradually increasing. Researchers are aware of the great influence of music on people's psychology and the link between music education and mental health. Some researchers have adopted music therapy to solve the psychological problems of students' test anxiety and achieved certain results [3, 4] and applied a certain method of music therapy to the music class and integrated it with the teaching content. However, in these studies, researchers have applied a variety of methods at the same time, and it is difficult to determine the main methods to achieve practical results in the study. On the basis of previous studies, the author will use the methods of receptive music therapy to explore the intervention of middle school students' multiple psychological stress experiences [5, 6]. Nowadays, the social environment is complex, the pace of life is accelerating, the learning competition is fierce, and the media communication channels are increasing. The growth problems and puzzles faced by middle school students in such a social environment are also increasing. At present, China is promoting the reform of quality education in an all-round way [7]. However, due to the time and cycle of the reform, it is impossible for primary and secondary education to get rid of the shackles of examination-oriented education. Society, schools, parents, and teachers have high expectations for students' academic achievements and attach importance to the transmission of knowledge and the cultivation of intellectual factors. However, in fact, physical and mental health, especially mental health and sufficient pressure resistance, are the important foundation for students to become adults and talents. The middle school stage is a critical period that determines a person's future development. Middle school students are faced with pressure from all aspects. They not only face the intense competitive pressure of the entrance examination but also deal with interpersonal relationships with teachers, classmates, and parents [8]. In the face of this incident, students are under a lot of psychological pressure, and the pressure can not be relieved. Finally, psychological problems such as truancy, weariness, anxiety, irritability, and depression will occur. At present, it is still an important feature of education in this era to define middle school students by academic achievement as the evaluation standard. Therefore, most of the psychological problems produced by students spread out indefinitely, becoming one of the most prominent psychological problems of middle school students, and also the key and difficult problems to be solved in the school mental health education and work.

In view of this, this paper proposes an artificial intelligence technology-based evaluation model of the auxiliary effect of music therapy on mental health. We construct the constraint index parameters for the evaluation of music therapy's auxiliary effect on mental health, conduct an independent sample t-test, use the big data mining method to analyze the artificial intelligence control of music therapy's auxiliary effect on mental health, combine the difference test and analysis of the data of music therapy's pressure release on mental health, and realize the quantitative evaluation of music therapy's auxiliary effect on mental health through artificial intelligence optimization control. Finally, the empirical analysis is carried out and the conclusion of effectiveness is drawn.

2. Big Data Mining Theory

In the era of big data, data mining is the most critical work. Big data mining is a process of discovering valuable and potentially useful information and knowledge from massive, noisy, fuzzy, and random large databases, and it is also a decision support process. It is mainly based on artificial intelligence, machine learning, pattern learning, statistics, and so on. Through highly automated analysis of big data, inductive reasoning is made, and potential patterns are mined. Big data mining needs to choose the corresponding solution according to the actual demand and provide stable support for the subsequent data processing. Big data mining can be handled in different ways according to different data types. The most common data type in big data mining applications is called structured data, which is defined as the data stored in the database and can be logically expressed by a two-dimensional table structure. Structured data is processed very quickly because of its regular format. Text is the largest recorded data form at present, such as text content in web pages, chat records, e-mails, and various documents of enterprises. They contain a lot of valuable information, and their analysis and processing give birth to natural language processing. The most difficult thing in big data processing is multimedia unstructured data, including images, voices, and videos. Deep mining and understanding of these data can produce many novel and practical functions, such as automatic monitoring, face recognition, and automatic driving. These fields are also potential fields for big data mining applications in the future. According to the analysis of the attributes and characteristics of objects, different classes are established to describe things, the internal rules are identified and analyzed, and the objects are divided into several classes according to these rules. Association is a kind of connection that something happens when other things happen. We grasp the law of the development of the analysis object and predict the future trend. Data mining methods can be divided into statistical methods, machine learning methods, neural network methods, and database methods. Statistics can be subdivided into regression analysis, discriminant analysis, cluster analysis, exploratory analysis, fuzzy sets, rough sets, support vector machines, and so on.

The basic principle of artificial intelligence technology is that artificial intelligence is equal to mathematical calculation. Artificial intelligence (AI) is a new technical science that studies and develops theoretical methods for simulating, extending, and expanding human intelligence. Artificial intelligence is a branch of computer science. It attempts to understand the essence of intelligence and produce a new intelligent machine that can respond in a similar way to human intelligence. The research in this field includes robots, language recognition, image recognition, natural language processing, and expert systems. Since the birth of artificial intelligence, theory and technology have become more and more mature, and the application field has also expanded. Artificial intelligence can simulate the information process of human consciousness and thinking. Artificial intelligence is not human intelligence, but it can think like humans and may exceed human intelligence.

3. Statistical Data and Characteristic Analysis of the Evaluation Model of Music's Auxiliary Effect on Mental Health

3.1. Research Methods. Under the guidance of the new music curriculum goal, the music curriculum should be a powerful method to regulate students' mental health, besides the traditional aesthetic significance. Music is used to relieve middle school students' exam anxiety, and in order to make music play its established effect, the researchers used the related methods of receptive music therapy, which went through a series of course intervention processes such as making plans, pretesting, pretesting, and posttesting [9]. In the classroom, they used receptive music therapy methods such as the “relaxation training method,” “music imagination method,” and “music emotion resonance method” to guide students’ relaxation, emotional guidance, and imagination guidance. The feasibility of music therapy in music class is clarified. Luo Tong 6 also introduced the method of receptive music therapy in middle school music class. She realized that modern middle school students’ psychological problems were getting worse, but they did not have the corresponding self-guidance ability:

(1) Interview method: through targeted visits to teachers, students, and parents of students, we can learn about the learning and living conditions of middle school students, find and record the problems and difficulties that students encounter in their learning and living, and collect more comprehensive information for designing the course teaching in the thesis [10].
(2) Investigation method: through the relevant information, targeted questionnaires are selected to investigate the current situation of students’ learning pressure in Zibo Middle School, so as to have a complete understanding of students’ psychological status. Through the statistics, classification, induction, and analysis of the survey data, we can find out the problems, provide effective data support for the paper writing, and provide a factual basis for the countermeasures to solve the problems [11].
(3) Observation method: the observation method refers to a research method of observing, recording, and analyzing the natural behaviors and phenomena of the observed objects in a purposeful and planned way under natural conditions. As the course implementer in the experimental process, the author participated in the course all the time. The observation method can be used to analyze the performance of the participants in the course, so as to provide feedback for further research program implementation [12].

3.2. Statistical Data Modeling of the Evaluation Model of Music’s Auxiliary Effect on Mental Health. In an early human society with limited aesthetic significance, music has already reached an indispensable position because human beings believe that music has the function of dispelling diseases and strengthening the body, and it is of great significance to human survival [13]. The music itself contains multiple stimulating experiences that human beings can feel, including auditory stimulation, visual stimulation, and tactile stimulation. These stimulating experiences make the human body produce different physiological and psychological reactions, such as heart rate and blood pressure, increase or decrease of endocrine substances, muscle reaction, respiratory rate, and brain waves. In view of the differences in life background, age, personality, preferences, and other factors, the same concert has different physiological and psychological effects on different people. Therefore, music therapists often use different music to intervene and treat visitors from different degrees and angles. In order to realize the evaluation of music therapy’s auxiliary effect on mental health based on data sharing, the optimal selection model of music therapy’s auxiliary effect on mental health is constructed, and the big data fusion analysis method is used to evaluate music therapy’s auxiliary effect on mental health. Combined with the fusion cluster analysis method, the big data sampling model of music therapy’s auxiliary effect on mental health is established, and the evaluation model of music therapy’s auxiliary effect on mental health is statistically analyzed [14]. The optimal fusion characteristic parameter analysis model for the evaluation of music therapy’s auxiliary effect on mental health is constructed. It is assumed that the phase space distribution W of the big data of music therapy’s auxiliary effect on mental health is an $n \times m$ fuzzy control matrix. Under the optimization decision of music therapy’s auxiliary effect on mental health, the parameter set of music therapy’s auxiliary effect on mental health is described as $P(n_i) = \{p_k | pr_{kj} = 1, k = 1, 2, \ldots, m\}$ by fuzzy statistical analysis method, and the constraint index parameter set of music therapy’s auxiliary effect on mental health is constructed as v_i. The sample set is as follows:

$$\overline{W_i} = \frac{1}{m} \sum_{q=1}^{m} W(v_i, p_q). \tag{1}$$

In formula (1), m is the heart rate and blood pressure, v_i is the auditory stimulation guiding parameter, p_q is the visual stimulation guiding parameter, S is the tactile stimulation process parameter, $W(v_i, p_q)$ represents the task set of big data scheduling for the evaluation of music therapy’s auxiliary effect on mental health, and $C(v_i, v_j)$ represents the characteristic distribution set of music therapy’s auxiliary effect on mental health. Under the fusion clustering mode, the constraint index parameters of music therapy’s auxiliary effect on mental health are as follows [15–17]:

$$x(t) = \sum_{i=0}^{p} a(\theta_i) s_i(t) + n(t). \tag{2}$$

In formula (2), p is the conditional probability distribution number of the evaluation mode of music therapy’s auxiliary effect on mental health, $n(t)$ is the characteristic distribution set of music therapy’s auxiliary effect on mental health, and $s_i(t)$ is the big data statistical characteristic quantity of music therapy’s auxiliary effect on mental health. K-means clustering is used to cluster music therapy mental health data, randomly set the center points of K categories, classify each data point to the nearest center point, recalculate the center points of each category according to the clustering results, and then construct new K categories according to the new center points. After many iterations, the center point will eventually converge and stop moving, thus completing data clustering. The clustering process is shown in Figure 1.

According to Figure 1, the fuzzy spatial structure reorganization method is adopted to construct the characteristic distribution set of music therapy's auxiliary effect on mental health, and the fuzzy membership function is obtained:

$$R_s^{(0)} = \sum_{n=0}^{k} \langle R_s^{(n)}, d_{\gamma n} \rangle d_{\gamma n} + R_s^{(k+1)}. \quad (3)$$

In formula (3), $R_s^{(n)}$ represents the scale information amount of music therapy's evaluation of mental health assistance, $d_{\gamma n}$ is the dimension of mental health assistance data reconstruction, and $R_s^{(k+1)}$ is the regression coefficient of music therapy's evaluation of mental health assistance. Different resonance sound waves of music will cause different physiological responses in the human body, for example, the increase or decrease of pulse blood pressure, the increase or decrease of breathing rate, the increase or decrease of hormone secretion, and the contraction or relaxation of muscles. In the past, these reactions will have a lasting impact on the human body and then play a therapeutic role. By combining the multiscale feature decomposition method, the optimal parameter distribution set for evaluating the auxiliary effect of music therapy on mental health is obtained as follows:

$$G(t) = \min\{G_1(t) + G_2(t)\} = \min\left\{\left[-\int F_\mu(t) \times \operatorname{sign}\left(k_\mu(t)\right)\right] + w\left[\int \left|\Delta T_m(t)\right| K_\mu \in \Theta\right]\right\}. \quad (4)$$

In formula (4), $k_\mu(t)$ represents the sampled pain nerve parameters of statistical big data in the evaluation mode of the auxiliary effect of music therapy on mental health at T time; $\Delta T_m(t)$ is the distribution characteristic set of evaluation indexes representing the auxiliary effect of music therapy on mental health at time T; w is the relative weight of reliable distribution of monitoring treatment after anesthesia; $k_\mu(t)$ is the probability condition of. By introducing the observation sets userInput, sanitize x, and flipCoin of music therapy's auxiliary effect on mental health, a big data information fusion model is obtained. According to the results of big data fusion and feature sampling, the statistical data of music therapy's auxiliary effect on the mental health evaluation model is modeled [18, 19].

3.3. Data Feature Extraction Based on Artificial Intelligence. It has a great influence on musicians' emotions. Lively music makes people happy physically and mentally, sad and gloomy music can easily arouse people's sad feelings, high music can stimulate people's fighting spirit, and exhausted music can make people lose their vitality. The quality of a person's mood affects a person's way of thinking, the angle of seeing problems, and so on. Therefore, music therapists only need to make rational use of this point and use different music to influence people's emotions. According to the mining results of music therapy's evaluation information on mental health assistance, this paper reconstructs the association rules of frequent itemsets of music therapy's evaluation data on mental health assistance, analyzes the distribution set of performance indicators of music therapy's evaluation on mental health assistance, and obtains the updated rules of music therapy's evaluation on mental health assistance by multiple regression analysis [20]:

$$\mathbf{p}_j(t+1) = \frac{\mathbf{a}_1 \mathbf{p}_j(t) + \mathbf{a}_2 \mathbf{p}_g(t)}{\mathbf{a}_1 + \mathbf{a}_2}, \quad (5)$$

$$\text{mbest}(t+1) = \frac{1}{n} \sum_{j=1}^{n} \mathbf{p}_j(t), \quad (6)$$

$$\mathbf{X_j}(t+1) = \mathbf{p}_j(t+1) \pm \beta \times \left|\text{mbest}(t+1) - \mathbf{X_j}(t)\right| \times \ln\left(\frac{1}{\mathbf{u}_j(t+1)}\right). \quad (7)$$

In formulas (5) to (7), $\mathbf{a}_1$ and $\mathbf{a}_2$ are the auxiliary dynamic components of receptive music therapy, $\mathbf{p}_j(t)$ is the application parameter of recreative music therapy, $\mathbf{p}_g(t)$ is the music rhythm, β is the interaction parameter between people, $\mathbf{u}_j$ is the guiding music imagination parameter, $\mathbf{X_j}(t)$ is the component of consciousness transformation state, and $\mathbf{X_j}(t)$ is the association rule set of the evaluation of the auxiliary effect of music therapy on mental health for the first time [21, 22]. After the evaluation of the auxiliary effect of music therapy on mental health, the adaptive adjustment model is as follows:

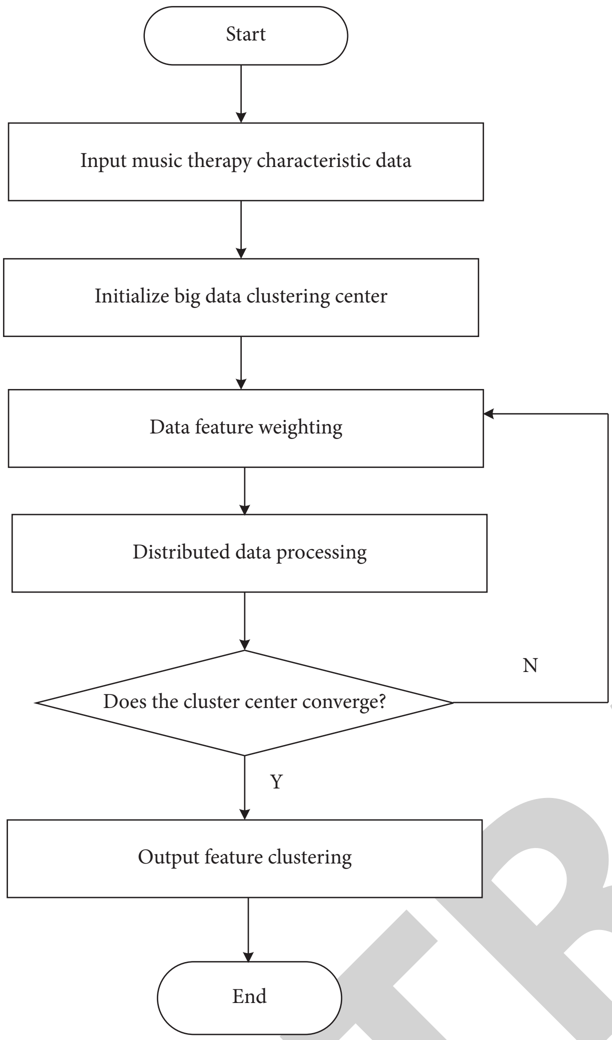

Figure 1: Music therapy mental health data clustering process.

$$\begin{aligned}&\min F = R^2 + A\sum_i \xi_i\\&\text{subject.to: } \left\|\phi(x_i) - o\right\|^2 \le R^2 + \xi_i \text{ and } \xi_i \ge 0, \quad i = 1, 2, \ldots,\end{aligned} \tag{8}$$

$$\begin{aligned}&\max \sum_i \alpha_i K(x_i, x_i) - \sum_i\sum_j \alpha_i\alpha_j K\left(x_i, x_j\right)\\&\text{subject.to: } \sum_i \alpha_i = 1 \text{ and } 0 \le \alpha_i \le A, \quad i = 1, 2, \ldots.\end{aligned} \tag{9}$$

In formulas (8) and (9), R is the self-state adjustment factor, $\phi(x_i)$ is the influence factor of music to relieve people's tension, A, ξ_i are language guiding components, and $\mathbf{p}_j(t+1)$ is the established content imagination experience parameter. In the optimal cluster center, using the statistical distribution set representing the $t+1$-th cluster center, the statistical characteristic quantity of music therapy's auxiliary effect evaluation on mental health is $\mathbf{p}_g(t)$. In the M-dimensional random vector, the adaptive characteristic component of performance index evaluation of music therapy's auxiliary effect on mental health is defined as

$$\mathbf{p}_g(t) = \operatorname{argmin}\left\{f\left(\mathbf{p}_j(t)\right) \mid j = 1, 2, \cdots, n\right\}. \tag{10}$$

In formula (10), $f(\mathbf{p}_j(t))$ is the statistical characteristic quantity of music therapy's auxiliary effect on mental health evaluation, thus realizing the big data characteristic analysis of performance index evaluation. Musical imagination is one of the commonly used therapeutic methods in receptive music. Under the guidance of therapists, visitors imagine music, accompanied by corresponding situational music [23, 24]. All the imaginary content is guided and controlled by the therapist. After the visitor enters the state of consciousness transformation, the therapist guides the language with the music, and the visitor imagines the established content in the music. Imagination content is the most beautiful natural scenery and self-experience, mostly used for physical relaxation and psychological decompression.

4. Optimization of the Evaluation Model of Music Therapy's Auxiliary Effect on Mental Health

4.1. Artificial Intelligence Control of Music Therapy for the Evaluation of the Auxiliary Effect of Mental Health. According to the different characteristics of parents' pressure, self-pressure, teachers' pressure, social pressure, and study pressure between the experimental group and the control group, combined with the difference test and analysis of some data on music therapy's pressure release on mental health, through artificial intelligence optimization control, the statistical information analysis model of music therapy's auxiliary effect on mental health is constructed, and the evaluation model of music therapy's auxiliary effect on mental health is optimized [25, 26]. This paper puts forward an evaluation model of music therapy's auxiliary effect on mental health based on data sharing. This paper reconstructs the association rules of frequent itemsets for the evaluation data of music therapy's auxiliary effect on mental health, extracts the association feature information of music therapy's auxiliary effect on mental health, adaptively updates and optimizes the evaluation feature quantity of performance indicators of music therapy's auxiliary effect on mental health, and filters the evaluation feature quantity of music therapy's auxiliary effect on mental health considering the constraints of association rules. The information update rules of statistical data are as follows:

$$\begin{aligned}&\lambda = \frac{1}{1 + \alpha(\partial S/\partial t)^2},\\&\hat{k}_\mu(t+1) = \hat{k}_\mu(t) + Q(t+1) \times \left[\frac{\partial \widehat{F}_\mu/Mg}{\partial t} - \frac{\partial S}{\partial t}\hat{k}_\mu(t)\right],\end{aligned} \tag{11}$$

wherein

$$
\begin{aligned}
Q(t+1) &= P(t+1)\frac{\partial S}{\partial t},\\
P(t+1) &= \frac{1}{\lambda}\left[P(t) - \frac{P^2(t)(\partial S/\partial t)^2}{\lambda + P(t)(\partial S/\partial t)^2}\right],
\end{aligned} \tag{12}
$$

$$
\frac{\partial S}{\partial t} = \frac{r}{v_c}\frac{\partial \omega_w}{\partial t}. \tag{13}
$$

In formulas (12) and (13), λ is the constraint index parameter set representing the evaluation of music therapy's auxiliary effect on mental health, $\widehat{F}_\mu$ is the fuzzy membership function of music therapy's auxiliary effect on mental health, ω_w is the adaptive weighting coefficient, $\widehat{k}_\mu(t)$ represents the regression analysis value of music therapy's auxiliary effect on mental health at time T, $P(t)$ is the correlation inverse matrix, and α is the residual characteristic quantity. The data link of the evaluation of music therapy's auxiliary effect on mental health is generated, metadata is generated as $S = \{1, 2, \ldots, N\}$, and the process optimization scheduling of music therapy's auxiliary effect on mental health is realized by using the association rule mining method and the optimal mode selection method.

4.2. Evaluation Output of Music Therapy's Auxiliary Effect on Mental Health. Correlation characteristic information of music therapy's auxiliary effect on mental health is extracted using the optimization control method to evaluate the auxiliary effect of music therapy on mental health. The fuzzy control function of music therapy's auxiliary effect on mental health is as follows:

$$
M_v = w_1\sum_{i=1}^{m\times n}(H_i - S_i) + M_h w_2\sum_{i=1}^{m\times n}(S_i - V_i) + w_3\sum_{i=1}^{m\times n}(V_i - H_i). \tag{14}
$$

In formula (14), the evaluation component of music therapy's auxiliary effect on mental health is M_h. After a group of clustering attribute characteristics are generated, the emotion management method is adopted to realize the evaluation and regression analysis of music therapy's auxiliary effect on mental health. The piecewise regression analysis model is adopted, and the performance evaluation model is expressed as follows:

$$
x_i = \begin{cases} 0, M - \sum\limits_{j=1}^{n/2} w_j - \sum\limits_{j=\lfloor n/2\rfloor+1}^{i} w_j - \sum\limits_{j=i+1}^{k} w_j < 0, i \le k, \\ f_i(M,n,w,c,r) = \min\{f(M,n,w,c,r)\} \\ 1, M - \sum\limits_{j=1}^{n/2} w_j - \sum\limits_{j=\lfloor n/2\rfloor+1}^{i} w_j - \sum\limits_{j=i+1}^{k} w_j > 0 \end{cases}. \tag{15}
$$

In formula (15), M is the constraint parameter of situational music, and n, w, c, r are negative, tired, rebellious, and tired of learning reaction parameters, and w_j is a comprehensive and dispersive stressor and a social interpersonal stress parameter. Through piecewise regression analysis and statistical analysis, the evaluation and optimization of music therapy's auxiliary effect on mental health can be realized. According to the differences between the experimental group and the control group in parents' pressure, self-pressure, teachers' pressure, social pressure, and study pressure, combined with the difference test and analysis of some data of stress release of music therapy on mental health, the quantitative evaluation of the auxiliary effect of music therapy on mental health was realized through artificial intelligence optimization control.

5. Empirical Analysis and Test

In order to verify the performance of the model in evaluating the auxiliary effect of music therapy on mental health, SPSS statistical analysis software was used to analyze the data, and the practice of this research course was conducted at a university. There are 66 teaching classes in colleges and universities, with more than 13,500 students and 1,309 faculty members, including 266 front-line teachers. The questionnaire consists of 21 questions in four aspects: parents' pressure, self-pressure, teachers' pressure, and social pressure. The original data collected by the questionnaire are input and summarized in Excel, and the data are compared and analyzed by professional statisticians. The data sampling length of the qualitative performance index evaluation of music therapy's auxiliary effect on mental health is 1024, and the regression coefficient of internal control of music therapy's auxiliary effect on mental health is 2.5. The KMO and spherical test of the learning stress scale are carried out, and the KMO value of the scale is 0.85, $p = 0.01 < 0.05$. Therefore, the validity of the learning stress scale in this study is very good. The initial value of the regression analysis model is $x_0 = 2$, $y_0 = 2$, $z_0 = 2$, and the correlation statistical analysis results are shown in Table 1.

According to the statistical results in Table 1, SPSS25.0 is used to analyze the data obtained from the questionnaire. Using the regression analysis method, the internal control and regression analysis of music therapy's auxiliary effect on mental health was carried out, the related characteristic information of music therapy's auxiliary effect on mental health was extracted, and the process optimization control method was used to evaluate music therapy's auxiliary effect on mental health. According to the data objects in Table 1, the overall characteristics ($N = 318$) were obtained as shown in Table 2.

Taking gender as the independent variable and students' learning pressure as the dependent variable, the independent sample t-test is conducted. The results are shown in Table 2: there are significant differences in students' self-stress, social stress, and learning pressure, and the scores of girls are significantly higher than those of boys, while there is little gender difference in teachers' stress. Taking class type as the independent variable and students' learning pressure as the dependent variable, the independent sample t-test is conducted. The analysis results are shown in Figure 2. The analysis shows that there is a significant difference in self-

Table 1: Statistical analysis results of the correlation between music therapy and the evaluation of the auxiliary effect of mental health.

Dataset	Number of attributes	Feature set scale/MBit	Statistical dimension
Dataset 1	43	13000	5
Dataset 2	36	14000	8
Dataset 3	34	54000	12
Dataset 4	56	12000	54

Table 2: General characteristics ($N = 318$).

Project/score	Minimum value	Maximum	Mean value	Standard deviation
Parental pressure	0.466	3.031	5.253	0.604
Self-pressure	0.471	4.302	4.296	0.862
Teacher pressure	0.206	2.350	0.740	0.106
Social stress	0.505	3.671	1.859	0.670
Learning pressure	0.282	3.501	5.750	0.758

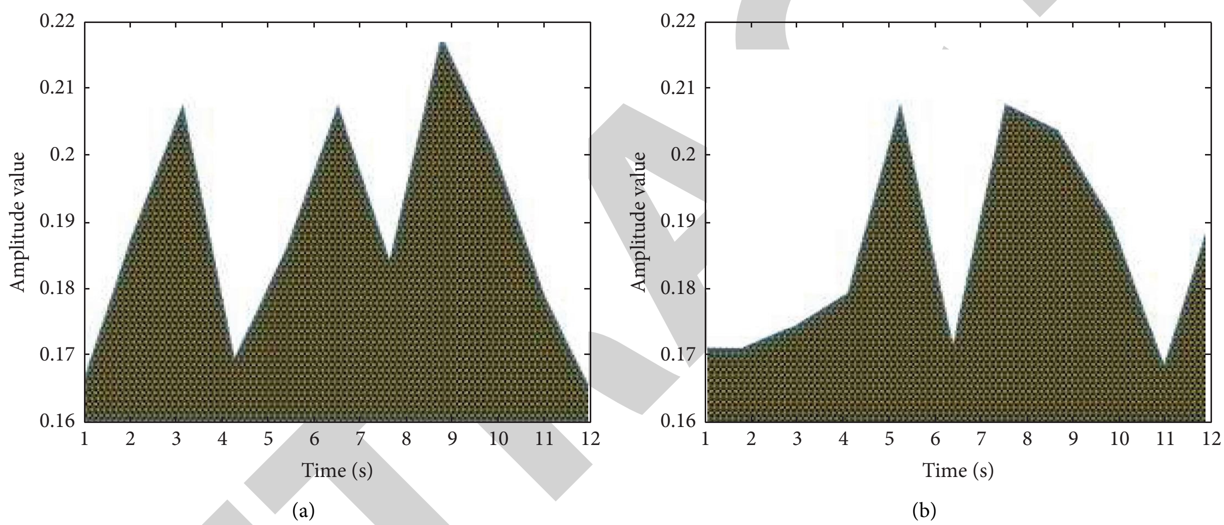

Figure 2: T-test results of independent samples for evaluation of music therapy's auxiliary effect on mental health. (a) Test set. (b) Training set.

stress in class type, and j is the score of the control class which is significantly higher than that of the experimental class.

According to the regression analysis results of the evaluation of music therapy's auxiliary effect on mental health (Figure 2), it is found that the contribution of music therapy using this model to the evaluation of mental health's auxiliary effect is high. The independent sample X-square test is carried out with the family location as the white variable and the student's learning pressure as the dependent variable. The analysis results are shown in Figure 3. The analysis shows that there are significant differences in parental pressure, self-pressure, teacher pressure, and learning pressure in the family location, and the scores of high school students from cities are significantly higher than those from rural areas.

According to the feedback data of the pretest questionnaire in Figure 3, two classes were selected as the subjects of curriculum intervention. Set once a week, 45 minutes each time, for a total of 4 weeks, as a course cycle. The first course is a preliminary stage, which guides students to put aside all kinds of restrictions in class on weekdays, follow the guidance, relax, pay attention to their inner feelings and changes, and adapt to the link and speed of the music relaxation experience course without disturbing others. The second course is the adaptation stage. Students who participate in the music relaxation experience have corresponding experience expectations or psychological preparation when they arrive at the designated classroom. The third and fourth times are in-depth experience stages, in which students devote themselves to music relaxation and self-feeling exploration.

At the end of the fourth experience course, we will give out the posttest questionnaire, collect the data, and make a comparative analysis of the data before and after the course, so as to obtain the course effect. We analyze the performance index evaluation feature distribution set of music therapy's auxiliary effect on mental health, extract the related feature

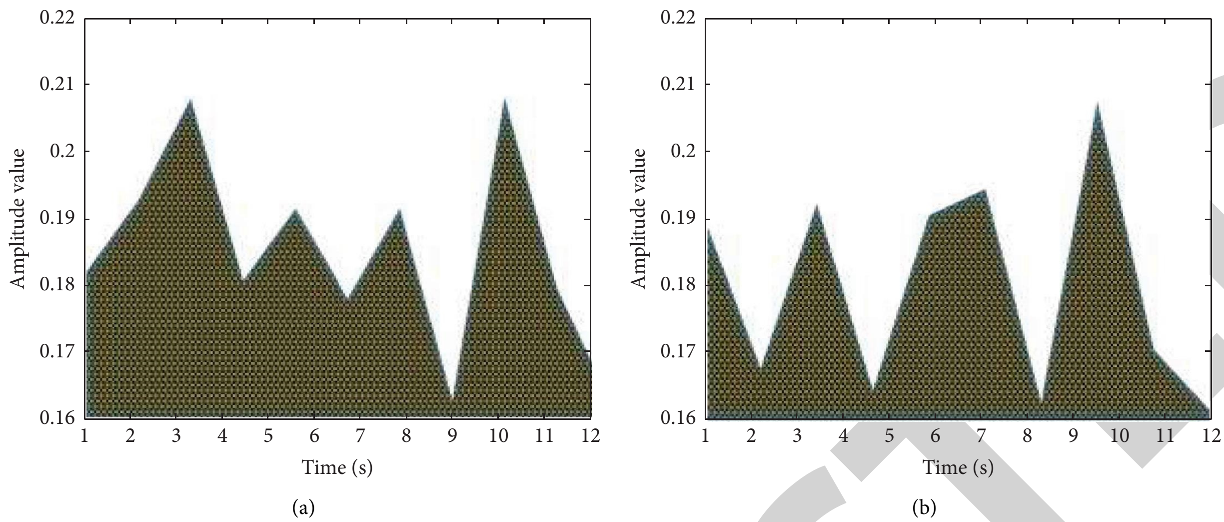

FIGURE 3: Independent sample X-square test for the evaluation of the auxiliary effect of music therapy on mental health. (a) Test set. (b) training set.

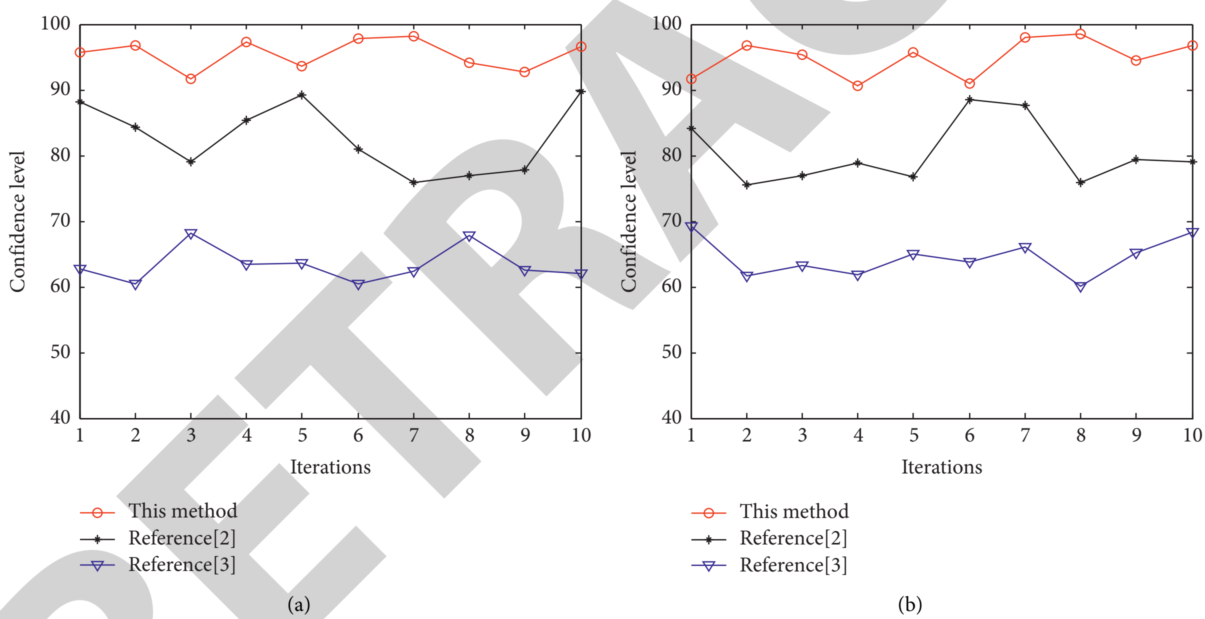

FIGURE 4: Confidence level of evaluation of music therapy's auxiliary effect on mental health. (a) Test set. (b) Training set.

information of music therapy's auxiliary effect on mental health, and get the evaluation confidence level as shown in Figure 4.

According to the analysis of Figure 4, the accuracy of music therapy in this paper in assessing the auxiliary effect on mental health is high, which is more than 90%, while the literature methods are more than 90%. Under the evaluation of music amplitude, music therapy has a higher ability to assist mental health and a higher level of contribution to performance indicators. Using this method to evaluate music therapy to assist mental health has higher accuracy, better adaptability, higher confidence level, and accurate and reliable evaluation results, which improves the quantitative analysis ability of music therapy to assist mental health. Schools do not pay enough attention to music lessons. Usually, only music appreciation courses are offered in schools, with a single type of courses and rigid teaching methods, so that students are not interested and the courses cannot be carried out smoothly. Some students will do things unrelated to the course content in the music class, such as doing homework in other subjects and sleeping. In order to enable the course to continue, teachers can only play music-related movies and videos for students, and students call the music and beauty class "sleeping class" and "film class." In addition, in the high school stage, some students have the learning experience of extracurricular art expertise, and the music quality among students is quite different. Some students learn the same course content easily, and some students start class by listening to gobbledygook, so it is difficult to achieve balanced and comprehensive teaching. Practical music skills courses are difficult to carry out, and all kinds of advanced equipment provided by the school can only be dusty. The lack of substantial music teaching for a long time leads to the students' lack of basic music literacy.

6. Conclusions

In this paper, the performance index evaluation model of music therapy's auxiliary effect on mental health is established, the informatization level of music therapy's auxiliary effect on mental health is improved, and the evaluation model of music therapy's auxiliary effect on mental health based on data sharing is put forward. This paper constructs the optimal fusion characteristic parameter analysis model for the evaluation of music therapy's auxiliary effect on mental health, reconstructs the association rules of the evaluation data of music therapy's auxiliary effect on mental health, analyzes the evaluation characteristic distribution set of performance indicators of music therapy's auxiliary effect on mental health, extracts the related characteristic information of music therapy's auxiliary effect on mental health, and adopts the process optimization control method to evaluate music therapy's auxiliary effect on mental health. The research shows that this model can effectively improve the accuracy of the evaluation of music therapy's auxiliary effect on mental health, and the evaluation results are accurate and reliable, with low error and good confidence.

From the perspective of facing groups, in the music therapy experience, it is an important basic ability for participants to accurately capture the information contained in music materials. The more accurate the participants capture music information, the deeper the follow-up music therapy experience will be, and the more obvious the desired effect will be. Therefore, original music learning in the traditional music classroom can lay the foundation for students' perception and comprehension of music materials. Secondly, as students, the time spent in school occupies most of their lives, and school is a small society for students. They will have pressure everywhere when they deal with their studies, teachers, and classmates in school, so all kinds of psychological discomfort will inevitably occur. However, students' ability to adjust their own psychology is limited, and it is difficult for them to correctly face problems and pay attention to their inner world in the face of various pressures. Internally, their coping ability is limited, and externally, they are ashamed to seek help from teachers, parents, or others. Therefore, students' demand for psychological counseling is very urgent. Thirdly, putting the application of music therapy in the music classroom fundamentally determines the comprehensiveness of this course, so that new experience forms and new course methods will no longer have only a small number of beneficiaries. From the point of view of the method itself, receptive music therapy emphasizes the related experience brought by listening, among which muscle gradual relaxation and guided music imagination method have simple operating conditions and have no special requirements for participants, so they are suitable for groups that need relaxation experience. Therefore, they can be based on the traditional music classroom, conduct a universal music relaxation experience for all students, and exert a subtle and positive influence on students' psychology. The experience of music therapy and relaxation is also the further deepening of the music curriculum, which can reach the new requirements of music curriculum for students more profoundly. Music therapy and traditional music classroom teaching complement each other, opening up students' new vision of music class and understanding another meaning of music. Finally, teachers' learning receptive music therapy is not only a brand-new challenge for themselves but also a good opportunity to explore and enrich themselves.

In a word, introducing receptive music therapy into middle school music classes can improve the deficiency of traditional middle school music classes and increase the richness of music classes. It can also expand the practicality of a music classroom, make music harmonious, make students develop healthily, and further deepen the people-oriented concept in education.

Data Availability

The raw data supporting the conclusions of this article will be made available by the author, without undue reservation.

Conflicts of Interest

The author declares no conflicts of interest regarding this work.

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Retraction

Retracted: Analysis of the Stage Performance Effect of Environmental Protection Music and Dance Drama Based on Artificial Intelligence Technology

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] L. Zeng, "Analysis of the Stage Performance Effect of Environmental Protection Music and Dance Drama Based on Artificial Intelligence Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2891993, 10 pages, 2022.

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Research Article

Analysis of the Stage Performance Effect of Environmental Protection Music and Dance Drama Based on Artificial Intelligence Technology

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There are a lot of environmental protection musicals and dances in public entertainment life to support the concept of environmental protection and to entice people to support the cause of environmental protection. As we all know, in a musical performance, the distance between the audience and the actors, the design of the stage environment, the training of the actors, the costumes of the actors, the makeup of the actors, and the musical accompaniment will all have more or less influence on the stage performance effects. In order to make environmental protection music and dance dramas profoundly meaningful to social production and human activities, it is especially important to analyze the stage performance of such music and dance dramas. The analysis of stage performance effects is not only beneficial to making the ideas spread by the music and dance drama penetrate into people's hearts but can also provide guiding suggestions for the production of music and dance drama. Therefore, this paper proposes a linear regression algorithm based on artificial intelligence to deeply explore and analyze the influence of the above six factors on the stage performance effects of environmental protection music and dance drama. In our method, first we preprocess the data collected by classification to remove the odd values from the data so that the various types of data conform to a normal distribution. Secondly, we obtained linear fit plots of the six factors with the stage performance effect scores by using a linear regression algorithm to deeply analyze the correlation between various types of data and the stage performance effect scores. Finally, through numerical calculations, we found that the distance between the audience and the actors, the training of the actors, and the musical accompaniment have a greater influence on the performance effect of the musical cabaret in the environmental protection category. Meanwhile, the costumes of the actors, the makeup of the actors, and the design of the stage environment have less influence on the performance effect of the musical cabaret. Therefore, in the production and performance of environmental protection music and dance dramas, producers and performers should pay more attention to the distance between the audience and the actors, the design of musical accompaniment, and the training of actors. To sum up, this paper has made a scientific, detailed, and reasonable analysis of the performance effect of environmental protection music and dance dramas on stage, contributing to the dissemination of environmental protection ideas.

1. Introduction

As the Earth's environment continues to deteriorate, humans will face many deadly threats. For example, the continued rise in temperature in Antarctica will cause the sea level to rise. The melting of permafrost will release gases containing unknown viruses. The African continent's plate split [1]. Large amounts of toxic plastic particles in the Arctic snow emerge. These issues compel us to protect and improve the Earth's environment, which is the only way to reduce unpredictable and deadly threats. However, protecting the environment is not something that can be done by just one person [2]. Although people's awareness of environmental protection has increased, the situation of environmental pollution and resource waste is still serious, and there are many people who still do not take action to protect the environment. Therefore, in order to spread the idea of environmental protection and call for people to participate in activities to protect the environment, there are many environmental protection music and dance dramas appearing in the entertainment lives of the public [3, 4]. The most direct and easily felt consequence of environmental pollution is that it degrades the quality of the human environment and affects the quality of human life, physical health, and productive activities.

People began to consider their own authoritarian attitudes about nature during the 1980s as they became aware of how dramatically the environment was changing. French dancers came to value the use of dance to explore the relationship between natural space and human beings [5, 6]. For example, the French modern dance choreographer Kibova, who created *Dance for Four* and *Movement* in 1980, has a creative idea according to the promotion of environmental protection. Daniel's *Waterproof* was performed in a real swimming pool, where the weightlessness and floating of people in the water were expressed by the dance. The relationships between people and water, people and people, and people and their surroundings are all presented in the water by the dance. This dance brings to light that human behavior in a water environment is quite different from that on land [7]. With the deterioration of the environment, environmental music and dance theater have been developing. French choreographers have often introduced film, television, and theater to dance, making environmental music and dance theater a truly comprehensive theater art. Currently, environmental protection music and dance theater are contemporary art forms of concern in many developed countries, where dancers improvise through the human body to express their perception of the environment, architecture, nature, or urban space. At the same time, they use pictures and images to record in time, recreate in the record, and dig deeper into the complex and subtle relationship between people, the urban environment, and architecture. Let the viewer feel the strong visual impact and look at our lives and living environment with new eyes to discover the essence of life [8, 9].

An excellent musical song and dance drama not only give the audience a good experience but also promote the dissemination of the ideas preached by that musical and dance drama and even promote the development of the musical song and dance drama. The good or bad stage performance of the musical song and dance drama determines the success or failure of the musical song and dance drama. In particular, environmental protection music and dance drama should have good stage performance, which will not only cause people to realize the harm of environmental degradation but also call on people to consciously restrain their own behavior and join the trend of environmental protection [10]. Therefore, the stage performance of environmental protection music and dance drama is an issue that writers and producers should think about in advance. There are many factors that affect the stage performance of environmental protection music and dance drama, including the distance between the audience and the actors, the design of the stage environment, the training of the actors, the costumes of the actors, the makeup of the actors, and the musical accompaniment. Here, we will explain how these factors affect the stage performance of environmental protection music and dance dramas in the following [11].

The audience is the appreciator, and without the audience, there is no performance. The audience is the core of the performance; the actor brings life and soul to the performance; and the audience receives the artistic beauty and emotion brought by the performance [12]. As an audience, there is a certain spatial distance from the stage from which it is impossible to see just one actor and observe every detailed action. As a standard outsider, they are often more able to see where the problems with the performance lie. In the musical cabaret, they can even see which actor made a small gesture. An excellent musical cabaret is precisely through the details to send strong emotional signals to the audience, causing the audience to resonate. When an audience watches a performance, they are bound to react emotionally to the performance on stage. The audience will directly express through their emotions how good or bad the musical cabaret is. Such emotions generated by the audience will not only affect the emotions of other theatergoers but also the emotions of the actors on stage [13].

Stage environment design is the most important part of stage visual artists' attention, which plays an important role in the expression and audience's understanding of musical cabaret. In stage environment design, the environment and the size of the venue in which the musical cabaret is viewed will have an impact on the performance. The mood conveyed by the use of space structure will draw the attention of the audience and continue to play an important role. During the performance, different changes in the mood of the space will also bring new visual experiences to the audience. With the development of science and technology, new technologies are slowly dipping into music, song, and dance dramas [14, 15]. Transforming these new technical languages into stage environment design will transfer new energy to environmental protection music, song, and dance dramas and will promote the spread and development of environmental protection music, song, and dance dramas.

The training of actors is an important way to develop the performance abilities of music and dance theater actors. The daily training is very rich and diverse, including both professional training in performance and training in psychological adjustment ability. Specifically, the daily training includes line ability, cultural training, movement ability, mental regulation ability, logical thinking and analysis ability, and other aspects of training [16]. For musical cabaret performers, daily training is the most arduous and boring. Daily training not only requires actors to have tenacity and tough character but also requires instructors to have scientific training methods to constantly help actors overcome inertia while effectively improving the level of training and respecting the laws of art, so that actors can gain improved acting ability in the shortest possible time.

For performers, there is more to performance costumes than simply a piece of clothing. The performance costume is the interpretation of the soul of the entire stage art and serves as an important prop to shape the external image of the character. A unique and effective costume can make the performers shine [17]. Specifically, the choice of costumes for the performers of environmental protection musicals and dances will influence the artistic image of the performers and the style of their performance. For example, children's performance clothes are more colorful, highlighting the lively and lovely children; the performance clothes of the elderly are relatively single color, highlighting the maturity and stability of the elderly.

Actor makeup is an important part of the art of the stage, helping to express the character and enhance the artistic expression of the stage [18]. Stage makeup is different from daily makeup; it needs to be closely matched with stage lighting and actors' costumes in terms of color and tone to achieve the best stage effect. Successful stage makeup contributes to an actor's expressiveness and can add color to the stage effect. A good makeup artist should not only focus on improving his or her skills and artistic training but also on cooperating with lighting artists, costumers, etc., using lighting and costumes to assist in the display of makeup effects. The makeup of the actor is a visual embellishment, which directly affects the appreciation value of the stage performance. The types of stage performances and the various characters are beautified with cosmetic tools in order to combine them with the content of the story.

Stage performance in the musical accompaniment can be accompanied by the performance of the content of continuous enrichment and, then in the process of interpretation, will naturally give the whole performance a more complete expression. The musical accompaniment is an essential part of the stage performance, and the musical accompaniment has more expressive power in the stage performance [19]. Music itself has the role and power to influence people's thoughts and feelings, and the flow of music melody has a direct impact on the movement of the human body and people's emotional changes. Harmonious and beautiful musical accompaniment can drive the passion of performers. A successful and influential musical cabaret requires a corresponding musical accompaniment to make it more complete. The aural art infection can stimulate the performance subject to perform more richly, encourage him to maintain a good state of mind for the whole performance at all times, and allow him to better grasp the feeling of performance and the expression of emotion in the process of interpretation. In turn, the whole stage performance effect has rich infectious power and enjoyable performance art.

Only when an actor has good line skills can he or she smoothly convey information to the audience in the process of performance, better portray the character, and promote the development of the plot. The actor's cultural cultivation directly determines the actor's acting ability and artistic achievement. Without good cultural cultivation, it is impossible for an actor to deeply understand the script, life, and role and to use acting skills to better portray the character on stage. With good movement ability, the theater actor will be able to better master the rhythm in the process of performance, to be relaxed and natural and steady, to better use body language to convey information, and to make the character's image more fleshed out [20]. In the course of a live performance, there are likely to be some temporary and sudden situations, including microphone loss, lighting failure, and audience reaction. All these sudden events and factors will have some impact on the actor's live performance. The most successful group of supervised learning models in machine learning is linear regression models. Despite being straightforward, they are crucial and serve as the foundation for many intricate models.

In order to thoroughly study and analyze the impact of the aforementioned six parameters on the stage performance effect of environmental protection class music and dance drama, we present a linear regression algorithm based on artificial intelligence in this work. In this approach, the data gathered through classification is first preprocessed to weed out any outliers and guarantee that the different categories of data are distributed regularly. Second, we thoroughly examined the relationship between various types of data and stage performance effect scores after obtaining linear fit plots of six components and stage performance effect scores using a linear regression technique. Finally, we discovered by numerical analysis that the audience-actor distance, actor training, and musical accompaniment have a stronger impact on the performance effect of musical cabaret in the field of environmental protection.

2. Related Works

Yan and Wang [18] compared the technical systems of outdoor live performance stages and indoor theater stages and proposed a unique stage effects presentation technology for outdoor live performance stages. Ardizzi et al. [21] conducted a study looking at the physiological responses of the audience and showed the expected increase in synchrony among those belonging to the same quartet during the viewing of the performance and during breaks. In addition, participants' cardiac synchrony was found to be associated with convergence in the audience's explicit emotional evaluation of the performance they were watching. These findings suggest that the mere copresence of others is sufficient for cardiac synchrony to occur spontaneously and that it increases in response to a shared and consistent explicit emotional experience. bin Paharul Rozi and Amirrul [22] used temu bual and pemerhatian methods and focused on the costumes of traditional plays in Pinan Island, identifying the understanding and function of costume elements in the costume components of each play. Their results show that the current costume variations have been concretized because the public is more attracted to them than to the actors' costumes.

Rahman et al. [23] examined the importance of musical theater, the definition of musical theater, the classification of song types and dramatic themes of performances, the impact of musical theater on students' development, and the advantages and disadvantages included in musical theater performances. Also, they described the important results of various previous studies on musical theater performances to increase students' motivation to study literature. Billeri [24] presented the first systematic analysis of the musical and external characteristics of the genre as popular theater and shows the process by which traditional forms were adapted to new audiences and performance environments, creating new forms of theater and dance. At the same time, they provide a general description of the origins of classical dance theater, costumes, characters, storylines, and ensembles related to performances of the last century. Oladipo and Akhigbe [25] focused on the design and implementation of the Performing Arts Enhanced Three Stage Instructional Model (PAEIM), which incorporates drama, dance, and music. Their results suggest that PAEIM is an effective model of performing arts instruction that greatly enhances conceptual understanding of actor training and influences students' self-determination and intrinsic motivation. It also showed that PAEIM improved the effectiveness of actors' stage presence when performing.

3. Modeling Methods

3.1. Linear Regression. Linear regression models are the most effective class of supervised learning models in machine learning. Although simple, they are the basis of many complex models and are very important [26, 27]. Linear regression deals with a class of problems where given a set of input samples and a target value corresponding to each sample, it is necessary to learn the relationship between the target value and the input value as a function of a certain loss criterion [28]. In this way, when a new sample arrives, it is possible to predict what its corresponding target value will be. Linear regression is the prediction of new data based on existing data, that is, the ability to describe the relationship between data more precisely with a straight line, so that when new data appears, a simple value can be predicted. Figure 1 shows a flow chart of how the linear regression algorithm works.

The model of linear regression is shaped as

$$h(x) = w_1 x_1 + w_2 x_2 + w_3 x_3 + \cdots + w_n x_n + b, \tag{1}$$

where w is the weight function, b is the deviation function, and x is the input variable.

The model from linear regression is not necessarily a straight line, but a straight line in a plane when there is only one variable [29, 30]. When there are two variables, the model is a plane in space. When there are more variables, the model will be higher dimensional.

Linear regression models have good interpretability and can be used to see directly from the weights W how much each feature affects the results. Linear regression is suitable for data sets where there is a linear relationship between x and y. A computer-aided scatter plot can be drawn to see if there is a linear relationship [31, 32]. We try to fit the data using a straight line so that the sum of the distances from all points to the line is minimized.

In fact, the sum of squared residuals, which is the distance from a point to a line parallel to the y-axis without using the vertical distance, is usually used in linear regression, and the sum of squared residuals divided by the sample size n is the mean squared error. The mean squared error is used as the loss function of the linear regression model [33]. Minimizing the sum of the distances from all points to the line minimizes the mean squared error, and this method is called least squares.

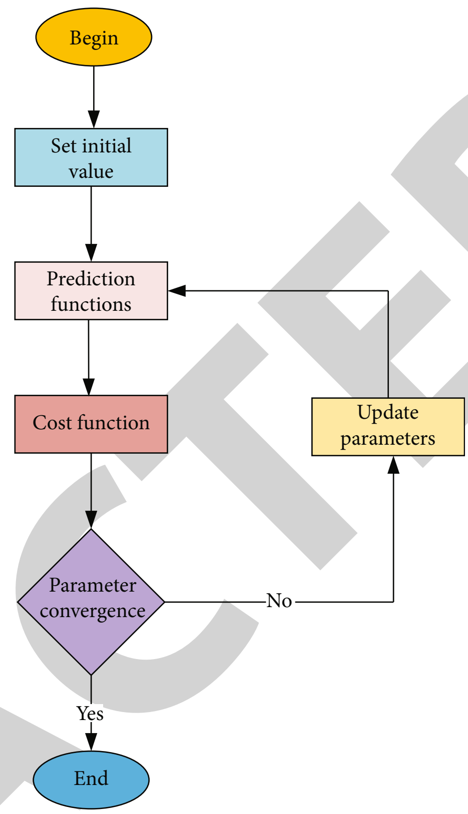

Figure 1: Flow chart of linear regression algorithm execution.

The loss function equation can be expressed as

$$J = \frac{1}{n}\sum_{i=1}^{n}\left(y_i - h(x_i)\right)^2. \tag{2}$$

On the basis of equation (1), the final equations for w and b are obtained by solving the following:

$$w = \frac{\sum_{i=1}^{n}\left((x_i - \bar{x})(y_i - \bar{y})\right)}{\sum_{i=1}^{n}(x_i - \bar{x})^2}, \tag{3}$$

$$b = \bar{y} - w\bar{x}. \tag{4}$$

By analyzing the problem, determining the loss function or utility function of the problem and obtaining a model for machine learning by optimizing the loss function or utility function, this is the general set of parametric learning algorithms [34, 35].

The following is a brief description of the data processing process. Suppose the input data set D has n samples and d features; then,

$$D = \left(\left(x^1, y_1\right), \left(x^2, y_2\right), \cdots, \left(x^n, y_n\right)\right), \tag{5}$$

where the i-th sample is denoted as

$$\left(x^i, y_i\right) = \left(x_1^i, x_2^i, \cdots, x_d^i, y_i\right). \tag{6}$$

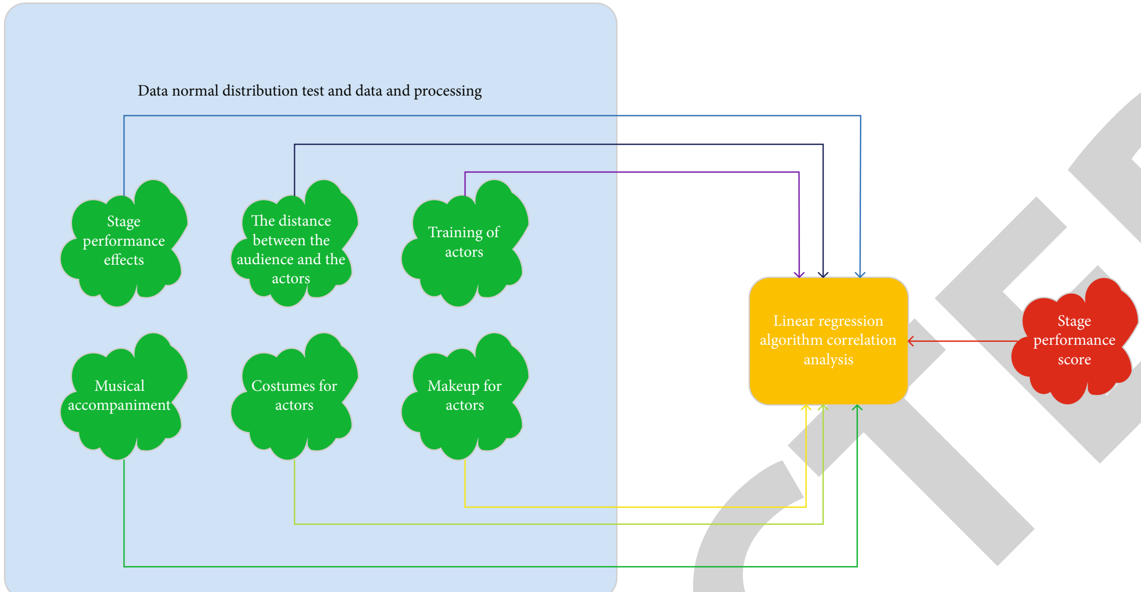

FIGURE 2: Preprocessing process and linear regression algorithm model diagram.

The linear model makes predictions by building linear combinations [36]. Our assumption function is

$$h_\theta(x_1, x_2, \cdots, x_d) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \cdots + \theta_d x_d, \quad (7)$$

where $\theta_0, \theta_1, \cdots, \theta_d$ are the model parameter.

Let $x_0 = 1$, $x^i = (x_1^i, x_2^i, \cdots, x_d^i)$, be a row vector, so that we get

$$X = \begin{bmatrix} x^0 \\ x^1 \\ \vdots \\ x^n \end{bmatrix}_{n\times d}, \theta = \begin{bmatrix} \theta_0 \\ \theta_1 \\ \vdots \\ \theta_d \end{bmatrix}_{d\times 1}, Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}_{n\times 1}, \quad (8)$$

where X is an $n \times d$ dimensional matrix and θ is a $d \times 1$ dimensional vector; then, assume that the function (7) can be expressed as

$$h_\theta(X) = X_\theta. \quad (9)$$

The loss function is the mean square error, which can be expressed as

$$J(\theta) = \frac{1}{2}(X_\theta - Y)^T (X_\theta - Y). \quad (10)$$

The least squares method of solving for the parameters and the derivative of the loss function $J(\theta)$ with respect to θ can be obtained:

$$\nabla J(\theta) = 2X^T(X_\theta - Y). \quad (11)$$

Let $\nabla J(\theta) = 0$; we obtain

$$\theta = \left(X^T X\right)^{-1} X^T Y. \quad (12)$$

3.2. Analysis of the Effect of Music Performance in Environmental Protection Themed Musical Cabaret Based on Linear Regression. Linear regression algorithm is an advanced correlation analysis method in artificial intelligence algorithm, which contains many important ideas in machine learning and has more advantages. For example, the idea is simple, easy to implement, rapid to model, and effective for small data volumes and simple relationships [37, 38]. At the same time, the linear regression algorithm is the basis for many powerful nonlinear models, and its results are well interpretable, which facilitates decision analysis. However, linear regression algorithms also have some disadvantages that are difficult to overcome. For example, linear regression algorithms are difficult to model for nonlinear data or polynomial regression with correlation between data features, and at the same time, it is difficult to represent highly complex data well [39, 40].

After analyzing the audience's rating data on the distance between the actors and the audience, the design of the stage environment, the training of the actors, the costumes of the actors, the makeup of the actors, and the musical accompaniment, we found that these data and the stage effect rating data in general have the characteristics of linearity, small amount of data, and simple data relationship. Therefore, these data sets have an innate fit with the linear regression algorithm. However, through the normal distribution test, we found that a small portion of these data did not conform to the normal distribution. Thus, we preprocessed this data to remove the odd values from them. Figure 2 shows the preprocessing as well as the analysis of the correlation between the six

Table 1: Scoring metrics for selected data.

Indicators	Audience 1 scoring	Audience 2 scoring	Audience 3 scoring
Stage performance effects	95	89	94
The distance between the audience and the actors	94	88	97
Training of actors	96	94	91
Musical accompaniment	90	73	88
Costumes for actors	88	65	77
Makeup for actors	75	79	86
Design of the environment	86	81	72

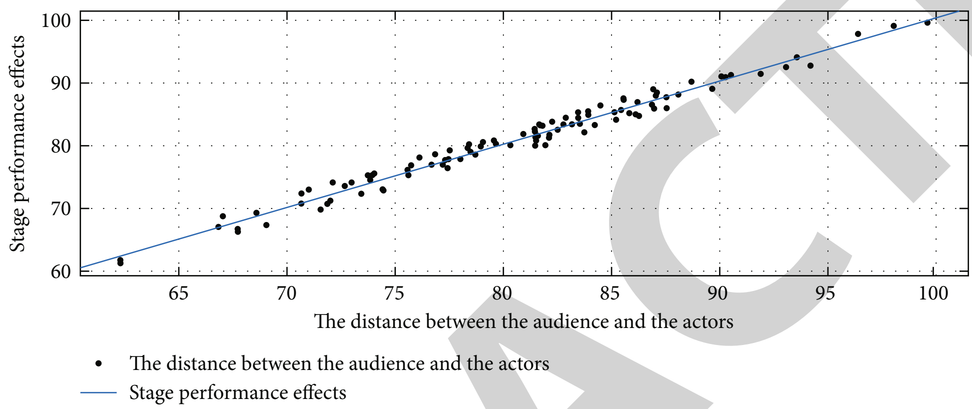

Figure 3: Fitting effect of stage performance effect and audience-actor distance.

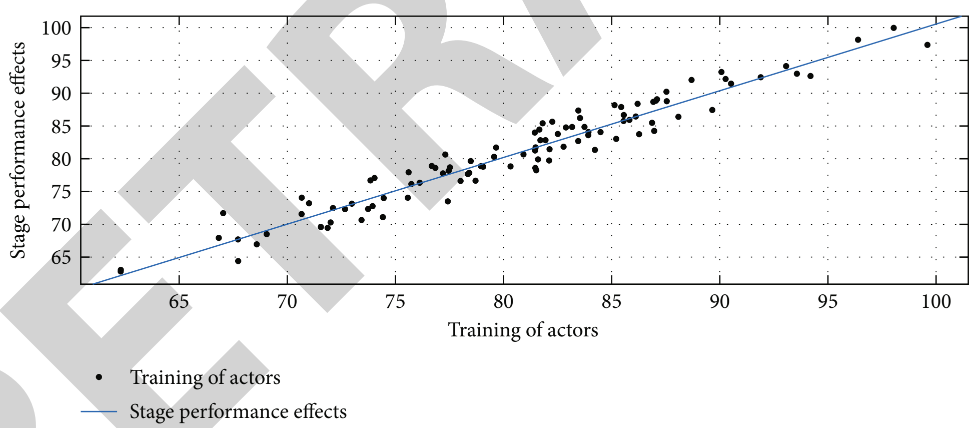

Figure 4: Fitting effect of stage performance effect and actor training.

influencing factors mentioned above and the stage performance score using a linear regression algorithm.

4. Discussion and Analysis of Results

The data in this paper uses the evaluation scores of a concert site audience on different indicators to test the validity of the relevant indicators, where the data size is 100,000 items, and the data content includes quantitative scores of the stage performance effect, the distance between the audience and the actors, the training of the actors, the musical accompaniment, the costumes of the actors, and the design of the actors' makeup environment. To enhance the credibility of the article, we give the characteristic values of the collected data in Table 1.

Figure 3 shows the fitting effect of stage performance effect and audience-actor distance. The rating of actor distance largely fits with the rating of stage performance effect, with a fit of 98.6%. It shows that the actor's distance has a greater connection to the stage performance effect rating. As an audience, there is a certain spatial distance from the stage; it is impossible to see just one actor and observe every detailed action. Therefore, audience seating arrangement is crucial.

Figure 4 shows the fit between the stage performance effect and actor training, where each audience member's rating of actor training is relatively uniform. It shows that the ratings of actor training largely fit with the ratings of stage performance effect, with a fit of 97.5%. It indicates that the actor's distance has a greater connection to the stage

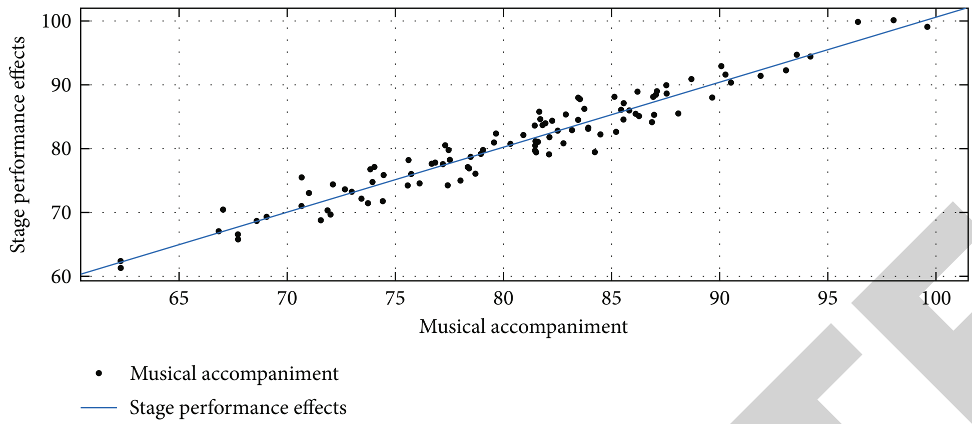

Figure 5: Fitting effect of stage performance effect and musical accompaniment.

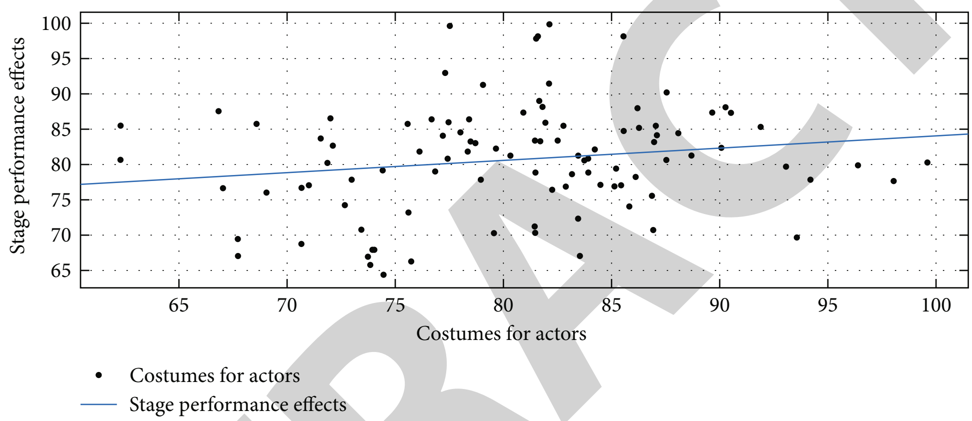

Figure 6: Fitting effect of stage performance effect and actor's costume.

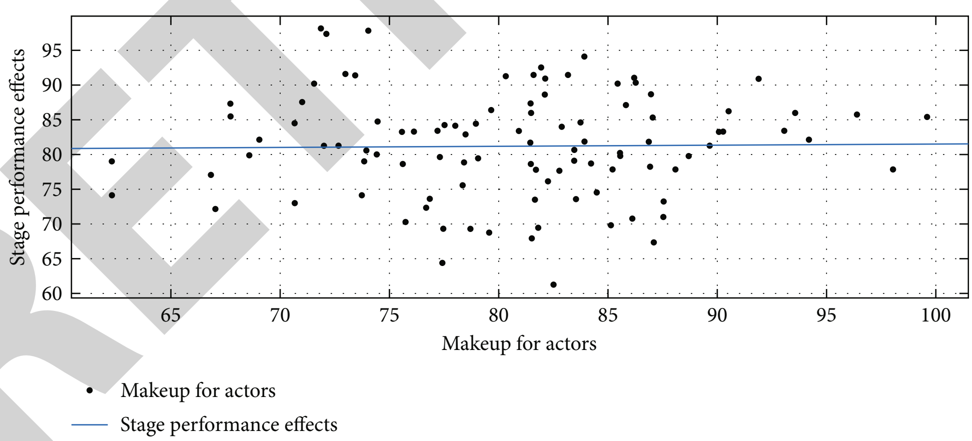

Figure 7: Fitting effect of stage performance effect and actor's makeup.

performance effect rating. Therefore, we have to avoid some temporary and sudden conditions during the proscenium performance, including microphone loss, lighting failure, and audience proscenium reaction. These sudden events and factors can cause some impact on the actors' live performance.

Figure 5 shows the fit between the stage performance and the musical accompaniment, with each audience member rating the musical accompaniment more evenly. It shows that the rating of musical accompaniment is largely fitted with the rating of stage performance, with a fit of 95.2%. It indicates that the training of actors has a greater connection with the rating of stage performance effect. It can be seen that the musical accompaniment can enrich the performance continuously and make the musical cabaret more infectious.

Figure 6 shows the fitting effect of stage performance effect and actor's costume; each audience's rating of actor's

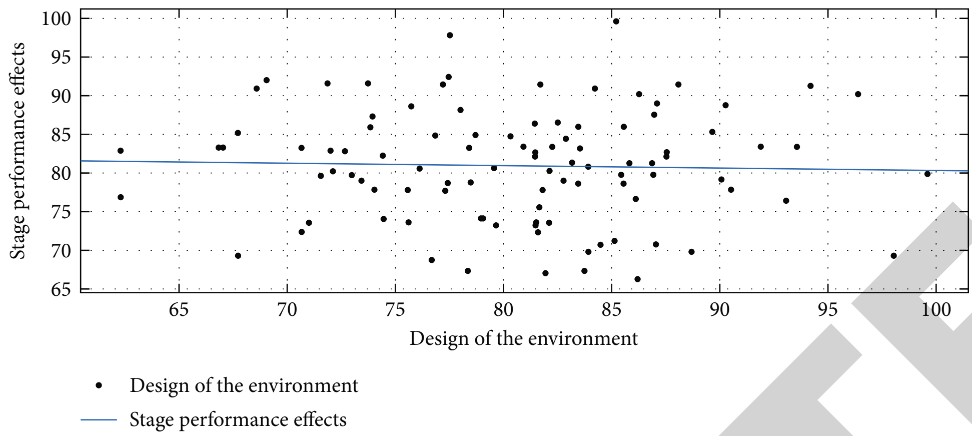

Figure 8: Fitting effect of stage performance effect and environment design.

costume is more scattered. It indicates that the ratings of the actors' costumes are poorly fitted to the ratings of the stage performance effect, with a fit of 75.9%. It indicates that the actor's costume has a small connection to the stage performance effect rating. Therefore, the diversity of audience aesthetics leads to a small correlation between actor's costumes and the performance effect evaluation of musical cabaret.

Figure 7 shows the fitting effect of stage performance effect and actor's makeup; each audience's rating of actor's makeup is more scattered. It indicates that the rating of actor's makeup has a poor fit with the rating of stage performance effect, with a fit of 69.7%. It means that the actor's makeup has a small association with the stage performance rating. The reason for this may be that the audience does not pay much attention to the actors' makeup.

Figure 8 shows the fitting effect of stage performance effect and environmental design; the rating of environmental design by each audience is more scattered. It indicates that the rating of environmental design is poorly fitted to the rating of stage performance, with a fit of 65.8%. It indicates that the design of the environment has a small connection to the rating of stage performance effect. Therefore, the design of the stage environment has less relevance to the performance and audience understanding of the musical cabaret.

5. Conclusions

Environmental protection music and dance drama are now an important way to promote environmental protection and an important art form to promote the spirit of environmental protection. A good stage performance is not only beneficial to making the ideas spread by the musical cabaret deeply rooted in people's hearts but can also provide guiding suggestions for the production of other types of musical cabarets. For the music and dance drama of environmental protection, we used the linear regression algorithm in artificial intelligence technology to analyze the six key factors affecting the stage performance effect. We used 100,000 quantitative ratings from a live concert audience for our experiments, where the ratings included audience-actor distance, actor training, musical accompaniment, actor costumes, actor makeup, and design of the environment. The experimental results revealed a 98.6%, 97.5%, and 95.2% correlation between the stage performance effect score and the distance between the audience and the actors, the actors' training, and the musical accompaniment, indicating that these three factors had a greater influence on the stage performance effect of environmental protection class music and dance drama. On the other hand, the correlations between the stage performance effect scores and actors' costumes, actors' makeup, and environmental design were 75.9%, 69.7%, and 65.8%, respectively, which indicated that these three factors had less influence on the stage performance effect of environmental protection music and dance dramas. To sum up, the proposed method has scientifically and rationally analyzed the relevance of factors influencing the stage performance of environmental protection music and dance dramas. At the same time, the results of this paper also provide important suggestions for the production of environmental protection music and dance dramas. Therefore, in the production and performance of environmental protection music and dance dramas, producers and performers should pay more attention to the distance between the audience and the actors, the design of musical accompaniment, and the training of actors.

Data Availability

The labeled data set used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

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Research Article

Analysis of College Students' Psychological Education Management in Public Emergencies Based on Big Data

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In recent years, college students' psychological problems have occurred frequently, and the early warning of college students' psychological crisis has received social attention. Artificial intelligence and big data, as emerging technologies that have attracted much attention in recent years, have broad application and development space in improving the development of intelligent and refined education in colleges and universities. Applying artificial intelligence and big data to the practice of college students' mental health education plays a very positive role in accurately finding and scientifically solving college students' mental health problems. This paper combs the current application and research of artificial intelligence and big data in college students' mental health education and then clarifies the problems existing in the practical application. Finally, on the basis of in-depth analysis of the characteristics of college students' psychological crisis, the paper designs college students' psychological crisis early warning data collection system from six aspects, including the educational administration system and the access control system. And from the aspects of establishing a multilevel linkage feedback early warning system, building a team of big data technical personnel and mental health education personnel, it puts forward countermeasures for college students' psychological crisis, so as to provide theoretical and methodological support for college mental health management.

1. Introduction

With the rapid development of society and big data technology, college students are facing more and more academic, employment, emotional, and economic pressures, which has seriously damaged the original balance ecology of mental health [1]. According to an authoritative survey released by an authoritative organization in China, about 10%~25.4% of college students in many places will have some mental diseases for various reasons and mainly freshmen. These psychological problems of a freshman have become increasingly prominent because of the vicious events such as leaving, suspension, dropping out, and suicide caused by psychological problems. Therefore, the early warning of freshmen's psychological problems has become an important problem that cannot be ignored and urgently needs to be solved in Chinese universities [2].

Although the students entering the university tend to be rational and mature in terms of knowledge and mind, they lack a deep understanding and experience of the reality and have a certain degree of vulnerability in terms of psychology, which leads to their mental health problems due to some bad experiences [3–6]. With the increasing pace of life and learning pressure, mental health has obviously become a prominent problem among college students. Therefore, more and more colleges and universities have incorporated mental health education into the college students' education system, hoping to enhance the ability of college students to discover and solve all kinds of psychological problems of these freshmen or seniors through professional and targeted mental health adjustment. However, the diversity of students' mental states and the lack of teachers' resources for mental health education make it difficult for students' personalized mental health education needs to be effectively met, and mental health education is often reduced to a public knowledge course [7, 8]. Under such circumstances, it is important to ameliorate college teachers' ability to screen, locate, and analyze mental health of students in school with the help of technical means so that teachers can focus more practice and energy on helping students solve psychological problems [9, 10]. Artificial intelligence and big data, as emerging technologies, can precisely meet the needs in this regard.

Since Caplan (1954) put forward the concept of psychological crisis, scholars have conducted a lot of research around psychological crisis. The research related to this paper is mainly reflected in the influencing factors of psychological crisis of college students [11, 12], early warning index system and early warning model of psychological crisis, early warning mechanism system, and early warning intervention management [13–15]. Weist et al. [16] believe that the causes of college students' psychological crisis are complex, and individual factors, family influence, and social environment have an important impact on students' psychological health. Perfect et al. [17–19] used the method of superiority relationship classification to obtain the factors causing psychological crisis of college students.

Reavley et al. [20] analyzed the difference in psychological stress between Chinese and American college students and explored the impact of stress on individual suicidal ideation and depression. Swisher determined the early warning indicator system of psychological crisis from three dimensions: external event indicator, individual information indicator, and social relationship indicator. The development of big data technology has provided a new means for the study of college students' psychological crisis, which has attracted the attention of many scholars. The research in related aspects mainly includes the necessity and feasibility of big data technology in college students' psychological research, implementation methods and model construction [21–23], and application system design. Talbott et al. [22, 24] believe that the traditional psychological crisis early warning system in colleges and universities is inefficient and excessively dependent on clinical scales. Therefore, big data thinking should be integrated into the psychological crisis early warning work in colleges and universities. Chen et al. [25] proposed an innovative path for college students' mental health education in the context of big data. Guedes et al. [24] introduced the concept of big data into the field of mental health education in colleges and universities, analyzed the mental health data of college students in detail, and established a model of mental health data feedback system. To sum up, the research on college students' psychological crisis early warning under the background of big data will be a new trend in the future. We should use big data technology and combine various data systems on campus to build a psychological crisis early warning system.

Existing studies have found that some scholars have put forward the conceptual model and mechanism of psychological crisis management based on big data [26, 27], but the operability is not strong. Based on this, on the basis of analyzing the concept and characteristics of college students' psychological crisis, combined with the problems and the needs of college students' psychological health education, this paper puts forward suggestions on deepening the application of technology in college students' psychological health education, systematically builds a college students' psychological crisis early warning system under big data, and puts forward scientific, targeted, and effective countermeasures and reference methods for college students' psychological crisis, in order to provide theoretical and methodological support for college mental health management.

2. The Concept and Characteristics of Young Students' Psychological Crisis

2.1. Concept. Academic circles have different views on the specific concept of psychological crisis. At present, the definition of the connotation of psychological crisis mainly meets the following conditions: ① psychological crisis is the manifestation of the conflict between ideal and reality in people's daily life, ② psychological crisis is a variety of negative emotions that individuals cannot find a way to deal with or solve sudden things, and ③ psychological crisis is the psychological and physiological imbalance caused by individuals' failure to cope with external interference. To sum up, college students' psychological crisis refers to the psychological imbalance caused by college students' failure to respond in time after encountering emergencies and then showing high tension, anxiety, confusion, and other negative emotions.

2.2. Characteristics. University is an important stage of life. College students who are separated from the supervision and assistance of their parents need to face the problems of professional study, making friends, employment, postgraduate entrance examination, etc., and their life in university is collective and free. Therefore, this paper believes that compared with other groups, college students' psychological crisis has the following characteristics:

(1) Concealment: the management of the university is relatively free. The teachers, counselors, and class teachers have limited contact with the students in the class, so they cannot know the real psychological status of the students. However, the classmates who contact the most often do not have the ability to identify psychological problems. When psychological problems cannot be solved in a timely manner, psychological problems tend to accumulate into a big one and turn into a psychological crisis

(2) Danger: when college students encounter psychological crisis, it is usually difficult to complete psychological repair alone. Without the help of the outside world, they are prone to fall into the vortex of self-denial and even to harm others and commit suicide

(3) Sudden crises are often unexpected and uncontrollable. For example, the SARS epidemic in the spring of 20d3 caused great panic to the college students in Beijing at that time. At that time, the normal study and life rank were disrupted; the destruction of the order, the departure of classmates and friends, and the isolation of the campus have all caused serious psychological crisis to college students

(4) The arrival of helplessness psychological crisis often makes people feel at a loss, and people's future plans

are threatened and destroyed. Because the previous coping style cannot cope with the crisis and the social support system is not perfect, college students often feel helpless and desperate

3. Challenges Faced by Big Data Application in Related Fields

3.1. Insufficient Attention to Technology Application. These years, the extensive use of artificial intelligence and big data in the business field has gradually deepened the perception and recognition of the practical value of these emerging technologies by colleges and teachers, but few colleges and universities really practice from the perspective of technology in related fields and psychological education for young students. On the one hand, this problem of low attention limits the effective application of scientific research achievements in big data and other place to the practice of young students' mental health guidance, making the mode of young students' mental health guidance too old and ineffective. On the other hand, it also weakens the research and practical exploration of some college teachers on the application of artificial intelligence and in young students' mental health education and lacks corresponding conditional support, which cannot change the good to promote this education.

3.2. Difficult Technical Development. Big data is a universal technology. Research shows that these technologies can be applied to college students' mental education. There is a lack of clear and mature content guidance on how to apply, which makes the application of artificial intelligence and big data in young students' mental education more difficult. Meanwhile, the application of big data in young students' health education involves the integration of professional technologies such as big data and professional disciplines such as psychology, which requires that personnel involved in technology development not only understand the technical growth of young students' mental health education system or platform but also understand the professional knowledge of psychology. Obviously, such talents are scarce among the new college talents in this period; this makes the application of big data in college students' mental health education face greater technical difficulties.

3.3. Data Sharing Is Difficult. In the application of 5g network, artificial intelligence, cloud computing, big data, "Internet of things+," and other information technologies, education management methods, models, and systems have been innovated and strengthened, and the status and value of management data in daily education management have been enhanced. Meanwhile, educational institutions and schools have gradually strengthened interschool exchanges and cooperation and paid attention to the sharing and circulation of education management data. However, due to the diversity and large number of big data in education management, it is difficult to achieve effective compatibility and sharing. For example, in the process of software construction and hardware construction, there are obvious differences among different cities, regions, and schools, resulting in many problems in the process of data transmission and sharing.

3.4. The Effect of College Students' Participation Is Not Good. Although the application of artificial intelligence and big data can improve the pertinence and accuracy of college students' psychological education, the premise to achieve this effect is to have enough data information so that various models and systems can operate on this basis. In other words, college students' participation in psychological education activities is the premise and foundation for big data to play its role in your field. At present, few students are able to take the initiative and participate in relevant activities in this field. Some students are worried about the leakage of their personal information, and they are not willing to participate in this kind of mental health education. This poor participation results in the poor role of technology in the mental health education of college students, significantly affecting the application of artificial intelligence and big data.

4. Construction of Psychological Crisis Early Warning System Based on Big Data Technology

There are a large number of students in universities. Students' big data belongs to scattered information resources, and its information value is extremely limited. However, using big data technology for in-depth mining and comprehensive utilization can transform these scattered information into valuable information and finally achieve the effect of information serving universities and students.

4.1. Collection of Psychological Early Warning Data. University is a process in which we gradually change from a student to a professional. During this period, we will inevitably experience various hardships and pressure will be generated in all aspects. Due to the limited psychological endurance and digestion ability, college students are prone to psychological imbalance. After reading the literature and in-depth research, this paper analyzes the following psychological warning data sources. Class attendance and examination results of each semester: take the professional course of a college student with 10 classes per week as an example, through random sampling survey of 8000 students in the school, the number of students in the sampling survey is 100, and the results of 100 students are summarized and averaged. The survey results are shown in Table 1.

Figure 1 describes the relationship between college students' attendance and their average scores. From the figure, it can be seen that if students are always late or absent from class, their average scores will be lower, and there is basically a positive correlation. However, for some special cases, some students still have high scores despite less class times; it is necessary to find out the reasons, whether they are part-time or have an improper weariness of learning due to economic difficulties. Usually, the school will have a relatively strict attendance system, requiring the class study committee to arrive before each class, count the list of students who are

Table 1: Attendance of three professional courses of college students and examination results of each semester.

Attendance times	Professional courses 1	2	3
10	90.0	95.7	87.6
9	92.1	91.6	91.5
8	88.4	92.3	95.3
7	75.3	84.7	77.6
6	70.1	80.2	81.7
5	71.7	63.9	60.3
4	55.8	61.8	59.7
3	42.0	50.4	45.0
2	49.8	45.0	48.0
1	50.1	44.6	30.2

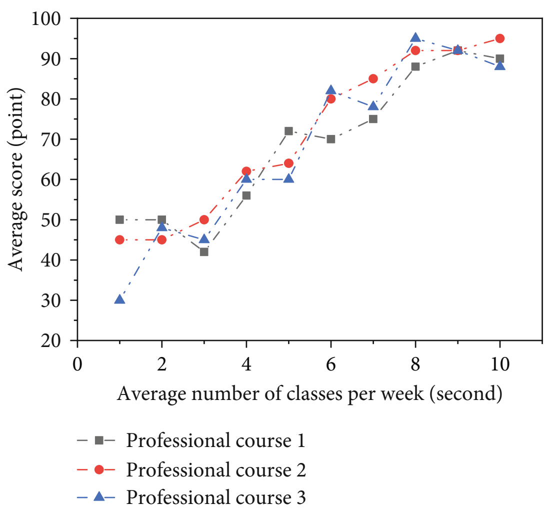

Figure 1: Psychological warning data—relationship between grades and class times.

late and absent, and submit it to the school study department every weekend. Then, the learning department will hand it over to the counselors. The Academic Affairs Office will keep the academic results of each student in each semester, and the data is easy to collect.

For dormitory access control system data, the survey statistics are shown in Figure 2. Taking the time of boys' arrival at bedtime as an example, two main data are grasped. One is the earliest time to swipe the card every day, and the other is the time to return to the dormitory at night. If the time of going out of the dormitory every day is after 11:00, such students are very likely to have the bad habit of staying in bed, staying up late, and getting up late. Such students are prone to feel confused about college life, which deserves attention. The late return to the dormitory but before the deadline of access control may be due to the high pressure of learning, part-time work, etc. If you frequently return to school in the early morning, you need to pay special attention.

In addition, the consumption data of school campus card and the payment of educational administration system can also reflect the mental health of students. Understand the fluctuation of students' consumption through the campus card and judge whether the students' life is stable. From the academic affairs office, we can learn about the payment of students' tuition fees. Most of the students who have been in arrears for a long time are in financial difficulties and face the pressure of the school to urge them to pay their tuition fees. However, we cannot rule out that some students use their tuition fees for other purposes, which leads to arrears. In any case, they need to bear the pressure psychologically. Data was published by students on major social networking sites. The Internet is the main way for college students to vent their emotions. The main social software we use are QQ, WeChat, and Weibo. With the consent of students, we regularly obtain valuable information related to mental health through big data technology.

Interpret the psychology of students from the perspective of psychology. There will be different troubles at different stages of the university. Generally speaking, in the freshman stage, it is easy to be far away from home, have no friends, feel lonely or do not like your major and school, and need a process of adaptation to the life on the university campus. In sophomore and junior years, emotional problems, such as interpersonal problems or love problems, are more likely to occur. In the third and fourth years of the university, the students are about to graduate. The biggest pressure of the students who take the postgraduate and civil service examinations comes from their heavy learning tasks. The students who are directly employed often have no confidence in their abilities and worry about their future development. In general, different students should have different problem preferences and should make full use of the file information of the students when they enter the school and keep the data updated in four years. At the same time, all data should be electronic and sent to the mental health education center to facilitate the analysis of the psychological crisis early warning system.

4.2. Construction of Psychological Crisis Early Warning System Based on BP Neural Network

4.2.1. Principle of BP Neural Network. From the principle of the neural network, it can be found that the initial goal of the network is to simulate the working mechanism of human brain neurons. By setting up a series of neurons in the network to sense external signals or some stimulating behaviors, these perceived signals are transmitted to the internal perception unit through a neuron called input gate and propagate along the forward direction. At the same time, in the process of propagation, back feedback the propagation error to adjust the model, so as to establish a network in which the skill is passing through the propagation signal and the error can be transmitted back to form a BP neural network. Its network structure is shown in Figure 3.

In this picture, n and k represent the number of input signals and output results, respectively; θ represents the connection weights between the layers, including the weights between the input layer and the hidden layer, the weights between the hidden layer and the hidden layer, and the weights between the hidden layer and the output layer; and

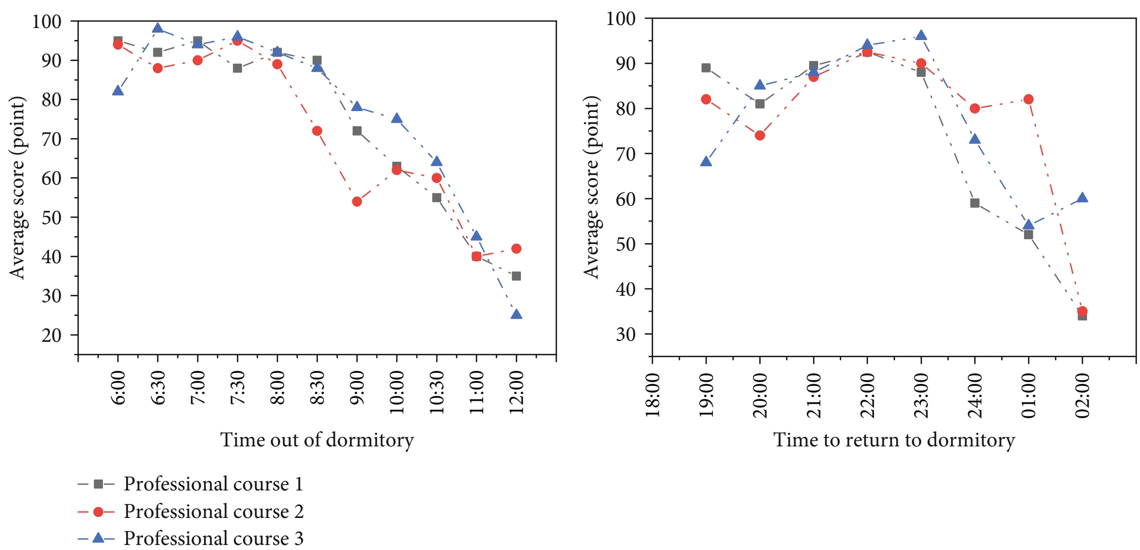

FIGURE 2: Dormitory access control system data—relationship between score and bedtime.

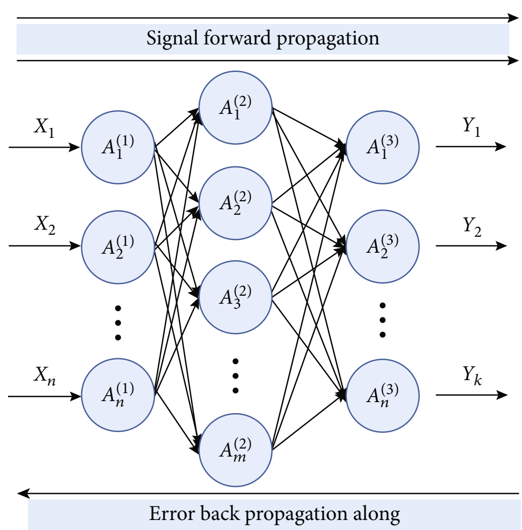

FIGURE 3: BP neural network structure diagram.

$a_j^{(i)}$ represents the excitation value, where i represents the network layer. Therefore, the BP neural network can be regarded as a nonlinear function. Through repeated learning, it can adjust the connection weights between multiple neurons and discover the complex rules within the data and has good robustness and fault tolerance.

4.2.2. BP Neural Network Operation Process. This section introduces the operation process of the BP neural network in combination with its learning algorithm and takes the three-layer BP neural network as an example. The specific process is shown in Figure 4.

Suppose that the input layer neuron node of the BP neural network is $x_n, (i = 1, 2, \cdots, N)$, the hidden layer neuron node is $z_j, (j = 1, 2, \cdots, J)$, and the output layer neuron node is $y_k, (k = 1, 2, \cdots, K)$. The connection weights between the hidden layer and the input layer and the output layer are μ_{nj} and ω_{jk}, respectively. The interlayer thresholds are represented by γ_j and θ_k, respectively, and the expected output value of the output layer is d_k.

Step 1. Set initialization parameters and learning parameters and input sample data. Initialization parameters include connection weight ω_{jk} and thresholds γ_j and θ_k. Learning parameters involve learning rate η, ε transfer function, allowable error 6, training times M, and the number of neuron nodes at each layer.

Step 2. Secondly, according to the optimization results of the previous step, the network function is used to calculate the values of each layer. The output value of the layer can be calculated from the formula in z_j below, and the output value of the layer can be calculated from the formula in y_k below.

$$z_j = f\left(\sum_{n=1}^{N} \mu_{nj} x_n - \gamma_j\right), \quad (1)$$

$$y_k = f\left(\sum_{j=1}^{J} \omega_{jk} z_j - \theta_k\right). \quad (2)$$

Step 3. Next, in the third step, after solving the values in the second step, we need to use the following formula to solve the mean square error:

$$E = \frac{1}{2}\sum_{k=1}^{K} (d_k - y_k)^2 = \frac{1}{2}\sum_{k=1}^{K} e_k^2. \quad (3)$$

Step 4. Judge whether the BP neural network training is over. When the mean square error E is less than the allowable error ε (network convergence) or when the training times exceed the preset M value (the network cannot converge), the training ends. When the mean square error$E$is greater

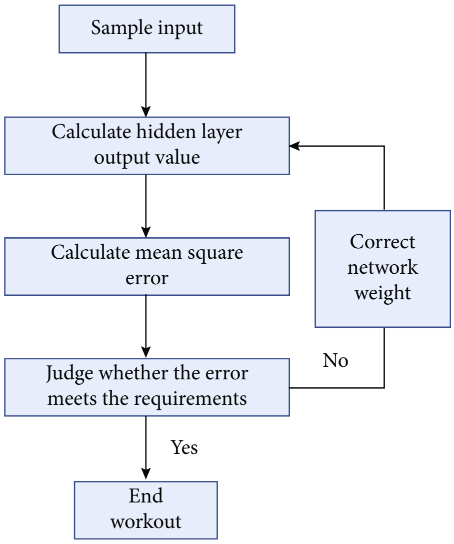

Figure 4: BP neural network operation flowchart.

than the allowable errorε, it is necessary to calculate the output layer correction error δ_{jk} and the hidden layer correction error δ_{nj} according to

$$\delta_{jk} = -\frac{\partial E}{\partial\left(\sum_{j=1}^{J}\omega_{jk}z_j - \theta_k\right)} = -\frac{\partial E}{\partial y_K}\frac{\partial y_K}{\partial\left(\sum_{j=1}^{J}\omega_{jk}z_j - \theta_k\right)} = \sum_{k=1}^{K}(d_k - y_k)y_k(1 - y_k), \tag{4}$$

$$\delta_{nj} = -\frac{\partial E}{\partial\left(\sum_{n=1}^{N}\mu_{nj}x_n - \gamma_j\right)} = -\frac{\partial E}{\partial y_K}\frac{\partial y_K}{\partial z_j}\frac{\partial z_j}{\partial\left(\sum_{n=1}^{N}\mu_{nj}x_n - \gamma_j\right)} = \delta_{jk}\omega_{jk}z_j\left(1 - z_j\right). \tag{5}$$

Step 5. Modify the weights and thresholds of neurons at each layer. Modify the connection weights according to formulas (6) and (7) and modify the thresholds of these two layers according to formulas (8) and (9). When the weights and thresholds are updated, continue with Step 2 until the end of the training.

$$\Delta\mu_{nj} = -\eta\frac{\partial E}{\partial \mu_{ij}} = -\eta\frac{\partial E}{\partial\left(\sum_{n=1}^{N}\mu_{nj}x_n - \gamma_j\right)}\frac{\partial\left(\sum_{n=1}^{N}\mu_{nj}x_n - \gamma_j\right)}{\partial \mu_{nj}} = \eta\delta_{nj}x_n, \tag{6}$$

$$\Delta\omega_{jk} = -\eta\frac{\partial E}{\partial \omega_{jk}} = -\eta\frac{\partial E}{\partial\left(\sum_{j=1}^{J}\omega_{jk}z_j - \theta_k\right)}\frac{\partial\left(\sum_{j=1}^{J}\omega_{jk}z_j - \theta_k\right)}{\partial \omega_{jk}} = \eta\delta_{jk}, \tag{7}$$

$$\Delta\gamma_j = -\eta\frac{\partial E}{\partial \gamma_j} = -\eta\frac{\partial E}{\partial\left(\sum_{n=1}^{N}\mu_{nj}x_n - \gamma_j\right)}\frac{\partial\left(\sum_{n=1}^{N}\mu_{nj}x_n - \gamma_j\right)}{\partial \gamma_j} = -\eta\delta_{nj}, \tag{8}$$

$$\Delta\theta_k = -\eta\frac{\partial E}{\partial \theta_k} = -\eta\frac{\partial E}{\partial\left(\sum_{j=1}^{J}\omega_{jk}z_j - \theta_k\right)}\frac{\partial\left(\sum_{j=1}^{J}\omega_{jk}z_j - \theta_k\right)}{\partial \theta_k} = -\eta\delta_{jk}. \tag{9}$$

4.2.3. System Construction Based on BP Neural Network. Through the preliminary work, the database of the psychological crisis early warning system has six aspects: attendance, academic performance of each semester, time of going in and out of the dormitory, consumption of campus cards and whether the tuition fees are paid on time, data from social networking sites, information reflected by class psychological committee members, and mental health diagnosis scale. Then, it can predict the psychological status of students through big data processing, mining, and analysis. After the prediction results are obtained, they are fed back to the school mental health education center. The physical and mental education center cooperates with the counselor. The counselor contacts the parents and uses professional psychological counseling methods to help the students with psychological crisis. The overall process is shown in Figure 5.

4.2.4. Result Analysis of BP Neural Network Model Training Set. Through Section 4.2.3, we have completed the construction of the psychological crisis early warning system based on the BP neural network model, and through the analysis of the campus psychological database about the students' academic performance in each semester, the time of entering and leaving the dormitory, the consumption of the campus card (average daily consumption expenditure), and whether the tuition is paid on time, the situation is reflected by the class psychological committee. The data of the six aspects of mental health diagnosis scale (diagnosis times in a year) (respectively, recorded as a, b, c, d, e, and f) (the results of some of the called data are shown in Table 2) and the above results are used in the training of the BP neural network model to predict the students' psychological conditions. At the same time, in order to compare the reliability of the model in this paper, the data in this paper are used in the conventional model (gray prediction model) for comparative analysis. The prediction accuracy and model prediction error of the two models are taken as the evaluation indexes. The prediction results of the two models are shown in Figures 6 and 7, respectively.

It can be seen from the change of the prediction error of the two different models with the number of iterations in Figure 6 that the test error of the two models gradually decreases with the increase of the number of iterations of the model, and both can reach a small value. However, the difference is that the BP neural network prediction model

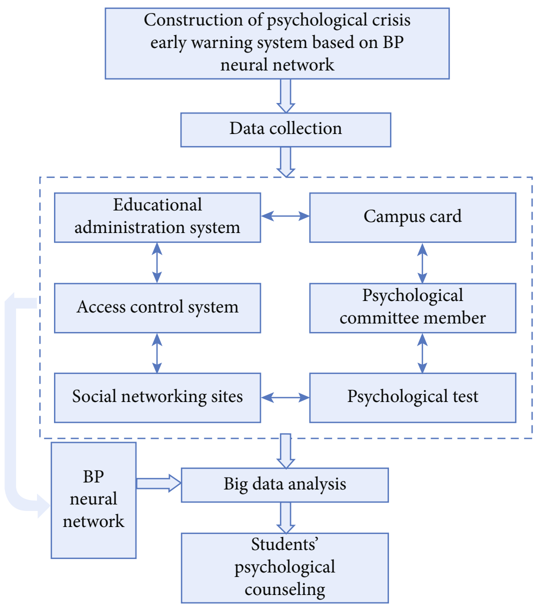

Figure 5: Construction of psychological crisis early warning system based on BP neural network.

Table 2: Mental health database of campus students.

Students	a	b Enter	b Out	c/RMB	d	e	f
1	84.16	22:17	7:26	21.0	Yes	Healthy	1
2	75.27	23:48	8:25	20.5	Yes	Healthy	1
3	82.14	23:02	8:44	16.0	Yes	Healthy	1
4	52.29	24:51	11:21	30.0	Yes	Unhealthy	6
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
$N-1$	63.98	20:16	10:25	24.0	Yes	Commonly	1
$N-2$	77.21	22:01	6:54	26.0	Yes	Healthy	1

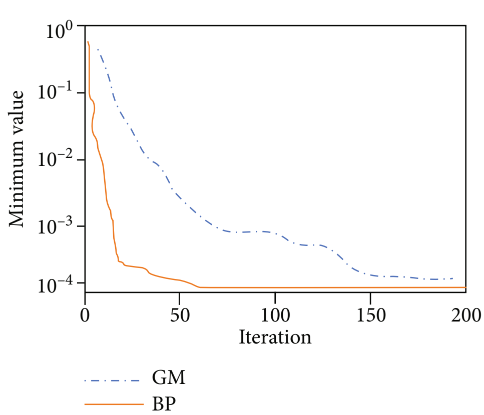

Figure 6: Change of prediction error of two models.

constructed in this paper is better than the gray prediction model of the comparison model in terms of the prediction error of the model and the number of iterations of the model. Among them, the error of the BP neural network quickly tends to be stable after traversing about 60 iterations, and the final error of the model is close to 10-4, which has reached a minimum error. It can be said that the test error of the model has little impact on the results. In contrast, the prediction effect of the gray prediction model is poor. The test error of the model is not only much larger than that of the BP neural network model but also the number of iterations is more than that of the BP model. It takes more than 150 iterations before the model error tends to be stable. Therefore, compared with the gray prediction model, the training speed and error control ability of the students' psychological change prediction model based on the BP neural network model constructed in this paper are better than those of the gray prediction model.

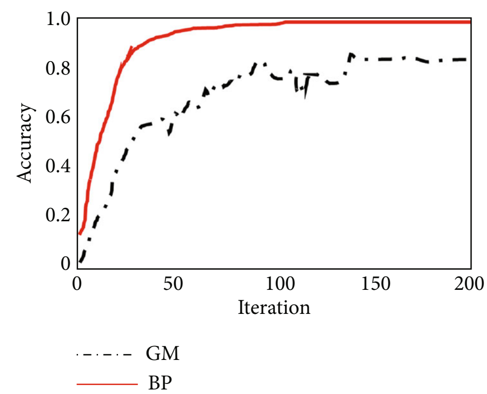

Figure 7: Prediction accuracy of two models.

Figure 6 shows the change of the prediction accuracy of the two different models with the number of iterations. It can be seen that the prediction accuracy of the two models gradually increases with the increase of the number of iterations of the model. However, the difference is that the BP neural network prediction model constructed in this paper is better than the gray prediction model of the comparative model in terms of the prediction accuracy of the model and the number of iterations of the model. Among them, the error of the BP neural network can be rapidly improved to above 0.95 after 100 iterations, and the maximum accuracy is as high as 0.976. In contrast, the prediction accuracy of the gray scale prediction model is poor. The prediction accuracy of the model is not only much lower than that of the BP neural network model but also the number of iterations is more than that of the BP model. After more than 150 iterations, the prediction accuracy of the model can reach the maximum value, and the maximum value does not exceed 0.8. The training speed and prediction accuracy of the student's psychological change prediction model based on the BP neural network model constructed in this paper are better than those of the gray prediction model.

In summary, it can be found that the student psychological prediction model based on the BP neural network constructed in this paper is not only better than other models in terms of training speed and training error but also more accurate in predicting students' psychological conditions, with the highest accuracy rate close to 1, which indicates the effectiveness and superiority of the model constructed in this paper.

5. Countermeasures for College Students' Psychological Crisis Based on Big Data Technology

At present, the development of the psychological crisis early warning system in Chinese colleges and universities has not formed a complete system, and various problems emerge in endlessly, which have seriously affected the response efficiency of colleges and universities to the psychological crisis of college students. Through research, this paper puts forward the following suggestions and measures according to the current situation.

5.1. Establish Multilevel Linkage Feedback Early Warning System. Mental health education centers, schools, colleges, parents, classes, and dormitories should unite to establish a six-level early warning system for psychological crisis and cooperate at all levels to help students overcome psychological problems. The school is responsible for overall planning. The mental health education center is responsible for providing professional psychological assistance. College mainly refers to the teachers led by counselors and class teachers, who are responsible for discovering the psychological changes of students at the first time. The responsibility of the family is not only limited to the students' money input but also needs to bear the responsibility of psychological cultivation. The students in the class, especially the psychological committee members, should help the students with poor psychological conditions and regularly feedback the students' psychological conditions to the counselors and teachers. The six systems shown in the figure not only represent the original information we have obtained but also the most effective tool for counseling and treating young students' psychological weaknesses. In this system, there are many factors that can produce effects, including family, school, and society. Therefore, for the physical and mental problems of young students, the three must work together to make this system effective.

5.2. Encourage Students to Actively Participate in the Construction of Psychological Crisis Early Warning. Usually, it is difficult for people to talk about psychological problems, and they show negative or unconcerned feelings about psychological tests and other psychological problems. However, due to the extensive use of mobile phones by college students, mobile phones do not need face-to-face communication, which reduces more psychological barriers. Through the app, college students are encouraged to actively participate in the psychological crisis early warning system and actively participate in the six functions of the app, including index data query, mental health test, mutual assistance in the forum, daily mood record, psychological status scoring, and psychological consultation appointment so that students can open their hearts to psychological problems and no longer repel.

5.3. Optimize Technology Application Mode. For a long time, college students have shown obvious sensitivity to their own psychological problems and are unwilling to talk about them too much, which makes it difficult to carry out young students' physical and mental education in an open and public way. Artificial intelligence, big data, etc. can be used with advantages of other platforms, such as the neural network model, so that colleges and universities and teachers can develop personalized young students' physical and mental health education platform with the network as the carrier so that students can log in from this interface at any time and at any place for content understanding and activity participation and truly eliminate the worry of young students about physical and mental education. In the actual operation of these technologies, colleges and universities can develop a physical and mental education platform for all young students and can also develop a personalized mental health education platform according to students' different age, gender, grade, major, and other conditions, meanwhile creating a better learning environment for them and conditions for students to participate in the application of technology. Meanwhile, we need to pay attention to the timely and objective feedback of the results of mental health education so that the young students can really feel the advantages and values of artificial intelligence and big data in mental health education and gradually eliminate the exclusion and resistance of students. For example, teachers can design some personalized questionnaire questions with the help of the system and make corresponding adjustments to the design of young students' mental education platform according to the final feedback results of students, so as to make the platform more appropriate to their lives and changes in their psychological activities.

5.4. Cultivate a Team of Psychological Talents with Big Data Technology. In practice, the mental education center in our universities lacks talents who master data technology, which is one of the important reasons why the psychological crisis early warning system in colleges and universities cannot be improved. This team needs compound talents who not only understand physical and mental education knowledge but also master big data technology. By establishing a university mental health education center with both physical and mental education talents and data technology talents, we can maximize the application of data technology and alleviate the bottleneck of traditional psychological early warning methods.

5.5. Integrate Data Technology Development Resources. The application of big data in college students' mental health education is an innovative content, which requires the participation of professional technical personnel and psychological experts and needs to be continuously developed and improved. Considering the fact that the research and practice ability of colleges and universities in this area is weak at present, we can enhance the ability of technology development and break through the difficulties of technology application through resource combination and other means. In the aspect of resource integration, it can be carried out in different ways, such as cooperation among universities and cooperation between universities and enterprises. For example, strong universities can carry out special research on the application of artificial intelligence and big data to college students' mental health education through the combination of strong and strong. Through the cooperation of technical experts and psychological experts, they can make up for the shortcomings of universities in technology development and application and create a technical platform that truly meets the needs of college students' mental health education.

In addition, colleges and universities can also carry out technical cooperation with enterprises or organizations outside the university with strong technical strength, integrate their professional advantages in psychology with the advantages of technological development of other organizations, and promote the transformation of relevant technological ideas into technological achievements. At the same time, considering the personalized characteristics of college students' mental health, the relevant subjects should not only pay attention to the development of the early-stage technology platform but also carry out regular technical maintenance and updating according to the follow-up college students' mental health education practice so that the application of artificial intelligence and big data technology can closely follow the development of college students' mental health education practice. For example, colleges and universities can regularly optimize the model in the college students' mental health assessment system to optimize the matching degree between the model and the data in the database.

5.6. Ensure the Data Security of Mental Health Education Center. The university stage is a critical time for people's growth. College students at this stage are extremely sensitive and unstable and dare not touch topics like psychological problems and psychological crises easily. In essence, colleges and universities establish a psychological crisis early warning system to help students. After obtaining the psychological status information of students, they should ensure the absolute security of the information and limit the number of APP information input ports. Counselors, class teachers, and psychological committee members should strictly keep students' secrets, so as to avoid the effect contrary to the original purpose.

6. Conclusion

In view of the current situation of frequent psychological crisis of college students, this paper uses big data technology to make up for the shortcomings of traditional psychological crisis warning methods. After collecting the six aspects of psychological early warning data, the big data technology is used to analyze, mine, and predict the data. The mental health education center and teachers carry out psychological intervention on the students according to the prediction results. At the same time, a BP neural network model for predicting psychological crisis is constructed, and the model is compared with the commonly used gray prediction model. The results show that the psychological crisis early warning system constructed based on big data technology and BP neural network can quickly and accurately judge the psychological status of students by using the timeliness of big data technology, with the highest prediction accuracy of 0.976. This shows the validity of the model and the necessity of research. In addition, in view of the problems existing in the current education management of college students, this paper puts forward six countermeasures based on the analysis results: (1) establish a multilevel linkage feedback early warning system, (2) encourage students to actively participate in the construction of psychological crisis early warning, (3) optimize the application mode of technology, (4) cultivate a team of psychological talents with big data technology, (5) integrate data technology development resources, and (6) ensure the data security of the mental health education center to ensure the mental health and physical and mental safety of college students.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest to report regarding the present study.

Acknowledgments

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Retraction

Retracted: The English Teaching Methods in the Field of Public Health in Colleges and Universities Based on Artificial Intelligence Technology

Journal of Environmental and Public Health

Received 17 October 2023; Accepted 17 October 2023; Published 18 October 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] S. Li, "The English Teaching Methods in the Field of Public Health in Colleges and Universities Based on Artificial Intelligence Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 1995924, 12 pages, 2022.

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Research Article

The English Teaching Methods in the Field of Public Health in Colleges and Universities Based on Artificial Intelligence Technology

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Artificial intelligence technology has become an important part of the development of Internet technology. Artificial intelligence technology can help colleges and universities to continuously optimize the English teaching system. This technology can help colleges and universities to carry out English education in the field of public health and can improve the overall quality of English teaching in colleges and universities. Artificial intelligence technology is related to the optimization of English teaching environment in colleges and universities. At the same time, artificial intelligence technology also affects the development of society and the future of the country. Artificial intelligence technology provides more accurate data resources for English teaching in the field of public health in colleges and universities. It also provides rich and reliable educational technology means for teachers. This technology improves the scientific nature of English education in the field of public health in colleges and universities. This paper comprehensively uses a variety of methods such as case empirical analysis and qualitative analysis to analyze the application mode of artificial intelligence technology in English teaching. This paper closely integrates artificial intelligence technology with English education in the field of public health in colleges and universities. College English teaching methods, teachers' personal factors, and teacher-student relationship will all have an impact on students' health. This paper makes a comprehensive analysis of the theoretical basis and actual situation of English teaching in colleges and universities, and then constructs an innovative system of English education in the field of public health in colleges and universities. Based on this, the text adopts a structured analysis method to conduct an in-depth analysis of the application mode of artificial intelligence technology. This paper analyzes in detail the opportunities and challenges faced by the development of public health education in colleges and universities. At the same time, this paper also summarizes the objective laws of the development of public health education, and then comprehensively analyzes the impact of artificial intelligence technology on the English education model in colleges and universities.

1. Introduction

Artificial intelligence technology has a great impact on public health education in colleges and universities. Under the wave of globalization, multicultural thoughts widely exist in the Internet space. In the context of deepening economic globalization, competition among countries has become increasingly fierce. These competitions are mainly reflected in the level of comprehensive national strength and talents. The key to talent construction is reflected in the comprehensive quality level [1, 2]. English ability is an important part of the comprehensive quality training of talents in colleges and universities. The cultivation of students' health awareness and English ability in colleges and universities is the focus of current development [3, 4]. In college English teaching, public health is the future trend of global competition.

Public health awareness is also a key way to cultivate students' psychological quality. Artificial intelligence technology, as an emerging type of computer technology, can optimize the current college English teaching work from multiple dimensions such as classroom teaching mode, English teaching form, English course dissemination path, and English course teaching method. The deepening of public health awareness is also the optimization direction of the English teaching system in colleges and universities. The cultivation of college students' public health awareness is an important part of the improvement of students' comprehensive quality, and it is also the fundamental requirement for the all-round development of colleges and universities [5, 6]. At this stage, the proportion of health education in college English teaching courses is relatively high. The teaching task of health education is arduous and urgent, and this type of English teaching faces many obstacles and problems. The basic goals of health education will also be difficult to achieve [7, 8]. Therefore, the influencing factors of mental health of students in college English teaching courses are very important. Such factors are of great significance to the development of English teaching and the smooth progress of college students' health education [9, 10].

With the improvement of people's quality of life, the reform of the English system in colleges and universities is also deepening. In the process of English teaching in colleges and universities, teachers also pay more attention to the development of students' healthy vision [11, 12]. In the book "English Teaching Methods and Strategies", the author takes English teaching as the focus of course study. English teaching needs to be fully implemented, so as to truly promote the all-round development of students and provide guarantee for the healthy growth of students [13–15]. Based on the perspective of health, this paper makes a multifaceted analysis of the theoretical innovation of English teaching in senior high schools. Considering the lack of interaction and real-time nature of the traditional English teaching mode, teachers mainly teach in class, and students are in passive listening mode under the stage. Artificial intelligence technology connects students and teachers in real time and optimizes the automatic teaching mode through data sampling, mathematical statistics, data interconnection, and other methods. This technology can simulate the online English teaching environment as much as possible and improve the learning effect of the student group. This article reviews the concept of public health. The focus of this paper is to carry out college English teaching activities from the perspective of students' health [16–19]. All teaching activities and teaching concepts are aimed at promoting the healthy development of students. College English teaching from the perspective of health is more humanistic and can better highlight the value of students and the status of students as the main body of learning. Textbooks such as "English Teaching Methods and Strategies" believe that human beings are a kind of living body, and they should realize the healthy development of physiology and psychology [20–23]. Only the students trained in this training mode can be regarded as real talents. Therefore, students at different ages should carry out public health education. At the same time, the stage of university study is also a critical period for students' health vision education. Therefore, when teachers carry out teaching work, they should design teaching activities from the perspective of health [24, 25]. Schools need to pay more attention to the cultivation of students' healthy vision, and parents should always pay attention to students' physical and mental state and help students adjust their mentality in time.

College English teaching needs to strengthen the cultivation of students' health vision and public health awareness. The book "English Teaching Methods and Strategies" believes that from the perspective of health, mental health is an optimistic and positive attitude, and physical health is a high overall physical quality [26–29]. Therefore, when colleges and universities carry out English education and teaching, they should start from the perspective of health and do a good job in the expansion of both physical and psychological aspects. For example, teachers can combine classroom content with sports content, ask students questions in class, and if they answer inaccurately, punish students for doing several sit-ups or push-ups to exercise students' physical fitness [30–32]. Teachers can also set up a small psychological counseling class based on the teaching content, so that students can anonymously write some of their happy and unhappy things on paper. For happy things, pass on happiness and joy to students. For unhappy things, the whole class comes up with ideas to help students solve unhappy problems. No matter which method is adopted, English teachers must focus on the degree of participation of students, design interesting content, and attract students to participate in classroom activities [33–36]. While achieving the goals of English teaching, they can also achieve the educational purpose of healthy vision for students.

The idea of public health in the process of English teaching in colleges and universities must be established within the student group. In general, artificial intelligence technology can provide educational decision-makers with a quantitative, visual, three-dimensional, and comprehensive global vision. Artificial intelligence provides new opportunities for college English teaching. In the era of artificial intelligence, college English teachers can use a variety of teaching modes to teach. Artificial intelligence technology helps teachers and students to carry out interaction and communication and helps to enrich the teaching form of English classrooms in colleges and universities. Allow decision-makers to fully consider all variables. At the same time, decision-makers can use computer simulations to check the results of artificial intelligence calculations. Decision-makers can further avoid possible wrong decisions by checking and verifying the model calculation results. In addition, relevant school administrators systematically analyze the policy factors that affect the allocation of educational resources through data analysis results. Artificial intelligence technology can help schools plan their development carefully. Finally, artificial intelligence technology has the advantages of real-time, scientific, and accurate. The technology can help English teaching staff improve the overall quality of public health teaching.

2. The Application of College English Teaching System Based on Artificial Intelligence Technology in the Field of Public Health

2.1. The Development Process of Artificial Intelligence Technology and Healthy English Teaching in Colleges and Universities. The development of information technology has entered a new era, and the development of artificial intelligence technology has certain regularity. The combination of artificial intelligence technology and healthy English teaching in colleges and universities can achieve better results. Faced with such a situation, public health English teaching in colleges and universities needs to be actively improved. The components of the world consist of a series of natural elements or social events. Under such a changing environment, the teaching of healthy English in colleges and universities needs to adapt to the requirements of the development of the times. Artificial intelligence technology is the direction of the development of the times, and the teachers and students in colleges and universities need to actively adapt to this change. On the one hand, the teaching of healthy English in colleges and universities needs to establish data awareness and build the data thinking of students. In addition, after a long period of development, healthy English teaching in colleges and universities has formed a relatively complete teaching system. English teaching in the field of public health in colleges and universities needs the support of new technologies. The traditional English teaching mode and teaching methods are relatively conservative, and the interaction between teachers and students is insufficient. Artificial intelligence naturally has many characteristics such as large amount of data, diverse data types, real data, and fast processing speed. Therefore, it is necessary to deeply analyze the application mode of artificial intelligence technology in public health English teaching and strengthen the deep integration of new technologies in English teaching. A large amount of data has also been accumulated in various stages such as school classroom teaching and students' after-school practice. In educational work, these data have attracted more and more attention from all walks of life, and data analysts have conducted an in-depth mining and use of these data. In addition, relevant research results have been gradually promoted and applied in the teaching of healthy English. On the other hand, the dissemination methods of healthy English education are more diversified. In the process of English education and teaching in colleges and universities, starting from healthy vision, offline health English publicity activities can be set up. English teachers can organize students to go to school to carry out healthy English learning activities on weekends. In addition, teachers choose some students with positive attitudes to share their attitudes when facing difficulties and problems in the learning process. Artificial intelligence technology has incomparable advantages over traditional methods in data analysis, platform construction, information expression, and course evaluation. Colleges and universities need to fully understand the importance of artificial intelligence methods in English teaching and apply them to English teaching in the field of public health for students. The school helps some psychologically vulnerable students find self-confidence. At the same time, teachers can also teach students the knowledge of healthy English through artificial intelligence technology, so that college students can correctly understand the connotation of healthy English.

The application framework of artificial intelligence technology in public health English teaching is obtained as shown in Figure 1. It can be seen from Figure 1 that the application framework of artificial intelligence technology in public health English teaching. Specifically, colleges and universities carry out English teaching in the field of public health through new paths, new ideas, and new methods. This paper further sorts out the combination mode of artificial intelligence technology in college English teaching. Colleges and universities use artificial intelligence technology to carry out precision teaching, and it is necessary to carry out stratified teaching according to the differences of student groups. The main contents include four aspects: English teaching habits, English learning modes, English teaching methods, and English teaching effects. Specifically, artificial intelligence technology further optimizes and innovates the English teaching mode in the field of public health in colleges and universities through various modes such as carrier innovation, mechanism innovation, method innovation, and concept innovation. On this basis, this paper further analyzes the influence of different influencing factors on the English teaching process in the field of public health in colleges and universities.

Formula (1) builds a correlation analysis model between the English teaching system and public health factors. All the evaluation factors are combined into the evaluation index system set of the fuzzy comprehensive evaluation method, and the corresponding factor set is as follows: the cross entropy (CE) formula is

$$\text{loss} = -\frac{1}{m}\sum_{j=1}^{m}\sum_{i=1}^{n} y_{\text{ji}} \log\left(\hat{y}_{\text{ji}}\right), \tag{1}$$

where the loss is the set of factors of the model; yn is a specific set of different types of factors. This paper adopts the fuzzy comprehensive evaluation calculation model. The corresponding evaluation level is set for the evaluation index. The higher the evaluation level, the more obvious the quantitative effect of the evaluation result. The original form of the gradient descent method is shown below:

$$\theta \coloneqq \theta - \alpha \frac{\partial}{\partial \theta} J(\theta). \tag{2}$$

In addition, the classification of comprehensive evaluation level is also a very important link in the fuzzy comprehensive evaluation method. The set of all evaluation levels is called the evaluation level set, and the corresponding formula is as follows: the mathematical expression of a

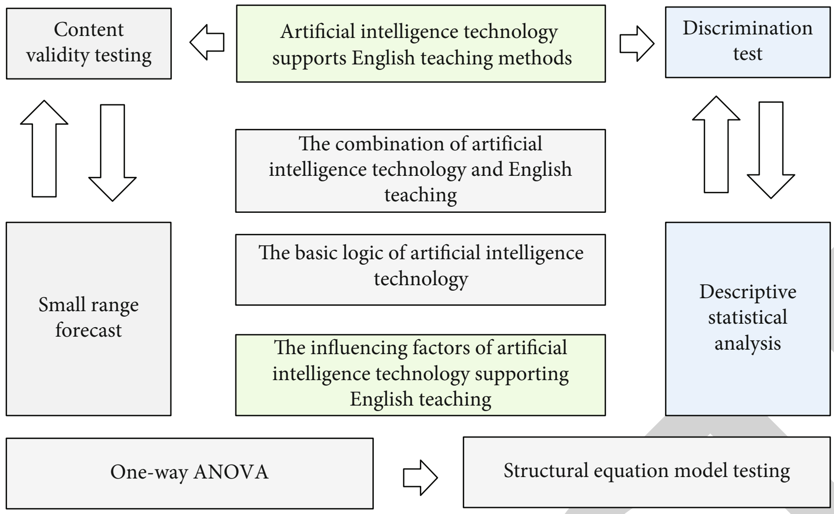

Figure 1: The application framework of artificial intelligence technology in public health English teaching.

common Adam optimizer is given as

$$\begin{aligned} m_t &= \beta_1 m_{t-1} + (1-\beta_1) g_t, \\ v_t &= \beta_2 v_{t-1} + (1-\beta_2) g_t^2, \end{aligned} \tag{3}$$

where v is the set of evaluation factors; mi is a set of specific levels of different types.

The public health factor index (f) is used to characterize the integration method and effect of health factors in the English teaching environment of colleges and universities. The fi values are based on the relationship coefficients in the regression model β. The calculation formula is as follows: the mathematical expressions of the three-gated structures are

$$\begin{aligned} f_t &= \sigma\left(W_f \cdot x_t + W_f \cdot h_{t-1} + b_f\right). \\ i_t &= \sigma(W_i \cdot x_t + W_i \cdot h_{t-1} + b_i), \\ o_t &= \sigma(W_o \cdot x_t + W_o \cdot h_{t-1} + b_o), \end{aligned} \tag{4}$$

where W_f and b_f represent the weights and biases of the forgetting gate, and σ represents the sigmoid activation function.

2.2. The Influence of Artificial Intelligence Technology on the Reform of English Teaching Mode in Colleges and Universities. First of all, artificial intelligence technology can support healthy English teachers to carry out their work. Artificial intelligence technology is a new technological revolution following the Internet, Internet of Things, and cloud computing. At the same time, artificial intelligence technology has gradually become an important technical means of modern production management. Artificial intelligence technology is closely related to our work, study, and life. Educational decision-making based on artificial intelligence technology has also entered a new stage. English teaching involves many complex issues, and artificial intelligence technology has gradually demonstrated its own potential and advantages in the upsurge of educational information development. In addition, the dependence of all walks of life on artificial intelligence technology is also increasing. The important content of healthy English education is to cultivate students' correct three views and positive life-learning attitude. Artificial intelligence technology also has many application forms in the field of public health teaching. The technology helps raise public health awareness among the student population and can also provide techniques and methods for the teaching process. When colleges and universities use artificial intelligence technology to integrate public health resources and English teaching courses, they need to adhere to the principles of professionalism, systematization, and formativeness. The contents of college English textbooks are selected into teaching materials after careful selection. Each classroom teaching content meets the development requirements of the times and spreads the correct values of public health. Therefore, when public health English teachers carry out teaching, they should dig deep into the content contained in each article and understand the author's three views and what they want to express. Teachers start with artificial intelligence technology to explore the English teaching model in the field of public health. The English classroom is not only a place for students to learn knowledge, but also the main direction for the development of students' health concept. Colleges and universities need to use artificial intelligence to analyze the difficulties and problems in the current public health teaching work. On this basis, colleges and universities need to make full use of the advantages of artificial intelligence technology, give full play to the advantages of strong interactivity and strong immersion of the technology, and innovate new methods, new means, and new mechanisms for English teaching in the field of public health in colleges and universities. Teachers should start from multiple angles to help students strengthen the learning of public health English. For example, artificial intelligence technology can help students better understand the content of the article. Artificial intelligence technology allows students to understand what books are good books. This technology can help students develop the habit of reading books and allow students to learn some theoretical knowledge of public health from books. The technology can guide students to actively face problems and guide students to seek reasonable solutions.

The impact path of artificial intelligence technology on public health English education in colleges and universities as shown in Figure 2. As shown in Figure 2, this paper constructs the impact path of artificial intelligence technology on public health English education in colleges and universities, including the English teaching section, the public health education section, the health culture communication section, and the English culture communication section. The curriculum system links multiple departments to achieve collaborative operation between departments. The course system of healthy English based on artificial intelligence technology emphasizes the customization and push of teaching content and builds a refined teaching mode and complete teaching content. This method realizes the refined display of public health teaching content. This paper realizes the intelligent innovation of the public health teaching system in colleges and the universities through the simultaneous promotion of various measures.

It can be seen from Figure 2 that college teachers carry out course teaching through the information system. The artificial intelligence resource library can actively provide teachers with teaching resources related to public health material courses. This team of teachers and students provides a variety of conveniences. On the one hand, the system provides a broader platform vision for public health teaching work and learning. On the other hand, the system helps teachers and students to obtain abundant public health teaching resources and promotes instant interaction between teachers and students. This method conforms to the current trend of Internet learning and reflects the value of public health English education to the greatest extent.

(1) CNN layer: Taking the CNN model calculation of encoder as an example, three vectors including query vector Q, key vector K and value vector V are used to describe the calculation process of self-attention mechanism. The corresponding formula is as follows:

$$\begin{aligned} Q &= X \times W^Q, \\ K &= X \times W^K, \\ V &= X \times W^V. \end{aligned} \tag{5}$$

Then, if there are n decision-making units in total, the input vector and output vector are shown as follows:

$$\begin{aligned} x &= (x_{1i}, x_{2i}, \cdots, x_{mi})^T, \\ y &= (y_{1i}, y_{2i}, \cdots, y_{ni})^T. \end{aligned} \tag{6}$$

Specifically, the indicators x and y, respectively, refer to the comprehensive evaluation results of the effect of healthy English teaching in the artificial intelligence analysis model.

2.3. The Impact of Artificial Intelligence Technology on the Reform of Healthy English Education System. The arrival of the era of artificial intelligence has provided a new "Internet +" thinking paradigm for the development of healthy English teaching in colleges and universities. Artificial intelligence technology is a scientific and technological revolution. More importantly, this method has promoted the reform of English teaching methods. Based on artificial intelligence technology, students have shaped new concepts of openness, equality, collaboration, and sharing. Public health education in colleges and universities needs to rebuild the English teaching system and improve the learning methods of student groups. This method can build a new English teaching platform and optimize the teaching management system of healthy English. This technology can continuously optimize the healthy English teaching mode, so that advanced teaching concepts can be effectively disseminated among students. The technology can also make teachers' teaching concepts more concrete. Based on the artificial intelligence technology platform, schools can strengthen the guidance and behavioral shaping of students by the main body of English teaching. Relying on artificial intelligence technology, the English teaching system in the field of public health can realize the reform of teaching curriculum and teacher team in an all-round way. Secondly, the English teaching system in colleges and universities also needs to strengthen the cultivation of students' public health literacy. Personalized cultivation of students' health literacy is an important educational model in the modern educational system. Artificial intelligence technology has been fully reflected in public health education work. Through the analysis of massive data, artificial intelligence technology further supports colleges and universities to carry out personalized healthy English teaching work for student groups. Public health English education is based on each student's personality characteristics. This educational model can adapt to the characteristics of students to the greatest extent, so that the potential of the student group can be brought into full play. The goal of the school's public health English teaching is to make every student have a better English learning environment.

The integration mode of ideological and political elements in the psychology teaching system of colleges and universities needs to be systematically sorted out. Artificial intelligence technology is fully applied to ideological and political elements and public mental health education. It can be seen from Figure 3 that we systematically analyze the integration mode of artificial intelligence technology in the public health English teaching system in colleges and universities. This system analyzes the construction method of the English teaching system in the field of public health in colleges and universities through the methods of refined service and precise management. Specifically, the teaching system includes five aspects: the English teaching experience that students care about, students' learning psychology,

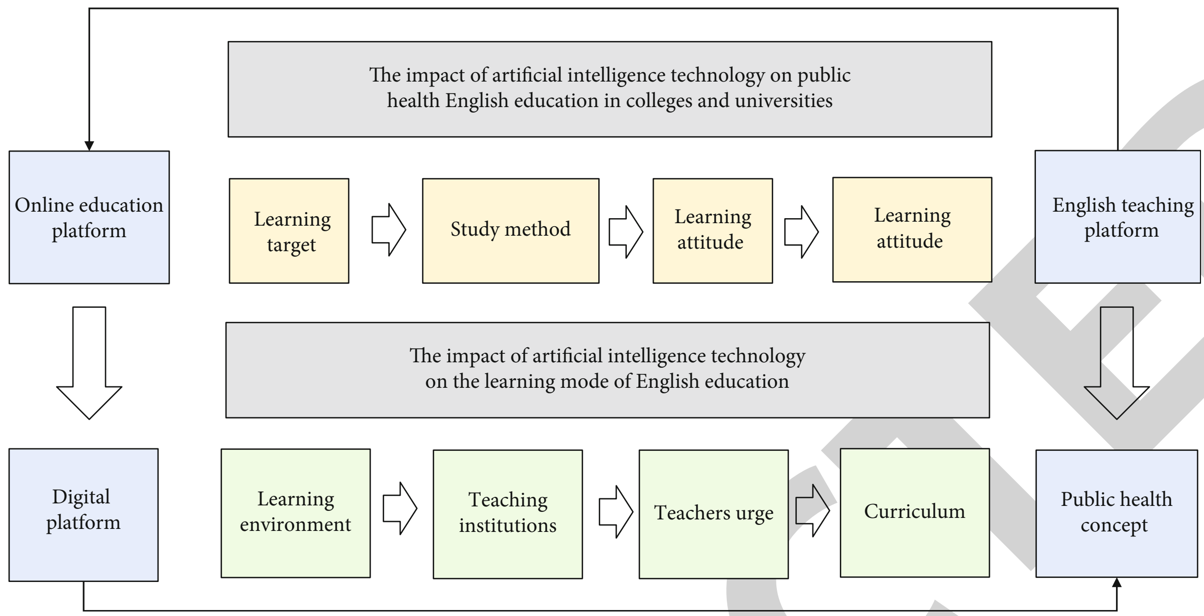

Figure 2: The curriculum system and implementation framework of public psychological education in colleges and universities based on artificial intelligence.

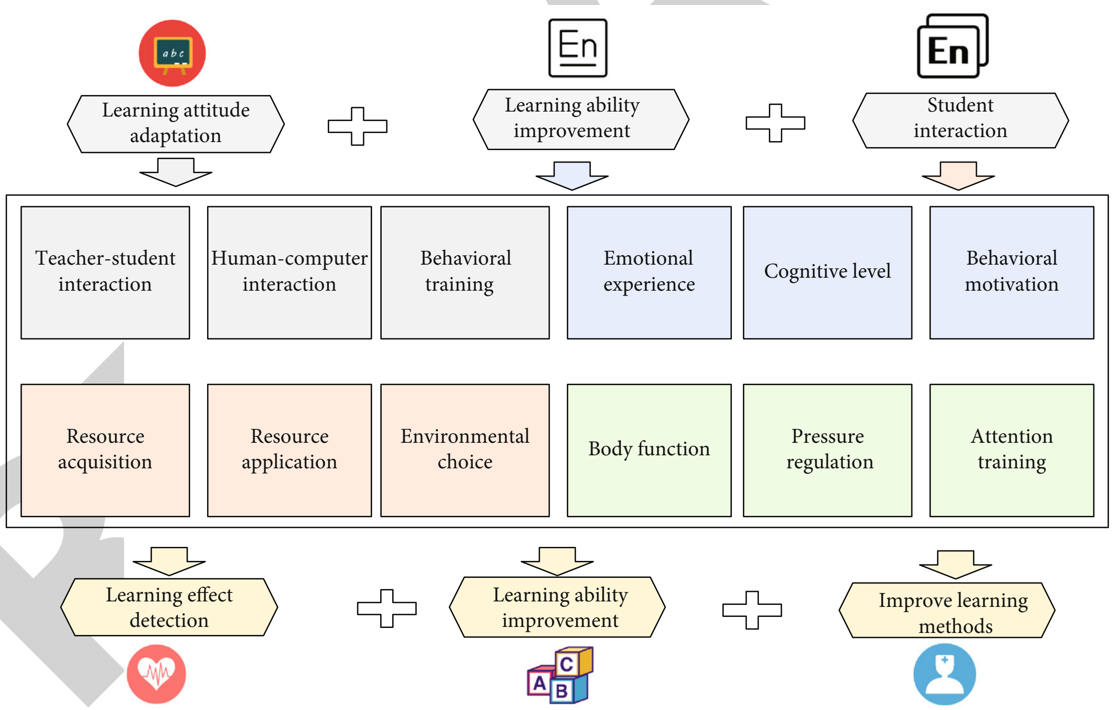

Figure 3: The integration mode of ideological and political elements in college psychology teaching system based on artificial intelligence technology.

students' public opinion supervision, students' learning effect evaluation, and development path research and judgment. The system corresponds to the English teaching system in the field of public health in colleges and universities and involves five aspects: resource acquisition, resource application, environmental selection, stress regulation, and attention training. The system organically integrates the public health teaching system and the English teaching system in colleges and universities through multiple subsystems such as the learning effect evaluation system, the student ability improvement system, and the learning method improvement.

3. Artificial Intelligence Technology Can Improve the Teaching Framework of Public Health English in Colleges and Universities

3.1. Schools Need to Actively Expand the Concept of Health in English Teaching. In English teaching work, teachers need to further explore public health-related materials and actively expand curriculum content. Through the integration of various teaching resources, the school cultivates students' positive learning attitude and life attitude and teaches students to face difficulties bravely. In the tutorial "English Teaching Methods and Strategies", experts believe that English teachers should pay attention to the mining and expansion of the content of teaching materials when teaching. College teachers need to help students build a positive attitude from the perspective of health. This attitude to life can help students to face academic pressure positively. The study of health concepts can help students face difficulties bravely and actively find ways to solve problems. With the rapid development of science and technology in modern society, teachers can choose some materials from the Internet to enrich the content of classroom teaching. Teachers can actively broaden students' health horizons through their own efforts. Artificial intelligence technology can be applied to all aspects of English teaching. In the process of classroom teaching, artificial intelligence technology plays the function of assisting teachers in teaching. In the process of after-school teaching, artificial intelligence technology has become the main body of teaching, and the communication between teachers and students is strengthened through the form of virtual interaction. For example, teachers can expand the field of reading teaching for students, and teachers can actively expand the scope of extracurricular reading to expand students' knowledge reserves. In the process of learning health-themed works, teachers can convey a free attitude to life and a positive outlook on life to students, so that students can develop a good attitude to life and learning. In addition, as the disseminator of healthy culture, teachers should share some more advanced ideas with students. In addition, teachers should strictly select the learning materials when choosing the learning content of healthy English. Teachers should avoid selecting content that is illogical and has a negative impact on students. English teachers should bring healthy values to students, so that students can face life in a positive and sunny way, maintain a healthy attitude when encountering problems, and solve problems independently. Teachers should start from the perspective of health and help students establish correct values by expanding teaching content and enriching students' activities.

Artificial intelligence technology can affect the English teaching process in the field of public health in colleges and universities through various factors. Among them, factors such as English teaching mode, public health theory, student group psychology, and English teaching mode are all related to healthy English teaching in colleges and universities. From the results in Figure 4, it can be seen that the influence of artificial intelligence technology on the effect of healthy English teaching in colleges and universities is characterized by a linear distribution. By analyzing the proportion of different indicators in the figure, it can be seen that the healthy English teaching mode has the most significant impact on the teaching effect. Secondly, the influence of healthy English teaching curriculum design is also more prominent, about 22%. The student public opinion analysis accounted for about 25%. The mastery of students' classroom knowledge accounts for about 20%; this proportion is the same as the proportion of students' learning mentality, both of which are 20%.

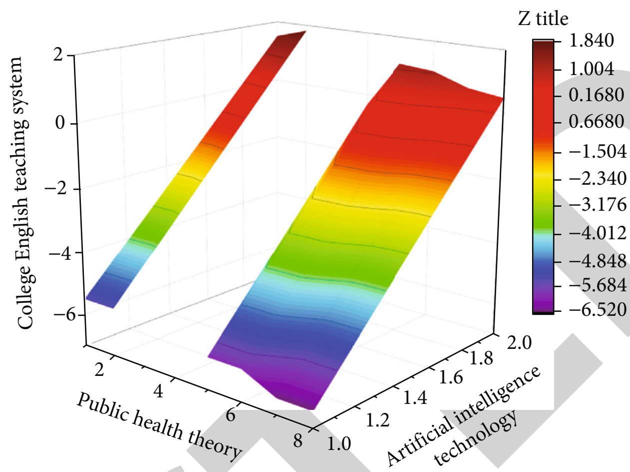

Figure 4: The role of artificial intelligence technology on the healthy English teaching system in colleges and universities.

3.2. Artificial Intelligence Technology Is Helpful for Healthy English Teaching in Colleges and Universities. The teaching activities of healthy English in colleges and universities generate massive data every day, and these data are generally unstructured. In the era of artificial intelligence, the amount of data stored shows a geometric level of growth. Artificial intelligence technology can systematically analyze and process these data. From the current trend of computer technology and information network development, 80% to 90% of future data structures will be semi-structured data. In the era of artificial intelligence, people are more willing to collect complex data quickly, rather than obsessing about the accuracy of the data. Data analysts in college English subjects will spend a lot of energy and cost in avoiding mistakes. Artificial intelligence technology has played a very important role in English teaching in colleges and universities. Artificial intelligence technology helps to connect different teaching subjects and strengthen the communication between the subjects. Artificial intelligence technology can provide internal driving force for healthy English teaching in colleges and universities, stimulate the state of elements, and improve the organizational vitality of English teaching. Generally speaking, large-scale data analysis work requires appropriate optimization and adjustment of data standards. Artificial intelligence technology has high requirements for data standards in the field of healthy English. Teachers in the field of healthy English in colleges and universities need to grasp the main laws of how things are going when data analysts do their work. Massive data resources are not absolutely accurate and perfect, but these data can satisfy people's predictions about the future. The benefits of this data far outweigh the general benefits of improved data accuracy. Therefore, this artificial intelligence dissemination mode allows the student group to obtain a better and healthy English learning environment.

The expression effect of public health elements in the English teaching curriculum system is analyzed through statistical models. Specifically, there are generally four main factors that affect English teaching in public health, including student psychological dynamic tracking, comprehensive evaluation of learning effect, optimization of teaching mode, and quantitative evaluation of teaching effect. The analysis results of the statistical model are shown in Figure 5. From the results of the model analysis, it can be seen that the focus of healthy English teaching in colleges and universities should be on the form of identification of key teaching achievements, and the overall English teaching results show a fluctuating upward trend. The emotional changes of students also showed an upward trend. The psychological state of the student group showed a steady and fluctuating trend, and the overall teaching effect showed a fluctuating downward trend. The overall change of students' English education level is in a state of high and small fluctuations. The results of the model analysis show that the above indicators can be applied to the expression analysis of public health elements in English teaching.

College English teachers should organize and carry out teaching activities of artificial intelligence technology. Due to the tight arrangement of English teaching courses in colleges and universities, students have relatively little time for physical and mental relaxation. The textbook "English Teaching Methods and Strategies" also expresses a similar view. The textbook believes that teachers need to provide students with English extracurricular learning content from a health perspective to help students relax. Artificial intelligence technology can enrich teaching materials and prevent students from being in a closed learning environment for a long time. Artificial intelligence technology also helps to cultivate students' healthy English learning concept. At the same time, the school will also organize extracurricular teaching activities, which can enhance the communication between students. Artificial intelligence technology can continuously improve students' ability to use English and reduce students' loneliness. Most college students are only children. During their growth, they lack the opportunity to communicate with their peers. Therefore, teachers can use new technologies such as artificial intelligence to create a harmonious English learning environment for students and promote the development of students' healthy vision.

The school analyzes the impact of artificial intelligence technology on the public health English teaching system through statistical models. Through the analysis of different indicators in the calculation process, the analysis results of

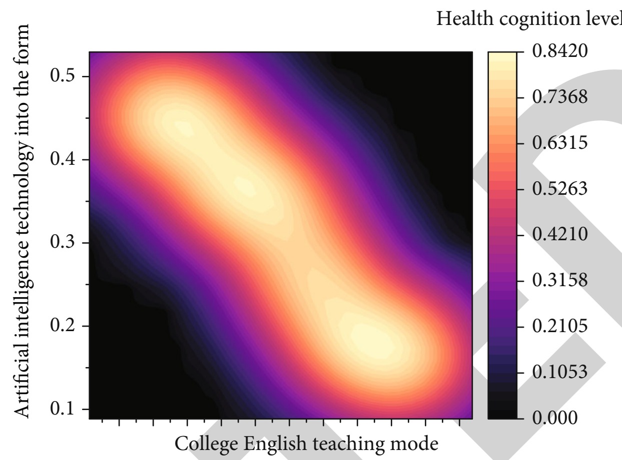

Figure 5: The effect of artificial intelligence technology on public health teaching mode.

the diversified intelligent statistical model in the current public health English teaching platform are obtained as shown in Figure 6. It can be seen from the calculation results in Figure 6 that different indicators show different development trends. Specifically, with the gradual increase of the sample, the curve corresponding to the effect of healthy English teaching first rose slowly, then gradually flattened, and finally showed an approximate linear upward trend. The learning effect of students also showed a trend of rising fluctuations. It is worth noting that the change trend of the index is basically consistent with the overall change of the teaching system. It can be seen from the change curve of BNN that the index first rises steadily, and then gradually stabilizes in two stages. This shows that the matrix change results corresponding to different indicators have different manifestations. Therefore, the above indicators can provide targeted supplementary explanations for the model analysis results.

3.3. The Path of Healthy English Teaching in Colleges and Universities Based on Artificial Intelligence Technology. In general, colleges and universities need to use artificial intelligence technology to carry out the screening of healthy English teaching content. The traditional teaching of healthy English in colleges and universities often lacks systematisms and flexibility. The content, concepts, and methods of public health education need to fully follow the development trend of the times. Through information methods such as artificial intelligence, schools can fully grasp the public health awareness and dynamics of college students. Schools can further carry out positive health behavior value education and guidance for college students. College English teaching courses need to collect as much data as possible. Colleges and universities need to optimize and upgrade the existing English teaching mode. On the one hand, artificial intelligence technology uses a large amount of structured and unstructured data collected in the information system to analyze the classroom teaching mode. On the other hand, artificial intelligence technology can also evaluate the teaching effect of

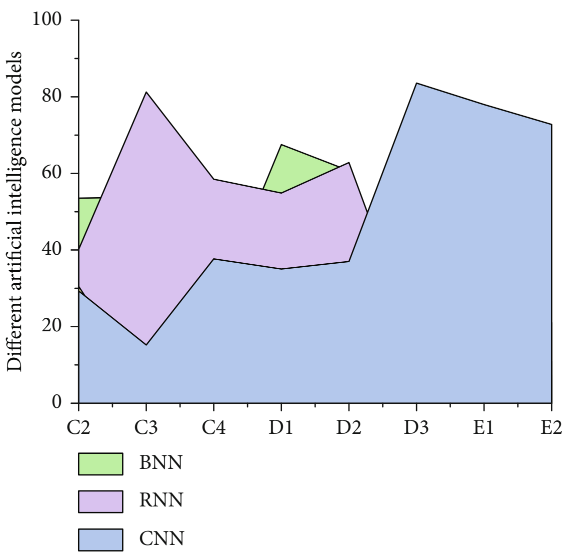

Figure 6: The influence mode of artificial intelligence technology model on public health teaching environment.

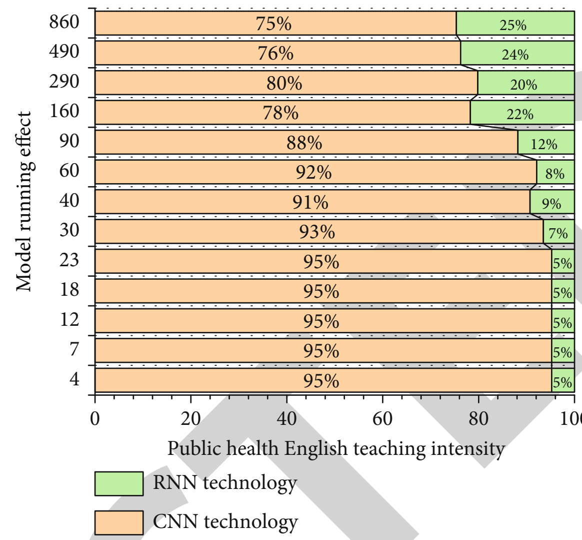

Figure 7: The analysis of the effect of different artificial technology modeling types on healthy English.

teachers and propose strategies for optimizing the teaching mode. Schools can train college students to become qualified successors to the cause of socialism with Chinese characteristics. The public health education in colleges and universities based on artificial intelligence technology should carry the mainstream ideology of the society. In the process of teaching healthy English in colleges and universities, teachers need to teach the core socialist values to students, and school education needs to reflect the value demands of students' self-growth. Schools need to carry out public health education activities in a way that is easy for college students to understand and accept.

This paper analyzes the integration of public health factors in college English teaching through mathematical statistical models. The model analysis results are shown in Figure 7. As can be seen from the results, public health elements can take many forms into statistical models. These forms include after-school reading, group education, classroom teaching, and comprehensive practice. Artificial intelligence technology pays more attention to the application of digital technology than the traditional public health English teaching content in colleges and universities. In the cluster analysis work of college English teaching work mode based on artificial intelligence technology, first of all, various events in public health English education are reasonably classified. In general, the technique can be classified according to the nature of various events. Under the background of the reform of the English teaching system in colleges and universities, public health teaching workers in colleges and universities can gain a sense of achievement, satisfaction, honor, and identity. English educators and participants in the field of public health in colleges and universities can also gain more sense of value. This technology can decompose the content of healthy English teaching in colleges and universities into different teaching areas. This paper divides the content of public health English teaching in colleges and universities into two levels. The first level is to perform cluster filtering analysis according to the main content of online English education courses. Specifically, it includes four types of classroom teaching directly related to academic content, social activities not directly related to students' interests, course cultural dissemination directly related to students' interests, and promotion of campus health concepts not directly related to students' interests. The second level is to screen and classify according to the content of online public health English teaching.

Through the statistical model, it can be found that there is a significant correlation between the teaching effect of healthy English courses in colleges and universities and the innovation of teaching tools. The model analysis results are shown in Figure 8. Specifically, the teaching effect is affected by which factors are the healthy English teaching platform, student health concept, and healthy English teaching management system. With the emergence and development of artificial intelligence technology, students' thinking mode and learning and living environment have been greatly improved. At the same time, the organizational structure of the public health English education environment in colleges and universities has also undergone certain changes. Colleges and universities need to actively explore healthy English teaching models and assessment methods based on artificial intelligence technology. For example, a pile of raw materials can only add value after being processed, packaged, and processed. This kind of path innovation is conducive to improving the timeliness of public health English education in colleges and universities. Artificial intelligence can collect complex and huge data information, and more importantly, the technology can process data.

3.4. Artificial Intelligence Technology Can Optimize the English Classroom Environment in Colleges and Universities. Artificial intelligence technology is also the guarantee for the realization of the value of healthy English

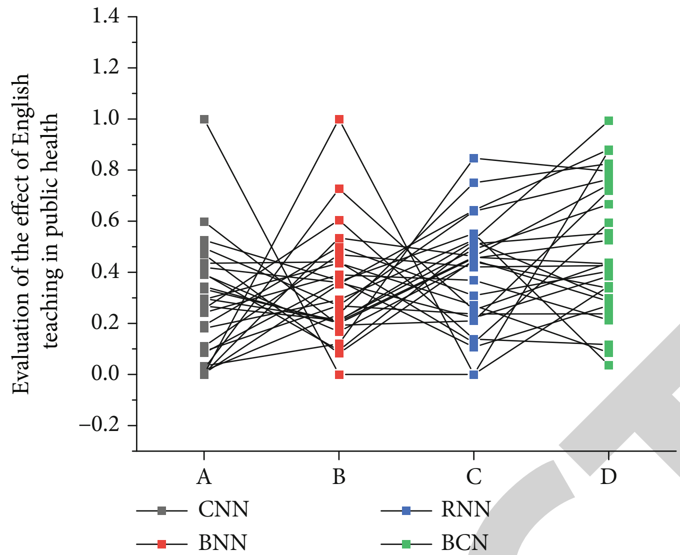

FIGURE 8: The application effect of artificial intelligence technology in college English teaching work.

teaching. Artificial intelligence technology puts forward higher requirements for healthy English teaching in colleges and universities. These contents relate to the sensibility and effectiveness of English teaching. Under the influence of artificial intelligence technology, teachers' English teaching habits and public health concepts have changed accordingly. The public health education system in colleges and universities needs to actively use artificial intelligence technology, and public health education also needs to change the traditional value dimension and implementation method. Artificial intelligence technology can enhance the pertinence and effectiveness of public health concepts in English teaching. At the same time, artificial intelligence technology has also brought severe challenges to healthy English education in colleges and universities. Public health education in colleges and universities must conform to the needs of the times and demonstrate its own value from more aspects. In terms of the intelligent perception layer, colleges and universities need to strengthen the ability of subject data collection and data analysis based on artificial intelligence technology. Through the in-depth application of artificial intelligence technology, the digital transformation and improvement of all aspects of English teaching in colleges and universities will be strengthened. In the process of English teaching in colleges and universities, artificial intelligence technology is further used to carry out the construction of virtual teaching scenarios. In the era of artificial intelligence, public health education in colleges and universities needs to pay full attention to the social goal value of students. The teaching of English courses in colleges and universities needs to continuously integrate the concept of health education, and the group of teachers also needs to actively optimize the classroom environment for English teaching in colleges and universities. Generally speaking, college administrators need to adopt more technical input in order to achieve better results in the public health English education in colleges and universities. Through the in-depth integration of artificial intelligence technology, colleges and universities have further combined online teaching with offline teaching to enhance the experience and interactivity of the teaching process. Through a good classroom environment, colleges and universities can guide students to have correct public health awareness. In the process of optimizing the English classroom environment, teachers need to regularly give students care and love. Teachers need to be patient with students with learning difficulties and psychological problems. At the same time, teachers should maintain a gentle tone and sincere expression in the daily teaching process, and constantly create a good classroom environment for students. Teachers' work can bring positive effects on students both physically and psychologically.

4. Conclusion

Artificial intelligence technology has shown its own advantages in most fields and industries. In addition to daily English teaching work, artificial intelligence technology has also shown wide applicability in the field of public health. Driven by artificial intelligence technology, the teaching environment in the field of public health in colleges and universities is also facing the impact of information technology. English education shows a trend of continuous digitization in teaching management and scientific research. Public health education will generate massive data in all aspects of teaching management. Artificial intelligence technology can refine the classification of public health education resources. Artificial intelligence technology has application channels in all aspects of English teaching in colleges and universities. Especially in the data collection and data analysis link, the key research direction of artificial intelligence technology application is to provide virtual servers required for artificial intelligence service platforms, to collect and store structured, semi-structured, and unstructured data, and to provide physical network resources and other basic support environments. The data analysis function in artificial intelligence technology will have an impact on all aspects of English teaching. Artificial intelligence is very important for the sharing of higher education resources and the construction of digital education platforms. This technology can reduce the communication cost between teachers in various colleges and universities, and reduce the time cost and economic cost of communication between students and teachers. Artificial intelligence technology has further gathered various data resources in the field of public health English teaching and further broadened the boundaries of English teaching in colleges and universities.

Artificial intelligence technology is very beneficial to the optimization of the healthy English teaching system in Chinese colleges and universities. At the same time, artificial intelligence technology has also broken through the constraints of time and space in college English teaching. This technology enables the comprehensive sharing of teaching resources among different subjects. The technology could also bring regions closer together. Artificial intelligence technology has strengthened the integration of resources among different subjects such as countries, regions, schools, and departments. The application of artificial intelligence technology makes the limitation of time and space no longer an obstacle, and the global sharing of educational resources becomes possible. Schools can use the construction of artificial intelligence technology analysis platform to strengthen the collection and analysis of different data in the process of college English teaching. The school English teaching platform can build a curriculum system that adapts to students' cognitive development level based on artificial intelligence technology. The digital education platform can provide positive feedback on teaching work and help teachers understand the learning effect of students. At the same time, the digital platform also provides teachers with an overall analysis of student performance.

Artificial intelligence technology has a greater impact on the teaching of healthy English in colleges and universities. Traditional education data reflects the macroscopic education situation, which inevitably creates an imbalance in data distribution. At this time, English teaching needs to obtain dynamic, real-time, comprehensive, and reliable data content. Artificial intelligence technology can make up for the shortcomings of traditional education methods. For example, artificial intelligence technology can provide dynamic feedback on how well a student population understands public health. The computer uses these data to make a comprehensive evaluation taking into account students' English learning level, students' age characteristics, and students' educational level. Schools can better reflect rationality and fairness when integrating educational resources.

Through the continuous evolution of artificial intelligence technology, it can have a greater impact on many industries in the future. The application direction of artificial intelligence technology in English teaching is diversified. Artificial intelligence has a broad application space in colleges and universities. This technology will become the cutting-edge technology of English teaching innovation in the future. Institutions of higher learning are keen to carry out technological innovation and intelligent creation. Colleges and universities are places with extremely rich information resources. In today's era of rapid development of artificial intelligence, colleges and universities share teaching resources in a centralized manner and maximize the benefits of educational effects through rational allocation of English teaching resources. Artificial intelligence technology can effectively manage and configure the school's information resources. The technology can help the scientific development of English teaching for public health in schools. Artificial intelligence technology can promote education reform and improve the quality of higher education in public health education in colleges and universities. At the same time, colleges and universities can fully meet the needs of students for the application of artificial intelligence technology and help colleges and universities achieve their own strategic goals.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The author declares that there is no conflicts of interest.

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Retraction

Retracted: Evaluation Method of Public Physical Training Quality Based on Global Topology Optimization Deep Learning Model

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] J. Yan, "Evaluation Method of Public Physical Training Quality Based on Global Topology Optimization Deep Learning Model," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4043876, 10 pages, 2022.

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Research Article

Evaluation Method of Public Physical Training Quality Based on Global Topology Optimization Deep Learning Model

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In the quality evaluation of public sports training, the selected indicators are not comprehensive, resulting in some errors in the results of quality evaluation. Therefore, this paper designs a public sports training quality evaluation method based on the deep learning model of global topology optimization. Determine the basic principles of public sports training quality evaluation, determine the human coordinate points of public sports training by determining the basic section and basic axis of human training, and extract the data of public sports training quality evaluation. On this basis, quantify the public sports training quality evaluation index, construct the evaluation matrix, calculate the weight of the evaluation index, and determine the importance of the public sports training quality evaluation index. Preprocess the public sports training quality evaluation index set, search the optimal fitness value in the global topology optimization depth learning model, introduce the global topology optimization depth learning model, input the evaluation index and output the evaluation quality results, and realize the quality evaluation of public sports training. The experimental results show that the evaluation method in this paper can improve the accuracy of the evaluation results and is feasible.

1. Introduction

With the rapid development of the social economy, people's living standards are also improving, but people's physical fitness has been declining year by year. The emergence of this phenomenon makes people feel very surprising but also caused widespread concern from all walks of life. An important reason for the decline of people's physical quality is the lack of physical exercise [1]. Obesity, weakness, and other problems one after another become major obstacles to health. In the long run, the physical condition of the masses will eventually become an important issue affecting the development of the national physical condition. In order to promote the healthy development of the human body and improve the level of physical health, a large number of human and material resources are invested to organize and implement physical health tests [2]. However, in reality, these efforts have not achieved the expected effect, and instead, the resulting evaluation based on "physical health level" leads to social cognition deviation, false reported data of physical health tests, and many other problems [3]. Therefore, it is urgent to enrich and perfect the evaluation index system of mass sports fitness in China, whether from the needs of the times of sports fitness or from the needs of the country to promote the rapid development of sports fitness. The quality assessment of public sports training is to test the quality effect of public sports and is also an effective way to regulate the process of sports training [4]. It conducts a comprehensive and effective evaluation of the quality and process of public sports training, finds out problems in the process of public sports training, and promotes the further development of public sports training [5]. The significance of teacher training quality evaluation in traditional schools lies in the investigation of the basic situation and effectiveness of training work and the summary of experience through evaluation, so as to further improve training work and improve training effectiveness [6]. Therefore, it is of great significance to evaluate the quality of public physical training.

Therefore, relevant researchers have conducted a lot of research and achieved some results. Reference [7] proposed a method of physical education quality evaluation based on integration. Through the methods of literature research, interview, and field investigation, this paper explores the current evaluation of physical education quality, focuses on the analysis of theoretical research and practical needs, repositions from an integrated perspective, constructs a multiclassification system of physical education quality, and focuses on the real content of school physical education quality evaluation. The evaluation of physical education academic quality focuses on knowledge, ability, action, and health and systematically studies the respective evaluation points and the key points that should be grasped in the systematic setting of physical education quality evaluation standard. However, this method is more theoretical than practical. Reference [8] proposed an evaluation method of public sports service supply level from the perspective of basic public service equalization. The method used the entropy method to evaluate the single factor supply level and the comprehensive level of public sports service supply and used the exploratory spatial data analysis method to analyze the spatial distribution characteristics of the comprehensive level and single factor supply level of public sports service in China. The results show that this method can effectively evaluate public service facilities, but it cannot directly evaluate the quality of public sports training, and the results obtained are not practical. Reference [9] proposed an IPA-BASED public sports service quality evaluation model research. This method uses mathematical statistics and logical analysis method and IPA analysis method to design the evaluation model of public sports service quality and takes a certain national fitness center as the empirical object to test, in order to explore the path for the continuous improvement of public sports service quality in China. In this study, the public sports service quality evaluation scale covers five dimensions: availability, facility quality, health status, staff quality, and cost performance, with a total of 30 evaluation indicators. A total of 343 valid questionnaires were collected through the empirical test, which were reasonable in reliability and validity and suitable for quality evaluation. According to the coordinate region where the index evaluation results are located, the method can find problems and put forward improvement countermeasures for the national fitness center. IPA analysis method is suitable for the practical needs of public sports service quality evaluation in China and can be popularized and applied in a wider range. However, it needs to be improved by itself and further promoted with the integration of other quality management tools. Reference [10] proposed a public sports service quality evaluation method for large stadiums based on public perception. Based on the perspective of public perception and the modified SERVQUAL model, this method constructed the evaluation index system of public sports service quality in large stadiums and gymnasiums. Taking 2,685 valid questionnaires as sample data, the empirical research on the public sports service quality of 5 large stadiums in Hubei province is carried out by using AHP, fuzzy comprehensive evaluation, and TOPSIS method. However, this method has few indicators for sports training, so it is difficult to get accurate evaluation results.

Aiming at the problems in the above methods, this paper designs a new public sports training quality evaluation method based on the global topology optimization deep learning model. By determining the basic criteria for the quality evaluation of public sports training, the effectiveness of evaluation is improved; the quality data of public sports training is extracted; the quality evaluation indicators of public sports training are constructed; the indicators are normalized; and the quality evaluation of public sports training is realized by using the global topology optimization deep learning model. The results show that the proposed method can effectively improve the accuracy of the evaluation results and has certain feasibility.

2. Evaluation Principles and Index System Construction of Public Sports Training Quality

2.1. Principles of Public Sports Training Quality Evaluation

2.1.1. Principle of Subjectivity. The principle of subjectivity means that the responsible subject must be clear in the quality evaluation of public sports training. Students are the main body of public sports training quality evaluation. In the process of evaluation, we should enhance the consciousness of the quality subject. The construction of the evaluation system should fully consider the main role of students, establish and improve the quality evaluation system, and improve the evaluation quality. Give play to the main role and continue to improve the quality of public sports training.

2.1.2. Objective Principle. The goal principle means that the quality system of public sports training should be consistent with the training purpose. The ultimate goal is to improve the quality of public sports training [11]. The objective principle requires the evaluation to pay attention to the establishment, guarantee, and implementation of project objectives.

2.1.3. Systematic Principle. The systematic principle refers to that all parts of the quality evaluation of public sports training are interrelated and interactive. To give full play to the overall advantages of evaluation, we must proceed from the whole and deal with it comprehensively. The part is the constituent element of the whole. The part should obey the whole. Any decision should not violate the overall goal of strategic decision-making.

2.1.4. Scientific Principle. The scientific principle refers to the construction of public sports training quality evaluation system to select the most characteristic and representative influence factors, select the most widely used index and the best response system on the basis of scientific research, optimize it to the simplest and best, and form the most scientific index system [12].

2.1.5. Principle of Feasibility. The principle of feasibility means that the scheme chosen in the construction of public sports training quality evaluation system cannot exceed the subjective and objective conditions. First of all, the evaluation index can use the corresponding sentences to explain its contents, get the corresponding data through the corresponding measurement tools and draw a clear conclusion, and use the principle of quantitative index measurement as the main and qualitative index measurement as the auxiliary. Therefore, based on the scientific demonstration of various possible schemes, we should pursue the simplicity of scheme implementation.

2.2. Data Extraction of Public Sports Training Quality Evaluation. In order to realize the effective evaluation of public sports training quality, it is necessary to clarify the relevant data of public sports training quality evaluation, that is, it is necessary to extract the data on human public sports training quality [13]. In order to facilitate the description and analysis of public sports, the basic plane and basic axis of the human body are usually defined in the standard upright position, as shown in Figure 1.

The basic plane of the human body includes sagittal, coronal, and horizontal planes, which are perpendicular to each other. Among them, the sagittal plane is a vertical section in the fore-and-aft direction, which divides the body into left and right parts along the fore-and-aft direction of the human body; coronal plane, also known as the frontal plane, is a vertical section in the left and right directions and divides the body into front and back parts along the left and right directions of the human body; and horizontal plane, also known as cross-section, is parallel to the ground and divides the body into upper and lower parts. The basic axes of the human body include sagittal, coronal, and vertical axes, which are perpendicular to each other [14]. Taking different basic axes of the human body as the tangent point, the relevant data on public sports training quality are determined. In human training data extraction, the relevant motion information data is extracted with the help of a camera. First, the five-parameter model of a linear camera is determined as follows:

$$\begin{bmatrix} \bar{a} \\ \bar{b} \\ 1 \end{bmatrix} = p_i \begin{bmatrix} \dfrac{a_c}{z_c} \\ \dfrac{b_c}{z_c} \\ 1 \end{bmatrix} = \begin{bmatrix} f_x & f_s & u_0 \\ 0 & f_y & v_0 \\ 1 & 1 & 0 \end{bmatrix}. \quad (1)$$

The matrix p_i is the internal parameter matrix under the linear model of the camera, making two sets of translation movements in three-dimensional space and controlling the attitude of the camera for self-calibration; (f_x, f_y) is the magnification coefficient of the image plane in the X-axis

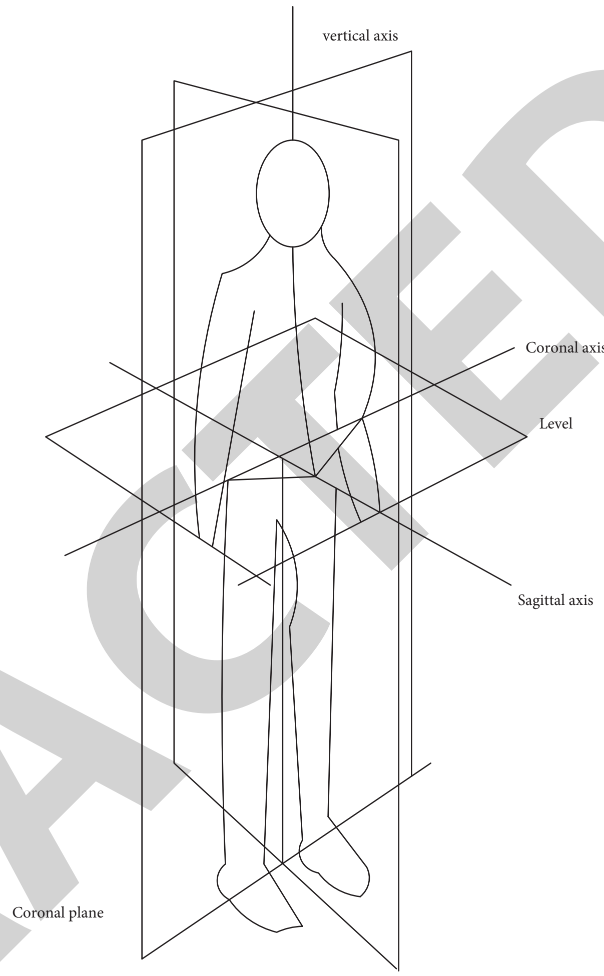

Figure 1: Schematic diagram of basic section and basic axis of the human body.

direction and the Y-axis direction: (u_0, v_0). Main point coordinate: f_s is the coupling amplification coefficient when the X-axis and the Y-axis are not perpendicular;

The nonlinear model formula of the camera for extracting human training data is then determined as follows:

$$\begin{cases} \bar{a} = a + D_a(a, b), \\ \bar{b} = b + D_b(a, b), \end{cases} \quad (2)$$

where $(\bar{a}, \bar{b})$ is the human training image point coordinate under the linear model, (a, b) is the actual human training image point coordinate, and (D_a, D_b) represents the nonlinear distortion value.

The nonlinear model camera imaging of the same target training point at multiple different human training viewpoints is set to $S^{(0)}, S^{(1)}, \ldots, S^{(n)}$, and the feature matching point in the extracted human training is set to

$$\left(S_j^{(i)}, S_i^{(i)}, 1\right) \in S^{(i)}, \quad i = 1, 2, 3 \ldots n. \quad (3)$$

According to the determined characteristic matching points in human training, the training movement coordinates of different points in human training are determined as follows:

$$\begin{cases} \overline{x_j}^{(i)} = x_j^{(i)} + S_x\left(x_j^{(i)}, y_j^{(i)}\right) \\ \overline{y_j}^{(i)} = y_j^{(i)} + S_y\left(x_j^{(i)}, y_j^{(i)}\right) \end{cases}, \quad i = 1, 2, 3, \ldots \tag{4}$$

Finally, matching human training points in public sports training and extracting public sports training quality assessment data requires a series of processing of images acquired by two cameras set side by side, and obtaining depth information, which has very important applications in robot navigation, three-dimensional reconstruction, and other fields. The stereo matching assumes that two cameras are identical and the optical axes are parallel with only lateral displacement between cameras. In the paired images, the pole line is parallel to the x-axis, and and horizontal state is maintained [15]. Since a completely ideal stereo camera configuration is difficult to achieve, feature detection, description, and sparse feature matching are required, that is, stereo correction to meet the assumed conditions of stereo matching. Here, feature detection is used to identify more obvious visual features that recur in multiple views. Such sparse features require a corresponding feature description for matching so that feature detection allows images from cameras with different viewpoints and different parameters. Get

$$E(p,q) = \exp\left(-\frac{\Delta_c(I_0(p), I_0(q)}{\gamma_c} - \frac{\Delta_g(p,q)}{\gamma_g}\right), \tag{5}$$

where $E(p,q)$ is human training points in public sports training, γ represents the weight value of stereo matching, and g represents the similarity value of sports training data.

In the process of extracting public sports training quality evaluation data, the basic section and basic axis of human training are determined, the human coordinate points of public sports training are determined through the five parameter model, and the evaluation of public sports training quality evaluation data is completed through three-dimensional matching and coefficient characteristics. Based on the relevant data of evaluation, it is convenient to carry out subsequent research.

2.3. Construction of Public Sports Training Quality Evaluation System, That Is, Quantitative Research on Indicators. Based on the data extraction of public sports training quality evaluation, this paper takes these data as the research object to construct indicators and quantify them. First, build a public sports training quality evaluation system. The establishment of public sports training quality evaluation index system needs to be based on the guiding ideology and working principles of the evaluation work. In addition to considering the main characteristics of the training project, it should also be combined with the project characteristics and various qualities and abilities that teachers should have [16]. This paper classifies and analyzes the factors affecting the public sports training quality evaluation system and the professional characteristics of teachers and, combined with expert interview opinions, divides the factors affecting the public sports training quality into four major aspects, namely the first-class indicators of the evaluation system: training resources, training scheme, training process, and training effect. See Figure 2 for details.

For the evaluation of public sports training quality, there are many influencing factors. Therefore, in the evaluation of public sports training quality, it has a certain fuzzy attribute, which is a more important part of the evaluation results. Therefore, this paper will introduce the combination of the fuzzy comprehensive evaluation method and the deep data mining method to determine the membership of the evaluation index of public sports training quality [17].

To quantify the evaluation indexes of public sports training quality through the fuzzy comprehensive evaluation method, it is necessary to construct the influencing factor set, evaluation set, and membership degree of relevant influencing factors of public sports training quality evaluation indexes. The influencing factor set of evaluation indexes is as follows.

Then, we construct the membership subset of the public sports training quality evaluation indicators, namely

$$\begin{aligned} L_i &= \{l_{i1}, l_{i2}, l_{i3}, \ldots l_{\text{in}}\}, \\ V_i &= \{v_{i1}, v_{i2}, v_{i3}, \ldots v_{\text{im}}\}, \end{aligned} \tag{6}$$

where L_i, V_i represents the specific membership set corresponding to the first index (or the teaching performance of a certain subject) corresponding to the related evaluation index of public sports training quality. At this time, the membership calculation formula of the specific public sports training quality evaluation index is as follows:

$$F_{(L_i,V_i)} = \frac{P_i}{q_i}, \tag{7}$$

where the value range of the lower angle mark is 1,2, ... P_i is used for the specific index level and q_i is used to represent the total number of participants participating in the public sports training quality evaluation.

After the scalarization of the above public sports training quality evaluation index, the weight calculation of the evaluation index is needed. The evaluation matrix is represented as W. The above evaluation indexes all have a subset of evaluation membership; all influencing factors are set as one; and the evaluation matrix of the evaluation index is constructed in the feasible domain of influence factors [18]. The membership value of the evaluation index of public sports training quality is obtained by normalization processing [19]. The calculation process is as follows:

$$W = \begin{Bmatrix} w_{11} & w_{12} & \ldots & w_{1n} \\ w_{22} & w_{22} & \ldots & w_{2n} \\ \ldots & & & \\ w_{n1} & w_{n2} & \ldots & w_{nn} \end{Bmatrix}. \tag{8}$$

In order to improve the accuracy of the public sports training quality evaluation index, the membership degree and the evaluation membership degree value are calculated repeatedly to obtain the evaluation value of the impact index. The quantitative evaluation index of public sports training quality is obtained, and the fuzzy comprehensive evaluation results are as follows:

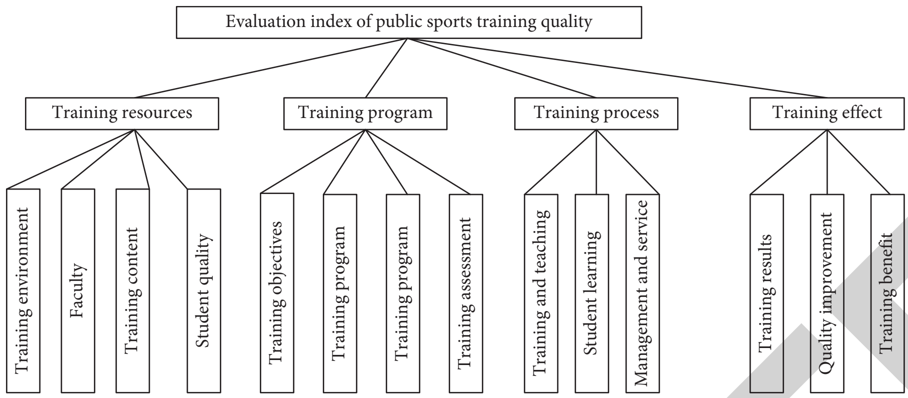

Figure 2: Schematic diagram of public sports training quality evaluation index system.

$$S \times W = (S_1, S_2, \ldots S_N)\begin{bmatrix} w_1 \\ w_2 \\ \cdots \\ w_3 \end{bmatrix}. \tag{9}$$

At the same time, the effectiveness of the evaluation is improved according to this result. The quantitative process of public sports training quality evaluation indicators is shown in Figure 3:

In the quantification of public sports training quality evaluation indicators, the public sports training quality evaluation indicators are quantified by the combination of a fuzzy comprehensive evaluation method and deep data mining method. On this basis, the evaluation matrix is constructed to calculate the weight of evaluation indicators and determine the importance of public sports training quality evaluation indicators, so as to lay a foundation for follow-up research.

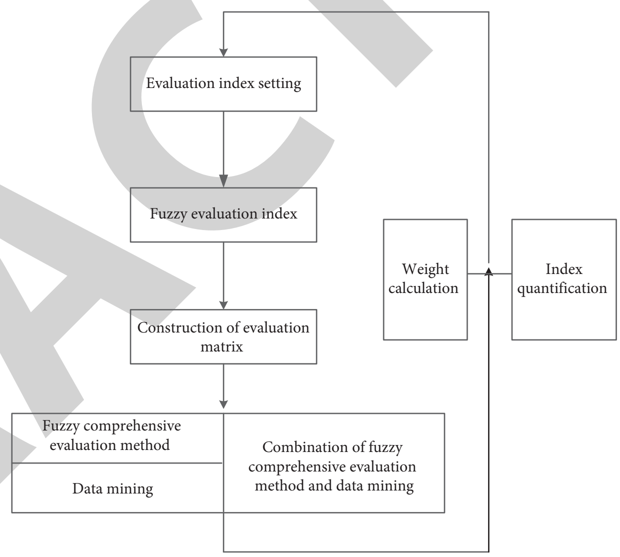

Figure 3: Quantitative process of public sports training quality evaluation index.

3. Implementation of Public Sports Training Quality Evaluation Based on Global Topology Optimization and Deep Learning Model

Public physical training quality evaluation is the measurement, analysis, and evaluation of the quality of physical education teaching. It takes the process and results of the organic combination of teaching objectives, teaching contents, teaching methods, and other factors involved in teaching activities as the evaluation object. It is the evaluation of the overall function of teaching activities. It is assumed that the evaluation of public physical education training and teaching mainly includes the evaluation of students' physical education academic achievement and the evaluation of physical education curriculum teaching quality. In the comprehensive evaluation of the teaching quality of public physical education in colleges and universities, we should determine the elements of evaluation and the specific evaluation contents scientifically and reasonably. In other words, a physical education teaching quality evaluation system should be determined. The evaluation index is the basic unit of the evaluation system and a relatively fixed parameter.

Based on the evaluation index system and quantification of public sports training quality, this paper designs an evaluation algorithm based on global topology optimization deep learning model to achieve the goal of this paper. Deep learning is a new research direction in the field of machine learning. It is introduced into machine learning to make it closer to the original goal: artificial intelligence. Deep learning is the internal law and representation level of learning sample data. The information obtained in the learning process is very helpful to the interpretation of data such as text, images, and sound. Its ultimate goal is to make the machine have the ability to analyze and learn like human beings and can recognize characters, images, sounds, and other data. Topology optimization is a branch of structure optimization. Structural optimization design was developed in the 1960s. It combines engineering design problems with mathematical optimization methods and produces a method that can solve the optimal engineering problems. According to the different variables of structural topology optimization design, the structural optimization design can be divided into three parts: size optimization, shape optimization, and topology optimization [20]. Among the three, topology optimization is the most challenging and practical direction in the current optimization design methods. This structure combines with a deep learning algorithm to form a more advanced training algorithm. Therefore, this paper adopts the global topology optimization depth learning model to realize the quality evaluation of public sports training [21]. The basic structure of the global topology optimization deep learning model is shown in Figure 4:

The global topology optimization depth learning model is composed of two dense connection layers and four transposed convolution layers. Its output result is the quantitative index data of public sports training quality evaluation obtained above, and the obtained result is the research result [22].

According to the global topology optimization depth learning model set above, determine the state of quantitative indicators for public sports training quality evaluation and effectively evaluate the quality of public sports training [23]. The specific process of public sports training quality evaluation is as follows:

Step 1. Through the global topology optimization, the smoothing factor in the neural network in the deep learning model is the optimization goal, and the optimal model of index evaluation is constructed [24]. Set and initialize the evaluation index data of public sports training quality as follows:

$$T = \{t_i, i = 1, 2 \ldots n\}. \tag{10}$$

The public sports training quality evaluation index is divided into a training set and a test set defined as follows:

$$\begin{aligned} T_{\text{train}} &= \{t_1, t_2, \ldots t_n\}, \\ T_{\text{test}} &= \{t_{m+1}, t_{m+2}, t_m\} m < n. \end{aligned} \tag{11}$$

Then, according to the division of the training set, the zero mean standardization method is used to preprocess the public sports training quality evaluation index set, and the following results are obtained [25]:

$$T'_{\text{train}} = \frac{t_t - \sum_{t=1}^{m} t_t/m}{\sqrt{\sum_{t=1}^{m} \left(t_t - \sum_{t=1}^{m} t_t/m\right)^2/m}}. \tag{12}$$

Step 2. Initialize the parameters of the preprocessed training set and randomly generate the initial neurons according to the size [26], location, and population size of neurons in the global topology optimization deep learning model. The neuron set is obtained as follows:

$$C = \left|c_1, c_2, \ldots c_n\right|. \tag{13}$$

Step 3. Calculate the fitness value by integrating constraints and fitness function according to the randomly generated initial neuron set as follows:

$$Z = \frac{T'_{\text{train}}}{1 + C}. \tag{14}$$

Step 4. According to the calculated fitness value, search for the optimal fitness value in the global topology optimization deep learning model, that is, y_i, the minimum error value erro_i between the actual quality value β_i and the public sports training quality evaluation index at i time from the prediction starting point, whose expression is as follows:

$$\text{erro}_i = \frac{1}{n} \sum_{i=1}^{n} \frac{\left|\beta_i - y_i\right|}{y_i} \times 100\%. \tag{15}$$

Step 5. Check the conditions for exiting the program to reach the maximum number of iterations or meet the convergence accuracy. If so, output the best result.

Step 6. Update the speed and position of neurons according to the current overall fitness value and individual fitness value.

Step 7. Use the modified linear unit to obtain the construction operation function, that is,

$$\eta_{i+1} = \max\left(0, v_i \times k_{i+1} + v_j\right), \tag{16}$$

where k_{i+1} describes the evaluation index value obtained when the model network layer, t_i describes the weight value obtained when the convolutional layer is used, and v_j describes the deep learning network bias parameter, represents the maximum extreme of the running function, and selects the maximum extreme method.

$$k_{i+1} = \max y_i. \tag{17}$$

Step 8. Extract the optimal value obtained from the model and use the optimal parameters to establish a global topology optimization depth learning model as follows:

$$R\left[g^2\right] = \varphi R\left[g^2\right]_{t+1} + z(1 - \varphi)\beta_i, \tag{18}$$

where z represents the gradient at time t and φ represents the coefficient of the expected value of g^2.

Step 9. Enter the training sample data into the global topology optimization deep learning model to train the model. Input the test data into the trained model, output the evaluation quality results in the output layer P, and complete the quality evaluation of public sports training as follows:

$$U_P = R\left[g^2\right]_t h, \tag{19}$$

where U_p represents the state of the neural network memory module and h represents the output of the memory module.

In the implementation of public sports training quality evaluation, the zero mean standardization method is used to preprocess the public sports training quality evaluation

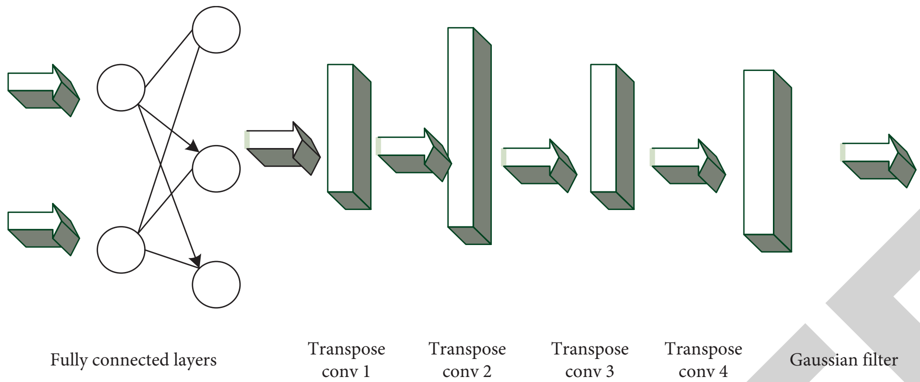

Figure 4: Basic structure of global topology optimization deep learning model.

index set, search for the optimal fitness value in the global topology optimization deep learning model, introduce the global topology optimization deep learning model, input the evaluation index, and output the evaluation quality results.

4. Experimental Analysis

4.1. Experimental Environment and Parameter Setting. The algorithm design in this experiment is based on the framework of PyTorch 1.2.0, Ubuntu 18.04 system, and two Titan-RTX 16g graphics cards. The network of global topology optimization deep learning model was trained for 50 times of generation selection, and the learning rate of different iterations was changed 0.2 for iteration 1, 0.01 for iteration 60, 0.001 for iteration 80, and 0.0001 for generation 100, and the batch size was set to 1. In the process of public sports training, the samples of full marks of test actions in training data sets are input into the conditional network for training, and various test action template information (feature layer parameters at the last layer of the network) is obtained. Then, this information is used as conditional input, and the score category prediction network is separately trained. The second method is to input all test action samples in the training set into the conditional network for training without screening and then train the score category prediction network separately. In the experiment, students of a physical education major class in a university were selected as the research object. There were 50 middle school students in the class, and 30 students were randomly selected as the experimental object. Experimental analysis was conducted on the public physical education training programs, teaching contents, and training effects of this major in our school. Thirty people were divided into two groups: one for the experimental group and the other for the control group. The environment and conditions in the experiment were consistent, and the error value of the evaluation was reduced. The schematic diagram of the training objectives of specific experimental subjects was shown in Figure 5.

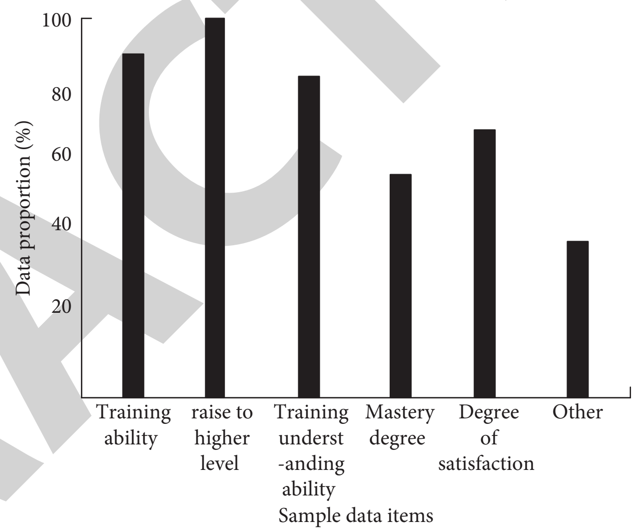

Figure 5: Schematic diagram of public sports training objectives of experimental subjects.

4.2. Analysis of Experimental Results. Based on the set experimental environment and relevant parameters, an effective evaluation of the quality of public sports training is carried out. In the experiment, the satisfaction of 30 people in training is investigated to determine whether the selection of experimental indicators determined by this method meets the wishes of the tester. According to the evaluation index of teaching quality of public physical training courses in Table 1, the quality of public physical training is studied.

Based on the contents of Table 1, the statistical results of training quality satisfaction of sample objects are shown in Table 2.

It can be seen from Table 2 that in addition to the objective and realistic conditions, the subjective feelings of the students are also an important basis for evaluation. Students are also the audience, and their satisfaction with public sports training is a direct reflection of the training quality. As can be seen from the data in Table 2, the training facilities have the highest satisfaction level, with the basic satisfaction level above 70%, from which it can be seen that the evaluation indicators selected in this paper have certain feasibility.

In order to further highlight the effectiveness of this method, the experiment compares the accuracy of the sample public sports training quality data evaluation by comparing this method, reference [7] method, and

Table 1: Evaluation indicators of teaching quality of public physical training courses.

Index	Content	Evaluation grade	Weight
Content of courses	Whether it is in line with students' reality and pays attention to students' personality development	Excellent	0.098
Teaching attitude	Prepare before class, communicate with teachers and students in class, and answer patiently after class	Excellent	0.092
Teaching method	Explain clearly, stimulate students' interest in sports, and mobilize students' learning enthusiasm	Excellent	0.096
Teaching effectiveness	Whether the lectures are vivid and attractive so that students' subjectivity can be brought into play	Excellent	0.095

Table 2: Statistical results of training quality satisfaction of sample objects (%).

Index	Very satisfied	Satisfied	Commonly	Unsatisfied	Very dissatisfied
Training facilities	62.12	30.14	4.56	3.18	0
Training resources	42.25	32.54	9.63	15.58	0
Training conditions	43.21	33.69	4.21	18.89	0
Dietary conditions	52.14	32.14	5.23	10.49	0
Training content	59.63	26.52	5.21	8.62	0
Training effect	54.32	32.14	4.96	8.58	0

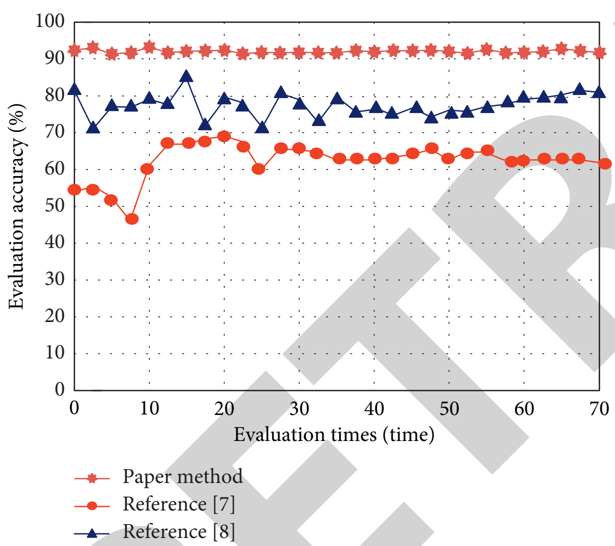

Figure 6: Accuracy analysis of public sports training quality data evaluation with different methods.

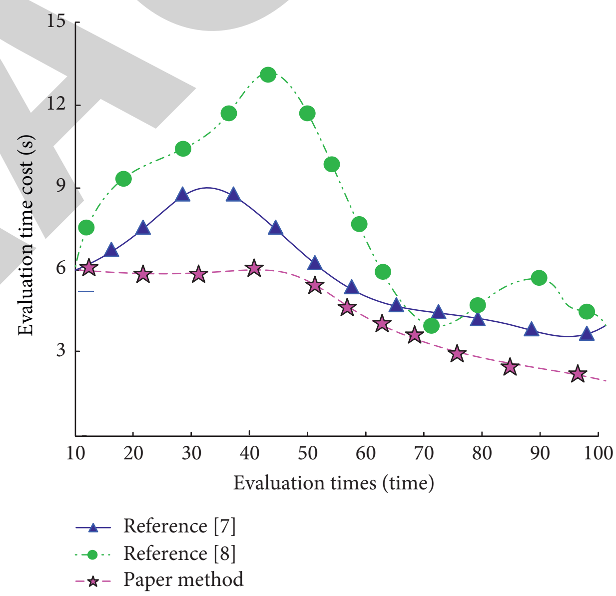

Figure 7: Comparison of time cost assessed by different methods.

reference [8] method many times and measures the accuracy results of the three methods on the sample public sports training quality data evaluation. The results are shown in Figure 6.

By analyzing the experimental results in Figure 6, it can be seen that there are some differences in the accuracy of sample public sports training quality data evaluation by using the methods of this paper, reference [7], and reference [8]. Among them, the accuracy of this method in the evaluation of sample public sports training quality data is higher than the other two methods, and the performance is always relatively stable, higher than 90%, while the evaluation accuracy of the other two methods is lower than that of this method. Therefore, it can be seen that the evaluation effect of this method is better.

On the basis of ensuring the accuracy of the above sample public sports training quality data evaluation, the experiment further verified the time cost of this method, reference [7] method, and reference [8] method for the sample public sports training quality data evaluation. The results are shown in Figure 7.

By analyzing the experimental results in Figure 7, it can be seen that there are some differences in the time cost of evaluating the sample public sports training quality data by using the methods of this paper, reference [7], and reference [8]. Among them, from the trend of the curve, the evaluation time of this method is shorter, while the evaluation time of the other two methods is longer. In contrast, the evaluation speed of this method is faster, which verifies the effectiveness of this method.

5. Conclusion

This paper designs a public sports training quality evaluation method based on the global topology optimization depth learning model. Determine the basic principles of public sports training quality evaluation, determine the basic section and basic axis of human training, use the linear camera to determine the human coordinate points of public sports training through the five parameter model, and complete the data extraction of public sports training quality evaluation through three-dimensional matching and coefficient characteristics. On this basis, through the combination of fuzzy comprehensive evaluation method and deep data mining method, the evaluation indexes of public sports training quality are quantified. On this basis, the evaluation matrix is constructed to calculate the weight of the evaluation indexes and determine the importance of the evaluation indexes of public sports training quality. The zero mean standardization method is used to preprocess the public sports training quality evaluation index set, search the optimal fitness value in the global topology optimization deep learning model, introduce the global topology optimization deep learning model, input the evaluation index and output the evaluation quality results, and realize the quality evaluation of public sports training. Although this paper has improved the evaluation accuracy in this study, the evaluation indicators are still incomplete. In the next step, I will continue to explore the evaluation indicators to improve the shortcomings of this method.

Data Availability

The raw data supporting the conclusions of this article will be made available by the author, without undue reservation.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding this work.

Acknowledgments

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Research Article

The Influence of Traditional Culture Integration into Chinese Language and Literature Teaching on the Improvement of Mental Health of College Students

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Contemporary college students not only face the pressure brought by their studies but also bear the pressure brought by society and their families. Helping college students correctly understand their mental health and effectively solve their' mental health diseases has become an important issue in education research. The cultivation of healthy psychological quality is inseparable from the cultivation of a humanistic spirit. Therefore, integrating excellent traditional culture into Chinese language and literature teaching and research and giving full play to and inheriting the educational role of excellent traditional culture can not only improve the literary quality of college students and benefit the construction of healthy mental of college students. The main purpose of this research is to analyze the effect of Chinese excellent traditional culture on the cultivation of college students' mental health, analyze the impact of traditional culture integration into Chinese language and literature teaching research on improving college students' mental health, and propose the valuable suggestion for integration of excellent traditional culture into Chinese language and literature teaching research. Firstly, we analyze the benefits of integrating traditional culture in literature to the construction of college students' healthy psychology; then, the current deficiencies of literature education are analyzed; next, through literature analysis and summary, the main factors affecting the mental health of college students were found and the importance of these factors was evaluated by questionnaire survey and mathematical statistics methods; finally, targeted opinions and suggestions are put forward. This research provides guidance and reference for inheriting excellent national culture through literature education and constructing university health psychology in the future.

1. Introduction

The rapid social and economic development and the gradual improvement of people's living standards have provided contemporary college students with a broad development platform and bright prospects but also brought them certain temptations and challenges [1, 2]. Contemporary college students are in an important period of growth, and their physiology and psychology are not yet fully mature [3, 4]. Although they are optimistic and cheerful, love life, and have a strong sense of responsibility to the society, psychological imbalance and moral anomie often appear in them [5]. It has become an urgent problem to be solved in the mental health education of college students [6, 7]. Although China's understanding of college students' mental health education has gradually deepened over the past ten years and the practice has been continuously strengthened, the current situation shows that mental health education has little effect. The future world belongs to young college students, and college students are responsible for national revitalization and national prosperity. In the construction of socialist modernization, while educating college students on patriotism and professional knowledge, inherit and carry forward the spirit of China's excellent traditional culture, learn from its moral education methods, has significant theoretical and practical significance for college students form socialist core values and life for college students under the conditions of a market economy [8, 9]. Only by identifying, affirming, and confident with the unique advantages, immortal charm, and values of our traditional culture can we be confident in the system, theory, and path of socialism with Chinese characteristics, and we can internalize the core socialist values in our hearts and actions [10]. Cultural self-confidence is the premise and support of institutional self-confidence, theoretical self-confidence, and road self-confidence [11, 12]. Under this background, colleges and universities, which shoulder the major task of cultivating morality and building talents, should vigorously carry forward Chinese traditional culture and fully tap the rich resources of traditional culture. The spirit of China's excellent traditional culture belongs to the positive and positive part of traditional culture and is the essence and core of traditional culture. Inheriting and developing Chinese traditional culture will surely inherit and develop the spirit of excellent traditional culture [13, 14].

Although the mental health education of college students in our country develops rapidly and has many research achievements, in the process of its development, it is generally guided by mature western psychological theories [15, 16]. China is a big country of cultural development, and there are rich mental health education ideas in traditional culture, which have a good guiding role in the construction of positive and healthy college students' psychology. The construction of healthy psychology for local college students should be based on the fundamentals of China [17]. Although mature Western psychological theories have provided a favorable reference for my country's mental health education, there are still some shortcomings, which have led to the current lack of mental health education [18, 19]. The actual effect is not ideal, and it cannot really penetrate the hearts of students. In order to really improve the effectiveness of college students' mental health education and play its important role, it is very necessary to carry out innovative research on it and to apply the essence of traditional culture [20]. Only innovation can promote the better development of mental health education, and only based on traditional culture can it improve its pertinence and effectiveness [21]. During five thousand years of historical development, China has formed a broad and profound excellent culture, which contains rich philosophical thoughts, humanistic spirit, moral concepts, and value orientations. Buddhism, Taoism, and Confucianism, as the three main bodies of traditional culture, are widely accepted and inherited by people; they contain the main traditional thoughts and culture that have been circulated in China for 5000 years, covering a large number of historical and cultural common sense, historical allusions, and philosophical truths. Extracting and learning from the excellent ideas will not only help us enhance national cohesion and national pride but also help us cultivate our virtues and realization of the value of life. Confucianism advocates self-cultivation, family order, governance of the country, and peace in the world. Self-cultivation is the foundation of everything and advocates people to be proactive and make achievements [22]. Taoism advocates letting nature go with the flow, ruling by inaction, advocating safety and duty, indifference to fame and fortune, and attaching importance to the harmony between man and nature. Buddhists advocate loving all beings, selfless devotion, refraining from doing evil, practicing all kindness, abiding by the Ten Commandments, having peace of mind, and using wisdom [23]. Although their ideological emphases are different, their inner thoughts are the same, and they all take people as the starting point to realize the meaning of life [24]. And since the Tang Dynasty, there has been a theory of the unity of three religions, so this research will use the excellent qualities mentioned, such as loyalty, filial piety, courtesy, and honesty, in various traditional Chinese cultures as the representative of traditional culture for research.

A university is a place where ideas meet and where people are cultivated. Universities should also be a place for people to think about the meaning of human existence and the true meaning of learning, and the places and platforms that universities can provide for this should at least include literary education and research [25, 26]. At present, Chinese language and literature occupy an important position in our current various learning subjects, and it is also an important carrier of quality education at this stage [27]. By learning the Chinese language, one can deeply perceive the traditional culture of the Chinese nation and absorb a more profound national spirit [28, 29]. On the basis of the ideological value and humanistic feelings of our ancestors, actively absorbing advanced ideas has important guiding value for our study and life, helping us to improve our humanistic quality and enrich our spiritual world. The purpose of this study are (1) to analyze the mental health of college students, (2) to investigate the current situation and existing problems of the integration of traditional culture into Chinese language and literature teaching research, (3) to analyze its impact on improving the mental health of college students, and (4) to propose solutions to the existing problems. The research route is shown in Figure 1. First, review the literature and organize data to identify factors that may affect college students' mental health and analyze the current situation and shortcomings of moral education through literature synchronous; next, a questionnaire survey based on influencing factors obtained above is performed; finally, according to the result of this study, some effective recommendations are proposed.

2. The Significance of Integrating Excellent Traditional Culture into Chinese Language and Literature Teaching on the Mental Health of College Students

2.1. Benefit for Improving Humanistic Quality. The content of the current Chinese language learning is rich, and different works contain the ancients' experience of nature and life and the pursuit of spiritual values. In-depth study of such traditional culture can not only improve the basic cultural quality of students but also allow us to deeply perceive more philosophy of life [30]. With the help of the ideological achievements of the ancients, we can face various confusions in current study and life and improve students' humanistic quality. Humanistic literacy is the basic quality, values, and code of conduct formed through learning and practical activities. At present, the content related to Chinese language and literature has penetrated various stages of quality education. The main purpose of learning Chinese language

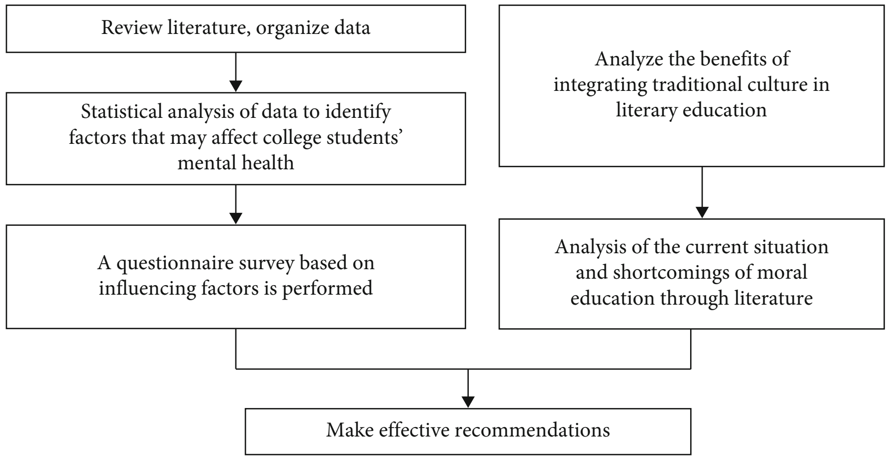

Figure 1: Technology roadmap.

and literature is to master the foundation of Chinese language and literature and to improve reading comprehension, writing, and work appreciation. After accumulating to a certain extent, literary knowledge can be transformed into personal inner temperament, which can better show the charm of traditional Chinese literature; excellent quality in literary works can cultivate the sentiments of college students and cultivate their positive attitudes and play a critical role in the comprehensive development of college students in the future.

2.2. Benefit for Improving the Quality of Thinking. Excellent language and literature work themselves have many excellent elements beyond the modern society, and they are also the epitome of our traditional culture [31]. Excellent culture can infect and guide our learners. Most of the important characters selected in the current Chinese language and literature works have noble characters. For example, when studying and appreciating the "Historical Records," the personal biographies of many characters are recorded, and different events are of great educational value to us. Reading historical works related to "Shiji" can not only optimize the ideological and moral character of our learners but also help students establish lofty and lofty ideals in life, which is a concentrated expression of the important role of Chinese language and literature works. Through the influence of Chinese language and literature, our students can establish principles and moral standards in their learning, which plays an important role in guiding our college students' practical activities. With the example of learning, college students will be strict with themselves, and college students under the influence of excellent culture will have a positive mentality, thereby subtly cultivating a healthy attitude of college students.

2.3. Benefit for Enriching of Spiritual World. Chinese's traditional culture and national spirit are profound and longstanding and are also the main carrier of my country's academic education [32]. At present, the external environment we face in the education stage is relatively complex, and in the materialistic real society, students ignore the spiritual pursuit and only pursue the comfort of life. Through long-term Chinese language learning, we can seek the main direction of learning and pursue spiritual beliefs in the complex modern society. We will face many difficulties in our daily study and life. Through the extensive knowledge of traditional culture and Chinese language and literature works, we can provide more guidance for life, find ourselves in learning, reflect on ourselves, pursue the true meaning of life, and enrich our inner world and keep us from being corrupted by all kinds of bad ideas and values.

2.4. Benefit for Improving Humanistic Behavior. There are many excellent ideas in Chinese traditional culture, and these excellent ideas have influenced generations of Chinese people [33]. It is precisely because of the study of Chinese language, on the basis of following the social system of the rule of law, that the daily behavior of our students is regulated by advanced ideas and the all-around development of the society is promoted. After learning the value concept of "hundreds of kindness and filial piety first," we can play a guiding role in various behaviors in life so that each of us can build sufficient ideological and moral power reserves in our hearts. Whether it is daily Chinese language learning or reading of excellent literary works, it is important in the establishment of advanced ideas and norms of behavior and can lay a good foundation for our comprehensive development in the future.

3. The Problems and Research Methods in the Cultivation of Mental Health in the Literature Education and Research of Colleges

3.1. The Shortage in Existing Research. In recent years, the mental health of college students has received extensive attention from scholars, and more and more studies have combined it with traditional Chinese culture. After reviewing many research results, it is found that there are certain deficiencies.

Most of the research on positive psychological qualities in traditional culture is presented in the form of theory, and the research on this is still in the stage of speculative discussion, mostly the interpretation of classic works in traditional culture. These studies mainly use the methods of logical speculation, literature analysis, and experience summarization, their theories are not deep enough, and there are few creative literature [34, 35]. In addition, most of these literatures are qualitative descriptions, lacking quantitative analysis of the impact of various qualities on college students.

Most of the researchers on positive thoughts and positive psychological qualities in traditional culture belong to philosophy, sociology, or education, and relatively few studies have been done on them from the perspective of literature [36, 37]. Little research has been done in this area. Research on the effect of positive psychological quality on college students' positive psychology in traditional cultures is particularly rare. The research on positive psychological quality is mainly concentrated in the field of mental health, and most of them are from the perspectives of ideological and political education and philosophy. It is important for building socialist values. Implanting traditional excellent culture in literature education can subtly affect the personality of college students, which can be of great help to college students' mental health. Therefore, it is particularly necessary to analyze the influence of traditional culture integration into literature education research on the positive psychology of Chinese college students.

3.2. The Research Methods of This Study. This research takes Chinese traditional culture as the main starting point, extracts the excellent qualities, and understands the influence of traditional culture integration into literature teaching research on the mental health of college students. First of all, we compiled a psychological quality evaluation scale, carried out item analysis, and used exploratory factor analysis to test and correct the dimensions of the prediction scale to form the final positive psychological quality scale. Then, the current situation of the positive psychological quality of college students is investigated, and the relationship between the integration of excellent traditional culture in literacy education and the psychological health of college students is analyzed.

The innovation of this research is illustrated in two aspects. In the first aspect, from the perspective of literary education research, we study the influence of excellent quality in traditional culture on college students' psychological well-being, not only limited to theoretical research but also trying to obtain new insights from research Second, for the combination of literature education research and traditional culture, it is mainly based on the positive factors in traditional culture, defines and studies the positive psychological quality from the original perspective of traditional culture, and provides a new perspective for the combination of them. In this study, quantitative analysis was used to obtain important procedures of factors affecting college students' mental health and then to cultivate college students' mental health by teaching students in accordance with their aptitude.

4. A Survey of College Students' Demand for the Excellent Quality of Traditional Culture

The purpose of this study is to explore the overall situation of the positive psychological quality of the selected sample college students through the questionnaire survey method and the self-compiled college students' positive psychological quality scale and to explore whether each dimension in the scale has obvious differences in various demographic variables, to provide data support for further research on the spiritual qualities required for cultivating college students' mental health in literary education. The impact factors to be investigated are determined through the literature survey method. According to the retrieval strategy, we searched the Web of Science for relevant literature, 901 articles were initially retrieved, and then 44 articles were finally included after heavy-duty and screening. A total of 179,469 college students were surveyed. The evaluation scores were 35 articles ranging from 4 to 7 points, and 3 articles were 8 points, which belonged to the medium- and high-quality literature. Figure 2 shows the specific screening process.

Before analyzing the data, it is necessary to divide the dataset and turn the disordered data into order. The change of information before and after dividing the dataset becomes the information gain, and then, the information gain obtained after each feature is divided into the dataset can be calculated, and it is the best choice to obtain the feature with the highest information gain.

Information entropy:

$$\mathrm{Info}(D) = -\sum_{i=1}^{m} p_i \log_2(p_i). \tag{1}$$

Information entropy after feature division:

$$\mathrm{Info}_R(D) = \sum_{j=1}^{k} p_i \frac{|D_j|}{|D|} \times \mathrm{Info}(D_j). \tag{2}$$

Information gain:

$$\mathrm{Gain}(R) = \mathrm{Info}(D) - \mathrm{Info}_R(D). \tag{3}$$

To analyze the data in the literature, the random forest algorithm was used to analyze the factors that need to be investigated in this study; the algorithm flowchart is shown in Figure 3; and gender, specialization, grade, birthplace, and whether an only child are the variables of this study. The random forest algorithm has various implementation methods such as bootstrap sampling and bagging. In a process of bootstrap sampling, suppose there is currently a dataset D with m samples, and we perform m random sampling with "replacement" on it; in each round of sampling, the probability of sample x being drawn is $1/m$, so after m rounds of sampling, the probability that the sample has not been drawn is

$$\lim_{m\longrightarrow\infty}\left(1-\frac{1}{m}\right)^{m} \approx \frac{1}{e} \approx 0.368. \tag{4}$$

That is to say, about 36.8% of the samples in the original dataset were not drawn. When the data is large, the bagging method should be used. This method includes three steps.

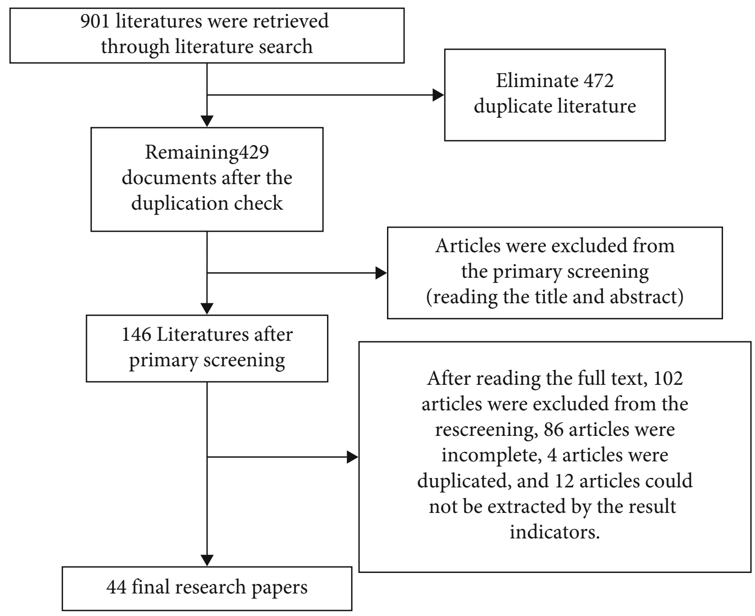

Figure 2: Literature screening process.

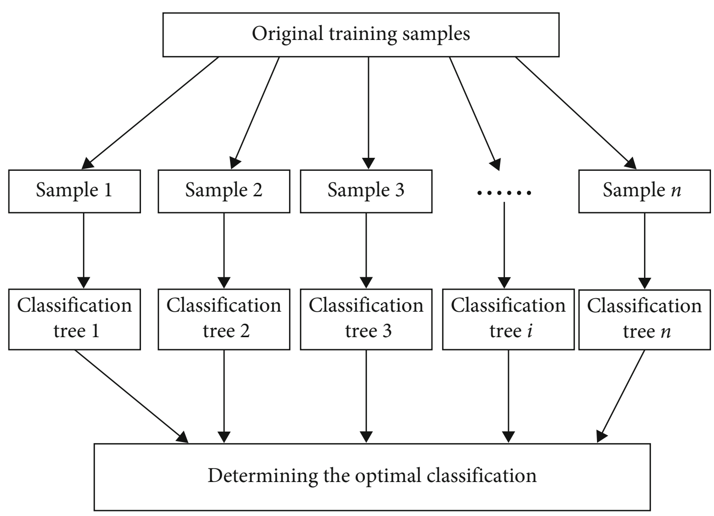

Figure 3: Schematic diagram of random forest algorithm.

The first step, input training times, the training set

$$D = \{(x_1, y_1), (x_2, y_2), \cdots, (x_m, y_m)\}. \tag{5}$$

Training algorithm

$$h = \mathfrak{I}(D, D_{bs}). \tag{6}$$

The second step, data processing, process is realized by a loop program, which is written as

$$\begin{gathered} \text{for } t = 1, 2, 3, \cdots, T, \\ h(t) = \mathfrak{I}(D, D_{bs}), \end{gathered} \tag{7}$$

end.

Finally, the output is

$$H(x) = \arg \max_{y \in Y} \prod (h_t(x) = y). \tag{8}$$

Unlike standard AdaBoost, which can only be used for binary classification tasks, bagging can be used for multiclassification, regression, and other tasks without modification.

To grasp the factors that affect students' personalities, it is also necessary to know which personality characteristics are most important to college students. AHP can solve this problem very well, and we found filial piety, kindness, courage, justice, fairness, probity, and creativity are the most important qualities college students need.

4.1. The Survey of College Students' Mental Health. College students from different regions were taken as subjects by

Table 1: Information distribution table of demographic variables.

	Variables	Number	Percentage
Gender	Male	1195	46.5
	Female	1375	53.5
Specialized	Science and engineering	1050	40.9
	Literature and history	1520	59.1
Grade	Freshman	650	25.3
	Sophomore	640	24.9
	Junior year	650	25.3
	Senior year	630	24.5
Birthplace	City	1580	61.5
	Countryside	990	38.5
Only child	Yes	1165	45.3
	No	1405	54.7

means of a free online questionnaire. In total, 3000 questionnaires were distributed and 2570 valid questionnaires were recovered. They come from different institutions, including nationally renowned universities, local comprehensive institutions, and professional institutions. The detailed data information is shown in Table 1.

The subjects were tested by a self-made positive psychological quality scale, which consists of seven dimensions of filial piety, kindness, justice, integrity, fairness, courage, and creativity, with a total of 40 items. The scores of the questionnaires are assessed using Likert's five-point method, and the higher the score, the more positive psychological qualities it has. SPSS 24.0 was used to organize and analyze the obtained data. The total score obtained by the subjects on the positive psychological quality scale and the mean and standard deviation of the scores on each factor were counted, and the results are listed in Table 2. In addition, in order to show the difference in the scores of each factor more directly, the mean value of each factor is shown by a histogram in Figure 4. The total score of the positive psychological quality scale ranges from 24 to 120 points. In Table 2 and Figure 4, it is shown that the total score of the positive psychological quality of college students is 78.811, which is higher than the average level of theoretical scores. The positive psychological quality of the subjects was in the middle and upper level and had high positive psychological quality. Arranging the factors in descending order of average value, the order is filial piety, kindness, courage, justice, fairness, probity, and creativity. This shows that college students put filial piety in the first place in life and at the same time have kindness and care for others. Creativity ranks last, but its average value is not much different from probity and fairness, indicating that these three factors are less recognized than other factors.

4.2. Difference Analysis of Demographic Variables of College Students' Positive Psychological Quality. The weight analysis of a single factor can provide teaching according to the different characteristics of college students, make up for the shortcomings of their mental health, and build a healthy

Table 2: Total score and the mean and standard deviation of each factor ($n = 2570$).

	Mean value	Standard deviation
Filial piety	4.339	0.5329
Kindness	3.721	0.6383
Courage	3.528	0.8054
Justice	3.040	0.7738
Fairness	2.703	0.7590
Probity	2.695	0.6392
Creativity	2.626	0.8782
Total score	78.811	7.6531

psychology of college students in the fastest way. Analytic Hierarchy Process (AHP), a hierarchical weighted decision analysis method, is applied to analyze the significance of the demographic variables of college students. AHP is used to decompose the decision-making problem into different hierarchical structures in the order of the overall objective, subobjectives, evaluation criteria, and specific investment plans and then use the method of solving the eigenvectors of the judgment matrix to obtain the priority weight of an element to an element at the previous level, and the final weighted sum method is to recursively merge the final weight of each alternative to the total goal, and the one with the largest final weight is the optimal plan.

The judgment matrix has the following properties:

$$a(i,j) = \frac{1}{a(j,i)}, \tag{9}$$

where $a(i,j)$ is the comparison result of the importance of element i and element j, and the matrix formed by the pairwise comparison results is called the judgment matrix. The consistency index is calculated by CI.

$$\mathrm{CI} = \frac{\lambda_{\max}(A) - n}{n-1}, \tag{10}$$

where n is the order of the matrix and λ is eigenvalues, calculated by

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{\lambda_i}{n}, \tag{11}$$

$$\lambda_i = \sum_{i=j}^{n} \frac{a_{ij} w_j}{w_i}. \tag{12}$$

The random consistency index RI is proposed to evaluate CI:

$$\mathrm{RI} = \frac{\mathrm{CI}_1 + \mathrm{CI}_1 + \cdots + \mathrm{CI}_n}{n}. \tag{13}$$

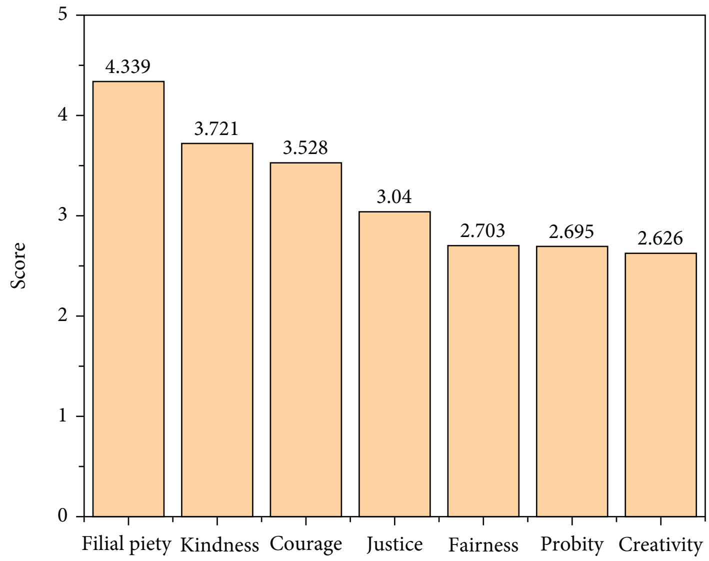

Figure 4: Scores for main factors that affect college students' mental health.

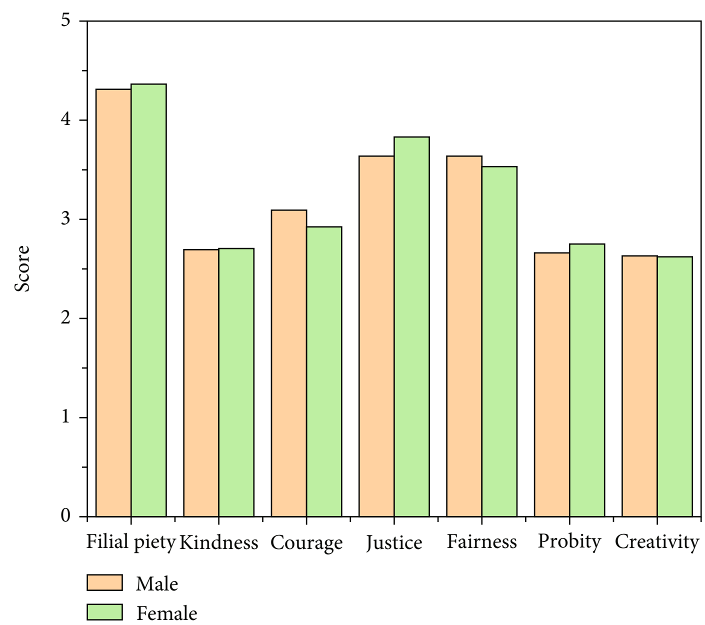

Figure 5: Scores for college students of different gender.

Table 3: Gender difference analysis.

	Male	Female	t	p
Filial piety	4.312 ± 0.6238	4.364 ± 0.5734	-0.694	0.256
Fairness	2.694 ± 0.6839	2.706 ± 0.6468	-0.274	0.449
Justice	3.093 ± 0.6914	2.924 ± 0.6217	3.887	0.002
Kindness	3.638 ± 0.7926	3.831 ± 0.6366	-4.295	0.001
Courage	3.638 ± 0.7926	3.532 ± 0.7478	-0.443	0.371
Probity	2.662 ± 0.7290	2.751 ± 0.6971	-1.628	0.055
Creativity	2.631 ± 0.6334	2.622 ± 0.6192	0.268	0.451
Total score	78.247 ± 9.4726	79.056 ± 7.9352	-1.623	0.067

Considering that the deviation of consistency may be caused by random reasons, a test coefficient CR is necessary:

$$CR = \frac{CI}{RI}. \tag{14}$$

Generally, if $CR < 0.1$, it means the result is consistent; otherwise, it means the result is not satisfactorily consistent.

4.2.1. Gender Difference Analysis. Taking gender as an independent variable, the total score of the positive psychological quality scale, and the scores on each factor as the dependent variable, the results of data analyses are shown in Figure 5 and listed in Table 3. It can be concluded from the table that

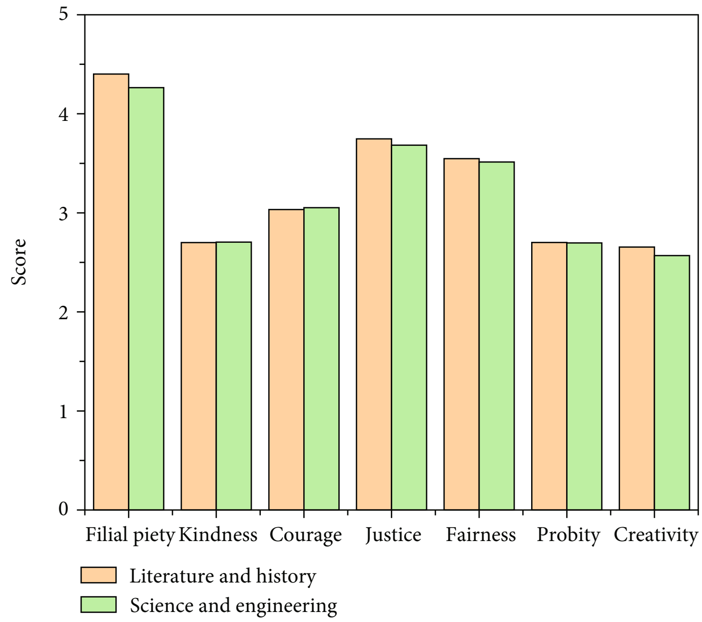

Figure 6: Scores for college students of different major.

Table 4: Major difference analysis.

	Literature and history	Science and engineering	t	p
Filial piety	4.402 ± 0.6228	4.264 ± 0.6182	2.753	0.031
Fairness	2.700 ± 0.7396	2.705 ± 0.6924	-0.046	0.971
Justice	3.033 ± 0.6297	3.052 ± 0.5903	-0.309	0.318
Kindness	3.747 ± 0.5893	3.683 ± 0.7430	0.775	0.178
Courage	3.547 ± 0.8241	3.513 ± 0.6475	0.461	0.391
Probity	2.701 ± 0.7392	2.697 ± 0.6391	0.659	0.443
Creativity	2.654 ± 0.6032	2.569 ± 0.6765	1.351	0.059
Total score	79.322 ± 8.9833	78.274 ± 9.6401	2.525	0.056

there is no significant gender difference in the overall, but the total score of positive psychological quality of girls is slightly higher than that of boys. There are significant gender differences in the dimensions of benevolence and justice. Girls score higher on the benevolence dimension than boys, indicating that girls are more fraternal and compassionate than boys, while boys score higher than girls on the justice dimension, indicating that boys handle things more rational, more reemphasize loyalty.

4.2.2. Major Difference Analysis. The result of major difference analysis is shown in Figure 6 and listed in Table 4. The results of the study show that there is only a significant difference in the dimension of filial piety between science and engineering and literature and history college students, and there is just a small difference in different majors of the total score and the score of other factors. Students of literature and history are more filial than students of science and engineering.

4.2.3. Grade Difference Analysis. The results of grade difference analysis are shown in Figure 7 and listed in Table 5. It can be seen from the table that there is no significant difference in the total score of the positive psychological quality of college students of different grades, but there are significant differences in the two dimensions of fairness and courage.

4.2.4. Birthplace Difference Analysis. Taking the place of birth as an independent variable, the total score of the positive psychological quality scale and the score on each factor are used as the dependent variable to conduct an independent sample test. Figure 8 and Table 6 show the results of this analysis. From Table 6, it can be concluded that there is no significant difference in the total score between rural and urban college students. However, there are significant differences in the dimensions of filial piety and courage. On the dimension of filial piety, college students from rural areas score higher, and college students from urban areas have more courage.

4.2.5. Analysis of the Impact of Whether an Only Child. Whether the child is the only child of a family is taken as an independent variable for the difference analysis, and the conclusion is shown in Figure 9 and listed in Table 7. Overall, there is no significant difference between only child and non-only child, but there are significant differences in the dimensions of fairness, kindness, and integrity. College students who are not an only child have higher average scores in the dimensions of kindness and integrity, indicating that they are more helpful to each other, have a spirit of solidarity and love, and are more committed to their commitments. The average score of the only child is better in the dimension of fairness, indicating that they pay more attention to the

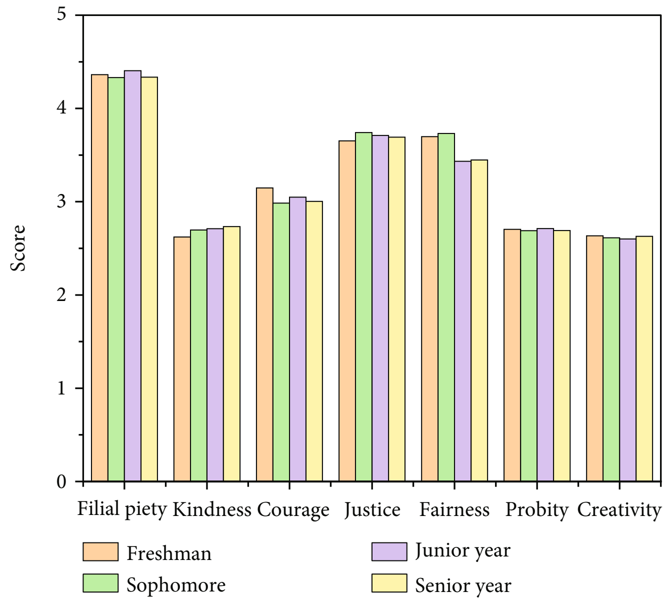

FIGURE 7: Scores for college students of different grade.

TABLE 5: Grade difference analysis.

	Freshman	Sophomore	Junior year	Senior year	F	p
Filial piety	4.362 ± 0.645	4.331 ± 0.615	4.405 ± 0.509	4.336 ± 0.710	1.412	0.294
Fairness	2.621 ± 0.728	2.697 ± 0.674	2.710 ± 0.625	2.734 ± 0.743	7.865	0.000
Justice	3.147 ± 0.661	2.985 ± 0.728	3.048 ± 0.753	3.004 ± 0.621	1.095	0.325
Kindness	3.653 ± 0.589	3.741 ± 0.791	3.711 ± 0.649	3.692 ± 0.677	1.167	0.319
Courage	3.698 ± 0.723	3.732 ± 0.592	3.433 ± 0.663	3.448 ± 0.712	3.877	0.009
Probity	2.703 ± 0.813	2.690 ± 0.640	2.712 ± 0.728	2.691 ± 0.636	0.932	0.430
Creativity	2.634 ± 0.717	2.613 ± 0.711	2.601 ± 0.678	2.629 ± 0.667	0.189	0.923
Total score	78.321 ± 9.164	79.024 ± 11.23	78.907 ± 15.57	79.321 ± 12.87	0.986	0.553

distribution of resources and the maintenance of their own power.

4.3. Analysis of the Results of the Survey. The total score obtained by the subjects on the positive psychological quality scale and the mean and standard deviation of the scores on each factor were counted, and the results are shown in Table 2. The total score of the positive psychological quality scale ranges from 24 to 120 points. Table 2 shows that the average total score of the positive psychological quality of college students is 78.811, which is higher than the average level of theoretical scores. The positive psychological quality of the subjects was in the middle and upper level and had a high positive psychological quality. Further analyze the factors in the positive psychological quality table, and arrange them in order of magnitude according to the average score of each factor. Filial piety is in the first place. Filial piety is a unique culture of our country. We were taught from childhood that “filial piety comes first,” which is also an important criterion for us to measure a person. The second is the dimension of benevolence. “Benevolence” is the main core of Confucius’ thought, which brought changes to the society at that time. In today’s society, the cultivation of one’s own ideological and moral character and the harmonious coexistence of people and people and society also have guiding significance. The top two rankings in these two dimensions indicate that contemporary college students are still deeply influenced by traditional Chinese culture. Culture has long-term inheritance, and the influence of traditional Chinese culture on Chinese people has always existed. The second is courage. In today’s increasingly convenient communication, we are exposed to more and more things, and traditional culture has gradually penetrated our lives. The rapid development of today’s society has put forward higher requirements for us. Courage, enthusiasm, and curiosity have become increasingly important qualities. As for justice, a very important quality in traditional culture, sacrificing one’s life for righteousness, courage to see righteousness, etc., it has been deeply rooted in the hearts of the people. Fairness, probity, and creativity rank in the bottom three of the seven dimensions, and the averages of the three dimensions are not much different. It is not that these

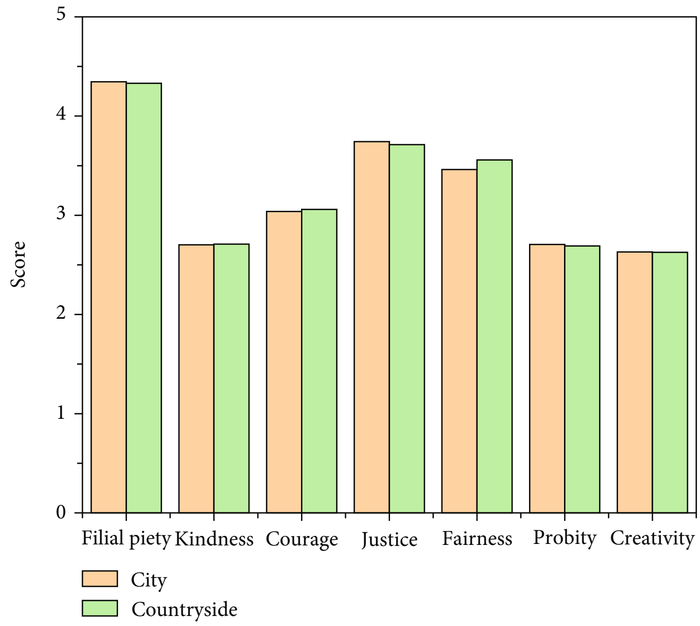

Figure 8: Scores for college students of different birthplace.

Table 6: Birthplace difference analysis.

	City	Countryside	t	p
Filial piety	4.346 ± 0.5278	4.331 ± 0.6132	3.045	0.027
Fairness	2.702 ± 0.6309	2.709 ± 0.7291	-0.286	0.512
Justice	3.038 ± 0.6281	3.059 ± 0.6478	-0.458	0.461
Kindness	3.742 ± 0.7013	3.712 ± 0.6254	0.984	0.249
Courage	3.461 ± 0.6794	3.558 ± 0.7325	-1.443	0.045
Probity	2.706 ± 0.6537	2.691 ± 0.6172	0.266	0.469
Creativity	2.630 ± 0.6667	2.627 ± 0.7903	0.213	0.533
Total score	79.003 ± 9.3752	78.734 ± 10.3417	1.823	0.084

dimensions are unimportant, but that in a society full of temptations, people pay too much attention to the result and ignore them in order to pursue the goals they want to achieve.

5. The Influence of Integrating Traditional Culture into Literature Education and Research on the Construction of College Students' Psychology

These excellent spiritual qualities above-mentioned that college students' being need can be reflected in traditional Chinese culture. Therefore, it is feasible and necessary to use traditional culture in literature education to build healthy college students' psychology. There is a consensus on the concept of "literature as humanities." Excellent literary works have a deep concern for people's living conditions and life values. Literary classics have a profound insight into the world we live in, penetrate the texture of human nature, illuminate the landscape of life, connect history, reality, and the future, and strike the hearts of generations of readers with beautiful expressions, profound thoughts, and broad minds. The resounding echoes span time and space and reach eternity. The fundamental purpose of literary education is to cultivate morality and cultivate people, and it focuses on the cultivation of personality and the cultivation of nonintelligence factors. It contains thinking about life and value orientation. To carry out literature education for students, we must stand on the standpoint of people, get rid of utilitarian thinking, and cultivate their aesthetic taste and aesthetic evaluation ability; to enrich students' spiritual world, pursuing the freshness of the soul and the richness of emotions; in imagination and experience based on cultivating the spirit of innovation, improve students' humanistic quality and aesthetic style. The influence of excellent culture can help college students form noble moral sentiments, maintain a positive attitude, and form a healthy psychology.

However, the teaching arrangement of basic education is aimed at examinations, and university education focuses on credits and employment. The purpose of students' studies seems to be to get into college with high marks and find a decent, high-paying job. To a certain extent, this ignores the development of education in the true sense and is too practical to deal with the rhythm of social change. Einstein said: "It is not enough to educate a person with professional knowledge. Through professional education, he can become a useful machine, but he cannot become a person who develops harmoniously." Literary education plays a role in coordination and balanced effect. But in actual teaching, literature education is often regarded as a matter of the Chinese classroom. And Chinese classrooms often turn literature education into simple and rigid knowledge teaching. Practical language trainings such as characters, words, sentences, blunt value standards, and boring preaching make works with profound emotions, profound meanings, and vivid images lacking flesh and blood, and the ideals of life, aesthetic awareness, and individual imagination inherent in

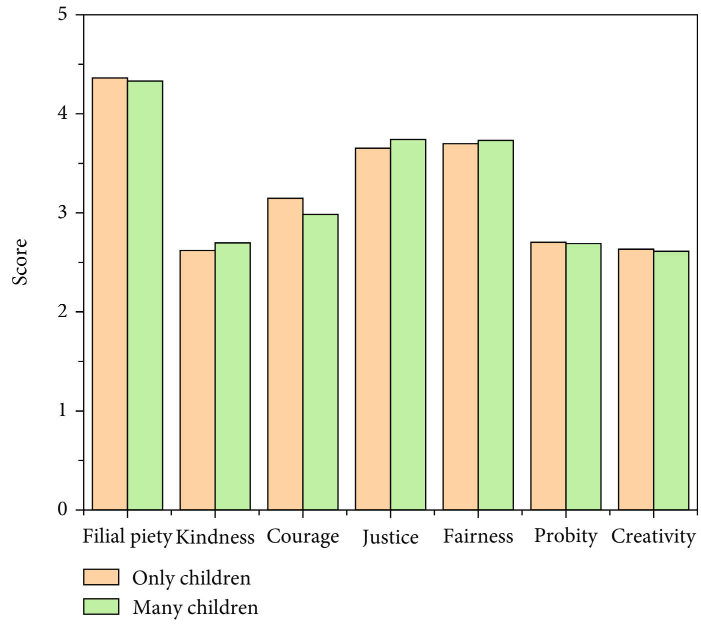

Figure 9: Scores for college students whether an only child.

Table 7: Difference analysis of the dimension of only child.

	Yes	No	t	p
Filial piety	4.335 ± 0.6461	4.342 ± 0.5839	-1.332	0.063
Fairness	2.637 ± 0.7462	2.776 ± 0.6327	2.294	0.037
Justice	3.030 ± 0.7294	3.043 ± 0.6291	0.275	0.532
Kindness	3.556 ± 0.7434	3.743 ± 0.6865	-2.823	0.031
Courage	3.532 ± 0.6907	3.525 ± 0.6281	0.378	0.529
Probity	2.688 ± 0.8339	2.705 ± 0.7326	-1.734	0.046
Creativity	2.573 ± 0.7242	2.665 ± 0.9367	0.830	0.073
Total score	78.305 ± 13.7821	79.947 ± 9.4365	-1.232	0.104

literature are all banished. At the university, literature education is considered to be only a matter of the Chinese Department and the Faculty of Letters. Students of other majors tend to keep an aloof and indifferent attitude toward literature. The lack of humanistic literacy represented by literary literacy affects the exploration of people's creative potential, and it is difficult to awaken the sense of life and value from the dormant self-consciousness and heart.

Literature courses are set as public elective courses by colleges and universities because they are useless for employment, or they are generally canceled. Educators should let students understand that literary reading requires awareness of concepts and actions and that literary reading is related to life experience and spiritual enjoyment. It is necessary for students to fully feel and appreciate the joy brought by free and independent literary reading and pay attention to the value orientation and emotional standpoint of literary works. The student stage is the beginning of life and the budding stage of individual life. It needs the supply of knowledge to contribute to the society. Therefore, the humanistic spirit is needed to cultivate students' humanistic heritage and to shape good humanistic conduct, healthy mind, and correct personality. Literary education is a process of indoctrination, and in the process of educating people, it gives full play to the two functions of moral education and aesthetic education. Humanistic quality and moral education are different from each other, and they are related to each other and influence each other. Both belong to the category of literary education. Moral education is the direction mark of humanistic quality. In the process of literary education, the principle of moral education is abided by, the moral education factors of literary works are fully explored, and the cultivation of humanistic quality and moral education is carried out at the same time. Incorporating excellent traditional culture into literature education and teaching is an important way to cultivate students' humanistic quality, and it should be permeated in the teaching of various subjects, which can promote the improvement of students' abilities and the sublimation of emotions. According to the characteristics of different students, teach students in accordance with their aptitude, considering the students' major, gender, grade, whether they are an only child, and other factors, analyze their psychological characteristics, carry out mental health education in a targeted manner, build the healthy psychology of college students, and cultivate them into outstanding talents.

6. Conclusions and Discussion

This study is based on the influence of the integration of literature education research into Chinese excellent traditional culture on the mental health of contemporary college students. Through the investigation of the existing literature and statistical analysis of their data, we found that seven factors, including filial piety, fairness, justice, kindness, courtesy, probity, and creativity, can be used as the main indicators to quantify the mental health of college students. Further, the above factors were evaluated based on differences in gender, major, grade, place of birth, and whether they were an only child by questionnaire survey and analysis of the data obtained by questionnaire survey through AHP. The results show that the mental health of college students is healthy overall, but there are differences in the scores of various factors, gender, grade, etc. In addition, the insufficiency of integrating traditional culture in literary education is analyzed and found that current literature education pays too much attention to knowledge and neglects moral education. Integrating traditional culture into literature education can cultivate the positive and healthy psychology of college students, which also can subtly affect the daily behavior of students, and it will inevitably change the mental health of students from external performance to inner self-restraint, thereby building a healthy college student psychology. Combined with the previous research results of experts and scholars, this paper discusses the current situation of college students' positive psychological quality and the relationship between college students' psychological health and literature education and puts forward a new way for constructing positive psychological quality of college students, students should be taught by their aptitude, and ideological education should be carried out according to the gender, origin, grade, etc. of the student group, to help them become talents. This study tries to create a new perspective on positive psychological quality research and at the same time provides a reference for literature teaching research. Traditional culture is extensive and profound. This research only initially explores several representative dimensions and selects several topics as representatives for measurement. There are great limitations. We should deepen the understanding of traditional culture, create more dimensions, and construct more rigorous topics and detailed and in-depth research. The discussion on the integration of traditional culture into literature is also not deep enough, and more in-depth research will be done in these areas in the future.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The author declares that there is no conflict of interest.

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Research Article

A Comprehensive Evaluation Method for the Effectiveness of Public Health-Oriented Music Performance Art Based on Blockchain Technology

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Music can promote the development of physical and mental health, and its therapeutic utility has begun to receive widespread attention from scholars, who have systematically studied the therapeutic methods, processes, and utility of music with the theme of music therapy, and the topic has been extended from music therapy at the individual level to the public health domain. Therefore, it is worthwhile to further explore how the effectiveness of music as a performing arts activity in the public health domain is evaluated. However, most of the current studies focus on the evaluation of the effects of music on individual physical and mental health, and few involve the evaluation of music performing arts activities in the public health domain, which greatly hinders the potential of music performing arts applications in the public health domain. Therefore, this study proposes a dynamic and comprehensive evaluation scheme based on the cross-chain technology in blockchain and establishes a cross-chain-based information exchange model for the feasibility of information exchange between music performing arts and public health. The research findings can not only provide theoretical guidance for the formulation of public health policies but also provide technical support for the comprehensive evaluation of the effectiveness of music performing arts activities.

1. Introduction

In recent years, with the development of society and the deepening of the aging population, China has been paying more and more attention to people's health. In the report of the 19th National Congress, China puts forward the strategy of "Health China 2030," and with the promotion of this strategic layout, the health medicine in China has been developed rapidly. Music therapy is a systematic intervention in which the therapist uses various forms of musical experiences, developed over the course of the therapy, as the driving force of the therapeutic relationship to help the client achieve wellness. The development of the discipline of music therapy began in the 1940s when the first music therapy program was established at Michigan State University in the United States. Since then, music therapy associations have been established in Canada, England, Japan, Germany, Italy, Singapore, and other countries, and music therapy has developed rapidly [1]. Currently, music therapy is relatively mature in foreign countries. Music therapy in China began in the 1980s, and although it started late, it is now being used and developed in a variety of fields.

Compared with individual therapy, group music therapy has the advantages of convenience, high acceptance, low cost, and noninvasiveness and is therefore widely used in the public health field and has achieved good results. However, group music therapy still faces some problems and challenges. First, the duration and frequency of music therapy vary widely from one to multiple sessions. The optimal duration of therapy for different conditions has not been explored. Determining the optimal dose of intervention for music therapy is an area that warrants further research. Second, previous studies have rarely assessed patients' musical experiences and preferences and taken them into account in treatment planning. This may have an impact on treatment outcomes. Therefore, treatment protocols need to be adjusted to take into account the client's preferences in the selection of repertoire in conjunction with the musical assessment of the client. Third, most studies have examined the short-term efficacy of group music therapy before and after interventions, but due to human and material constraints, long-term follow-up has not been conducted to determine its long-term efficacy [2]. Therefore, longitudinal data collection is needed. Finally, group music therapy lacks a comprehensive, unified, and scientific evaluation tool, and there are few studies on evaluation indicators.

In light of the above problems, this study introduces a new evaluation method—blockchain technology. Blockchain is the innovative power of new generation information technology and an important breakthrough for China's independent innovation of core technology. It is also included in the 14th Five-Year Plan of National Economy and has become one of the key industries of digital economy. With the development of blockchain technology and economy, the demand for data circulation and application synergy between blockchains is becoming more and more obvious. Cross-chain technology undertakes not only the transfer of data but also connects the collaboration networks behind different blockchain networks and cross-agency information exchange processes, improves the efficiency of collaboration between interrelated information modules on different blockchains, and provides technical support for the evaluation of multiple information sources. The development of blockchain cross-chain technology has formed two models, single-chain cross-chain and multichain cross-chain, and is developing into a multilevel multichain cross-chain blockchain. Importantly, the emergence of cross-chain data transfer in blockchain provides the technical conditions for two-way information collection of music performing arts and public health and also provides the methodological basis for comprehensive evaluation of the effectiveness of the application of music performing arts in the field of public health. However, most of the current studies focus on the evaluation of the impact of music on physical and mental health at the individual level, and few focus on the evaluation of music performing arts activities in the field of public health, and the evaluation methods are relatively single and lacking in science, thus hindering the potential application of music performing arts in the field of public health and limiting the development of public health-related policies.

Therefore, based on a systematic review of the relationship between music and public health, this study incorporates blockchain technology into the evaluation of the effects of music performing arts to provide a scientific evaluation of the effectiveness of music performing arts on public health and provide a relevant theoretical basis for the formulation of public health policies.

2. Literature Review

2.1. Music and Public Health: Music Therapy. Music therapy is a therapeutic technique in which the therapist uses music as a medium and applies the unique physiological and psychological effects of music to achieve the elimination of psychological barriers and the restoration or enhancement of physical and mental health through various specially designed musical behaviors, musical experiences, and musical experiences. It can be divided into individual therapy and group therapy, and in terms of techniques, it can be divided into active, passive, improvisation, and song writing. Among them, active music therapy refers to the use of singing and breathing adjustment to improve physiological indicators of the elderly, or to improve interpersonal communication, enhance the enjoyment of life, and change the state of mind through choral singing and instrument playing. Passive music therapy is an intervention that involves listening to appropriate music, accompanied by progressive muscle relaxation training, guided relaxation exercises, and song discussions to regulate the body and mind [3]. There is no significant difference in the effectiveness of active and passive music therapy in various groups, and studies have generally used a combination of active and passive interventions. The songs themselves reflect the richness of the listener's life and emotional experiences, so the music should be selected based on the age, experience, personality, and temperament of the client. Appropriate form and content can increase the homogeneity of the group members and effectively enhance the effectiveness of the group intervention.

Music therapy approaches have evolved in a variety of ways. These approaches can be broadly classified into four types: receptive music therapy, recreative music therapy, creative music therapy, and improvisational music therapy [4]. Different approaches to music therapy include a variety of different techniques. Listening is a common form of receptive music therapy, in which listening to music evokes different feelings and experiences in the client. The music therapist works in a planned and goal-oriented way through different musical experiences. Recreative music therapy invites clients to participate in specific activities that combine music with dance, singing, and games and is often used in group settings to provide opportunities for social interaction and to stimulate creativity among members. Creative music therapy is the creation of vocal or instrumental music with the client. Music composition is used as a vehicle for expressing the full range of emotions. Improvisational music therapy involves improvising with musical instruments such as mallets, string bells, triangles, tambourines, and Cajon drums. This approach does not require the client's skills to play the instrument, but rather to express emotions through the instrument, with the therapist intervening accordingly [5].

Music therapy can be divided into two types of therapy: group and individual. Group music therapy has unique advantages over individual music therapy. It creates a network of relationships between the therapist and the client and between group members, which improves the client's behavioral problems and builds the skills necessary for social integration [6]. Cohesiveness and member support play an important role in the reticulation of group music therapy. Group music therapy emphasizes a multidimensional collective interaction among the group members, interspersing playing, talking, and listening, using music and language as a vehicle for communication, and establishing a channel for expressing oneself and connecting with others in a better way, allowing for more dynamic and creative group members [7]. With music, group members are able to feel their own emotions and states in group activities, and with the facilitation of music, group members are more likely to discover the effects of their own states on themselves [8]. The discovery of one's own negative emotional experiences through others, with peer support, can also reduce participants' feelings of isolation and be more conducive to dissipating their negative internal emotions.

Group music therapy has been increasingly used in the management of anxiety in healthy, subhealthy, and ill populations to promote mental, physical, and spiritual health. Group music therapy is relatively well established abroad, having been studied in different populations such as college students, parents of premature infants with Alzheimer's disease, preoperative patients, and infertility patients [9, 10] and has been shown to be effective in improving anxiety states. In recent years, scholars have also gradually carried out the application of group music therapy in various groups of people with negative emotions such as anxiety. However, most of the studies have been conducted with dysregulated groups, especially cancer patients, psychiatric patients, and special populations [11, 12]. In conclusion, group music therapy is effective for interventions with physically and mentally challenged groups. With the development of group music therapy in the field of alleviating negative emotions such as anxiety, research has become more extensive and has begun to focus on the role of music therapy in public health [13], but fewer studies have addressed the evaluation of the role of music performing arts in public health.

Currently, the effectiveness of group music therapy in the management of negative emotions is mostly evaluated using relevant negative emotion scales before and after the intervention and the music therapist's subjective evaluation of the whole treatment process, but there are few scales to evaluate the quality of the music therapy process itself, and there is a lack of effective evaluation tools to consistently assess the music therapy process.

2.2. Blockchain: A New Approach to Evaluation. As an emerging Internet technology, blockchain is a decentralized, trustless distributed data ledger that has attracted widespread attention both domestically and internationally. Blockchain has been hailed as the most disruptive and innovative technology in the Fourth Industrial Revolution. China has also proposed to make blockchain an important breakthrough for autonomous innovation of core technologies. Thousands of blockchain applications have already started to be implemented, bringing not only great social and economic benefits but also playing a key role in promoting the digitization of the real economy, building a new smart city, and promoting supply-side reform [14].

The data structure of a blockchain is shown in Figure 1. From the blockchain perspective, a block is an atomic structure in the chain that records all the data in the chain, and blocks are linked to blocks to form a one-way chain structure. The consensus mechanisms used in a blockchain may be the same or different, which distinguishes the blockchain as homogeneous or heterogeneous with the block data structure. Some consensus mechanisms may appear to fork multiple chains, but in the end, the consensus mechanism can be used to determine the only master chain.

While the scale of blockchain application transactions is growing, performance bottlenecks and silos in blockchain are beginning to emerge. Firstly, the design and technical limitations of some blockchains lead to low system throughput and slow processing efficiency and large performance differences between blockchains. Secondly, the inability to quickly interoperate between different chains to meet the demand for business collaboration and data/value flows between different blockchain applications has led to the emergence of blockchain silos [15]. These issues are limiting the large-scale use of blockchain in society and industry.

Cross-chain technology is an important technical approach to achieve interconnection and interoperability of blockchain to enhance scalability and interoperability, which can solve the problems encountered in the abovementioned blockchain. In recent years, cross-chain technology has been developing rapidly, and the current mainstream cross-chain technology solutions include hash locking, notary mechanism, side chaining/relaying, and distributed keying. On the basis of these technologies, a complete cross-chain implementation solution is developed, taking into account issues such as data transfer performance, privacy and security, originality, and transaction [16]. New cross-chain solutions are constantly being proposed by blockchain platforms to solve the problems of blockchain performance bottlenecks and information silos [17].

There are currently dozens of hundreds of cross-link implementations available for users to choose from, but there are no well-developed standards for evaluating cross-link approaches. When choosing a cross-link solution, users consider a variety of factors, such as data transfer performance, privacy and security, and atomic and transactional issues. The better the data transfer performance, the more efficient the cross-link solution will be, and the more time-critical functions it will perform. Data transfer performance measurement is one of the ways to measure the data transfer performance of a solution [18]. Through data transfer performance measurement of cross-link solutions, users can obtain performance indicators of cross-link solutions, such as time delay and spit volume, and compare the data transfer performance of different cross-link solutions to facilitate the evolution and development of cross-link solutions.

2.3. Cross-Chain: Objective and Technology. Cross-chaining enables not only the exchange of information but also the exchange of value. This requires cross-chain to ensure both accurate two-way value circulation and accurate information flow. There are two main purposes of cross-chain: firstly, cross-chain interoperability. In blockchain system, the data on the chain can only circulate in this blockchain and cannot form a circulation with the external world, but the actual scenario often occurs in multiple chains for information exchange, which needs to enable two or more chains to

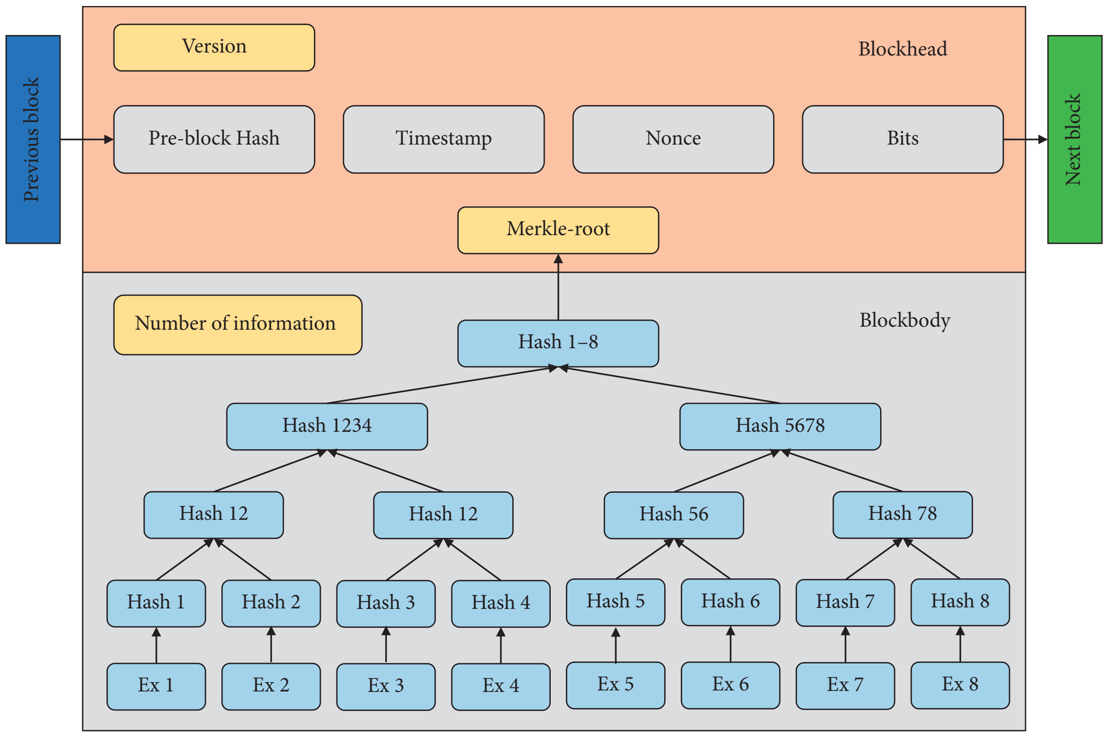

Figure 1: Data structure of blockchains.

change the corresponding account status and data according to a unified agreement, forming a standard cross-chain interoperability [19]. Secondly, in performance bottleneck, some blockchains have lower performance because they use some consensus mechanisms and block rules with lower performance, which limits the operation speed of blockchain and the development of blockchain ecology, resulting in the information exchange speed of blockchain system being much lower than that of traditional centralized system, and the information exchange process can be transferred to other blockchains with better performance through cross-chain technology to improve the operation of blockchain system efficiency [20].

The basis for cross-chain interoperability between blockchains is the cross-chain communication protocol, and the design of cross-chain information exchange and other functions is based on the realization of cross-chain communication. The first is the cross-chain communication protocol. The cross-chain communication needs to encapsulate the cross-chain data format, input and output interfaces, etc., and realize the transmission of block data and status information between several different blockchain networks, including the chain identifier of the source chain, the communication address of the current chain height, and the communication packet containing the starting chain identifier, the target chain identifier, the communication status, the communication survival time, and the trigger communication transaction, using relay [21, 22]. The cross-chain communication structure is implemented as shown in Figure 2. Cross-chain routing implements the interconnection topology description of multi-blockchain networks and the addressing method between blockchains based on the cross-chain communication.

Secondly, cross-chain asset exchange is one of the important directions of current cross-chain research, which aims to establish asset transfer methods between different blockchains, enabling users of different cryptographic assets to exchange assets between source and target blockchains in an atomic and trustless manner. Since it is difficult to fully replicate the state of a blockchain in another blockchain, efficient mechanisms are needed to allow the verification of events that occur on one blockchain from another blockchain without relying on the other blockchain [23]. Cross-chain atomic swapping was one of the earliest implementations, as shown in Figure 3, that could not transfer information from one blockchain to another, i.e., destroy a certain amount of information on the source blockchain and recreate the same amount of information on the target blockchain [24]. Therefore, atomic swaps always require a transaction partner willing to exchange information and thus require cross-chain platforms to provide an aggregation mechanism for information exchange partners.

Atomic exchange protocols require methods to scale to more than two users [25], as well as optimal methods to match users seeking to perform atomic exchanges, and need to enable information exchange between more blockchain users while ensuring that the total amount of assets across blockchains remains constant. Notary-based oversight of cross-chain asset exchanges is a primary approach, and the atomic cross-chain exchange protocol [26] uses third-party notaries with rewarding incentives to migrate information across blockchain ecosystems and ultimately guarantee the ultimate consistency of information standards across blockchains. Relay-based approaches are new approaches to enable cross-chain asset transfers [27], which improve relaying by applying a content-addressable storage model that

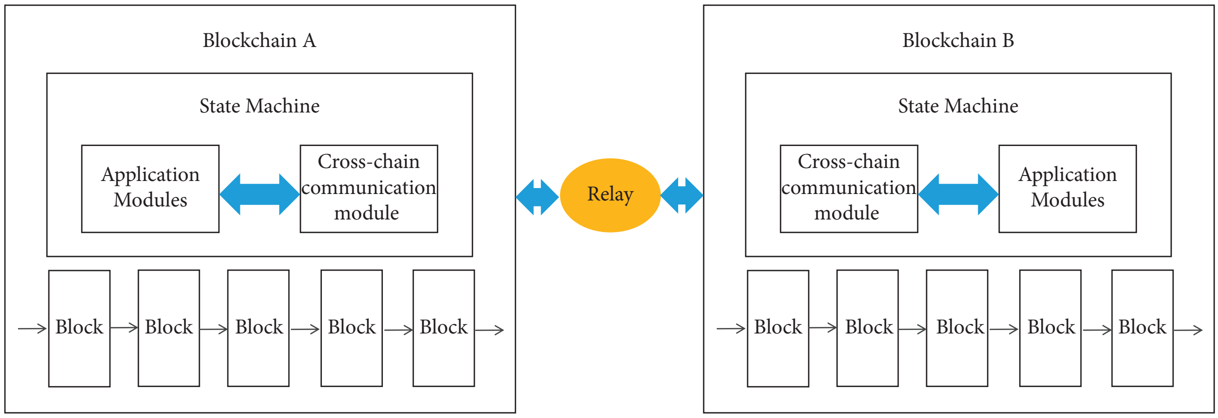

Figure 2: Cross-chain interaction architecture based on relay.

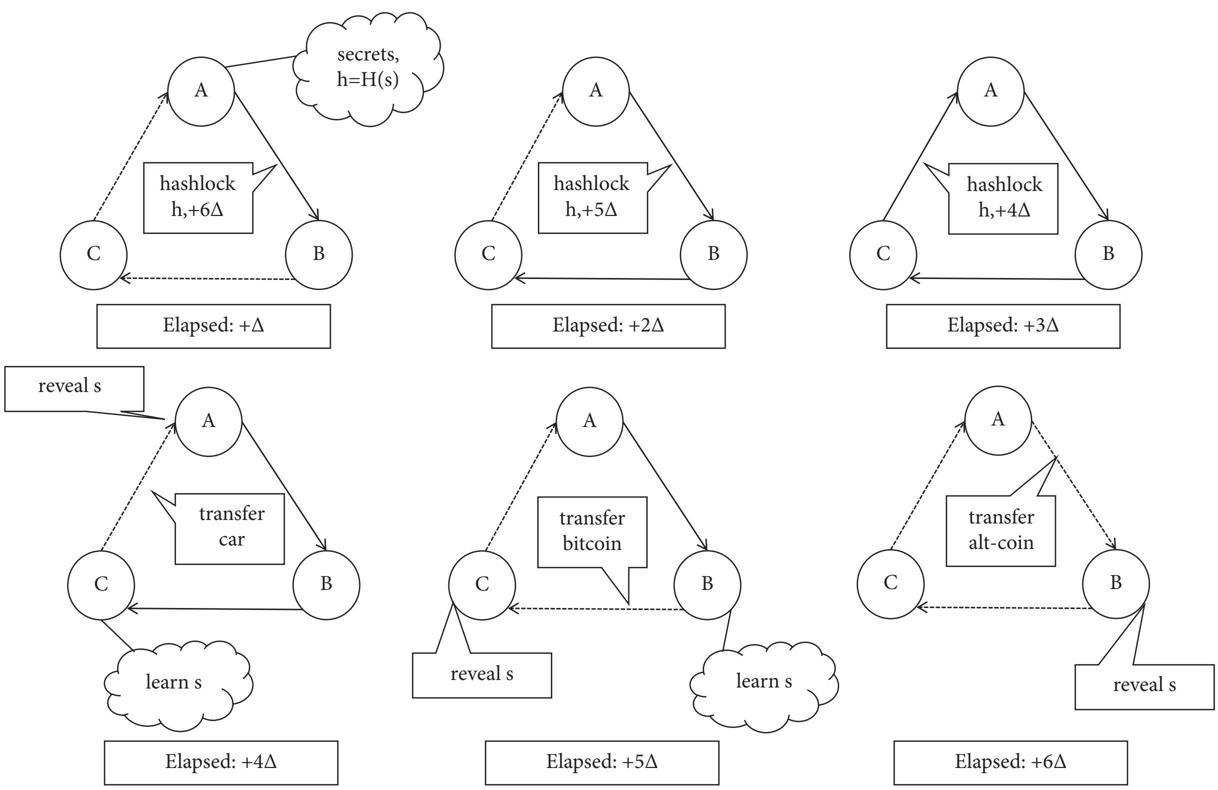

Figure 3: Example of cross-chain asset atom swap process.

enables cross-blockchain information transfer through smart contracts, where each invocation is implicitly recorded in the blockchain's information exchange history and the client can extract block header information from the information exchange history, which can be used by the relay contract to execute transactions and ensure that the provided information is actually available to the exchange's properties. The relay contract can use this information to perform transactions to ensure that the information provided can indeed be verified by the blockhead to which the exchange belongs. The convergence of multiple approaches is also a new direction, requiring the construction of a new approach to complex distributed computing to manage information assets in an adversarial environment, with the emergence of convergent approaches such as time-locked protocols and protocols that blend classical atomic protocols with modern atomic exchanges [28]. The CBC protocol, which combines classical atomic protocols and modern atomic exchanges, enables information exchange through an authenticated blockchain [29].

However, there are few studies on cross-link performance data transfer, mainly on the performance evaluation of individual cross-link solutions. The lack of generalized cross-chain data transfer performance has hindered the use and development of cross-chain solutions in blockchain platforms. In this study, we analyze the current situation and needs of cross-link solutions in blockchain platform, study the key technologies involved in each link of blockchain, propose an index system and method for evaluating the data transmission performance of cross-link solutions, and design and implement an evaluation system to evaluate the existing cross-link solutions in the industry. The feasibility and validity of the method and system are demonstrated.

3. Methodology

The comprehensive trust evaluation scheme proposed in this study uses cross-chain in blockchain technology to ensure the trustworthiness of static data and solve the cold start problem [30]. The static and dynamic evaluation steps are the same, but the reference data for calculation are different; i.e., the static evaluation refers to the data provided by the information provider, and the dynamic evaluation is based on the data monitored by the information after invocation. The steps of comprehensive evaluation are as follows.

Step 1. Ensure the Trustworthiness of Information. When releasing services, service providers consider that some parameters may fluctuate due to network fluctuations, causing large uncertainties, and to ensure the authenticity of the parameters, they do not adopt the simple averaging method, but set the parameters in the form of interval numbers. In the cross-chain, only the services that reach consensus can be put on the chain, and the consensus stage mainly verifies whether the parameters of information exchange are reasonable. Considering the storage performance on the blockchain, this study represents the static parameters of each service in an array, hashes the array, and stores the hash value on the block, to prevent the information from being tampered and reduce the storage pressure on the block.

Step 2. Determine the Information Requirements. The platform coarsely selects the candidate services through the user's functional requirements. Considering that different users have different requirements for the same information, the platform allows the user to set the number of intervals for the requirements of various parameters and additionally sets the maximum tolerance threshold for the negative type parameters. The threshold is set to take into account the dynamic nature of the service being invoked, and if the current dynamic information is monitored to exceed the user threshold, the appropriate service is reselected.

Step 3. The candidate information is filtered by the interval number model, and the probability of the interval number is calculated and a probability matrix is constructed. The user requirements are compared with each parameter interval provided by the service provider, and the services with intersection between the number of intervals of user requirements and the number of intervals of service release are selected. The probability matrix is then constructed by calculating the probability of the interval number. The interval number is used to take into account the dynamic variability of the service, while the likelihood is quoted to measure the degree of fit between the current service and the user's information needs.

Let any two interval numbers be $a = [a^-, a^+]$, $b = [b^-, b^+]$, $l_a = a^+ - a^-$, and $l_b = b^+ - b^-$. Then, the degree of possibility that a is greater than b is as follows:

$$P(a \geq b) = \max\left\{1 - \max\left(\frac{b^+ - a^-}{I_a + I_a}, 0\right), 0\right\}. \quad (1)$$

Considering that throughput and success rate are positive indicators and response time, cost, and latency are negative indicators in this study, the values of different indicators are represented as follows.

$$P_{ij} = \begin{cases} p\left(c_{ij} \geq d_{ij}\right), \\ p\left(d_{ij} \leq c_{ij}\right), \end{cases} \quad (2)$$

where c_{ij} represents the matrix of the number of intervals of user requirements, i.e., the j_{th} indicator of the i_{th} information needs; d_{ij} represents the matrix of the number of intervals of information.

Step 4. Weight Setting. Weights are important parameters for evaluating multi-attribute questions, and traditional entropy weight method is influenced by sample data and may not match the realistic perception, while the hierarchical analysis method [31] relies too much on subjective emotion. Therefore, this study first uses the hierarchical analysis method to set the subjective weights, then uses the entropy weighting method [32] to set the objective weights and reduce the influence of subjective judgment on the weights, and finally combines the two to obtain the mixed weights.

The expert establishes the hierarchical analysis judgment matrix f_{ij} using the two-by-two comparison method on a scale of 1–9 and then verifies the matrix according to (3) and (4), where n is the matrix order and is the maximum $\phi_{\max}$ eigenvalue of the matrix. The value of R_{RI} can be obtained from the table, and the matrix is considered valid when $C_{CR} < 0.1$. After passing the validation, the subjective weights are calculated from (5). The subjective weights do not change due to the change in parameters, while the objective weights change according to the static data or dynamic data. The entropy of the ϕ_{th} index is first calculated by equation (6) based on the probability obtained in Step 3, then the weights are calculated by equation (7), and finally the mixed weights are calculated by equation (8).

$$C_{ci} = \frac{\phi_{\max} - n}{n - 1}, \quad (3)$$

$$C_{cr} = \frac{C_{c1}}{R_{R1}}, \quad (4)$$

$$w_j^s = \frac{\sqrt[m]{f_{i1} \times f_{i2} \times \ldots \times f_{im}}}{\sum_{j=1}^{m} \sqrt[m]{f_{i1} \times f_{i2} \times \ldots \times f_{im}}}, \quad (5)$$

$$e_j = \frac{1}{\ln\ n} \sum_{i=1}^{n} P_{ij} \ln \frac{1}{P_{ij}}, \quad (6)$$

$$w_j^o = \frac{1 - e_j}{\sum_{j=1}^{m} 1 - e_j}, \quad (7)$$

$$w_j = \gamma w_j^s + (1-\gamma) w_j^o, p = 1, 2, \ldots, m. \quad (8)$$

Step 5. Comprehensive Service Evaluation and Ranking. The approximate ideal solution ranking method [33, 34] evaluates the services by calculating the distance between the candidate information needs and the best and worst information needs, respectively.

Firstly, according to the possible readings of the interval number in Step 3, the evaluation matrix P of the possible degree is established, and then, according to the corresponding mixed weights in Step 4, the weight matrix W is established and rewritten in diagonal form, and then, the comprehensive evaluation matrix Z is obtained. Then, the maximum value in each index is taken to form a positive ideal solution [35], and the minimum value in each index forms a negative ideal solution, and each candidate information service is calculated once by equations (9) to (11). Finally, the information needs that are closer to the positive ideal solution and farther from the negative ideal solution are the best information need.

$$V_i^+ = \sqrt{\sum_{j=1}^{m} \left(z_{ij} - z_j^+\right)^2}, \quad (9)$$

$$V_i^- = \sqrt{\sum_{j=1}^{m} \left(z_{ij} - z_j^-\right)^2}, \quad (10)$$

$$C_i = \frac{V_i^-}{V_i^+ + V_i^-}. \quad (11)$$

Considering the cold start problem, when the information service has no history of being invoked, the evaluation is based on the static information provided by the information provider, and the evaluation level is relatively high because the information is stored in the blockchain. As the number of invocations of the information needs increases, the static weight will be from up to down, and the comprehensive evaluation of the information exchange and need should focus on the dynamic evaluation data of the current information service, so the comprehensive evaluation value of the information exchange and need is calculated as follows:

$$Q = \frac{1}{\mu + 1} C_{\text{static}} + \frac{\mu}{\mu + 1} C_{\text{dynamic}}. \quad (12)$$

The comprehensive evaluation process is shown in Figure 4.

4. Discussion and Results

To validate the evaluation scheme proposed in this study, the Dataset (2.0), which was updated at the end of 2019, is used.

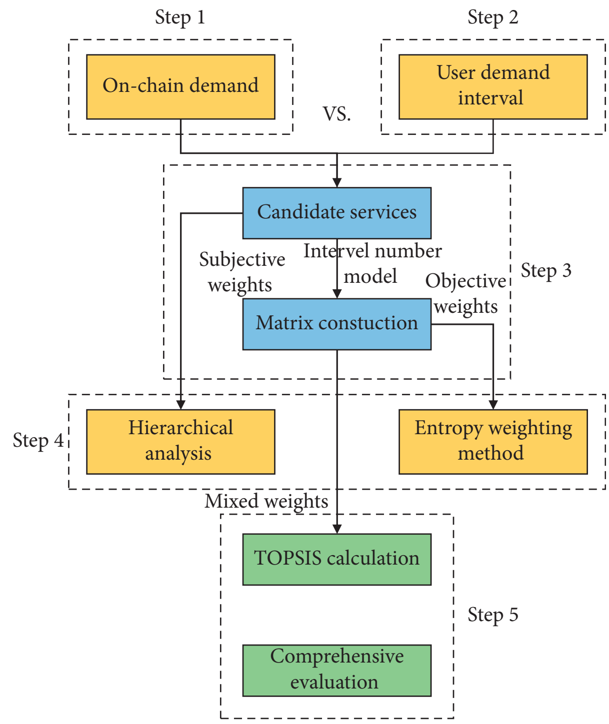

Figure 4: Comprehensive evaluation process.

The dataset contains 2,507 real performance metric values of Web service invocations. The performance metrics are response time (RT), throughput (TP), success rate (SA), price (BP), and latency (LC), with response time, price, and latency as negative metrics and throughput and success rate as positive metrics.

Since the newly released service has no runtime data, the static trust evaluation is weighted as 1. After each service is invoked once, the dynamic information is calculated based on the data at the time of invocation, and the comprehensive trust value is finally calculated to provide reference for subsequent user selection. As can be seen from Figure 5, the ranking of the services fluctuates slightly with the addition of real-time dynamic information when the services are invoked, which is due to the instability of information, but reflects the performance of the recently invoked information, and finally, the two are combined to make the evaluation results trustworthy and consistent with the facts. As can be seen, CSP7, CSP8, and CSP11 are no longer involved in the ranking because the subscriber sets the threshold and the most recently invoked service detected that the dynamic parameters of the services provided by these three cloud service providers exceeded the maximum tolerance threshold, so they are not included in the recommendation list.

The original static information is guaranteed to remain unchanged, but the static composite weights will change, and the change in the service ranking of the top 5 (CSP10, CSP1, CSP5, CSP13, and CSP2) is calculated as shown in Figure 6.

The degraded parameters of the first ranked service (CSP10) and the optimized parameters of the fifth ranked service (CSP2) are used to determine whether this scheme correctly reflects the change in service ranking in time (Figure 7). The static original information does not change

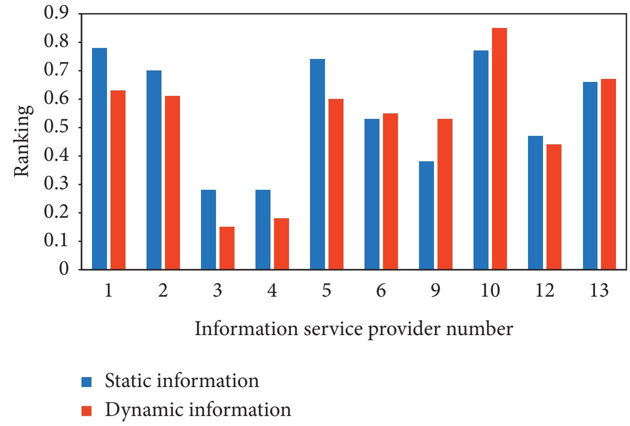

FIGURE 5: Static ranking during cold start and comprehensive ranking after service call.

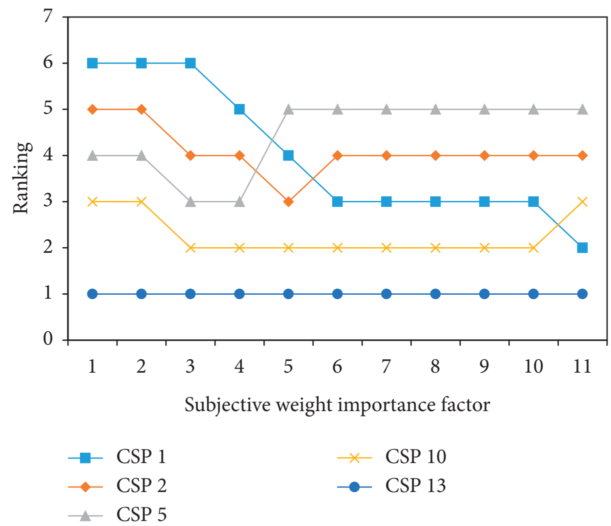

FIGURE 6: Influence of subjective weight importance coefficient on comprehensive service ranking.

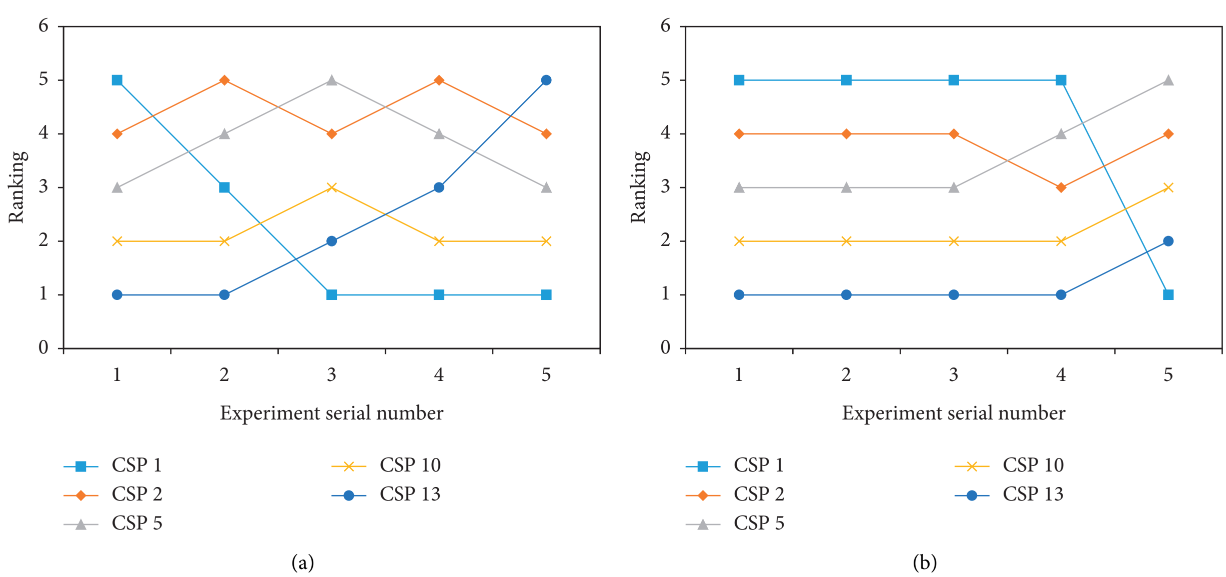

FIGURE 7: (a) Impact of changing dynamic value on comprehensive service ranking. (b) Impact of user demand change in comprehensive service ranking.

during the experiment and $\gamma = 0.5$. As shown in Figure 7(a), we can see that when the QoS parameters of CSP10 and CSP2 are constantly changing, the comprehensive ranking of the service is also changing, and through continuous optimization, CSP2 changes from the worst service to the best service and CSP10 changes from the best information exchange efficiency to the worst information exchange efficiency. It is clear that the scheme in this study can correctly reflect the change in service ranking in time. In addition, the experiment observes the service ranking according to the change in user demand. With $\gamma = 0.5$, the service ranking of five CSPs is shown in Figure 6. As shown in Figure 7(b), it can be seen that when the user demand keeps changing, the number of intervals into which static information and dynamic information are transformed changes, and the ranking will change.

In conclusion, the comprehensive evaluation scheme proposed in this study shows good comprehensive evaluation effects in both dynamic parameter changes and information service demands, and the evaluation weights change accordingly as the number of calls increases, thus ensuring the objective and reliable evaluation results.

5. Conclusion

As music can nurture people's emotions and promote healthy physical and mental development, it is not difficult to conclude that music therapy is indeed very therapeutic and helpful for people's mental problems and plays a unique role in promoting people's personal development. We must not only focus on the social development of people but also on their individuality, so that they can become richer and more independent individuals. In addition to influencing people's emotions, music can also stimulate their imagination and be an effective way to subconsciously change their acceptance of certain things. Of course, music can also help people regulate their emotional problems by eliminating negative emotions, diverting their attention, calming or improving their stress and problems, evoking their inner perceptions, effectively improving their aesthetic abilities, and so on. Music is an essential part of our daily lives, and society cannot afford to be without music therapy, which is a two-pronged treatment option. Music therapy is an area worthy of further investigation and development, both from the perspective of the medical profession and from the perspective of the development of music aesthetics and the social function of music. The field of music therapy is one that is worthy of further investigation and development. More importantly, the use of group music therapy in public health is beginning to bear fruit, and music is becoming a complementary element in ensuring public health. However, few current studies have discussed comprehensive evaluation methods for public health-oriented music performing arts.

Therefore, this study proposes a dynamic comprehensive evaluation scheme based on cross-chain technology in blockchain and establishes a cross-chain-based information exchange model for the feasibility of information exchange between music performing arts and public health. The interval number model is chosen to describe static and dynamic information, respectively, for the dynamic nature of different module information, while the evaluation matrix is constructed by calculating the intervals. The subjective and objective weights are combined to set mixed weights to ensure the comprehensiveness of service evaluation.

In conclusion, this study provides technical support for the comprehensive evaluation of the effectiveness of music performing arts activities in the public health field by introducing blockchain technology while realizing the information exchange between music performing arts activities and the public health field. Given that the scheme proposed in this study is not limited to specific information modules, the method can be extended to more fields in the future.

However, it should be clarified that the technical steps of the scheme adopted in this study are still complicated, and only a small sample is adopted for the effectiveness testing session. Future research can transform the comprehensive evaluation process into a generic-only contract and enhance the practicality and generalizability of the scheme in this study by simplifying the data processing process.

Data Availability

The data are available on request from the corresponding author.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Research Article

Building Better Cities: Evaluating the Effect of Circular Economy City Construction on Air Quality via a Quasi-Natural Experiment

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The resource utilization of a circular economy should reflect both economic and environmental values. Resource utility can be measured by GDP in the short term, while environmental value is challenging to measure; that is, the improvement in air quality is not effectively evaluated. In order to examine this initiative, using China's pilot cities of circular economy as a quasi-natural experiment, we construct a difference-in-difference (DID) strategy for estimation. The results demonstrate the following: (1) the pollutant emissions of pilot cities decline by 2.92 percentage points ($p < 0.01$) compared to unpiloted cities, (2) the policies on pilot cities more rapidly enhanced air quality for central cities and those with a low level of economic development, and (3) pilot cities significantly enhance air quality by decreasing energy consumption per unit of GDP. We provide the first empirical evidence of the effectiveness of circular economy pilot cities in improving air quality.

1. Introduction

Measures to mitigate climate change have often been presented dramatically as a "prohibition of the nice things of life." However, a cutoff of such nice things only delivers an 8% reduction in air pollution [1], indicating that a completely different approach to tackling urban climate issues is required. The circular economy is recognized as having a great potential for mitigating global issues such as climate change, resource scarcity, air pollution, water contamination, and soil pollution [2].

Every week, the global population increases by 1.5 million people [3], and 3 million people enter the global middle class [4]; many people move from rural to urban areas. This rapid demographic shift has one inevitable consequence: worldwide, there is an increasing demand for essential goods, housing, and transportation [5]. All of these processes burden the Earth and contribute to air quality deterioration. The circular economy is a growing concept, the goal of which is leading to a more sustainable economy and contributing to recycling and reusing products, thereby making them "circular." Circular economy is an advanced economic model in order to pursue greater economic benefits, less resource consumption, and lower environmental pollution, and it is an important way to improve urban environmental air quality. In order to achieve the goal of long-term and stable improvement of urban ambient air quality, we must build the city into a circular economy and a society.

There are many reasons why circular economy city construction plays a vital role in air quality improvement. First, reducing, reusing, and recycling eliminate $PM_{2.5}$ by decreasing emissions from traditional waste management strategies: energy recovery and landfilling. Second, circular economy strategies help reduce fine particulate matter emissions by cutting the energy needed in industrial production to convert primary raw materials into products. However, at the theoretical level, the reasons for improving air quality through circular economy city construction are still unknown. It is worth noting that, in addition to cities, there are pilot firms or industrial parks in the pilot scheme. In this study, these pilot firms or industrial parks all belong to the scope of circular economy city construction.

Globally, while countries have adopted the construction of circular economic cities as an essential means to cope with climate change, there is no systematic review summarizing the results of the scientific literature on the extent to which circular economic city construction can contribute to air quality improvement. In recent literature, Nishijima and colleagues (2020) analyzed the impact of price increases on greenhouse gas (GHG) emissions in a circular economy and stated that a 30% price increase could reduce GHG emissions. Although this paper involves the relationship between the circular economy and air pollutant emissions, the research perspective does not focus on the circular economy itself.

In terms of policy, there is scarce literature examining the effect of China's circular economy pilot policies in cities. China's development of an urban circular economy began as early as 17 years ago. The National Development and Reform Commission (NDRC) successively offered the pilot circular economy city initiative twice in 2005 and 2007 in China. The NDRC appointed 178 circular economy pilot units, which included 58 cities. Although a few studies [6, 7] have focused on assessing the development level of circular economy cities, the research focus does not directly encapsulate the policy of pilot cities for the circular economy. Thus, the achievements of the research objectives for the cities appointed by the National Development and Reform Commission in 2005 and 2007 have been unknown. Furthermore, in terms of research methods, on the one hand, most literature has failed to quantify evaluation of the effects of the circular economy on the prevention of air pollution. On the other hand, a few studies have used the method of establishing an evaluation index system and case analysis to assess the effects of the policies of the circular economy pilot city on the reduction of $PM_{2.5}$ emissions. However, the determination of the circular economy pilot cities is inherently potentially endogenous. Furthermore, circular economy pilot cities are not randomly selected, and the unobservable differences between the pilot city and the unpiloted city may impact air quality. Therefore, the result of regression analysis can be biased, which indicates that the circular economy pilot cities cannot determine the result of the direct regression.

On the basis of preceding, reconsideration, and reevaluation of circular economy city pollution, prevention and control effects appear necessary. First, most existing literature on circular economy development models contains elements of the circular agricultural economy, the circular industrial economy, and waste recycling in the service industry [8–11]. However, cities are essential for developing a circular economy [12]. Furthermore, with the adoption of the 2030 Sustainable Development Goals by the United Nations and the adoption of a new agreement on global climate change at the Paris Conference, countries around the world are attaching greater importance to developing a circular economy [13, 14]. However, the impact of implementing a pilot circular economy policy on urban air quality has not been formally examined and understood empirically. Therefore, we aim to close this gap by investigating how China's pilot policies on a national circular economy affect air quality and provide a frame of reference for countries worldwide to transform economic development mode.

On the basis of the existing literature, the following questions are proposed: Does the implementation of the circular economy pilot policies improve air quality in cities? Are there temporal and spatial differences in their impacts? What is the mechanism affecting air quality? We propose a novel analytical model to investigate these questions using a national annual panel dataset of 115 prefecture-level cities. This work has a guiding significance for the regions of China to further underline the vital role of the circular economy in reducing air pollution.

2. Policy Background and Research Hypotheses

2.1. Policy Background. From the late 1990s to 2003, China introduced the circular economy concept from developed countries. Subsequently, Shanghai, Guiyang, the province of Liaoning, and the province of Jiangsu, launched pilot projects on the circular economy. Since then, there has been a boom in national research on the circular economy. In 2005, according to the "Several Opinions of the State Council on Accelerating the Development of Circular Economy" issued by the State Council, the Chinese government issued the "Notice on Organizing and Carrying out Circular Economy Pilots (First Batch)" and launched the first batch of national pilots in three provinces and seven cities [15]. In 2007, in cooperation with the relevant departments, the National Development and Reform Commission issued the "Notice on Organizing and Carrying out Circular Economy Demonstration Pilots (Second Batch)." The second batch of the national pilot projects was launched, including 1 province and 12 cities [16]. Subsequently, a series of laws related to the circular economy was promulgated and implemented, and the development of the circular economy in China entered a legalized track.

2.2. Research Hypotheses. The circular economy city pilot policy focuses on the fundamental transformation of the pattern of economic growth, intending to reduce the consumption of resources, decrease waste discharge, and improve resource productivity. The goal of circular economy pilot policies in cities is to organize economic activities under the principle of "reducing, reusing, and recycling" and plan and build a city of economic efficiency, social harmony, and a virtuous ecological cycle. According to Grossman and Krueger [17]; Brock and Taylor [18]; Auffhammer et al. [19]; and other related literature, the impact of haze and other environmental pollutants mainly includes three aspects: the scale effect, the structure effect, and the technology effect. Therefore, this paper argues that the pilot policies on the circular economy can affect air quality through optimizing industrial structures (the structure effect), reducing energy consumption per unit of GDP (the scale effect), and promoting technological progress (the technology effect).

Firstly, the pilot policy on circular economy cities enhances air quality by optimizing the structure effect. The structure effect refers to the pollution density of production activities, which directly affects environmental quality. The more concentrated the production activities are, the more intensive the pollution becomes, which directly influences environmental quality. In other words, in transforming the industrial structure from primary industry to secondary industry and then to tertiary industry, environmental quality is first reduced and then improved [20].

Specifically, the circular economy is essentially an ecological economy, which requires using ecological laws to guide the economic activities of human society and reconstruct the economic system according to the laws of energy transformation and material circulation in natural ecosystems. As far as the relationship between circular economy and industrial structure optimization is concerned, first of all, the principle of reduction in circular economy requires that the goal of improving resource utilization is to promote the development of modern service industries, high-tech industries, and environmental protection industries, thereby reducing pollution per the unit output value [21]. Then, the recycling principle of the circular economy will prolong the service life of products and promote the development of after-sales services such as repair, maintenance, and renovation [22]. Finally, the recycling principle of circular economy will strengthen the recycling of various wastes [23], comprehensively exploit resources, and promote the development of the packaging industry and other producer services. Taking the packaging industry as one of the productive service industries as an example, since it has that are primarily disposable, about 80% of the packaging in China changes into waste after one-time use. The circular economy aims to efficiently utilize and recycle resources, and most of the various products in the packaging industry can be recycled after being discarded. After treatment, they can be recycled into new products to achieve a win-win situation for economic and environmental benefits [24].

Moreover, the circular economy will stimulate the development of consumer service industries such as the horse racing industry [25]. Therefore, a circular economy promotes advanced industrial structure and optimizes and upgrades traditional service industry to a modern service industry, creating a modern service industry with minimal pollution emissions and achieving an advanced industrial structure conducive to improving air quality.

Nonetheless, the rapid development of China's economy cannot be separated from the support of heavy industry. The current development model of heavy industry in China produces high emissions of pollutants and exploits resources inefficiently. Furthermore, the industrial structure of relying on heavy industry to develop the economy has seriously affected the air quality of China's cities. The rationalization of the industrial structure is a dynamic process of synergizing and strengthening the coordination and correlation between industries. It reflects whether resources are being exploited rationally and indicates the coordination between industries. First, the circular economy requires the integrity and coordination of the industrial structure and environmental protection. Therefore, we posit the following:

Hypothesis 1. Circular economy cities improve air quality through (a) advanced industrial structure and (b) rational industrial structure.

Second, the construction of circular economy pilot cities can improve air quality by reducing electricity consumption per unit of GDP, that is, via the scale effect. The scale effect refers to the fact that economic development brings more significant economic activities and demand for resources and energy, resulting in higher emissions of pollutants and thus adverse effects on the environment. The atmospheric environment correlates closely with the emissions of pollutants and energy consumption. In fact, the rapid consumption of energy is one of the leading causes of urban atmospheric pollution [26]. Therefore, the circular economy development model of "reduction" and "low energy consumption" has become an inevitable and realistic choice. A circular economy leads to the lowest possible consumption of resources, reduces emissions, and provides the greatest possible economic and environmental benefits so that the material circulation process of the economic system and the natural ecosystem mutually promote and coordinate each other. Therefore, this paper proposes the following hypothesis:

Hypothesis 2. Circular economy cities reduce electricity consumption per unit of GDP.

Finally, the construction of circular economy cities can enhance air quality through the technology effect. The basic principle of and the driving force behind the development of a circular economy is to accelerate technological progress, an essential means to realize the coordinated development of the environment and the economy. Through its policy-oriented function, the circular economy can promote many potential and wide-ranging energy conservation and alternative technologies, zero-emission technologies, and technologies for pollution reduction. Meanwhile, the advancement of China's current modernization requires the development of energy and heavy industry, which leads to a series of energy consumption and pollution problems. The construction of resource-saving and environmentally friendly cities requires accelerated technological progress. According to an elaboration of classic growth theory, continuous technological progress is the key to achieving long-term economic growth, and the growth of total factor productivity is an essential manifestation of technological progress [27]. In neoclassical economic growth theory, technological progress is a broad concept, often equivalent to the improvement in total factor productivity. However, technological progress is different from the change in total factor productivity in economics and management, which is a narrow concept. This work uses the total factor productivity index calculated by data envelopment analysis (DEA) (Malmquist) to measure technological progress [28] and to investigate whether the construction of circular economy cities can improve air quality through technological progress. Therefore, on the basis of the above, we propose:

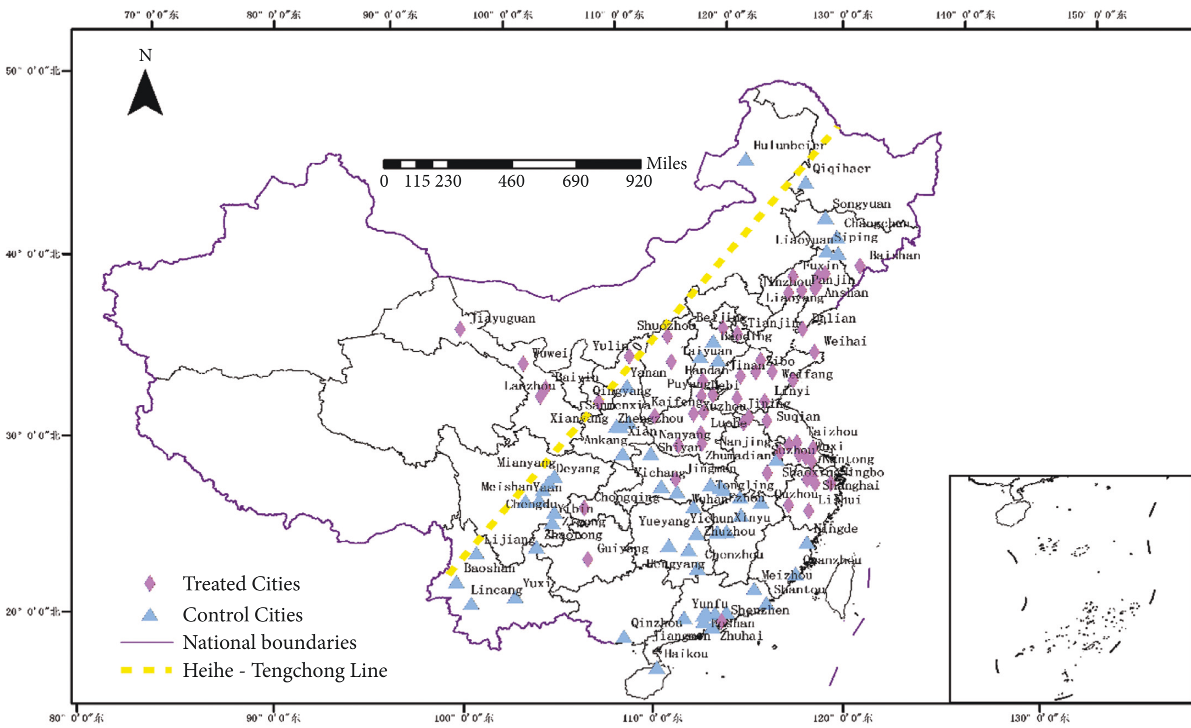

Figure 1: Pilot cities and unpiloted cities of circular economy in China. Note: the Heihe-Tengchong Line was proposed by Chinese geographer Hu [33] and is a demarcation line of population density extending from Heihe in Heilongjiang province to Tengchong in Yunnan province, from the northeast to the southwest of China. Its formation and development are closely related to natural conditions such as terrain, landform, climate, hydrology, and other factors correlated closely with social, economic, and human activities.

Hypothesis 3. Circular economy cities improve air quality through technological innovation.

3. Methodology

In this section, we describe the model, methods, and data used in the investigation.

3.1. Baseline Model. The question explored in this work is whether constructing a circular economy city can reduce the emissions of air pollutants and improve air quality. To this end, this study regards the policy on circular economy pilot cities as a quasi-natural experiment and thus recognizes and evaluates its effects through the DID approach, which can solve most of the endogenous problems encountered in the related literature [29]. The current research considers 32 cities in the first batch of the pilots in 2005 and 26 cities in the second batch of the pilots in 2007 to be the treatment group and uses the remaining 57 cities as the control group to compare the difference in the air quality of the pilot and unpiloted cities before and after implementing the policy, as shown in Figure 1. This work follows the practices of Gehrsitz [30]; Cheng et al. [31]; and Song et al. [32] and specifies the following measurement model:

$$Y_{it} = \alpha + \beta \mathrm{Treat}_{it} + X_{it}'\gamma + \delta_i + \mu_t + \varepsilon_{it}, \tag{1}$$

where i indicates the city, t denotes the year, Y_{it} is the air quality of a city, and Treat_{it} represents a dummy variable reflecting the status of a circular economy pilot city; the value of Treat_{it} is one if a city is a pilot, otherwise it equals zero. X_{it}' is a control variable. This model also includes the city-fixed effect (δ_i), the year-fixed effect (μ_t), and an error term (ε_{it}). β is the coefficient on which this paper focuses most; it indicates the impact of the construction of the circular economy pilot cities on air quality. A significantly negative β value indicates that the pilot policy on circular economy cities is effective; on the contrary, a positive β value implies that the pilot policy on circular economy cities negligibly affects the improvement in air quality.

It is necessary to satisfy the parallel trend test to ensure the effectiveness of the DID method, which indicates that the trends of variation in air quality in the circular economy pilot cities (the treatment group) and in the unpiloted cities (the control group) are parallel. On the basis of the works of Jacobson et al. [34]; Moser and Voena [35]; Li et al. [36]; and Zhang [37]; this paper analyzes the parallel trend hypothesis. Since the pilot policy on the circular economy was launched in 2005 and 2007 separately, the status of a specific city in the control group or the experimental group varies. Therefore, it is more reasonable to use the event analysis method for testing rather than draw the average trend chart between the experimental and control groups. Thus, the following calculation model is developed:

$$Y_{it} = \alpha + \sum_{k \geq -4}^{4} \beta_k \times V_{c,t_0+k} + X_{it}'\gamma + \delta_i + \mu_t + \varepsilon_{it}, \tag{2}$$

where i indicates the city, t denotes the year, Y_{it} is the air quality of a city; V_{c,t_0+k} is a virtual variable indicating that t_0

is the first year when city i implements the policy on the circular economy, and k represents the kth year after starting the circular economy pilot. $k < 0$ implies the years before the pilot policy on the circular economy is launched, and $k > 0$ indicates the years after the pilot policy on the circular economy is launched. The current work examines the dynamic effects of the pilot policy on the circular economy city four years before and four years after the policy was launched. The remaining variables in (2) are defined the same as those presented in (1). This paper focuses on parameter β_k, which represents the impact of circular economy cities on air quality before and after the pilot policy was launched. From the assumption of the standard trend test, it can be inferred that when $k < 0$, parameter β_k does not significantly differ from zero, indicating that this paper fulfills the requirements of the assumption of the standard trend test.

Estimated results are affected by other unobservable urban characteristics that change with time when using the DID method to identify the hypothesis. Although this paper adds a series of control variables, including indicators at the characteristic city level and at the weather level, it is impossible to control for all characteristics, especially unobservable ones. Therefore, to eliminate the influence of legacy variables, this work conducts an indirect placebo test based on the random selection of the circular economy pilot cities. The following calculation model is developed:

$$\widehat{\beta} = \beta + \omega \times \operatorname{cov}\frac{(\mathrm{Treat}_{it}, \varepsilon_{it}, |Q)}{\operatorname{var}(\mathrm{Treat}_{it}|Q)}, \tag{3}$$

where Q represents all of the control variables and the fixed effects, and ω indicates the influence of the unobserved factors on the explained variables.

We also judge the robustness of the primary outcomes related to confounding effects derived from unobservable variables utilizing a matched sample of observations, i.e., propensity score matching (PSM). We employ the nearest neighbor matching algorithm with replacement and caliper. Our difference-in-difference analysis constructs a counterfactual outcome using a set of untreated cities: no circular economic policies are implemented during the observation window period. The intuition behind matching is that the more similar treated and untreated cities are in their observed characteristics, the less likely they will differ in unobserved ways, including bias-inducing factors. Matching methods aim to reduce endogeneity concerns by ensuring comparability between treated and untreated units [38].

In addition, the ideal situation of the DID model is that both the control group and the experimental group are randomly selected. However, the scope of pilot cities is not randomly selected since many factors such as the geographical location and economic and social development levels are taken into account when selecting pilot cities. Moreover, the differences between the cities have diverse impacts on the urban environment over time, so it is difficult to guarantee the accuracy of the results.

For this reason, we attempt to control the above influences and then investigate whether the conclusion still holds. Referring to the practices of Zhang [37] and Song et al. [32]; this work adds the cross-term of the benchmark variable and the linear trend of time to the regression as follows:

$$Y_{it} = \alpha + \beta \mathrm{Treat}_{it} + X_{it}'\gamma + O_i' \times \mathrm{trend}_t + \delta_i + \mu_t + \varepsilon_{it}, \tag{4}$$

where i represents a city, and O_i' indicates the inherent characteristics of the city, such as the geographic location and the original socioeconomic characteristics. The proxy variables of these prerequisite factors identified in this paper are the capital cities, the cities piloted for the "two-control areas" in 1998, and the cities in special economic zones. trend_t represents a linear trend over time, so $O_i' \times \mathrm{trend}_t$ uses the linear trend to control the impact of the original differences between the cities on air quality, which reduces the deviation caused by the nonrandom selection of the pilot cities and the unpiloted cities.

The variation in air quality correlates closely with urban meteorological conditions, geographic location, and economic scale [32]. The similar differences between the cities may lead to various effects after their respective policies are implemented. Thus, this paper further examines spatial differences in the impact of the pilots on air quality from three specific aspects in this section. It should be noted that the heterogeneity analysis does not have causal interpretations but helps understand the channels through which circular economy pilot policies in cities affect air quality. First, according to the characteristics of the climatic zones, we define three subsample cities: the temperate monsoon climate, the temperate continental climate, and the subtropical monsoon climate. There are very few cities in other climatic zones which do not constitute a statistical condition, so we mainly analyze the cities in the three climatic zones mentioned above. Second, according to the geographical location, the cities are divided into the east, the middle (central), and the west. In addition, the subsample cities are divided according to the level of per capita GDP.

Furthermore, what is the specific transmission mechanism of circular economy city pilot policy to improve air quality? In other words, what are the key variables affected by the circular economy urban pilot policies to change air pollution levels? Referring to the practices of Gelbach [39] and Heckman et al.'s [40] method, we construct the following model:

$$\mathrm{Media}_{it} = \beta_0 + \beta_1 \mathrm{Treat}_{it} + \xi X_{it}' + \delta_i + \mu_t + \varepsilon_{it}, \tag{5}$$

$$\begin{aligned} \mathrm{CE}_{it} = {} & \gamma_0 + \gamma_1 \mathrm{Treat}_{it} + \gamma_2 \mathrm{Media}_{it} \\ & + X_{it}' + \delta_i + \mu_t + \varepsilon_{it}, \end{aligned} \tag{6}$$

where Media_{it} represents the intermediary variable, and V_{it}' denotes a set of control variables consistent with the benchmark regression. Model (5) is the regression equation between virtual variables and intermediary variables in the pilot cities of circular economy, and Model (6) is the regression equation between virtual variables and intermediary variables in the pilot cities of circular economy and $PM_{2.5}$. In the basic regression, if β_1, γ_1, and γ_2 are all significant, it can be predicted that Media_{it} plays a partial mediating role in improving air quality in the pilot cities of circular economy.

3.2. Data Description and Preliminary Statistical Description. The data on the explained variable for air quality originate from the world density map in the period from 1998 to 2016, jointly published by the Center for Socio-Economic Data and Application (SEDAC) of Columbia University's International Earth Science Information Network (CIESIN) and the United States Atmospheric Composition Group. The raster data cover the information on Earth pollution from 70° north latitude to 60° south latitude, with an observation accuracy of 0.5° × 0.5°. On the basis of the raster data and the methods of Li and Zhang [41]; this work uses ArcGIS to consider the average value of the city administrative unit and the concentration of $PM_{2.5}$ emissions from the city and generates continuous and complete data on $PM_{2.5}$ emissions from 2003 to 2016, along with the annual maximum index of $PM_{2.5}$. The annual maximum pollution index was further tested for the robustness of the model.

The core explanatory variable is the circular economy pilot city. The value equals one if the city implements the circular economy pilot in the current year and later, otherwise it equals zero. Since the pilot policy on circular economy cities was implemented in two batches separately, in 2005 and 2007, the lists of the two pilots overlap. Thus, this work uses the method of Zhang [37] regarding both provinces and cities under its jurisdiction as the pilots.

The climate data were obtained from the 2345 Weather Network and the National Climate Data Center, including the average wind speed (m/s), the number of sunshine hours (h), and average air pressure (hPa).

This paper selects the indicators of city-level energy consumption per unit of GDP, advanced industrial structure, rationalized production structure, and technical progress to analyze the specific impact mechanism. Among them, the structure effect is represented by an index of advanced industrial structure and rationalized production structure, the scale effect is represented by an index of energy consumption per unit GDP, and the technology effect is represented by an index of technical progress. The primary data originate from the statistical yearbooks of various provinces and cities, the *China Energy Statistical Yearbook*, and statistical bulletins. The current study employs a tertiary industry to account for the proportion of GDP to measure the degree of advanced industrial structure. The formula for calculating energy consumption per unit of GDP is defined as

$$\begin{aligned}\mathrm{EI}_{it} &= \frac{\mathrm{Energy}_{it}}{\mathrm{GDP}_{it}} = \frac{\sum_j^J \left(\mathrm{GDP}_{ijt}\cdot \mathrm{EI}_{jt}\right)}{\mathrm{GDP}_{it}}\\ &= \frac{\sum_j^J \left(\mathrm{GDP}_{ijt}\cdot \left(\mathrm{Energy}_{it}/\mathrm{GDP}_{it}\right)\right)}{\mathrm{GDP}_{it}},\end{aligned} \tag{7}$$

where i, t, and j denote the city, year, and industry, respectively; Energy_{it} represents the total energy consumption in period t of region i (metric tons of standard coal); GDP_{it} indicates domestic (regional) GDP in period t of region i (100 million yuan).

Moreover, this work draws on the Theil index to measure the degree of the rationalization of industrial structure in each city [42]. The index has the prominent properties of considering the structural deviations of the output value and the employment of the different industries and the various economic statuses of each industry. The specific calculation formula is given by

$$M_{i,t} = \sum_{n=1}^{3} \theta_{i,n,t} \ln\left(\frac{\theta_{i,n,t}}{\omega_{i,n,t}'}\right), \quad n = 1,2,3, \tag{8}$$

where $\theta_{i,n,t}$ represents the proportion of the nth industry in region i to regional GDP in period t, and $\omega_{i,n,t}'$ indicates the proportion of employees in the nth industry in region i to total employed persons in period t. The Theil index reflects the output value structure and personnel employment structure of three primary industries in China. A zero value indicates that the industrial structure is at an equilibrium level; otherwise, the industrial structure deviates from the equilibrium, and the mean industrial structure is unreasonable.

This paper refers to the method of Shao and Xu [27] to develop a total factor productivity index by using GDP as the output indicator (y) and by employing the labor force (L), energy consumption (S), and capital stock (K) as the inputs. The total factor productivity index is utilized to measure technological progress and is expressed in

$$\begin{aligned}&T^t = \left\{\left(x^t, y^t\right): \text{all } x^t \text{for produce } y^t\right\},\\ &K_o\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \left[\frac{D_o^t\left(x^{t+1}, y^{t+1}\right)}{D_o^t\left(x^t, y^t\right)} \times \frac{D_o^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_o^{t+1}\left(x^t, y^t\right)}\right]^{1/2},\end{aligned} \tag{9}$$

where $x^t \in R_+^N$ and $y^t \in R_+^K$, respectively, represent an $(N\times 1)$-dimensional input vector and a $(K\times 1)$-dimensional output vector in period t. Production technology in period t is defined by the set of the production possibilities given in (1), and $D_o^t(x^t, y^t) = \inf\{\varnothing > 0\colon (x^t, y^t/\varnothing) \in T^t\}$ denotes the output distance function; inf indicates the maximum lower bound of the set; subscript o denotes the use of an analysis model based on the output perspective.

The data on the control variables are obtained from official statistics such as the *Statistical Yearbook of China's* Urban *Construction* and *City Statistical Yearbooks*. The control variables include industrial sulfur dioxide emissions, emissions of industrial smoke and dust, the treatment rate of domestic sewage, the rate of the comprehensive utilization of industrial solid waste, the rate of the harmless treatment of the domestic garbage, the rate of the innocuous treatment of domestic garbage, the industrial wastewater discharge, the green coverage in the built-up areas, the actual foreign investment, the total industrial output value of the enterprises above the designated size (10,000 Yuan), the number of the registered unemployed in the urban areas at the end of the year, the population density, the number of public automobiles and electric vehicles per 10,000 people, and the proportion of the secondary industry in GDP. Table 1 tabulates the statistical description of the above variables.

Table 1: The descriptive statistics for the model variables.

Variables	Obs.	Pilot city Mean	Pilot city Std. dev.	Unpiloted city Mean	Unpiloted city Std. dev.
Air quality					
$PM_{2.5}$ ($\mu g/m^3$)	1610	64.06	23.22	51.01	20.47
Climate data					
Average wind speed (m/s)	1610	2.23	0.59	1.93	0.92
Sunshine hours (h)	1610	5.75	1.26	4.94	1.37
Average air pressure (hPa)	1610	4.99	0.02	4.99	0.03
City characteristic data					
The proportion of the secondary industry in GDP	1608	52.51	9.97	48.38	10.01
Industrial wastewater discharge (10 thousand tons)	1606	3.85	0.50	3.68	0.47
Industrial sulfur dioxide emissions (tons)	1604	4.74	0.44	4.48	0.52
Emissions of industrial smoke and dust (tons)	1602	4.37	0.41	4.11	0.50
Rate of comprehensive utilization of industrial solid waste	1588	82.18	39.59	80.95	19.76
Treatment rate of domestic sewage	1545	72.19	23.45	65.23	26.71
Rate of harmless treatment of domestic garbage	1530	88.18	20.10	79.85	26.73
Green coverage area in built-up areas (hectares)	1606	3.66	0.49	3.41	0.47
Actual foreign investment (10 thousand dollars)	1592	4.57	0.93	4.16	0.87
The total industrial output value of enterprises (10 thousand yuan)	1607	6.99	0.67	6.60	0.75
Number of urban unemployed registered (person)	1601	4.38	0.41	4.30	0.36
Population density (person/km^2)	1491	2.64	0.35	2.54	0.37
Number of public automobiles and electric vehicles per 10,000 people	1609	9.91	12.25	7.85	9.77
Technology progress	1610	0.93	0.15	0.926	0.15
The proportion of the tertiary industry in GDP	1610	38.41	10.75	36.95	8.69
Industrial structure rationalization	1610	−4.98	86.89	−1.45	52.93
Energy consumption per unit of GDP (ton of standard coal/100 million yuan) (log)	1610	3.99	0.26	4.01	0.22

Source: the data on air quality originate from the world density map; the weather data come from the National Climatic Data Center; the China Energy Statistical Yearbook calculates energy consumption per unit of GDP; other city characteristic variables are from the Statistical Yearbook of Cities.

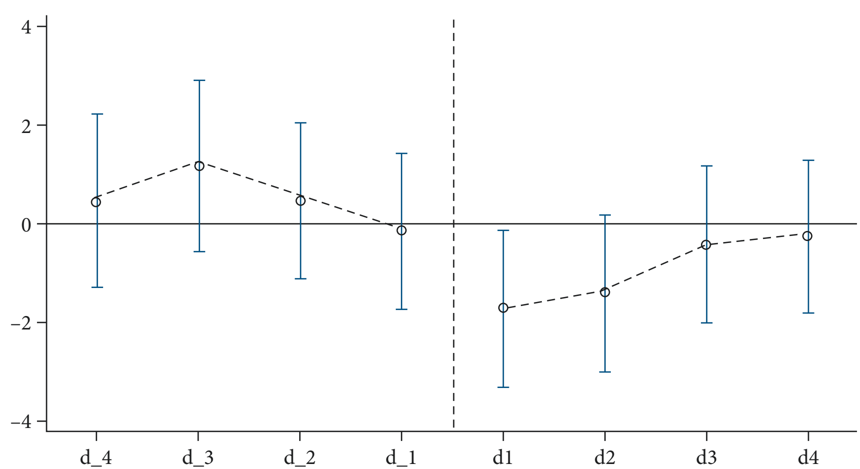

Figure 2: Dynamic effect test. Note: the vertical line represents the 95% confidence level of each point.

4. Empirical Estimation and Results

Using the data on 115 cities across China from 2003 to 2016, we utilize the DID method to empirically analyze the impact of circular economy city pilot policy on air pollution and conduct the related tests. We estimate the heterogeneity of circular economy city effects on air quality and perform event analysis, the placebo test, and a series of robustness tests. Finally, we identify the mechanisms influencing air pollution reduction and formally test the hypotheses.

4.1. Dynamic Effect Test: Event Study Designs. A prerequisite for using the DID model is that the treated and control groups must maintain the same time trend before policy implementation. We used the event study method to estimate the dynamic effects by generating the interaction terms between the time dummy variables and the group dummy variables. Figure 2 delineates the estimated value of parameter β_k at a 95% confidence level. The vertical dotted line represents the year when the policy was implemented. The x-axis indicates the number of years before and after the circular economy city pilot, and the y-axis denotes the

Table 2: Baseline regression results for the impact of circular economy pilot cities on air quality ($PM_{2.5}$ in $\mu g/m^3$).

Variables	Air quality (1)	(2)	(3)	(4)	(5)	(6)
$treat_{it}$	−1.2573**	−1.6823***	−1.3529**	−1.7831***	−1.4101**	−1.8027***
	(0.5665)	(0.5990)	(0.5811)	(0.6167)	(0.6391)	(0.6683)
Weather control variables	No	Yes	No	Yes	No	Yes
City control variables	No	Yes	No	Yes	No	Yes
City-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1610	1608	1554	1552	1274	1272
R^2	0.4397	0.4574	0.4371	0.4572	0.4366	0.4595

Note: (1) The weather control variables include the average wind speed, the sunshine hour, and the average air pressure index. (2) The city control variables include the industrial sulfur dioxide emissions, the emissions of the industrial smoke and dust, the treatment rate of the domestic sewage, the rate of the comprehensive utilization of the industrial solid waste, the rate of the harmless treatment of the domestic garbage, the rate of the innocuous treatment of the domestic garbage, the industrial wastewater discharge, the green coverage in the built-up areas, the actual foreign investment, the total industrial output value of the enterprises above the designated size, the number of the registered unemployed in the urban areas at the end of the year, the population density, the number of the public automobiles and electric vehicles per 10,000 people, and the proportion of the secondary industry in GDP. (3) Robust *t*-values are stated in parentheses below coefficients and clustered by city level. (4) The symbols *, **, and *** represent a significance level of 10%, 5%, and 1%, respectively.

difference in the changes in $PM_{2.5}$ levels. It can be seen that the estimated value of parameter β_k cannot reject the null hypothesis, indicating that before implementing the pilot policy, the indicator of the $PM_{2.5}$ emissions in the pilot cities is similar to that in the unpiloted cities; thus, this demonstrates that the DID method employed herein satisfies the dynamic effect test. Therefore, compared with the control group, the treatment group changed significantly after 2005, which is due to implementing the circular economy pilot city policy rather than previous differences.

4.2. Basic Results. Table 2 tabulates the baseline regression results for the impact of the pilot cities on air quality. Columns 1 and 2 present the estimation results of all the cities, and Columns 3 and 4 show the estimation results except for the municipalities; Columns 5 and 6 list the estimation results of the ordinary cities. In other words, based on Columns 3 and 4, Columns 5 and 6 further remove the cities and the provincial capitals separately listed in the National Social and Economic Development Plan. Columns 1, 3, and 5 consider the year-fixed effects and the city-fixed effects, and Columns 2, 4, and 6 take the weather control variables and the other control variables into account. Therefore, after controlling for the city-fixed effect and the year-fixed effect, the estimated coefficient of the circular economy urban pilot is negative and significant regardless of whether the model contains control variables, indicating that implementing the pilot policy reduces the emissions of air pollutants and helps enhance air quality.

Regarding the economic significance of the estimated coefficients for the circular economy cities, compared with the unpiloted cities, it is clear that the pilot cities markedly reduce $PM_{2.5}$ levels by 1.68 $\mu g/m^3$ ceteris paribus. The estimated coefficient of the benchmark model is the average treatment effect for a total of 12 years from 2005 to 2016. Implementing the pilot policy on circular economy cities reduces the pollution index by 14% each year. Meanwhile, according to the data, the average $PM_{2.5}$ in the sample cities is 57.59 $\mu g/m^3$, indicating that the construction of the circular economy pilot cities decreases a city's $PM_{2.5}$ by about 2.92%.

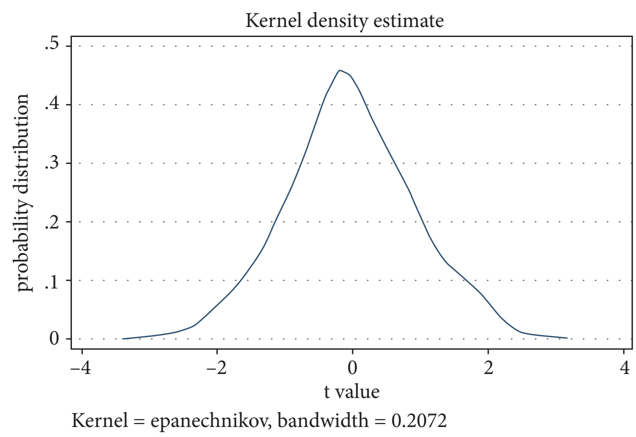

Figure 3: The kernel density distribution.

4.3. Placebo Test. Although the above demonstrates that constructing circular economy pilot cities achieves a preliminary air pollution control effect, this result may still be disturbed by omitted variables and self-selection. Thus, a placebo test is required to verify the reliability of the DID identification strategy employed herein. A group of cities was randomly selected as the control group and the experimental group in the sample, and the selection was repeated 1,000 times; the regression was also performed based on model (1): $Y_{it} = \alpha + \beta \mathrm{Treat}_{it} + X_{it}'\gamma + \delta_i + \mu_t + \varepsilon_{it}$. The kernel density distribution in Figure 3 reveals that the t-values obtained based on the random samples are normally distributed near zero, and the p-values are all higher than 0.1, implying that the pilot cities used in the 1,000 random samplings have an insignificant effect. Therefore, the policy effect of circular economy pilot city construction on $PM_{2.5}$ levels is not disturbed by omitted variables.

Table 3: The estimation results based on the PSM-DID method.

Variables	Air quality			
	Year-by-year matching (1)	Neighboring 1 : 1 matching (2)	Neighboring 1 : 2 matching (3)	Neighboring 1 : 3 matching (4)
treat_{it}	-1.6703^{**} (0.7023)	-1.9550^{**} (0.9673)	-1.8199^{**} (0.8157)	-1.3112^{*} (0.7706)
Weather control variables	Yes	Yes	Yes	Yes
City control variables	Yes	Yes	Yes	Yes
City-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes
Observation	1226	605	818	953
R^2	0.4790	0.5319	0.5158	0.5084

Note: (1) The matching method in Column 1 is the year-by-year matching, and the matching method in Columns 2–4 is the nearest neighbor matching. (2) The control variables are the same as the benchmark regression equation. (3) The symbols *, **, and *** represent a significance level of 10%, 5%, and 1%, respectively.

4.4. How Robust Are These Findings? Despite using the best available multiperiod data set, we may not be able to rule out the possibility that implementing and not implementing circular economy policy units experienced differential outcomes because of selection. Hence, we report on numerous checks to see how our essential findings are affected.

First, Table 3 lists the regression results. Column 1 is the year-by-year matching result, and Columns 2–4 represent the results of neighboring 1 : 1 matching, neighboring 1 : 2 matching, and neighboring 1 : 3 matching, respectively. The estimated coefficient of the circular economy city pilots is between −1.3112 and −1.9550, which passes at least the 10% significance level test. The estimation results in Column 1 are consistent with the benchmark regression results, and, after alleviating the endogenous effects, the reverse effect of circular economy pilot policies on air quality is still significant.

The second robustness test examines the influence of the annual maximum value of $PM_{2.5}$ on the regression results. The above regression uses the annual mean value of $PM_{2.5}$ as the dependent variable to measure the degree of air pollution. However, the maximum value of pollution may attract people's attention more than the average value. Therefore, here we replace the core explanatory variable with the annual maximum value of $PM_{2.5}$ as an indicator of measuring the degree of air pollution. The results listed in Column 1 of Table 4 indicate that circular economy city construction reduces the maximum annual pollution value to about $1.54\,\mu g/m^3$.

The third robustness test considers the impact of the regression results after incorporating the other benchmark factors into the pilot cities. Column 2 of Table 5 presents the estimated results after adding the other benchmark variables. The coefficient of the cross term is still significantly negative, and the coefficients before the added benchmark variable and the cross term of the linear trend of time are both very small and negligible, implying that the inherent interregional differences do not cause a bias in the estimated results.

The fourth robustness test takes account of the influence of geographical location and demographic factors on the estimated results. A variable that can comprehensively consider spatial differences in population distribution, regional differences in the resource and environment base, and the characteristics of the man-land relationship in China is the Heihe-Tengchong Line. The majority of the circular economy pilot cities are located on the right side of the Heihe-Tengchong line, and there are apparent differences between the left and right sides of the Heihe-Tengchong line. Therefore, the distribution of the samples may bias the estimation of the results. Hence, this work further adds $B_i' \times \text{trend}_t$, which is a cross term between a dummy variable on the left and right sides of the Heihe-Tengchong line and the time trend to control for the influence of factors related to the Heihe-Tengchong line on the estimated results in the time trend. The results tabulated in Column 3 of Table 4 indicate that the principal estimated coefficients are basically consistent with the estimated results in Table 2, implying that the estimated results are not affected by the geographic location.

The final robustness test examines the influence of other environmental policies implemented simultaneously on the regression results. Since there are many environmental policies in other regions during the sampling period, and this paper cannot exhaustively list all of the policies, we select representative large-scale environmental policies: the "low-carbon city" pilot policy, the policy on new-energy vehicle city pilots implemented in 2010, and the policies on limiting the emissions of particular air pollutants implemented in 2013. According to equation (8), this part further employs the cross term between these three dummy variables of the policies mentioned above and the linear trend of time to control for the impact of the other regional-based policies regarding the environment on the results. The results in Column 4 of Table 5 demonstrate that the principal estimated coefficients are still consistent with the benchmark results in Table 2, indicating that the other environmental policies implemented in the sampling period do not affect the estimated results.

4.5. Heterogeneity Analysis. The above regression results demonstrate that climate conditions affect the efficiency of air pollution diffusion, while the effect of the circular economy on the improvement in air quality is more

Table 4: The heterogeneity results.

Variables	Climatic zone			Economic development level		
	Temperate monsoon (1)	Temperate continental (2)	Subtropical monsoon (3)	High (4)	Medium (5)	Low (6)
$treat_{it}$	−2.5877** (1.1101)	−4.7858 (3.7357)	−0.3426 (0.7564)	−1.6634 (1.0471)	−0.3895 (1.0467)	−3.5551*** (1.1852)
Weather control variables	Yes	Yes	Yes	Yes	Yes	Yes
City control variables	Yes	Yes	Yes	Yes	Yes	Yes
City-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observation	616	97	881	546	531	531
R^2	0.5067	0.7692	0.5912	0.4995	0.4772	0.5064

Variables	*Geographical location*		
	East (7)	*Central* (8)	*West* (9)
$treat_{it}$	0.4515 (0.8425)	−6.3822*** (1.1188)	−1.5485 (1.2900)
Weather control variables	Yes	Yes	Yes
City control variables	Yes	Yes	Yes
City-fixed effects	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes
Observation	728	531	349
R^2	0.4717	0.5348	0.6906

Note: (1) Robust t-values are stated in parentheses below coefficients and clustered by city level. (2) The symbols *, **, and *** represent a significance level of 10%, 5%, and 1%, respectively.(3) Sample cities (1)–(3) are divided into temperate monsoon climate, temperate continental climate, and subtropical monsoon climate, respectively, according to climate zone characteristics. Sample cities (4)–(6) are categorized into high-, medium-, and low-level economic development, respectively, according to the level of per capita GDP, and sample cities (7)–(9) are divided into eastern, central, and western cities, respectively, according to their geographical locations.

Table 5: The regression results of the robustness tests.

Variables	The annual maximum value of $PM_{2.5}$ (1)	Other benchmark factors (2)	Heihe-Tengchong line (3)	Other environmental policies (4)
$treat_{it}$	−1.5384** (0.7305)	−1.7324*** (0.6028)	−1.6798*** (0.5994)	−1.6712**** (0.5991)
"Two-control area" × time trend		−0.1202 (0.0734)		
Capital cities × time trend		−0.0923 (0.0996)		
Special economic zone × time trend		−0.0519 (0.2134)		
Weather control variables	Yes	Yes	Yes	Yes
City control variables	Yes	Yes	Yes	Yes
City-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes
Observation	1608	1608	1608	1608
R^2	0.4185	0.4595	0.4582	0.458

Note: (1) The regression result in Column 1 is the annual maximum value of $PM_{2.5}$, and the regression results in Columns 2–4 are $PM_{2.5}PM_{2.5}$. (2) Column 1 controls the annual maximum value of $PM_{2.5}$ of the city. (3) Column 2 further controls the time trend of the original characteristics of the city on the basis of the baseline regression. The characteristics of the city include whether the city is a pilot city of the "dual control area," a provincial capital city, or a particular economic zone city. (4) Column 3 controls the influence of the difference between the left and right sides of Heihe-Tengchong Line on the estimation. (5) Column 4 controls other location-based environmental policies. (6) The control variables are the same as the benchmark regression equation. (7) The symbols *, **, and *** represent a significance level of 10%, 5%, and 1%, respectively.

significant in the subsamples of the temperate monsoon climate. Meanwhile, air quality in central cities and those with a low level of economic development improves markedly.

4.6. Mechanism Analysis. Column 1 in Table 6 is listed as the baseline regression result. The result demonstrates that the coefficient of air quality estimated by the pilot policies of circular economy cities is −1.682 and significant at 1% level,

Table 6: The results of the mechanism analysis.

Variables	Air quality	Advancement of the industrial structure	Air quality	Industrial structure rationalization	Air quality
	Structure effect				
	(1)	(2)	(3)	(4)	(5)
$treat_{it}$	−1.682*** (0.599)	0.496 (0.405)	−1.615* (0.863)	−0.653 (0.996)	−1.833 (0.234)
Advancement of the industrial structure			−0.026 (0.108)		
Industrial structure rationalization					−5.652 (3.118)
_cons	−79.011* (81.352)	110.861*** (36.390)	−76.105 (86.305)	−65.345 (41.236)	−49.545 (56.921)
Weather control variables	Yes	Yes	Yes	Yes	Yes
City control variables	Yes	Yes	Yes	Yes	Yes
City-fixed effects	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes
Observation	1608	1608	1608	1608	1608
R^2	0.457	0.849	0.457	0.029	0.011

Variables	*Energy consumption per unit of GDP*	*Air quality*	*Technological progress*	*Air quality*
	Scale effect		*Technology effect*	
	(6)	*(7)*	*(8)*	*(9)*
$treat_{it}$	−0.044*** (0.017)	−1.819** (0.843)	0.001 (0.009)	0.988 (0.760)
Energy consumption per unit of GDP		−4.310* (2.394)		
Technological progress				3.622 (1.543)
_cons	4.047*** (1.692)	−61.572* (85.531)	56.345 (35.451)	39.298 (51.332)
Weather control variables	Yes	Yes	Yes	Yes
City control variables	Yes	Yes	Yes	Yes
City-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes
Observation	1608	1608	1608	1608
R^2	0.756	0.459	0.122	0.168

Note: (1) The control variables are the same as the benchmark regression equation. (2) The symbols *, **, and *** represent a significance level of 10%, 5%, and 1%, respectively.

meeting the prerequisite requirements of mechanism analysis.

Columns (2)–(5) indicate that the pilot policies on circular economy cities do not appear to emerge significantly on advanced industrial structure and rationalization of industrial structure, and neither of them has a significant impact on air quality, indicating that the pilot policies on the circular economy cities have failed to induce a structure effect to improve air quality. Hence, hypothesis 1 is not supported.

Columns (6)–(7) demonstrate that the impact of the pilot policies on circular economy cities with respect to the energy consumption per unit of GDP is negative and significant at the 1% level, while the energy consumption per unit of GDP on air quality is negative and significant at the 5% level, indicating that circular economy urban pilot policy can induce a scale effect to reduce air pollution. Thus, hypothesis 2 is supported.

Column 4 demonstrates that the pilot policy has an insignificant effect on technological progress, indicating that in the short term, the construction of circular economy cities does not affect air quality through progress in science and technology. Hence, hypothesis 3 is not supported.

In summary, the above results confirm that the pilot cities are associated with a significant decrease in the emissions of pollutants by inducing a scale effect, thereby enhancing air quality. However, there is not sufficient evidence that the pilot policy on circular economy cities improves air quality through a technology effect and a structure effect in the short term.

5. Discussions and Implications

With the adoption of the 2030 Sustainable Development Goals by the United Nations and the adoption of a new agreement on global climate change at the Paris Conference, countries around the world are attaching greater importance to developing a circular economy [13, 14]. However, there is limited evidence in the literature to foresee the impacts of implementing circular economy city construction on air quality. To fill this gap in the literature, we study the effect of China's national circular economy pilot policies on air quality.

Our study contributes to the growing body of literature on the interactions between the formal environmental regulations of China's government and pollutant emissions. While previous studies have shown that the development of a circular economy has a positive effect in urban areas, the research focus does not directly encapsulate the effect of the policy on air quality [7, 43]. We demonstrate for the first time the impact of building a circular economy city on air quality through a novel analytical model. The concentration of $PM_{2.5}$ in the pilot cities is reduced by 2.92% compared to the unpiloted cities, which implies that the air quality of the pilot cities is substantially enhanced after the policy on circular economy cities is implemented, confirming the effectiveness of the policy on pollution reduction.

Regional differences in environmental regulations in previous studies via the environmental policies implemented by the government are more prominent in the eastern and developed regions than in other regions. However, exploring the heterogeneity of the impact of the pilot policy on air quality, our analysis demonstrates that the effect is more considerable in the subsample of cities with a temperate monsoon climate, and the enhancement of air quality is more significant in cities located in the central region and cities with a low level of economic development. The possible reason for this finding is that the cities with a temperate monsoon climate are primarily distributed in areas with a low level of economic development and are geographically located in the middle of China. Compared with the cities located in the east with a high level of economic development, these cities have relatively low emissions of air pollutants, low population density, and low energy consumption, so the lock-in effect of the air pollutants is weaker. As a result, the cities in the middle of China with a low level of economic development respond more quickly to the policies on the circular economy. In other words, the pilot policy enhances air quality more effectively in the cities located in the central part of the country with a low level of economic development.

We developed our research hypotheses by drawing upon the prior literature on environmental economics [17–19]. The mechanism analysis supports our second research hypotheses. The mechanism analysis demonstrates that the circular economy city pilot policy can reduce air pollution and improve air quality by decreasing energy consumption per unit of GDP. However, there is not sufficient evidence that the pilot policy on circular economy cities improves air quality through technological progress advancement of the industrial structure and industrial structure rationalization in the short term. The circular economy pilot policy has no significant impact on the structure effect possibly because China's industrial structures have severe structural imbalances, structural problems are prominent, and the urban industrial structure does not follow the local economic development level and consumer demand. The structure, the essential quality of the labor force, and the resource endowment are adjusted rationally, and economic growth is overly dependent on this unreasonable industrial structure, indicating that the rationalized development of the industrial structure may not yet fully utilize its $PM_{2.5}$ emission reduction. Thus, in promoting the advanced development of the industrial structure, more attention should be paid to the rational development of industrial structures, and the effect of the rationalization of industrial structures on $PM_{2.5}$ pollution reduction should be prioritized. The circular economy pilot policy has no marked impact on technological progress possibly because technological progress mainly comes from original innovation and basic innovation activities.

On the one hand, the application of innovation results to enterprise production practices often has a long lag, which affects the technological level of enterprises since the improvement in energy and management efficiency are difficult to achieve in a short period. On the other hand, using innovation results in enterprise production practices will often make a leap in developing new technologies and products, which will give rise to energy rebound effects. As a result, the energy-saving effects and pollutant emission reduction impacts produced by the improvement in energy efficiency at the technical level are eroded by the new round of energy consumption and pollutant emissions brought about by capital deepening and output growth. Thus, the promotion effect is relatively weak [44].

According to the mechanism analysis, the local government could establish a reasonable and orderly industrial structure based on local industrial characteristics to further optimize the allocation of resources and enhance the relationship between industries so that the rationalization of the industrial structure becomes an important channel for improving air quality. Finally, the government could strengthen the independent development and innovation of common and key technologies and could promote the technologies for pollution control and cleaner production. It may be highlighted that the government could pay more attention to breaking through technical bottlenecks in environmental protection and could develop technologies for the comprehensive prevention and control of air pollution.

This research has limitations, some of which represent future research opportunities. Our study only explored the net effect of circular economy pilot policies on air pollution. Firstly, air pollution significantly affects human health, and pollution control results in substantial benefits. Therefore, future studies can further assess the health benefits of circular economy urban pilot policies based on our findings. Secondly, air pollution leads to health problems and economic losses worldwide. Future studies can further evaluate the economic benefits of pilot policies on circular economy cities.

Data Availability

The empirical data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding the present study.

Authors' Contributions

The first author was responsible for conceptualization, methodology, software provision, data curation, formal analysis, and supervision. The second author helped in conceptualization, reviewing and editing, supervision, and funding acquisition. The third author performed conceptualization, visualization, and reviewing and editing. The fourth author contributed to conceptualization, formal analysis, project administration, reviewing, and editing. The fifth author carried out reviewing and editing and supervision.

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Research Article

Construction and Application of Curriculum System of Design Major Integrating Environmental Protection and Big Data

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Design subject curriculum system is a major subject in the field of design education. The gap between ideal and reality makes the design of the curriculum system of design discipline a serious and urgent problem. Facing the "integration of industrialization and industrialization," we can explore the professional curriculum system of environmental design and construction. And the method of constructing the corresponding system is initially proposed. The fuzzy comprehensive evaluation method is used to evaluate and analyze the comprehensive effect of the model. According to the suggestions of experts and teachers, the designed indicators include 4 first-level indicators and 16 corresponding second-level indicators. The primary indicators include classroom response, teacher satisfaction, teaching effectiveness, and teaching environment. According to the fuzzy comprehensive evaluation steps and corresponding calculation methods, the final evaluation results are obtained.

1. Introduction

The "14th Five-Year Plan" period will be a critical period for national industrial transformation and upgrading. Design major exists as a creative and cultural industry and is regarded as an important tool to promote industrial upgrading. It can promote the transformation of the cultural and creative industry to high-end comprehensive design services, and promote the extension of the design service field and the upgrading of service models [1]. Design majors should actively adapt to the needs of local economic and social development and cultural industry innovation. It not only needs to combine its own school-running orientation, service orientation, and subject characteristics, but also clarify the training objectives, training norms, and curriculum for professional talent system. The purpose of environmental art design in the 21st century is to use science and technology to integrate art, humanities, and nature. In this way, a living space with high cultural taste and in line with human nature can be created. With the high development of China's social economy, people's quality of life has gradually improved, the level of material civilization and spiritual civilization has continued to improve, and the requirements for environmental art design have also continued to increase. At the same time, environmental art design is still a very young and new discipline in China [2]. Although it is developing rapidly and urgently needs a large number of specialized talents in environmental art design, there is a serious shortage of design talents with high cultural accomplishment and professional technical level in this young industry. Thus, higher education in Chinese environmental art design is born. Departments of architecture and fine arts in major universities in China have established environmental art design majors to meet the needs of social development for high-quality intelligent and compound design talents. They have also actively carried out the teaching reform of environmental art and design to accelerate the training of high-level professionals in environmental art and design [3–5].

At the same time, people's living environment starts from the needs of people. It constitutes an environmental system with more complex functions, more diverse types, and richer forms. Due to the increasingly close interaction between people and the environment, people's awareness of environmental protection is increasing. At the same time, the status of art participating in environmental

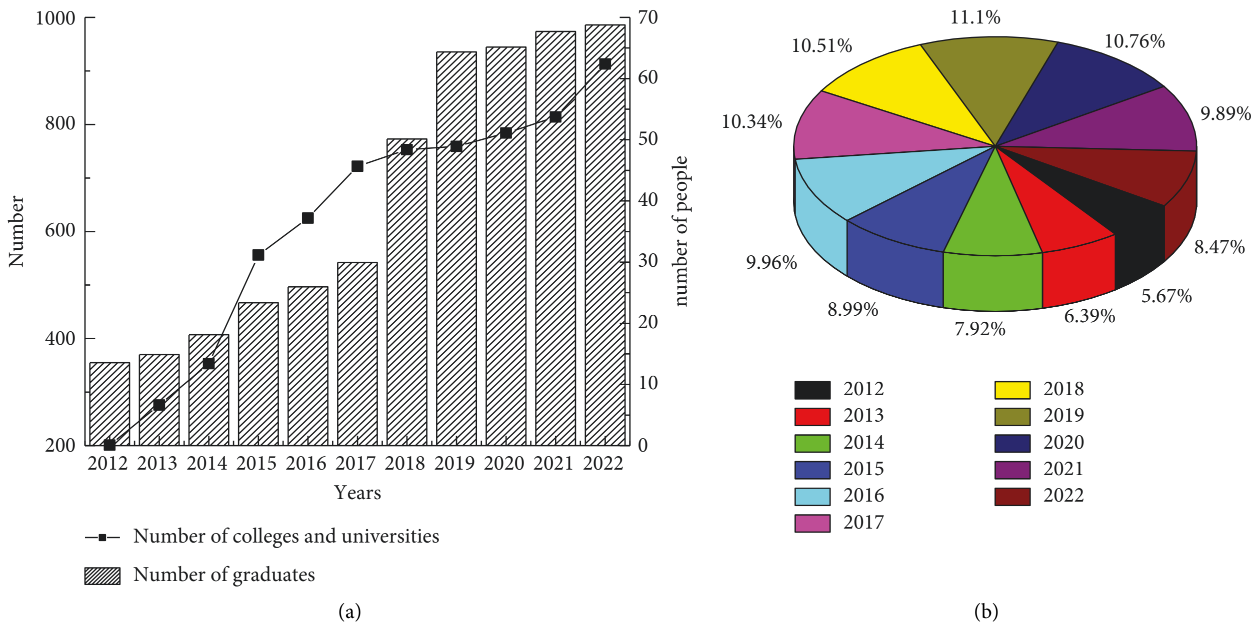

Figure 1: Changes in the number of design colleges and graduates in the past ten years. (a) Number of graduates and colleges. (b) Practitioners as a percentage of the number of graduates that year.

transformation is also becoming more and more prominent. "Environmental art," which is difficult to find in classical aesthetics in the past, comes into being. Then, it develops into a relatively independent art design category that integrates multidisciplinary knowledge. It makes people begin to explore the harmonious relationship between the environment and people from the height of culture and art. It also endows human environmental construction activities with more sustainable and better vitality [6]. In 1988, the former Central Academy of Arts and Crafts changes the major of interior design to the major of environmental art design, and expands the content of interior design to outdoor environment design. Subsequently, colleges and universities across the country have established this major [7]. Under the circumstances of reform and opening up and the rapid development of economic construction at that time, in order to meet the needs of urban construction for outdoor environmental design in a timely manner, the establishment of the environmental art design major greatly meets the requirements of the development of the times. Since the establishment of the environmental art design major, the number of Chinese colleges and universities offering this major has gradually increased in the past ten years. At the same time, the number of students graduating from environmental art and design is also increasing every year. And the proportion of students engaged in this industry is also increasing day by day, as shown in Figure 1.

The era of big data has come, but the curriculum system of environmental design talent training schools rarely involves the courses of big data design. There are certain problems in the adjustment and integration of the curriculum system. This paper takes the construction of the curriculum system of environmental design major as the research object. Its purpose is to investigate the current state of the curriculum system of environmental design majors. On the basis of discovering the deficiencies in the course system construction of environmental design and exploring the existing problems in the course system construction process, the corresponding construction strategies are put forward. By trying to build a curriculum system that meets the requirements of smart tourism development, it will lay a solid foundation for the future tourism industry to cultivate qualified talents and provide a strong guarantee for the career development of students [8].

The research significance of this paper mainly includes the following points.

1.1. Theoretical Significance. Through the research on the existing curriculum system of environmental design, the key ability of talent demand in the era of big data is analyzed. By finding out the deficiencies of the existing curriculum system, it stimulates the renewal of the curriculum system construction concept of environmental design and promotes the innovation of the curriculum system design concept.

1.2. Practical Significance. The practical significance has the following three aspects:

(1) It is necessary to attract the attention of the school of environmental design to the curriculum system. Through the reflection of various problems existing in the construction of professional curriculum system, the construction of curriculum system is improved.

(2) It is necessary to attract the attention of education administrative departments and secondary vocational tourism colleges and universities to the

construction of the curriculum system of secondary vocational tourism management. Thereby, it provides a guarantee for the improvement of the quality of students in secondary vocational tourism colleges and the promotion of their careers.

(3) It is necessary to attract the attention of the academic circles to the construction of the curriculum system of the vocational tourism management major. By promoting its gradual improvement, the perfect combination of industry needs and talent training has been achieved.

2. Related Theories

2.1. Definition of Big Data. The term Big Data was first coined by McKinsey in the book The Third Wave, but it does not give a complete definition of Big Data. In 2011, a McKinsey Global Institute research report defined big data as a collection of data larger than traditional databases can collect, store, and analyze. Wikipedia defines big data as the amount of data involved. And it cannot be manually acquired, managed, and processed into human-readable information within a reasonable time. Some scholars believe that big data is a powerful tool that generates, collects, or stores a huge amount of data and can be used to make smarter decisions. They also believe that big data is a collection of data that is processed by using advanced data storage, management, analysis, and visualization technologies. Big data is characterized by large capacity, various types, fast access speed, and low-value density. At the same time, it is rapidly developing into a new generation of information technology and services. It is possible to discover new knowledge and create new value by collecting, storing, and correlating data from scattered sources and various types of data [9].

Big data needs to be used as a tool. This will not confuse the concepts of big data and big data analysis techniques. Big data analysis technology is a technical means of using big data. It can discover new knowledge and new value from data. Thinking of big data as an asset is primarily an abstract description of the value of big data. Big data is composed of massive amounts of data. Based on big data analysis technology, the collected massive data is cleaned, desensitized, processed, and calculated. It not only obtains potential and regular information and knowledge, but also realizes the functions of prediction and judgment[10].

The integration of big data and the curriculum system of design majors is the general trend of education development. The professional curriculum system in the era of big data integrates several advantages and fully reflects the development characteristics of its informatization. The details are shown in Figure 2.

Figure 2 shows the characteristics of the professional curriculum system in the big data environment. The relatively important ones of all the features include real-time data, reliable decision-making, and intelligent interaction. The data runs through the professional curriculum system, and teachers can obtain real-time student learning data and give feedback on the classroom situation. According to the

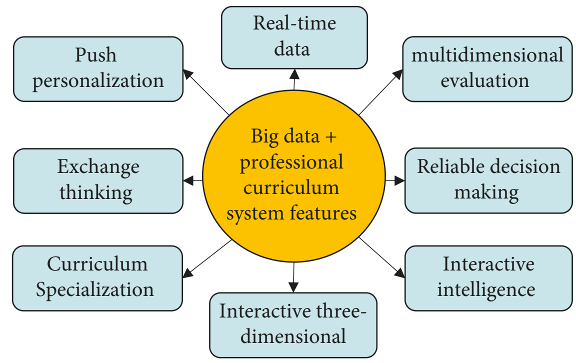

Figure 2: Advantage feature map.

feedback of the professional curriculum system data, teachers can timely make teaching strategies and make decisions that are based and reliable. Teaching in the environment of professional curriculum system, teachers and students through remote control, can well reflect the intelligence of teacher-student interaction [11, 12].

2.2. Curriculum and Its System. In school education, curriculum refers to the process of learning subject content. But after the twentieth century, under the influence of Dewey and other progressive curriculum ideas, curriculum scholars begin to redefine the concept of curriculum. People from different perspectives have different opinions on the definition of "reshaping" the curriculum, criticizing, modifying, and replacing the original meaning of the curriculum. According to the statistics of American scholar Brewer, the term curriculum has at least one meaning. This gives the curriculum diverse and even esoteric meanings [13]. The definition of a course with a large audience is nothing more than limiting its connotation from the following dimensions.

2.3. Curriculum Structure. Curriculum system refers to the whole formed by some interrelated and restrained things. Therefore, the system is not a single thing. It contains a number of things that are related to each other. The system contains the meaning of the system to a certain extent. It also reflects the characteristics of integrity. China's curriculum system can also be divided into broad and narrow perspectives [14].

From a narrow perspective, the curriculum system refers to the internal structure of each course and the way each course is combined. The curriculum structure is the curriculum system. Both of them are equivalent. The meaning is that the courses offered by the school have different divisions of labor and cooperate with each other. It is the most important part of the teaching plan [15].

From a broad perspective, the so-called curriculum system refers to the basic principles of specific educational concepts and values. It is a combination of many elements that make up the curriculum in a certain way. In turn, these elements can better promote the smooth realization of the goals of the curriculum system.

The courses are divided vertically and can be divided into 3 levels:

(1) Macro level: it refers to the establishment of disciplines and majors in colleges and universities.
(2) Meso-level: it refers to how to arrange the course content of a specific major and how to design the course structure.
(3) Micro level: it refers to how to arrange and determine the teaching content of a certain course in a certain major.

2.4. Element Analysis of the Curriculum System. The horizontal analysis of the curriculum shows that the curriculum is composed of multiple links. Each link is independent of each other, and each has different content and characteristics, but each link affects and restrains each other [16]. Whether the goals and functions of the curriculum system, as shown in Figure 3, can be realized depends on whether each link is normal. At the same time, it also depends on whether the cooperation between each link is good. The author will elaborate and analyze the components of the curriculum system in detail.

2.4.1. Course Targets. Curriculum objectives refer to the specific goals to be achieved by the curriculum itself. It is the degree to which students at a certain educational stage are expected to develop morality, intelligence, and physique. Subject area curriculum objectives relate to the expected requirements for student growth and development in a particular discipline in a particular area. It should have a strong disciplinary nature and fully reflect the characteristics of the discipline itself. This is the commonly understood course goal.

The course objectives have the following characteristics:

(1) The course goal reflects the characteristics of finality, but it also reflects a certain process.
(2) The course goal should be a complete system. It reflects the school's overall and unified planning for teaching work and student education.
(3) Curriculum objectives need to provide direction for educational activities. The entire teaching of the school is based on this and revolves around this goal.

2.4.2. Course Content. The so-called curriculum content refers to the teaching content of various majors and disciplines offered by the school. It can refer not only to the specific content of a certain discipline, but also to all the content of all disciplines under a certain major, and it can also refer to the sum of all the content of all disciplines offered by the school. Curriculum content occupies a central position in the curriculum structure, which reflects and embodies curriculum objectives. Colleges and universities will be affected by cultural factors, ideological factors, student factors and other factors when selecting and determining course content. Different people will have different views on the nature of the course. This makes a big difference in their understanding and perspective of course content.

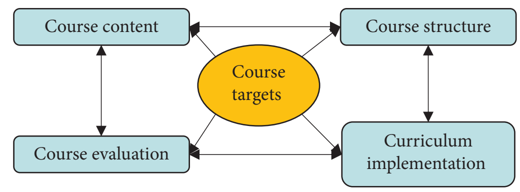

Figure 3: Curriculum system elements.

2.4.3. Course Structure. The characteristics of the course structure are as follows:

(1) The curriculum structure needs to proceed from an objective basis. The curriculum structure is an artificial structure and not an unnatural structure in nature. It is the result set by people according to certain curriculum principles, and it must have certain objective basis.
(2) The curriculum structure reflects the characteristics of orderliness.

    The so-called order refers to the relationship between the elements and parts of things according to certain rules and mutual transformation. The orderliness of the curriculum structure means that the various elements and parts that constitute the curriculum structure interact with each other according to certain rules. It is embodied in the dual order in space and time.

(3) The curriculum structure has the characteristics of sequential change.

    Specifically, the curriculum structure should be able to adapt to the changing needs of society and students, and the curriculum should be able to change constantly. It is necessary to proceed from the social reality and according to the new situation and new needs, through continuous adjustment of the curriculum structure to make it more reasonable.

2.4.4. Curriculum Implementation. Domestic scholars have made different definitions of the concept of curriculum implementation. Curriculum implementation can be seen as the process of putting the curriculum plan into practice. Taking curriculum implementation as one of the links in curriculum development and preparation, it is considered that curriculum implementation is the process of implementing curriculum plans. The concept of curriculum implementation as part of curriculum change is a process that requires putting innovation into practice. At present, it has become the leading understanding of "curriculum implementation" at home and abroad.

2.4.5. Course Evaluation. Curriculum evaluation refers to educational evaluation. By systematically collecting certain information and according to certain value standards, it can judge the development and changes of educated people in educational activities. At the same time, to what extent the factors that constitute its change meet the needs of social and individual development. It can provide the basis for the self-improvement of the evaluators and the scientific decision-making of the relevant departments. Curriculum evaluation in a narrow sense that refers to the activity or process of judging the value of curriculum plans and curriculum standards in improving students' learning. It generally includes core content such as course objectives and course plans. The range of subjects for course evaluation is very wide. A representative view holds that the object of curriculum evaluation has at least one aspect: curriculum design, curriculum used by teachers, student achievement, and curriculum system.

3. Current Situation of the Curriculum System of Environmental Design Major in Colleges and Universities

3.1. Profile Analysis. The history of setting up environmental protection design majors in Chinese colleges and universities is not long. At present, most of this major is offered in art colleges and some engineering colleges. Due to the different understanding and understanding of the concept of environmental protection and the different nature and foundation of schools, there are differences in the positioning of professional construction and the setting of teaching content. The status quo is that the environmental design major with comprehensive discipline characteristics is only positioned in a single direction of interior design.

Although some are called environmental design majors, the curriculum is only the content of interior design. There are also schools that focus on landscaping such as interior decoration and decoration. The reason for the formation of this situation is the problem of academic cognition. It is also the need for social development in a specific historical period. At the 21st century, social development needs will be different. The students who are trained away from the teaching system based on architecture are too narrow in their professional scope and have a single knowledge structure. Due to the lack of comprehensive quality of students and poor social adaptability, this state is contrary to the needs of national construction for talents with a comprehensive knowledge structure. Therefore, through reforming the professional structure of environmental art design and carrying out discipline construction, the task of cultivating high-quality intelligent and compound design talents has been placed in front of the education department. With the development of society, from the perspective of industry construction and management, it is necessary to establish a construction and design talent pattern with three levels of relationship: urban planning and design, architectural design, and environmental art design. The emerging discipline of environmental design has the characteristics of pluralistic structure. It is a systematic project that scientifically and holistically grasps disciplines such as urban planning, architecture, art, and gardening. It has the dual nature of art and technology. The requirements for environmental art designers are comprehensive quality and the ability to organize and collaborate. In urban construction, it plays an important role in improving the quality of the environment.

According to the survey, practitioners believe that the abilities that they need to have are mainly as follows. The survey results show that 12.13% of the people give top priority to their overall quality and ability to organize and collaborate. The proportion of people who put the ability to work independently first is 26.32%. The proportion of people who put professional skills and operational ability first is 15.69%. The proportion of people who put professionalism and initiative in the first place is 8.96%. The proportion of people who put interpersonal communication and teamwork spirit first is 36.9%. The relationship between the ability of the above survey results and the proportion of supporters is shown in Figure 4.

3.2. Problems Existing in the Design Major Integrating Environmental Protection

3.2.1. Lack of Knowledge about the Design Industry. The prosperity of the design industry has made the society and parents pay unprecedented attention to design. This kind of attention not only promotes the development of design education, but also raises people's irrational expectations for the design industry. This has caused art and design education to expand rapidly when its foundation is not yet solid. Not only are colleges and universities rushing forward in response to the market orientation, but many secondary vocational and technical schools also offer relevant design courses. However, there is a lack of teachers and theoretical research, which will inevitably cause the quality of education to be difficult to guarantee. At the same time, society's understanding of design is also too simplistic. It is generally believed that with the foundation of art and software operation, design work can be carried out.

3.2.2. The Training Objectives Do Not Meet the Employment Needs of the Enterprise. The training goal of the original curriculum system of the existing design major is to imitate the foreign training system and be highly professional. As a result, graduates cannot reach the level of designers. Such graduates do not meet the recruitment requirements of employers who are not only familiar with basic knowledge of graphic design and software operations, but also can integrate environmental protection and big data features. Employers need the breadth of knowledge and proficient operational and practical ability, but also the depth of knowledge and research significance.

3.2.3. The Curriculum System Lacks Scientific Planning. Course objectives tend to focus only on the techniques and methods in the creation. The emphasis on the cultivation of

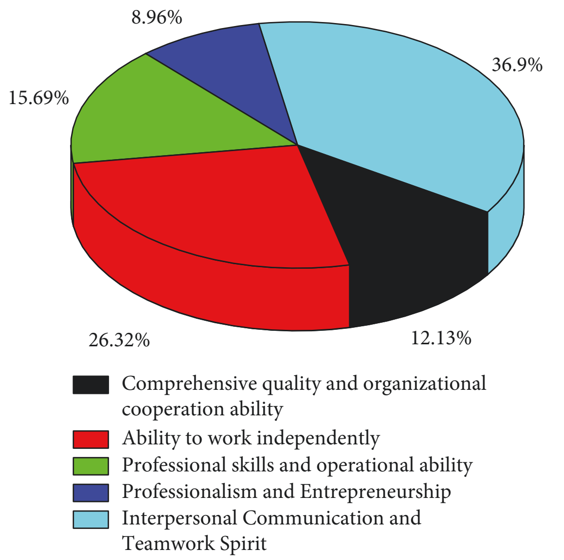

Figure 4: The relationship between the ability of the above survey results and the proportion of supporters.

students' thinking and creativity is neglected. It also ignores the research on the internal relationship between courses and the logic of their own development. The content of the course is too fragmented. The teaching of basic courses often becomes a simple patchwork of teaching content. It is difficult to link the subject content with the spirit of the times. It has deviated from the basic principles of applying what has been learned.

Due to the weak research on curriculum and teaching issues, the subject-systematized curriculum model is a fixed model under specific conditions in the early stage of industrialization. In the context of the information age, it has finally become an immutable teaching routine. The curriculum and teaching plan have not been properly adapted to the market, social development, and new technology development system, and the mechanism has not been established. This status quo is not only reflected in educational practice, but also reflects that the basic teaching objectives of the design are not strong and the structure of teachers is unreasonable. At the same time, it also reflects the backward teaching concepts and outdated teaching methods. It is reflected in the society that the students' comprehensive quality, sustainable development ability, and career extension space cannot meet the needs of the design market.

The basic courses under the systematic mode of disciplines are not suitable for the rapid development of the current information society. This kind of malady has become one of the chronic diseases that hinder the development of design education in colleges and universities. The teaching of basic courses for design majors in colleges and universities must be reformed. The depth of its reform and the number of achievements are important criteria to test and measure the quality of design education in colleges and universities. This has become the consensus of people in the contemporary design vocational education industry.

3.2.4. Weak Practical Ability of Full-Time Teachers. Some teachers' professional theoretical knowledge is outdated. Although some teachers have a certain knowledge base, most teachers stay in the school to work directly and have no experience in designing companies. Therefore, professional practice teaching is a weakness, and teachers are unfamiliar with the specific knowledge of love mirrors. Teachers in the school lack the update and understanding of knowledge. They will not fully realize the importance of these practical skills in the cultivation of students' overall quality. Most teachers avoid the important in teaching, and the course is mainly theory. Due to the reduction of the practical teaching part, the graduates cannot achieve the goal of cultivating "practical" talents. The vast majority of teachers have not systematically studied design pedagogy and teaching theory and other related knowledge. It lacks sufficient understanding of the characteristics, laws, and professional teaching methods of design education. Therefore, it is impossible to provide effective design education guidance to students in teaching.

3.3. Current Situation of the Curriculum System of Environmental Design

3.3.1. Single Course Mode. China's education system reform is constantly advancing, and environmental design education is no exception. Compared with foreign countries, this discipline in China starts relatively late. The curriculum education model still adopts the traditional public system, so the school-running features lack distinctiveness and the curriculum model is single. The talent training model is also relatively rigid and lacks innovation. It is difficult to make substantial progress if it is limited to a simple teaching and lecturing mode [17].

3.3.2. Inadequate Teaching Facilities. The teaching facilities of some colleges and universities are relatively old and lack multimedia teaching equipment. At the same time, the hardware facilities cannot keep up, which may lead to a great reduction in the teaching level.

3.3.3. Teaching Methods Are in Urgent Need of Innovation. Nowadays, the teaching method of most colleges and universities is still based on one-way teaching by teachers, and students are in a passive accepting position in learning. In this way, the teaching ability of teachers cannot be improved, and the teaching method is single. At the same time, students cannot participate effectively, which reduces students' interest and thinking and practical ability. There is less interaction with students, which will lead to students not being in the main position of the whole teaching process. Under the guidance of inherent thinking, most teachers teach in a one-way teaching method. And students have long been accustomed to passive acceptance. Over time, students will not only lose their ability to think independently, but also lose their interest in exploring and learning [18].

3.3.4. The Structure of the Teaching Staff Needs to Be Improved. Teachers' own understanding of knowledge is not thorough enough. They cannot extend the knowledge they impart. At the same time, the teaching method itself has many shortcomings. Because the teaching team is too young, it has caused a lot of instability, and the mobility and loss of personnel are relatively large. However, senior teachers are too rigid in the traditional teaching model. It is difficult for such teachers to make great breakthroughs and improvements in teaching. As a result, there is a lack of a relaxed classroom atmosphere during the class. Therefore, the balance and perfection of the teaching staff are very important.

3.3.5. The Quality of Teaching Needs to Be Improved. Colleges and universities blindly expand the scale of running schools and recruit a large number of students, and it is easy to ignore the improvement of teaching quality. Schools place too much emphasis on the acquisition of teaching benefits. The teaching quality of environmental design major needs to be improved.

3.3.6. Students' Foundation Is Not Solid. In the environment of exam-oriented education, many students only take exams for their studies. Many students blindly choose majors and schools without a solid foundation, and they are even more blind in their future career choices. This creates a vicious circle. Later education and teaching are naturally more difficult to advance.

4. Construction and Application of the Curriculum System for Design Major

4.1. The Value of Curriculum Objectives in the Curriculum System. In the field of curriculum research, the study of curriculum objectives and their theories is an independent and very important part. In the course of constructing the curriculum system, the role of curriculum objectives is self-evident. In the circulatory system of curriculum system elements, curriculum objectives are both the starting point and the ending point. It is the directional guide of the whole curriculum system. It is the most basic and important principle to be followed in course setting. It is also the final direction of the other four elements of the curriculum system [19, 20].

The training goal of the integrated design major is the starting point for the construction of the design major curriculum system. It is necessary to consider the specific social environment or context and the background of big data environmental protection, and the four elements and links of the curriculum system can be successfully implemented. And when the course objectives are set, the expected results can be achieved. The course goal of design major is the orientation of design talents and the design coordinates of future development, and it is also an important lever for course adjustment. It plays a significant role in the breadth and depth of curriculum setting and the proportion of curriculum structure.

4.2. Specific Measures to Design Professional Curriculum Goals

4.2.1. From Emphasizing "Double Base" to Emphasizing "Four Dimensions". One of the important contents of "integration of industrialization and industrialization" is informatization. In a sense, the informatization of each element of the curriculum system also means the educational values of contemporary society and the value orientation of the curriculum system, which are directly reflected through the curriculum goals. Referring to the relevant literature on curriculum learning objectives at home and abroad, this paper believes that it is more appropriate to divide the curriculum objectives of industrial design education for "integration of industrialization and industrialization" into knowledge, skills, attitudes, and methods. At the same time, it should be supplemented by three levels of behavioral goals, generating goals, and expressing goals. It can also promote the multidimensional growth and development of students.

4.2.2. Emphasis on "Information Literacy". "Information literacy" requires the ability and attitude of "people" in contemporary society. It can be achieved through the representation of "information education class" and "wide use of information technology." But the system theory point of view proves that the power of the whole system can solve the corresponding problem. The cultivation of "information literacy" can not only rely on the setting of courses, nor is it limited to the operation of technical means. These concepts should be infiltrated in the reform of the entire curriculum system. Facing the changes of society, the way of "responding to all changes with the same" is lagging behind. The goal of the course is to make a timely response to the era of "integration of industrialization and industrialization." It can also be said to promote the transfer of curriculum values. However, this change is not a specific adjustment to the subject curriculum. It should be the overall and comprehensive penetration of the design curriculum system goals.

4.2.3. Design Professional Talent Competency Framework. Environmental design mainly relies on environmental engineering and design. It is also an interdisciplinary and comprehensive marginal subject. The characteristics of environmental design discipline are also applicable to design education. At present, the state has put forward the strategy of "integration of industrialization and industrialization." Under the background of the integration of informatization and industrialization, it is particularly important to integrate environmental design professionals with complex, innovative, applied, and diversified integration. Therefore, environmental design talents need to have various professional abilities such as integration and innovation for the social trend of "integration of industrialization and industrialization." The increasingly complex design issues of the twenty-first century have involved all aspects of people, nature, and society in a globalized world. Many factors that affect the success or failure of a curriculum system are outside the internal elements. Therefore, the design curriculum system should also pay attention to external elements such as society and environment, humanities and ethics, teamwork, communication, and interdisciplinary in the design background. When a balance of internal and external elements is achieved, the curriculum system can prepare design graduates for industrial work.

4.3. Selection of Course Content for Design Majors

4.3.1. The Value of Course Content in the Curriculum System. One of the most important research topics in the field of curriculum theory is the specific content of the curriculum. The content of the curriculum has a very important influence on the characteristics and abilities of talents. The content of the course reflects and realizes the goal of the course, and the function of the course must depend on the content of the course to be brought into play. Course content is the main basis for distinguishing industrial design majors from other majors. Course content is of great significance to the curriculum system. In fact, the process of selecting course content is not simply the questioning and selection of knowledge. It also reflects the deep content of teaching philosophy, values and so on.

4.4. Specific Measures to Design Professional Course Content. The knowledge structure contains many elements, and it presents multiple levels. When these elements are combined in a reasonable way, they can work best by themselves. Under the background of "integration of industrialization and industrialization," the knowledge structure of design talents should show the characteristics of fonts, and there should be different levels within it. The author has established a pyramid-like knowledge system of environmental design talents in the context of "integration of industrialization and industrialization," as shown in Figure 5. This model shows that under the background of "integration of industrialization and industrialization," environmental design talents should have profound knowledge and high professionalism at the same time. The pyramid-like structure is conducive to the subject's open mind. It can also enable the subject to use professional thinking and professional knowledge to think about problems and propose creative solutions. At the same time, it can learn from the knowledge of other disciplines and obtain innovative inspiration. This is conducive to discovering new fields from the intersection of disciplines and innovating in this field.

The course content should cover the knowledge of this major and adjacent majors. The course content not only imparts theory and knowledge to students, but also focuses on cultivating and exercising students' abilities and qualities. The course content should pay attention to cultivating and improving students' cultural literacy, and should focus on cultivating students' learning ability, practical ability, and innovative thinking. Students should be encouraged to explore and research independently, and organically combine quality education and ability education.

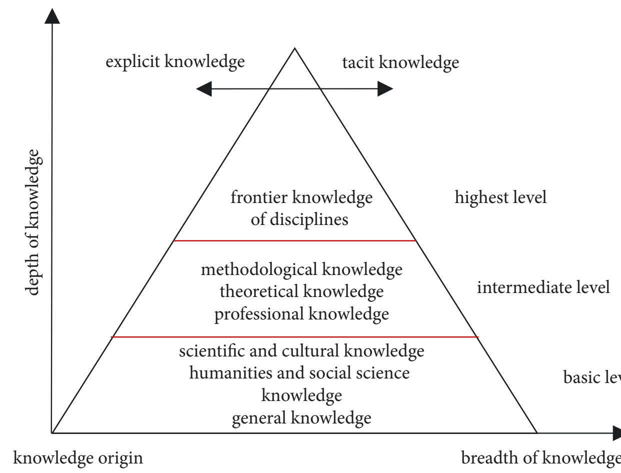

Figure 5: "Integration of informatization and industrialization" design talent knowledge system.

4.5. Integration of Environmental Protection and Big Data with Course Content. The course content for the "integration of industrialization and industrialization" needs to pay more attention to the nature of environmental protection and big data design. Environmental protection design is a synthesis of environmental science and art, but it is fundamentally different from the nature of design and science. Scientific activities are centered on invention, while technological activities are centered on discovery. Environmental design activities are based on creation. Design pursues innovation and is constantly changing. Especially in the context of today's big data, the process of design pursuit of innovation is also a dynamic process. But the kernel of the environment design never changes. The core of this is that design is an environmental protection activity that humans consciously carry out in order to achieve a certain purpose. It is future-proof and also innovative. Design thinking is also different from artistic and scientific thinking. It is a thinking that integrates analysis, divergence, synthesis, diversity, innovation, and differentiation. The distinguishing feature of today's society is the knowledge economy. This puts forward higher requirements for the innovation of environmental design. The so-called design is essentially the rearrangement of the knowledge structure. It is also to reintegrate the existing resources and innovate the industrial mechanism. By enabling human beings to achieve sustainable development, it can meet the overall requirements of human survival and development.

4.6. Addition of Science and Technology Frontier Courses. With the rapid development of science and technology, not only science and technology are constantly being updated, but also scientific concepts are being updated. Therefore, in order to conform to the development of the times, Chinese environmental design has correspondingly added content related to modernization in its curriculum. From the perspective of the long-term development of environmental design, there must be courses related to the development of science and technology in teaching the activities of design. Through the opening of this course, students can master the new trends of scientific and technological development in today's world. At the same time, it can master certain advanced science and technology. It can also be applied to its design. Through the advancement of science and technology, the problems encountered in the design are solved. It is beneficial to improve the scientificity and practicability of the design or product.

4.7. Open Information Technology Courses. In educational activities for environmental design, courses related to information development should be offered. Through the teaching of the course content, students can improve their ability to collect and use scientific and technological information. Possessing this ability is to prepare students for the needs of an evolving society. The development of Internet information technology has raised the requirements for environmental design students to a certain extent. It must have the corresponding modern information to deal with the development of information technology.

Informatization talents have different training methods in different fields, and their roles are not the same. But there is one thing in common, while expanding the horizon of talent information, talent informatization can be used as a means to promote communication between talents in different fields. In turn, different disciplines can learn from each other and complement each other.

4.8. Structural Idea. The concept of curriculum structure needs to have the following three aspects of thinking.

4.8.1. Clarifying the Goal, Building a Framework, Waiting for the Opportunity, and Improving the Practice. During the student period, the main goal of teaching is to help students complete a period of growth from professional enlightenment to entry. Although the previous series of studies have been fruitful, the details of the teaching content under the new teaching idea are still preliminary. It is necessary to design a curriculum structure framework according to the requirements of integrating big data and environmental protection. It is expected that under this framework, the ideas can be verified through teaching practice. And the specific content and connotation of each course can be enriched and improved.

4.8.2. In-Depth Study and Comprehensive Application. Deep learning requires ample study time and coherence. The learning time span of each professional skill is no less than one year. The dominant idea is to emphasize the in-depth study of various software, scientific knowledge, and their synergistic applications. Integrated application refers to the overall link between course content. On the basis of in-depth study, comprehensively apply the acquired knowledge and skills through teaching-based design projects and practical work tasks in enterprises. Applying knowledge can be the focus of studio teaching and the inherent needs of students to complete their studies.

4.8.3. Proportion of Professional Class Hours. Now, the respective proportions of professional courses and public culture courses in the total class hours of a school with environmental art design from 2018 to 2021 are calculated. The statistical results are shown in Figure 6.

Each professional course and each public culture course were broken up separately during the course arrangement and interspersed with each other in the class schedule. Cultural courses and professional courses are given equal attention, and the courses are arranged centrally. It needs to ensure the integrity and coherence of professional teaching. The specific schedule can be seen in Table 1.

4.9. Course Evaluation

4.9.1. Professional Basic Assessment. It is stipulated that after completing the professional basic courses in the first academic year, students must participate in a professional basic skills assessment organized by the school's professional department. Students who fail to pass the examination will be treated as repeating grades. If it can be implemented, it will definitely cause the necessary learning pressure to the students. It can better ensure the starting point requirements of studio project teaching.

4.9.2. Work Evaluation Mechanism. It is necessary to weaken the traditional mid-term and final examination assessment mode and strengthen the work practice evaluation orientation. A work practice evaluation mechanism can be established. It is stipulated that at the end of each semester, each student studio team must submit a work practice report and design work. All teachers are organized by the professional department. It needs to focus on reviews and ratings. This will be considered the grade for the semester.

4.9.3. Enterprise Evaluation Mechanism. Studio logs and monthly schedules need to be created for each studio. It is necessary to count and sort out the work output of each studio on a monthly basis. Business feedback needs to be collected on a regular basis. There is a need to develop a corporate feedback response mechanism for the studio. Formulating an appropriate studio incentive and reward system can not only actively interact with the enterprise, but also enrich the form and connotation of the enterprise evaluation mechanism.

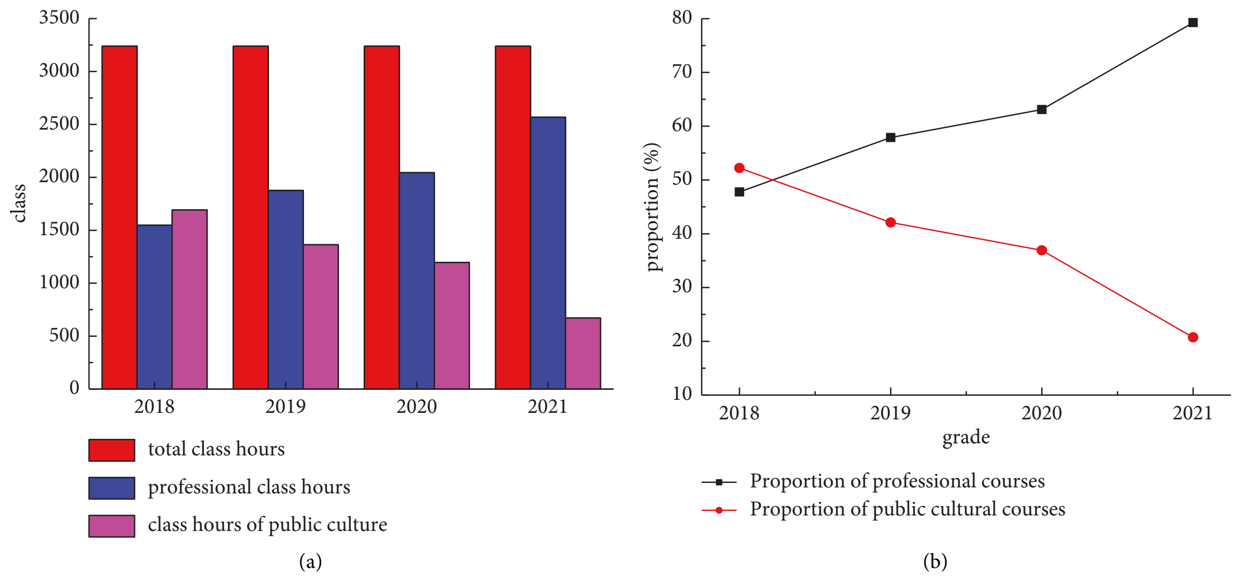

Figure 6: The respective proportions of professional courses and public culture courses in the total class hours. (a) Class. (b) Proportion.

Table 1: Suggested schedule for design majors.

Section number		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Morning	Section 1 Section 2 Section 3 Section 4	Holiday	Professional course	Professional course	Professional course	Professional course	Cultural course
Afternoon	Section 5 Section 6	Holiday	Cultural course	Cultural course	Cultural course	Cultural course	Cultural course
Evening study	Section 7 Section 8	Professional course	Professional course	Professional course	Cultural tutoring	Cultural tutoring	Holiday

4.9.4. Graduation Design Evaluation Mechanism. The content of graduation design includes three parts: research, graduation design creation, and production practice, which run through the entire student period. The final presentation form is to organize a student graduation project report exhibition every year. This exhibition can be regarded as a comprehensive report of the students' three-year professional learning results. It is the basis for our evaluation of students, and it is also a centralized review of the teaching effect. The establishment and improvement of the graduation design system are of great significance for improving the teaching process, evaluating the teaching quality, and accumulating teaching materials.

5. Analysis of Fuzzy Comprehensive Evaluation Effect

Big data provides a reference for the construction and application of the design major curriculum system. The third chapter constructs the curriculum system of design major. However, whether the constructed curriculum system of design major is scientific and reasonable needs to be evaluated. Due to the influence of multiple factors, the evaluation cannot be quantitatively evaluated. The author introduced the fuzzy comprehensive evaluation method in this research. This method is a comprehensive evaluation method based on fuzzy mathematics. It can effectively transform qualitative evaluation into quantitative evaluation [21–23]. Therefore, the problem of systematic evaluation of the fuzzy and difficult to quantify factors in the evaluation process can be solved.

5.1. Selecting Judgment Objects and Scope. This study will evaluate the quality and effect of the curriculum system of design majors under the environment of integrating environmental protection and big data. The object and scope of the evaluation are school teachers majoring in design.

5.2. Establishing and Determining the Index Set U of the Evaluation Object. Through the review of relevant literature, the rules and elements of the fuzzy comprehensive

Table 2: 1–9 scale.

Relative importance level setting	Meaning description
1	Equally important
3	Slightly important
5	Obviously important
7	Strongly important
9	Extremely important
1/3	Slightly unimportant
1/5	Obviously unimportant
1/7	Strongly unimportant
1/9	Extremely unimportant
2, 4, 6, 8, 1/2, 1/4, 1/6, 1/8	The importance is between the two adjacent levels above

evaluation method are sorted out. Combined with the practical investigation of the evaluation system of classroom teaching mode, this research determines that the index set of the evaluation object is U. It includes four levels: teaching environment (A), classroom response (B), teacher satisfaction (C), and teaching effect (D). The specific indicators can be expressed as follows.

The teaching environment includes the degree of informatization environment construction (A1), the degree of intelligence of the teaching process (A2), and the ease of operation of the equipment system (A3). Classroom responses include students' overall attitude towards learning (B1), students' enthusiasm for learning (B2), improvement of collaboration and communication skills (B3), application of innovative mechanisms (B4), and rationality of the setting of wisdom links (B5). Teacher satisfaction includes the satisfaction of classroom students' learning status (C1), the reform and innovation of the professional curriculum system (C2), the psychological changes of students' acceptance of the system (C3), and the comparison of teaching effects before and after the application of the system (C4). The teaching effect includes a firm grasp of students' basic knowledge and theory, improvement of students' ability to analyze and solve problems, active classroom atmosphere, active cooperation of students, and achievement of teachers' teaching and students' abilities.

5.3. Constructing the Judgment Matrix Corresponding to Each Level. In order to construct the judgment matrix corresponding to each level and determine the corresponding evaluation index weight, the 1–9 scaling method is introduced, as shown in Table 2 [24, 25].

According to the construction of the above indicators and the statistics of relevant questionnaire data, the first-level indicators and the second-level indicators are compared. After comparing the two indicators, a set of judgment matrices (represented by U, A, B, C, D respectively) are obtained as follows:

$$
\begin{aligned}
U &= \begin{bmatrix} 1 & \frac{1}{3} & \frac{1}{3} & \frac{1}{5} \\ 3 & 1 & 1 & \frac{1}{2} \\ 3 & 1 & 1 & \frac{1}{2} \\ 5 & 2 & 2 & 1 \end{bmatrix}, \\
A &= \begin{bmatrix} 1 & \frac{1}{3} & 3 \\ 3 & 1 & \frac{1}{2} \\ \frac{1}{3} & 2 & 1 \end{bmatrix}, \\
B &= \begin{bmatrix} 1 & \frac{1}{3} & \frac{1}{2} & 1 & \frac{1}{4} \\ 3 & 1 & 1 & 2 & \frac{1}{2} \\ 2 & 1 & 1 & 2 & \frac{1}{2} \\ 1 & \frac{1}{2} & \frac{1}{2} & 1 & \frac{1}{4} \\ 4 & 2 & 2 & 4 & 1 \end{bmatrix}, \\
C &= \begin{bmatrix} 1 & 2 & 2 & \frac{1}{3} \\ \frac{1}{2} & 1 & 1 & \frac{1}{3} \\ \frac{1}{2} & 1 & 1 & \frac{1}{3} \\ 1 & 3 & 3 & 1 \end{bmatrix}, \\
D &= \begin{bmatrix} 1 & \frac{1}{6} & 2 & 1 \\ 6 & 1 & 7 & 2 \\ \frac{1}{2} & \frac{1}{7} & 1 & \frac{1}{2} \\ 1 & \frac{1}{2} & 2 & 1 \end{bmatrix}.
\end{aligned}
\tag{1}
$$

Due to the pairwise comparison of the various factors involved in the effect application evaluation, there may be conflicting situations, and it is impossible to make a completely correct judgment. In the course of the research, almost all pairwise comparisons are allowed to have some degree of inconsistency. To solve this problem, a consistency check is required. The maximum eigenvalues of each matrix are calculated as $\lambda_A = 3.038$, $\lambda_B = 5.0198$, $\lambda_C = 4.0501$, and $\lambda_D = 4.1153$.

In order to determine the allowable range of the degree of inconsistency, the corresponding average random consistency index RI value is found according to the requirements. The RI values are shown in Table 3.

The calculation formula of the consistency index is as follows:

$$\begin{aligned} \mathrm{CI} &= \frac{\lambda_{\max} - n}{n-1}, \\ \mathrm{CR} &= \frac{\mathrm{CI}}{\mathrm{RI}}, \end{aligned} \tag{2}$$

where $\lambda_{\max}$ is the largest eigenroot of the judgment matrix.

The calculated consistency indicators are $\mathrm{CR}_A = 0.0327$, $\mathrm{CR}_B = 0.0044$, $\mathrm{CR}_C = 0.0185$, and $\mathrm{CR}_D = 0.0427$. The CR results obtained were all less than 0.1. Therefore, the judgment matrices have good consistency. The relative weight vector of indicators at all levels is calculated by the summation method. The eigenvector value corresponding to each level factor is Y.

$$\begin{aligned} Y_U &= \begin{bmatrix} 0.082 \\ 0.235 \\ 0.235 \\ 0.448 \end{bmatrix}, \\ Y_A &= \begin{bmatrix} 0.332 \\ 0.361 \\ 0.286 \end{bmatrix}, \\ Y_B &= \begin{bmatrix} 0.092 \\ 0.216 \\ 0.198 \\ 0.099 \\ 0.395 \end{bmatrix}, \\ Y_C &= \begin{bmatrix} 0.235 \\ 0.138 \\ 0.138 \\ 0.489 \end{bmatrix}, \\ Y_D &= \begin{bmatrix} 0.150 \\ 0.572 \\ 0.083 \\ 0.196 \end{bmatrix}. \end{aligned} \tag{3}$$

Table 3: Values of the average random consistency index RI.

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45

Through the online distribution and recycling of the evaluation questionnaire on the effect of this model, the comprehensive evaluation of 16 experts or teachers is collected. The statistical results are shown in Figure 7.

The change law of the four evaluation levels is shown in Figure 8.

By summarizing the process of experts participating in the evaluation and combining with the questionnaire, four evaluations are carried out on the 16 indicators. After data statistics and sorting, the corresponding fuzzy evaluation moments are obtained.

$$\begin{aligned} R1 &= \frac{1}{16}\begin{bmatrix} 3 & 7 & 6 & 0 \\ 4 & 6 & 6 & 0 \\ 4 & 8 & 4 & 0 \end{bmatrix}, \\ R2 &= \frac{1}{16}\begin{bmatrix} 7 & 5 & 4 & 0 \\ 9 & 6 & 1 & 0 \\ 6 & 8 & 2 & 0 \\ 8 & 6 & 2 & 0 \\ 7 & 8 & 1 & 0 \end{bmatrix}, \\ R3 &= \begin{bmatrix} 6 & 7 & 3 & 0 \\ 7 & 5 & 4 & 0 \\ 6 & 8 & 2 & 0 \\ 9 & 5 & 2 & 0 \end{bmatrix}, \\ R4 &= \begin{bmatrix} 8 & 6 & 2 & 0 \\ 5 & 8 & 3 & 0 \\ 7 & 7 & 2 & 0 \\ 6 & 7 & 3 & 0 \end{bmatrix}. \end{aligned} \tag{4}$$

The evaluation result set in four aspects of teaching environment, classroom response, teacher satisfaction, and teaching effect can be calculated as follows:

$$\begin{cases} R1 = \begin{bmatrix} 0.224 & 0.424 & 0.331 & 0 \end{bmatrix}, \\ R2 = \begin{bmatrix} 0.458 & 0.443 & 0.098 & 0 \end{bmatrix}, \\ R3 = \begin{bmatrix} 0.475 & 0.368 & 0.157 & 0 \end{bmatrix}, \\ R4 = \begin{bmatrix} 0.364 & 0.464 & 0.173 & 0 \end{bmatrix}. \end{cases} \tag{5}$$

After normalizing the result set, R' can be obtained:

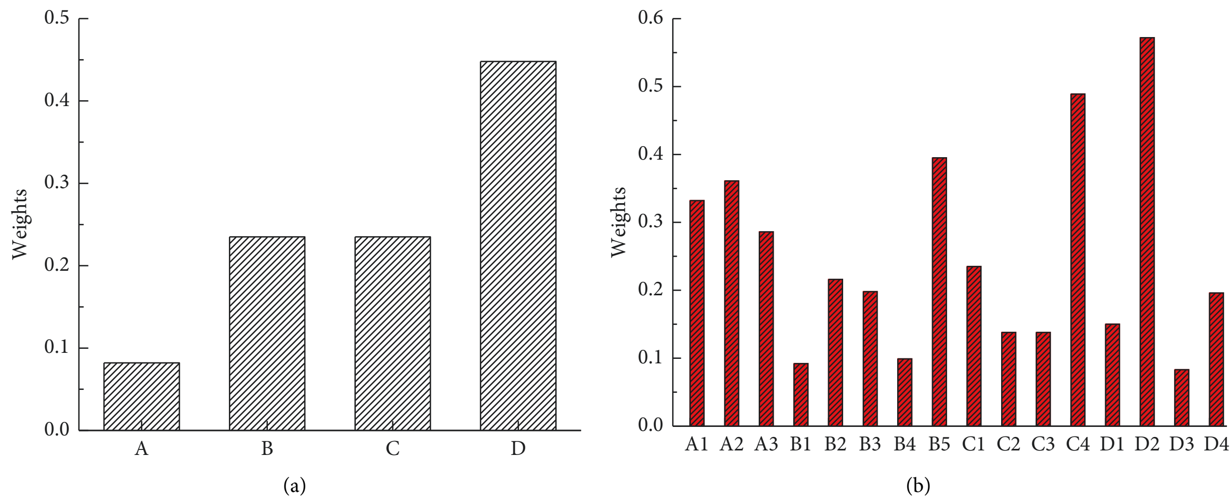

Figure 7: The statistical results. (a) First-level indicator. (b) Secondary indicators.

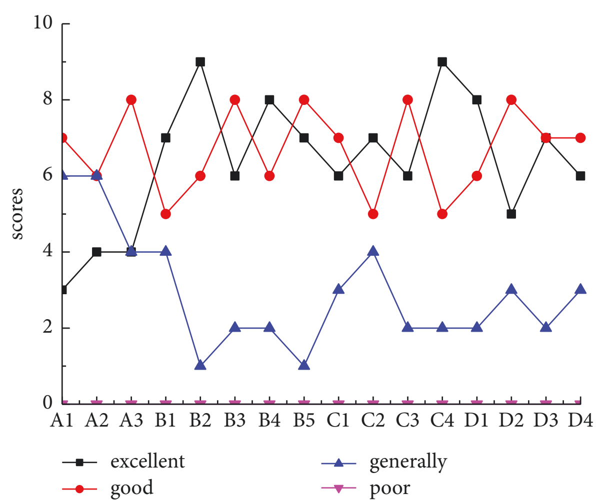

Figure 8: The change law of the four evaluation levels.

$$R' = \begin{bmatrix} 0.229 & 0.433 & 0.338 & 0 \\ 0.459 & 0.443 & 0.098 & 0 \\ 0.475 & 0.368 & 0.157 & 0 \\ 0.364 & 0.463 & 0.173 & 0 \end{bmatrix}, \quad (6)$$

Through the comprehensive evaluation of two levels, the evaluation result set is finally obtained:

$$R = [\,0.401 \;\; 0.434 \;\; 0.165 \;\; 0\,], \quad (7)$$

The comprehensive evaluation set is set as V = {excellent, good, fair, poor}, and the corresponding scores are shown in Table 4.

A corresponding score needs to be set for each evaluation level. It can be set to 95, 75, 55, 25, respectively. The evaluation level parameter matrix is $V\prime = \{95, 75, 55, 25\}$. The evaluation result S is

Table 4: Corresponding score table of comprehensive evaluation.

Rank	Excellent	Good	Generally	Poor
Score	[80, 100]	[60, 80]	[40, 60]	[0, 40]

$$S = [\,0.401 \;\; 0.434 \;\; 0.165 \;\; 0\,] \begin{bmatrix} 95 \\ 75 \\ 55 \\ 25 \end{bmatrix} = 79.72 > 60. \quad (8)$$

The evaluation result is good on the upper side. By using the fuzzy comprehensive evaluation method, the author conducts a comprehensive analysis and evaluation of the construction and application of the curriculum system of the design major under the environment of big data and environmental protection. The final comprehensive application effect is good. It is fully proved that the application of this model to teaching is beneficial to enhance students' perception of the classroom. It is beneficial to improve students' classroom enthusiasm and interaction, to improve students' collaboration and communication ability, to improve students' ability to analyze and solve problems, to improve classroom teaching efficiency, and to promote the generation of teachers' teaching and students' learning ability, etc.

5.4. Evaluation Effect Feedback. Based on big data and environmental protection, the construction of professional curriculum system needs to be designed in detail. The system is also applied to the classroom of specific subject teaching. In the later period, the author collected valuable opinions and survey feedback from experts and teachers on this system by using the survey method and interview method. Then, various evaluation indicators are designed. The comprehensive effect of applying this model in the classroom is judged. It is known from the results that the effect of applying this model is good. It shows that this model has brought spring for the innovation of teaching model and the development of education informatization. But there is still room for further improvement. In the subsequent use process, the teaching process in this mode can also be optimized and improved to provide a more efficient and smarter classroom teaching mode for education and teaching.

6. Conclusion

The fact that the curriculum is oriented towards the "integration of industrialization and industrialization" does not mean from the "traditional industrialization" side of the pendulum. It can be completely swayed to the other end of "informatization." Instead, it seeks to balance the fulcrum of theory and practice, and achieve connection, transformation, and transcendence in dynamic adjustment. The "integration of industrialization and industrialization" in reality does not mean abandoning the "design based on scientific and technological knowledge" that was emphasized in the past. It is to emphasize that industrial design education should be in line with "informatization."

The comprehensive application effect of this model is evaluated and analyzed by the fuzzy comprehensive analysis method. The factors affecting the teaching effect after the implementation of this model are investigated and analyzed first. By adopting the valuable opinions of experts and teachers, a set of relevant indicators was designed and the effectiveness of the indicators is verified. The conclusion is drawn that the classroom teaching effect is good after applying this model. Finally, the questionnaire survey method and fuzzy comprehensive evaluation method are used to verify the good application effect of this model. The validity of this model is further verified.

The optimization of curriculum structure is the focus of school-level curriculum reconstruction. The direction of optimizing the curriculum structure of environmental design education in China should focus on adjusting the integration of general education and professional courses in the curriculum structure. At the same time, attention should be paid to the integration and integration of subject courses, the modularization of compulsory and elective courses, the integration of theoretical courses and practical courses, and the synergy of explicit and implicit courses. The "modular curriculum structure model" of China's environmental design major proposed in this study can be used as a reference for the reform of the curriculum system of environmental design education in colleges and universities.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The author declares no conflicts of interest.

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Retraction

Retracted: Grey Correlation Analysis of Low-Carbon Governance in Yangtze River Delta Cities

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] L. Min, "Grey Correlation Analysis of Low-Carbon Governance in Yangtze River Delta Cities," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2029087, 10 pages, 2022.

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Research Article

Grey Correlation Analysis of Low-Carbon Governance in Yangtze River Delta Cities

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The excessive emission of carbon dioxide will bring unpredictable ecological crisis, so it is particularly urgent to study the related factors of carbon emissions. Based on the grey correlation model, 31 factors in 5 aspects are selected as the reference frame for low-carbon governance, and the grey correlation degree of urban carbon emissions is calculated by using the IPCC method to calculate the annual carbon emissions of 9 major cities in the Yangtze River Delta from 2010 to 2019. Through the calculation and analysis of panel data, the following conclusions are drawn: The allocation of urban environmental practitioners is an important factor in carbon governance, and the reasonable and scientific allocation of environmental practitioners can have a significant impact on low-carbon development; the relationship between the amount of industrial power consumption and carbon dioxide emissions is not significant. On the contrary, the power consumption of urban residents can well reflect the level of carbon emissions. High residential power consumption means that the living standard of the people in the region is high, and the corresponding resource and energy consumption is large, so the carbon emissions will increase; the size of population density is particularly important for carbon governance, which is more obvious in economically developed areas. Urban economic development will inevitably lead to the improvement of people's quality of life, a stronger demand for resources, and a significant increase in carbon emissions.

1. Introduction

With the acceleration of industrialization and urbanization, carbon dioxide emissions have further increased, and the relevant ecological and environmental problems have become increasingly prominent. Since industrialization, carbon dioxide emissions have increased significantly [1]. In 2019 alone, energy-related carbon dioxide emissions reached 33gt [2]. According to the assessment report of the Intergovernmental Panel on Climate Change, more and more evidence show that carbon dioxide emissions are closely related to climate change [3]. The carbon dioxide produced and emitted by human activities exceeds the carrying capacity of nature, causing the earth's greenhouse effect, which in turn leads to the emergence of ecological and environmental problems such as climate warming, sea-level rise, and glacier melting. Industrialization will inevitably bring about the accumulation of labor force, which will lead to the rapid development of urbanization. Today, more than half of the population lives in cities, and this number is expected to be close to 70% by 2050 [4]. The concentration of a large number of people and industrial industries has led to the rapid development of transportation and construction industry, which has increased the demand for energy and produced a large amount of carbon dioxide. In the context of rapid urbanization, cities consume 80% of the total energy, and carbon dioxide emissions exceed 70% of the total [5]. It can be seen that cities play a key role in reducing carbon dioxide emissions and achieving proper governance of carbon dioxide. For the governance of urban carbon dioxide, we need to consider not only the single factor of emissions, but also the comprehensive analysis of pollution factors, governance factors, economic factors, and social factors generated by carbon dioxide, so as to grasp the key to urban low-carbon governance and to realize urban low-carbon development from the root. China is a big carbon emitter. Facing the ecological problems caused by carbon emissions, China should shoulder the responsibility of reducing carbon emissions and help people and nature coexist harmoniously. As an important regional development center in China, the Yangtze River Delta urban agglomeration has developed rapidly, and its urbanization rate is leading the country. This also leads to a large amount of energy consumption and carbon dioxide emissions, thus facing the dilemma of urban low-carbon development. By studying the correlation between carbon emissions of important cities in this region and other factors, we can point out the direction for urban low-carbon governance, find a way of urban low-carbon, and then provide reference for the low-carbon development of other cities and regions.

2. Literature Review

In order to study the relevant factors of urban low-carbon governance, scholars have made many useful explorations. Sarwar and Alsaggaf [6] studied the carbon dioxide emission reduction level in Saudi Arabia by using indicators such as GDP, oil consumption, industrialization, urbanization, and education, combined with the effectiveness of government governance and regulatory norms, tested the positive and negative effects of indicators on carbon emissions, and found that the effectiveness of governance and regulatory norms can effectively reduce carbon emissions. Mohareb and Kennedy [7] studied the impact of relevant technological innovation on urban emission reduction with the goal of light passenger vehicles, residential buildings, and commercial buildings and found that technological innovation can greatly reduce carbon emissions, which is beneficial to the realization of emission reduction targets to a certain extent. Friberg [8] studied Brazil's clean development mechanism, clarified the relevant interests, assessed the impact of the mechanism on Brazil's ecological environment, and found that the mechanism was conducive to the development of energy diversification and improved the government's carbon governance capacity. Drożdż et al. [9] investigated the determinants of decarbonization in urban and rural Poland by means of online questionnaires and found that the phenomenon of coal as a direct heat source for urban residents has gradually disappeared, but the coal used for power generation has not been reduced, and efforts need to be made on clean energy to reduce carbon emissions in the future. Lind and Espegren [10] took Oslo as the research object, used the energy system model to analyze the number of low-carbon cities to turn, and found that only taking measures on the energy system is difficult to achieve low-carbon development, but also need to carry out low-carbon development in transportation and other aspects. Falahatkar et al. [11] studied the relationship between urban form and carbon dioxide emissions based on the panel data of 15 important cities in Iran, starting from the compactness, complexity, and centrality of urban form. They found that the faster the city grows, the more complex the form is, and the greater the carbon dioxide emissions are. On the contrary, the more compact the urban form is, the smaller the carbon dioxide emissions are. Azizalrahman and Hasyimi [12] selected Stockholm, Vienna, and Sydney as the entropy model of the characteristics of low-carbon cities and selected 20 indicators including the proportion of gross national product and renewable energy, trying to build a general model to evaluate low-carbon cities. Through calibration and testing, the model can distinguish whether the target city is low-carbon. Mollaei et al. [13] used the life cycle cost analysis method to build a low-carbon city analysis model based on the United Nations climate data and Iran's national development data. On this basis, the factors affecting economic development and carbon dioxide emissions are discussed. The results show that reducing urban carbon emissions depends on corresponding investment.

The above research provides reference and ideas for analyzing the related factors of urban low-carbon governance. However, due to the late start of the relevant research on urban low-carbon governance factors, the research is relatively insufficient, so it is difficult to grasp the key factors affecting carbon emissions in general, so as to carry out governance activities based on this to achieve urban low-carbon development. In order to fill the research gap, this paper selects 31 factors from the five aspects of urban pollution, environmental governance, energy consumption, social environment, and economic development; analyzes the grey correlation degree with carbon dioxide emissions; and calculates the grey correlation degree of each factor. It finds the factors closely related to carbon emissions, discusses the internal logic behind it, grasps the governance direction as a whole, and helps urban low-carbon development.

3. Research Methods

3.1. Related Factors of Urban Low-Carbon Governance. In December 2021, the State Administration of market supervision and administration and the National Standardization Administration of China issued the guidelines for the evaluation of low-carbon development level of sustainable development of cities and communities. Carbon emissions, energy, construction and transportation, economy, society, scientific research, policies and regulations, and other indicators are important factors to evaluate the level of low-carbon development of cities. In addition, some scholars have also incorporated indicators such as industrial structure, agricultural production, air quality, water environment, and urbanization rate into the urban low-carbon development evaluation system [14–16], which is closely related to urban low-carbon governance. On the basis of combing the relevant concepts of low-carbon cities, this paper selects reasonable factors closely related to carbon governance for grey correlation analysis and then grasps the key factors of carbon governance.

A low-carbon city is considered to be a city with a low-carbon development and operation model economically; citizens adhere to low-carbon concepts and behaviors in life, and the government takes a low-carbon society as its development standard and blueprint. Some scholars believe that the construction of low-carbon cities is to take measures such as changing people's ideas, formulating low-carbon policies, and changing people's lifestyle, with the goal of achieving low-carbon emissions. Generally speaking, low-carbon cities are summarized as the following points [17]: (a) the important foundation of low-carbon cities is low-carbon economy, which requires economic development to meet the conditions of low energy consumption, low pollution, low emissions, and high efficiency; (b) the construction of low-carbon cities is no longer limited to technology and product production, but also involves many social and economic factors such as lifestyle and consumption concept; (c) low-carbon cities should have high economic vitality, meet the requirements of ecological and environmental protection, and improve people's living standards at the same time.

According to these characteristics, combined with the requirements of urban low-carbon governance for low-carbon emissions, taking urban carbon dioxide emissions as the target, refer to the low-carbon city evaluation system established by Lin et al. [18] and Su et al. [19], to establish low-carbon governance-related factors evaluation system. Through the screening of relevant factors of carbon governance, based on the availability and relevance of data, 31 factors are finally selected to evaluate their grey correlation with carbon governance. As shown in Table 1, the grey correlation evaluation system covers five related factors: urban pollution, environmental governance, power consumption, social environment, and economic development.

3.2. Grey Relational Model of Urban Low-Carbon Governance. Grey correlation theory began in the late 1970s. The interval analysis method founded by Moore is considered to be the initial form of grey system [20]. Deng made great contributions to the development of grey correlation theory in the 1980s, and the classical grey system he founded was widely recognized by people [21]. The main function of the classical grey system is to deal with the discrete series dimensionless and get the correlation degree of each factor. As the grey relational model gradually matures, the model is used in various scenarios, such as industrial innovation evaluation, ecological environment impact evaluation, and economic growth factor analysis [22, 23]. In the face of the rapid increase of carbon dioxide emissions, resulting in increasingly prominent ecological and environmental problems, the research on carbon governance is particularly important and urgent. Many scholars have made in-depth analysis of carbon governance factors with the help of various theoretical tools, but the application of grey correlation system model is less. This paper uses the classical grey correlation system model to study the carbon governance factors of important cities in the Yangtze River Delta and analyzes the correlation between economic, social, environmental, and other factors and carbon governance.

Step 1. Matrix processing of index data

The panel data is presented in the form of a matrix, in which the first row of the matrix is the reference sequence x_0 of dependent variables and the comparison column X_i of other independent variables.

$$x_i = \begin{bmatrix} x_0(1) \cdots x_0(m) \cdots x_0(n) \\ x_1(1) \cdots x_1(m) \cdots x_1(n) \\ . \\ . \\ . \\ x_i(1) \cdots x_i(m) \cdots x_i(n) \end{bmatrix}, \qquad (1)$$

where $i = 1, 2, 3, \cdots, s$; $m = 1, 2, 3, \cdots, T$; I is the index to be investigated, s is the total number of indicators, and N is the total number of observation points.

Step 2. Calculation of index relevance

(1) Dimensionless processing of index data

The various indicators of panel data are different in dimension, which is difficult to compare and easy to make mistakes in the calculation of results. In order to eliminate the obstacles with different dimensions, the panel is treated dimensionless.

$$x_i(d) = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}}. \qquad (2)$$

(2) Calculation of correlation coefficient:

$$r_i(d) = \frac{\Delta_{\min} - \rho\Delta_{\max}}{\Delta_i(k) + \rho\Delta_{\max}}. \qquad (3)$$

(3) Correlation calculation:

$$\varepsilon_i(d) = \frac{1}{N}\sum_{d=1}^{N} r_i(d). \qquad (4)$$

Step 3. Sort the correlation degree and analyze the reasons for the difference of correlation degree.

4. Empirical Analysis

4.1. Data Source. Aiming at the Yangtze River Delta region, this paper selects nine major cities such as Nanjing, Changzhou, Wuxi, Suzhou, Hangzhou, Ningbo, Wenzhou, and Huzhou for research and analyzes the factors related to carbon governance in the development process of these major cities. There are many factors involved in carbon dioxide emissions. Of course, its governance should also be comprehensively considered from many aspects. In order to be close to reality and conform to the internal logic, mechanism, and operation mechanism of carbon governance, this paper selects 31 closely related factors for grey correlation analysis from five aspects: urban pollution, environmental governance, power consumption, social environment, and economic development. The data used are from the bulletin data of the National Bureau of statistics of China from 2010 to 2019, including China Statistical Yearbook, China Environmental Statistical Yearbook, China Energy Statistical Yearbook, and China Urban Statistical Yearbook.

4.2. Calculation of Carbon Emissions. Combined with the previous research methods of carbon emissions, after comprehensive consideration, the IPCC method is selected to

Table 1: Grey correlation evaluation system of urban low-carbon governance factors.

Level	Environmental pollution	Urban governance	Power consumption	Social environmental	Economic development
Factors	Annual average concentration of inhalable fine particles Industrial sulfur dioxide emissions Industrial wastewater discharge Industrial NOx emissions Industrial smoke emission	Number of employees in water conservancy, environment, and public facilities management industry Comprehensive utilization rate of general industrial solid waste Industrial sulfur dioxide removal Comprehensive utilization rate of industrial solid waste Industrial wastewater discharge reaches scalar Industrial dust removal Centralized treatment rate of sewage treatment plant Harmless treatment rate of domestic waste Domestic sewage treatment rate	Annual electricity consumption Urban domestic consumption electricity Industrial power	Population density R&D internal expenditure Number of invention patents authorized Education expenditure Total water resources Scientific expenditure Number of employees in scientific research, technical services, and geological exploration industry	GDP Proportion of added value of secondary industry in GDP Number of employees in manufacturing industry Number of employees in the tertiary industry Product sales revenue Total industrial output value of foreign-invested enterprises Total output value of industries above designated size

Table 2: Carbon emission initialization data.

Year	Nanjing	Changzhou	Wuxi	Suzhou	Shanghai	Hangzhou	Ningbo	Wenzhou	Huzhou
2010	1.1061	1.1288	1.1480	1.1622	1.1120	1.1268	1.1074	1.1108	1.1098
2011	0.4743	1.2302	1.1724	1.2184	1.1338	1.2094	1.1785	1.1446	1.1185
2012	0.5124	1.3096	1.1918	2.1326	1.1661	1.2470	1.3551	1.1337	1.2154
2013	0.5868	1.4495	1.2701	2.3089	1.2209	1.3620	1.4166	1.1729	1.3171
2014	0.5888	1.4325	1.2397	2.2569	1.1513	1.5593	1.4712	1.1792	1.3379
2015	0.5850	1.6400	1.2009	2.3086	1.1355	1.4658	1.5158	1.0759	1.3478
2016	0.6014	1.6797	1.2739	2.2719	1.1610	1.4869	1.5598	1.1669	1.4585
2017	0.6245	1.8182	1.3829	2.2287	1.1496	1.6060	1.6688	1.1983	1.5377
2018	0.6181	1.8136	1.3505	2.1534	1.1001	1.5835	1.6866	1.2080	1.5035
2019	0.6691	1.9821	1.3864	2.2434	1.1203	1.7509	1.9043	1.3100	1.7048

Table 3: Grey correlation coefficient of panel data.

Year	Nanjing	Changzhou	Wuxi	Suzhou	Shanghai	Hangzhou	Ningbo	Wenzhou	Huzhou
2010	0.9722	0.9336	0.9324	0.9326	1.0000	0.9492	0.9339	0.9322	0.9270
2011	0.9217	0.8957	0.8940	0.8949	1.0000	0.9195	0.8951	0.8931	0.8855
2012	0.9046	0.8728	0.8724	0.8860	1.0000	0.9022	0.8759	0.8696	0.8602
2013	0.9007	0.8643	0.8658	0.8803	1.0000	0.8992	0.8673	0.8592	0.8501
2014	0.9395	0.9148	0.9164	0.9260	1.0000	0.9418	0.9140	0.9133	0.9045
2015	0.8755	0.8295	0.8385	0.8532	1.0000	0.8847	0.8305	0.8364	0.8163
2016	0.8976	0.8618	0.8666	0.8779	1.0000	0.9092	0.8558	0.8702	0.8480
2017	0.8850	0.8389	0.8458	0.8544	1.0000	0.9009	0.8331	0.8503	0.8247
2018	0.8919	0.8402	0.8488	0.8547	1.0000	0.9082	0.8365	0.8549	0.8288
2019	0.8919	0.8366	0.8409	0.8514	1.0000	0.9141	0.8438	0.8422	0.8126

calculate the carbon emissions of major cities in the Yangtze River Delta. The specific calculation formula is as follows:

$$CO_2 = \sum_{i=1}^{3} E_i \cdot L_i \cdot N_i \cdot \frac{44}{12}. \tag{5}$$

CO_2 refers to the total amount of carbon dioxide emitted by the consumption of various fossil fuels in the region; i refers to coal, oil, and natural gas; E_i is the consumption of respective energy; L_i and N_i are the carbon emission and coal conversion coefficient of energy; 44/12 is the ratio of carbon dioxide to carbon relative molecular weight.

4.3. Results and Discussion

4.3.1. Grey Correlation Coefficient. The article first initializes the 31 index data of urban pollution, environmental governance, power consumption, social environment, and economic development and initializes the carbon emission data. See Table 2 for details. Secondly, the correlation coefficient between 31 indicators and carbon emissions is calculated, in which the grey resolution is set as $\rho = 0.5$, taking the added value of the secondary industry as an example; see Table 3 for details.

4.3.2. Timing Relevance of Carbon Governance. Through Deng's grey correlation model, the temporal correlation between 31 factors in five aspects, including urban governance, environmental pollution, power consumption, social environment and economic development, and carbon governance, can be calculated. The results are shown in Figures 1–5. The time series correlation reflects the correlation between 31 factors and carbon governance, as well their changes in the 10 years from 2010 to 2019.

It can be seen from the above figures that, the grey correlation between various factors and carbon governance has not changed significantly. The reason is that the Chinese government has long insisted on strengthening the protection of the ecological environment while developing the economy, trying to get rid of the extensive development mode of high energy consumption and high carbon emissions, and taking the road of sustainable green development. However, in 2014, the grey correlation between various factors and carbon governance fluctuated upwards, which led to the rise of the subsequent grey correlation. The reason behind this is that the Chinese government made a clear commitment to "reaching the peak of carbon" for the first time at the UN climate summit in 2014 and launched practical actions to this end, formulating a series of emission reduction policies. Of course, these policies are multifaceted and comprehensive, thus resulting in an overall upward fluctuation.

Through Figure 1, it can be seen that the grey correlation between the number of employees in the water conservancy, environment and public facilities management industries,

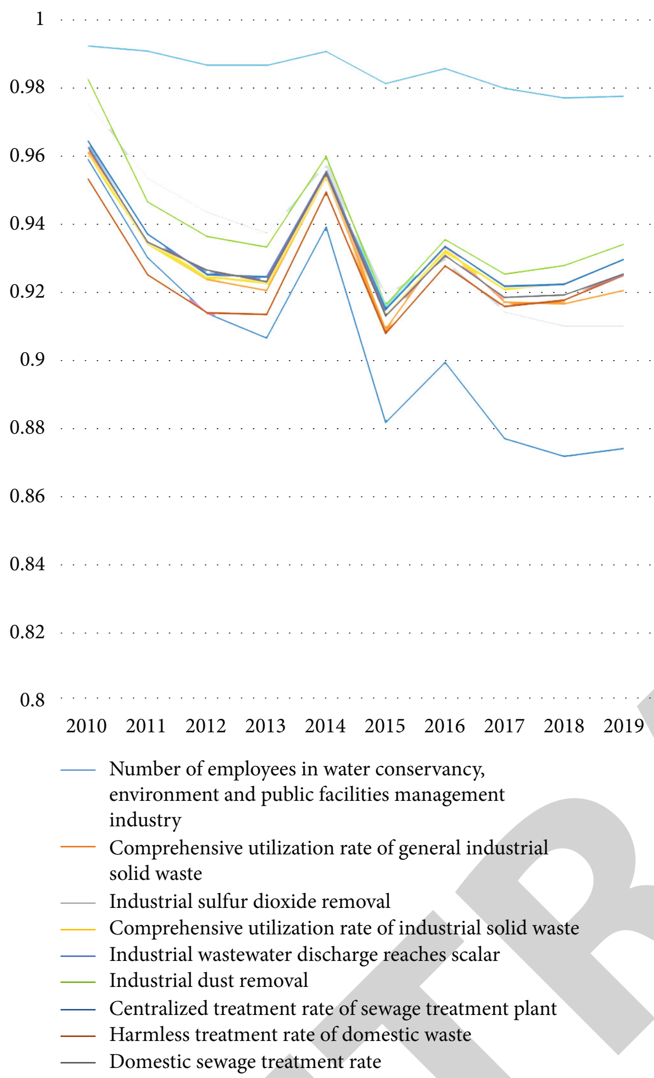

Figure 1: Correlation degree of urban governance time series.

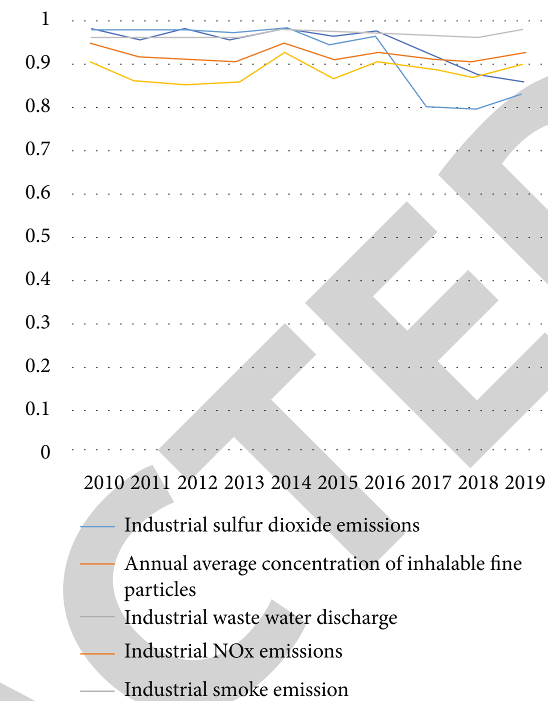

Figure 2: Correlation degree of environmental pollution time series.

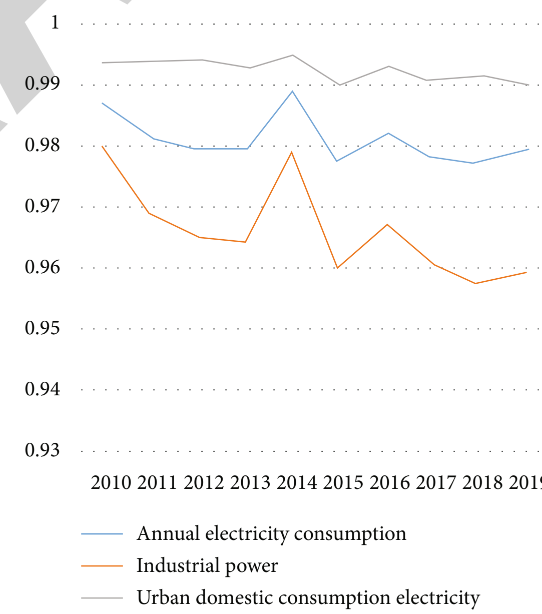

Figure 3: Correlation degree of electric energy consumption time series.

and carbon governance has been maintained at a high level. The number of environmental management personnel is positively related to carbon emissions. Only scientific and reasonable allocation of environmental personnel can have a positive impact on carbon governance. Secondly, the grey correlation between the standard discharge of industrial wastewater and carbon treatment fluctuates greatly and continues to maintain a downward trend. As an important industrial base, the Yangtze River Delta region has its own environmental pollution, and the problem of water pollution is particularly serious. With the adjustment of industrial structure, the pollution of high-tech industries on water resources has been greatly reduced, resulting in a decline in the correlation between the standard discharge of wastewater and carbon treatment.

According to Figure 2, it is not difficult to find that the correlation between industrial soot emissions, industrial sulfur dioxide, and carbon governance has dropped significantly since 2016 and has remained at a low level. It was the most serious year of China's smog problem. Smog has become the top priority of the country, and the control of smog has risen from a local requirement to a national will. As an important component of smog, sulfur dioxide and industrial soot have become the focus of governance, while the related carbon emissions are not important enough. From Figure 3, the correlation between urban domestic electricity and carbon governance remains at a high level, because in areas with high urbanization, the substitution of domestic electricity for fossil energy is significant and irreversible. The more widely

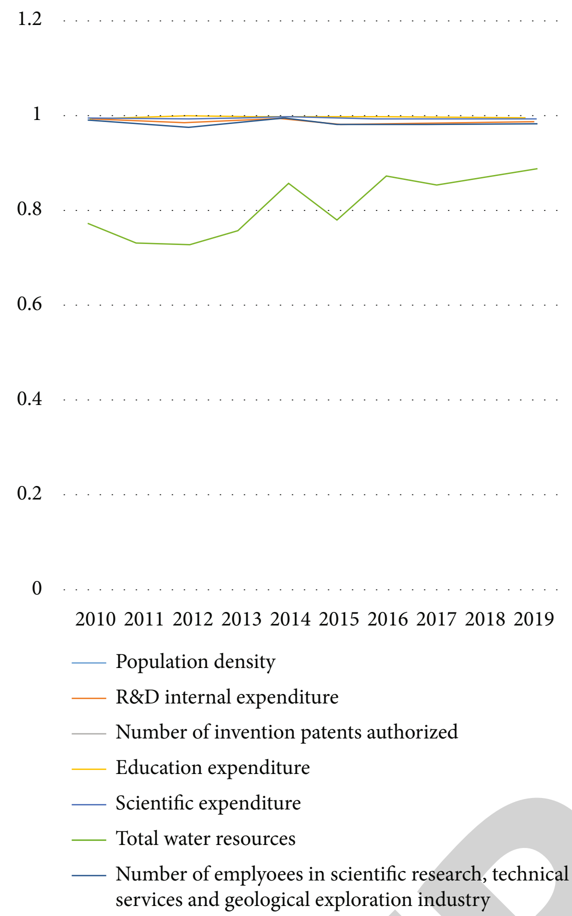

Figure 4: Correlation degree of social environment time series.

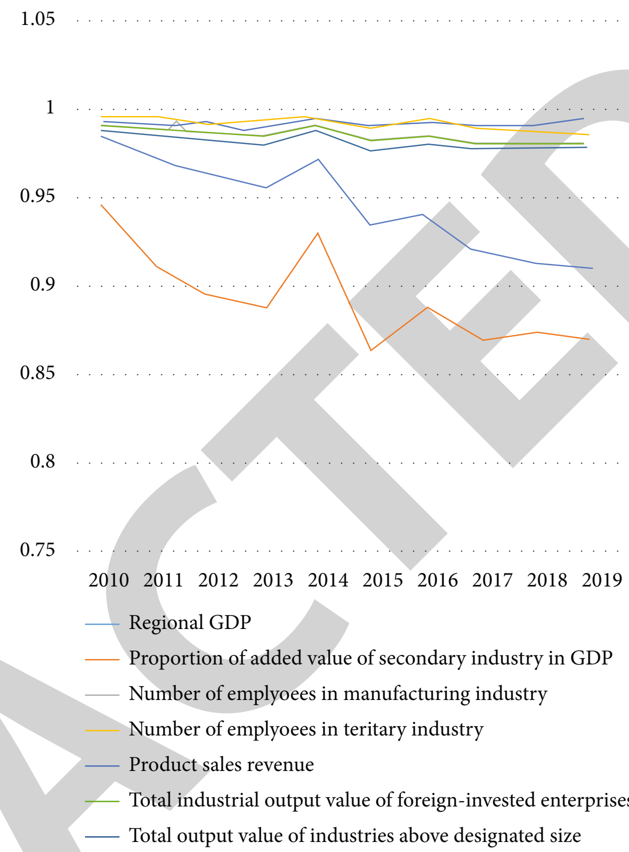

Figure 5: Correlation degree of economic development time series.

electricity is used, the less carbon emissions will be. However, the correlation between industrial power consumption and carbon governance remains at a low level. It is difficult for industrial power to comprehensively replace fossil energy, and the cost of industrial power consumption is much higher than that of fossil energy. In the Yangtze River Delta, where the market economy is highly developed, the use of fossil energy will not be reduced because of electricity, and the use of fossil energy will lead to an increase in industrial power consumption. According to Figure 4, we can see that many factors of the social environment are closely related to carbon governance. Carbon dioxide emissions come from people's production and life, and the root of carbon governance lies in people's governance, low-carbon life, and low-carbon consumption. In addition, the grey correlation between the total amount of water resources and carbon governance shows an upward trend. Water resources are the source of human life. The protection of water resources is related to the normal development of people's production and life. With the reduction of water resources pollution by industry and life, the carbon dioxide emitted by normal production and life is also closely related to the total amount of water resources. From Figure 5, the grey correlation between the added value of the secondary industry in GDP, product sales revenue, and carbon governance shows a downward trend. The secondary industry is usually dominated by industry, and the early products are also dominated by industrial products. For a long time, the Chinese government has no longer satisfied with the extensive, high-energy consumption and high emission industrial production mode, emphasizing the transformation from made in China to intelligent manufacturing in China. The original traditional industry is gradually replaced by modern industry with low energy consumption and high efficiency. Therefore, there is a decline in the correlation between two factors and carbon governance.

4.3.3. Correlation Degree of Carbon Governance Section. According to the grey correlation degree calculation model, the grey correlation degree between 31 factors in 5 aspects and carbon governance in major cities in the Yangtze River Delta can be calculated (Table 4), which shows the correlation between 31 different factors and carbon emissions in a decade.

The grey correlation between various factors in urban governance and carbon dioxide emissions shows that the grey correlation between the domestic sewage treatment rate and the comprehensive utilization rate of general industrial solid waste is high and balanced, and the impact is relatively significant. First of all, because the Yangtze River Delta has a dense population, residents' living carbon emissions are also very high. Secondly, the scale of industrial production is huge. Generally, industrial solid waste is often accompanied by carbon dioxide emissions. The higher the utilization rate, the more industrial waste gas will be treated. The grey

Table 4: Grey correlation degree of carbon treatment section.

factors	Shanghai	Nanjing	Changzhou	Wuxi	Suzhou	Hangzhou	Ningbo	Wenzhou	Huzhou
GDP	0.7364	0.6963	0.8799	0.8487	0.9254	0.8266	0.8963	0.8456	0.8556
Secondary industry	0.8381	0.8932	0.8397	0.9238	0.8011	0.8176	0.8373	0.9393	0.8792
Population density	0.9786	0.8566	0.8752	0.9690	0.8253	0.8896	0.8628	0.9816	0.9092
Employees in manufacturing industry	0.8106	0.8514	0.8870	0.9147	0.9208	0.8457	0.8829	0.8829	0.8904
Water conservancy and environment	0.7680	0.8325	0.7311	0.6003	0.9160	0.8141	0.9173	0.8601	0.8893
Scientific research and technical services	0.8532	0.7304	0.6263	0.6911	0.5333	0.9107	0.6850	0.7591	0.8614
Number of employees in the tertiary industry	0.6668	0.7375	0.9665	0.9252	0.9265	0.9767	0.9528	0.9343	0.9718
R&D	0.6378	0.8644	0.8679	0.9678	0.8208	0.7215	0.7470	0.9805	0.7410
Comprehensive utilization	0.9558	0.8686	0.8698	0.9666	0.8208	0.8627	0.8624	0.9776	0.9120
Product sales revenue	0.9683	0.6822	0.7784	0.8640	0.8999	0.8165	0.8027	0.6502	0.8124
Annual electricity consumption	0.9675	0.8517	0.8901	0.9782	0.8212	0.8896	0.8945	0.9458	0.9499
Invention patents	0.9618	0.8589	0.8645	0.9554	0.8144	0.8803	0.8549	0.8391	0.8731
Inhalable fine particles	0.9312	0.8741	0.8652	0.9496	0.8191	0.7450	0.7724	0.9591	0.7865
Domestic consumption electricity	0.9595	0.8432	0.8803	0.9637	0.8206	0.9330	0.9212	0.9913	0.9332
Foreign investment	0.9166	0.7436	0.9414	0.9709	0.8437	0.8698	0.8356	0.9675	0.9547
Sulfur dioxide removal	0.9661	0.9293	0.9728	0.9713	0.8172	0.8546	0.8869	0.9717	0.9103
Sulfur dioxide emissions	0.7245	0.6326	0.7888	0.8594	0.8275	0.7749	0.7878	0.8251	0.7952
Industrial solid waste	0.9722	0.8592	0.8649	0.9226	0.8038	0.8643	0.8541	0.9773	0.9052
Industrial wastewater discharge	0.8070	0.9460	0.7205	0.8378	0.7974	0.7045	0.8305	0.8113	0.8615
Up to standard emission	0.8797	0.9174	0.8658	0.9238	0.8224	0.8710	0.8789	0.8678	0.9020
nitrogen oxide	0.9099	0.9323	0.7704	0.9300	0.7891	0.7242	0.7781	0.9436	0.7833
Industrial dust removal	0.9553	0.6634	0.7882	0.8912	0.9393	0.4672	0.8758	0.8738	0.4802
Industrial smoke emission	0.6168	0.7552	0.7196	0.8444	0.8602	0.8009	0.8293	0.7029	0.7464
Industrial power	0.9537	0.8639	0.8974	0.9775	0.8189	0.8665	0.8793	0.9750	0.9642
Education expenditure	0.6228	0.6478	0.8246	0.8319	0.9040	0.7393	0.7781	0.8044	0.7501
Total water resources	0.9128	0.8844	0.7038	0.7779	0.8069	0.8314	0.8646	0.9618	0.8853
Sewage disposal	0.9475	0.8246	0.9080	0.9852	0.8560	0.8749	0.8849	0.9341	0.9381
Domestic garbage	0.9228	0.8192	0.8679	0.9583	0.8208	0.8716	0.8572	0.9252	0.9047
Domestic sewage	0.9809	0.8318	0.8684	0.9622	0.8162	0.8756	0.8395	0.9864	0.9373
Scientific expenditure	0.7409	0.5614	0.7092	0.7501	0.8216	0.6848	0.7179	0.7871	0.6968
Total industrial output value	0.9801	0.7671	0.9518	0.9714	0.8585	0.9105	0.9673	0.9675	0.8755

correlation degree of industrial dust removal is uneven. The correlation degrees of Shanghai and Suzhou are higher, which are 0.9553 and 0.9393, respectively, and the correlation degrees of Hangzhou and Huzhou are lower, which are. 4672 and 0.4802, respectively. The reason behind this is that Shanghai and Suzhou have complementary industrial structures, resulting in highly similar energy structures, and the use of fossil energy is relatively common. In terms of industrial structure, Hangzhou and Huzhou are dominated by modern high-tech industries such as e-commerce, tourism, and electronic technology. Their demand for fossil energy is low, and the removal of industrial dust has little impact on carbon dioxide emissions.

The grey correlation degree of various factors in environmental pollution and carbon dioxide emissions shows that Shanghai, Wuxi, and Wenzhou have a high grey correlation degree of the annual average concentration of inhalable fine particles, which are 0.9312, 0.9496, and 0.9591, respectively. These three cities have developed rapidly in the past ten years. Both industrial emissions, domestic emissions, and construction waste gas are closely related to carbon emissions. However, from the perspective of sulfur dioxide emission factors, the grey correlation degree of this factor is obviously low. As an important pollution gas, sulfur dioxide is under strict monitoring and treatment, and its emission is not necessarily related to carbon dioxide emission.

The grey correlation degree of various factors in economic development and carbon dioxide emissions shows that Suzhou, Hangzhou, and Huzhou have higher grey correlation degree of the number of employees in the tertiary industry, which are 0.9665, 0.9767, and 0.9718, respectively. In the process of industrial city transformation, the booming of the tertiary industry in these cities has reduced carbon dioxide emissions, while Shanghai has a low grey correlation degree, only 0.6668. This is due to the early development of industry and the tertiary industry in Shanghai and its dense population. The original industrial structure is relatively reasonable and fixed, and the carbon emissions are relatively stable, which leads to the development of the tertiary industry having little impact on carbon emissions.

The grey correlation degree of various factors in social development and carbon dioxide emissions shows that Shanghai has the highest grey correlation degree of population density, which is 0.9786. Shanghai has a developed economy, complete industrial departments, high people's living standards, and high consumption will inevitably lead to high emissions. Population density has a significant impact on carbon emissions. From the perspective of product sales income, Wenzhou has the lowest grey correlation degree, only 0.6502. The industrial structure of Wenzhou determines that the demand for industrial power is far greater than that of fossil energy. Most small commodities are processed with supplied materials, which belongs to low emission industry. Therefore, the impact of product sales income on carbon dioxide emissions is not significant enough.

5. Conclusion

Based on the above analysis, this paper studies the low-carbon governance of major cities in the Yangtze River Delta, analyzes the grey correlation between 5 aspects and 31 factors and carbon emissions, and draws the following conclusions:

(1) From the perspective of urban governance, first of all, the allocation of urban environmental practitioners is an important factor in carbon governance. The reasonable and scientific allocation of environmental practitioners can have a significant impact on low-carbon development. Secondly, water resources should be taken as an important indicator factor for the carbon governance. Water resources should be taken as a necessary basis for production and life. The governance of water resources can drive the realization of multiple environmental governance goals, including carbon governance. Finally, the removal of industrial smoke and dust is generally carried out in areas with high fossil energy consumption. The amount of industrial smoke and dust removal has a significant impact on carbon emissions, which should be given necessary attention

(2) From the perspective of environmental pollution, we should focus on industrial wastewater discharge and industrial ammonia nitrogen discharge, because these factors do not reduce the grey correlation degree by controlling haze, and its grey correlation degree is still significant. Through the monitoring of the above two factors, we can clearly understand the regional carbon emission level

(3) In terms of power consumption, the relationship between industrial power consumption and carbon dioxide emissions is not significant. On the contrary, the power consumption of urban residents can well reflect the level of carbon emissions. High residential power consumption means a high living standard of the people in the region, and the corresponding large resource and energy consumption will increase carbon emissions

(4) From the perspective of economic development, the correlation between industrial development and carbon emissions should be analyzed according to the actual situation of each region. The basis of urban development is different, and the grey correlation degree of industry is also different. In cities with rapid industrial development, but mainly heavy industry, attention is paid to the number of manufacturing employees. In cities with a large scale of light industry development, we should pay attention to the total output value of industries above scale

(5) From the perspective of social environment, the size of population density is particularly important for carbon governance, which is more obvious in economically developed areas. Urban economic development will inevitably lead to the improvement of people's quality of life, a stronger demand for resources, and a significant increase in carbon emissions

(6) On the whole, there is a high degree of grey correlation between various factors and low-carbon governance, which is closely related to the national policy of environmental governance that the Chinese government has long adhered to. In 2014, the grey correlation degree of various factors and low-carbon governance has obviously increased and fluctuated, and the subsequent grey correlation degree has been driven higher. The reason behind this is that in 2014, the Chinese government explicitly made the commitment of "carbon peak" at the UN climate summit for the first time and took practical actions to develop a series of emission reduction policies. It can be seen that relevant national policies have played a key role in urban low-carbon governance

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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Research Article

Integrating Mental Health Education into French Teaching in University Based on Artificial Intelligence Technology

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In recent years, there has been a lot of news about college students committing suicide. In the university stage students, self-esteem is stronger and more sensitive, and the ability to withstand pressure is weak. At the same time, college students are in a key stage of mental health development. School education to a certain extent for the cultivation of students' mental health has a crucial impact. In our country, it is undoubtedly the main way to infiltrate mental health education through subject knowledge teaching. French teaching is a good way to infiltrate mental health education. In the learning practice, the improvement of students' mental health levels can strengthen their interest in French learning. Based on this, this paper, from the perspective of French teaching, carries out the infiltration of mental health education in French teaching classes in universities and promotes the cultivation of students' learning abilities and the development of mental health. This paper mainly studies the feature extraction of mental health data, tries to use the optimized BP (backpropagation) neural network to infiltrate the mental health model of college students, and describes the differences in mental health among students. Finally, the results are applied to French teaching in universities, and a good teaching effect is achieved. Finally, the experimental results show that the infiltration strategy proposed in this study is feasible and effective.

1. Introduction

When it comes to health, people used to think that there was no disease in the body and that they could live a long life without seeking medical advice. In the minds of Chinese people, there are still many people who agree with this point of view. As early as the 20th century, related organizations had the world within the scope of the definition of health, the most typical is the world health organization (WHO) definition of the concept of health, which has no exception. It points out that health is where the body does not need to please the medical medicine but also has good mental condition to be able to keep up with the pace of development and trends. In the 1990s, the organization refined the concept, saying that health refers to a person's physical and mental state, as well as his or her mental state, being well adapted to social development. In the context of increasing public attention to their own conditions, it is more acceptable to pay attention to mental health [1, 2]. With the rapid development of China's economy, the spectrum of diseases in the population is also growing. Many psychological diseases appear in the population, these psychological diseases will have a lot of negative effects and have the nature of being universal and harmful. Therefore, mental health has become an important public health issue in China [3, 4].

In fact, in recent years, with the rapid development and transformation of China's economy and society, people's ideas have undergone tremendous changes and intense collisions, resulting in more and more psychological problems. Among them, adolescent mental health has become the focus of our attention. Contemporary teenagers are mostly only children and are in an important period of physical and mental development. They experience an immature big flood clash with social change, then a series of social problems. A lot of minors in getting along with people cannot properly handle interpersonal relationships, self-centeredness, or even bad life habits, losing themselves in the world of the Internet and violence. This has formed a major threat and challenge to the growth of minor students. In the past, emotional disorders and other symptoms that used to occur only in adults have now begun to show a trend in younger people. Many teenagers are also troubled by depression and obsessive-compulsive disorder which can even affect their normal life and studies. At the same time, the relevant survey data shows that nearly 15 percent of middle school students have obvious mental health problems. In addition, there are a number of provinces and cities-related research institutions that have carried out the corresponding investigation and research. Data show that the number of psychological problems in China's teenagers increase year by year [5, 6]. At the same time, various cases caused by the psychological problems of teenagers are often reported in the media. Among them, the events that make countless people feel cold are also torturing people's hearts all at the same time. This judgment reveals and emphasizes the important position and role of youth in national development and national rejuvenation. As a progressive force among young people, young college students play a key role in national development and rejuvenation, which requires them not only to have firm ideals, beliefs, and excellent professional qualities but also to have a mature personality and healthy psychological quality.

Health is one of the most concerning problems in modern society. The health of the people is a sign of the prosperity of society as well as the country. In a modern civilized society, education plays an important role in the cultivation of national health and comprehensive quality, and education has an important impact on people's physical and mental health. In recent years, there has been a lot of news about college students committing suicide. In college stage students' self-esteem is stronger and they are more sensitive and their ability to bear pressure is weak. At the same time, school and society will directly or indirectly affect the physical and mental development of high school students. The majority of students spend the longest time in school each day, except at home. Therefore, school education has a vital impact on students' mental health development. There are many ways to educate students about mental health. For example, in China, psychological courses and counseling rooms are common methods of mental health education. Infiltrating mental health education into subject knowledge is also one of the main ways. The purpose of positive psychology is to make individuals live a happy life. It pays attention to the positive psychological quality of individuals and the development of people's potential. Positive psychological quality is an important research topic in positive psychology, which can not only stimulate individual potential and improve people's happiness but also help to prevent and cure physical and mental diseases [7, 8].

Teaching infiltration in psychological education means that teachers consciously teach the art of psychological guidance to mobilize students' intelligence and non-intelligence factors and integrate the contents of teaching materials into psychological education. In the teaching of the conscious penetration and guidance of students, teachers cultivate their keen observation, stable attention, and abstract thinking ability and help them to establish a scientific attitude and scientific spirit, so as to improve the quality of classroom teaching and promote the overall development of students' psychological counseling activities. The course is taught in class through a case study, group discussion, psychological test, group training, and so on. The psychological education course is a series of teaching activities that promote the development of a student's body and mind by cultivating students' good psychological qualities, and finally, enabling students to develop harmoniously. For middle school students, the realization of mental education is one of the important requirements of quality education. The main difference between the psychological education course and teaching is oneness. Mind education class is a single pure form from the angle of mind education. The maximum use of class time results in a single imparting of mind education knowledge. The infiltration of psychological education into teaching has more advantages, with its flexibility, penetration, persistence, multidisciplinary intersections, and imperceptible effects, which can broaden the teaching way of psychological education and adapt to the existing domestic psychological education teaching objectives [9, 10].

The educational and teaching activities are closely related to the development of a student's personality and psychology, and the school's educational activities are mainly subject-teaching activities. So, the main way to infiltrate schools is to infiltrate the course of subject teaching. This kind of infiltration education approach can not only enable students to acquire knowledge and skills related to the subject but also imperceptibly improve students' psychological quality. In this paper, the author will analyze the necessity and feasibility of infiltrating psychological health education into college French teaching. First, it is the need for the development of The Times to infiltrate French teaching into mental health education. Good psychological quality is the basis of high-quality creative talents, but with the increasingly fierce social competition, college students are under more and more pressure in their studies, life, and other aspects, and mental health problems are increasingly prominent, which are extremely adverse factors for the cultivation of creative talents. It is an extremely efficient way to infiltrate mental health education through French teaching to improve mental health and develop creative thinking [11, 12]. Secondly, psychological health education in French teaching is the need for cultivating students' core quality in the biology subject. Psychological health education in college and French teaching can effectively develop students' core French literacy and improve their mental health. Therefore, school education should not only pay attention to the development of intelligence but also pay attention to the cultivation of students' mental health quality, so as to create favorable conditions for the cultivation of people with core literacy. Thirdly, psychological health education in French teaching is the realistic need to solve students' psychological problems. College is not only the golden period for acquiring knowledge but also the critical period for psychological development. However, considering the tight teaching time and heavy teaching tasks in universities, it is an economical and efficient way to infiltrate mental health education through French teaching classes. Students can obtain French knowledge and skills at the same time. Psychological problems can also be effectively solved.

Mental health development is an eternal topic, and related research is also in progress. However, the academic discussions on mental health education and foreign languages are mostly confined to the perspective of the French subject itself, and there is almost no discussion and analysis from the perspective of French teaching. Therefore, from the perspective of foreign language learning, the infiltration of mental health education into French classrooms can provide new ideas and experiences for later related research and university French teaching. This study will provide some teaching methods that incorporate foreign language learning into the mental health knowledge and education of university students in the teaching of French. For example, there are situational creation methods, cooperative learning methods, and so on. At the same time, French knowledge is taken as a carrier to convey information to students to promote the development of mental health, so as to achieve the goal of promoting the psychological health and harmonious development of school students.

2. Related Work

School mental health education in the modern sense originated in developed western countries. The research shows that at present, school mental health education in Britain and the United States has been characterized by scientific talent training, rich and comprehensive content, a wide range of services, various implementation approaches, unique and effective methods, rapid research progress, standardized development of qualification certification, and a complete theoretical and practical system. According to the retrieval and analysis of relevant literature, in the early stages, the United States was mainly permeated by the curriculum of physical education and moral education, and there was no special mental health education curriculum [13, 14]. However, some schools will offer psychology courses such as introduction to psychology and social psychology in social subjects, mainly for students to better adapt to society and learn to use psychological theories to adjust to emotions and pressure. Among Asian countries, Japan is the first country to carry out school mental health education research. At present, Japan has formed a primary and secondary school health education network of one school, one community, and one family by the government, with a sound school psychological counseling mechanism and relevant laws and policies. Similar to the United States, the mental health education courses in Japanese schools are scattered and infiltrated with moral education, health care, sports, and other in-class activities, and there are no separate mental health education courses. The main occupation of students is learning. Because of the existence of competitive pressure, their psychological problems generally come from learning, so it is necessary to infiltrate the discipline of mental health education. There are many documents and papers in detail to discuss this point of view and put forward the significance of infiltration ways.

It is not difficult to see from the above content that there is some theoretical support for the penetration of psychological health education in discipline teaching. In recent years, some practical studies have shown that the penetration of mental health education into college courses can provide learners with opportunities to express their emotions and interact with each other, so as to improve the motivation level of the students and improve their individual autonomy. Take the United States as an example. We now gradually try to adopt the whole grade multidisciplinary curriculum infiltration mode and emphasize the common participation of teachers and students to achieve the purpose of mental health education [15, 16]. Compared with western countries, mental health education in China started late. School mental health education, as the most important, basic, and effective way to carry out mental health education in China, is the focus and starting point of Chinese scholars' research. The research on mental health education in foreign countries started earlier with rich theoretical achievements and practical experience. The research on the problems existing in the integration of mental health education into ideological and political education in colleges and universities has always been the focus of academic attention. Only by identifying the existing problems can we lay the foundation for putting forward targeted countermeasures. The academic circle is mainly summarized from three perspectives: educator, educated, and educational environment. To sum up, although the academic circle of mental health education in college teaching research results are quite abundant, the research quality is not high, and there are some deficiencies. The specific performance is as follows: first, the research on the relationship between the two is not in-depth enough, and some views remain superficial and persuasive. Second, there is a lack of systematic investigation and the process cannot be thoroughly grasped. Thirdly, many of them are discussed from a macro perspective, and the requirements proposed are not strong in implementation and lack innovation.

It is clearly pointed out in the teaching syllabus of the basic stage of French majors in colleges and universities that the teaching aim of the basic stage of French learning [17, 18] is to have the basic skills of listening, speaking, reading, and writing as well as certain communication skills, and have the preliminary self-learning ability, which will lay a good foundation for the improvement of French learning or other professional courses with French as a tool. The general idea of the syllabus for senior French majors in colleges and universities is consistent with the syllabus for the basic stage of French majors in colleges and universities, which places more emphasis on the cultivation of students' social and cultural knowledge and independent working ability. In terms of teaching principles, apart from strengthening the training of basic language skills, it is also required to expand the scope of students' knowledge, and it is pointed out that the imparting of language skills complements each other. To know the Francophone countries' social and cultural background, master the language and acquire knowledge related to professional orientation [19, 20]. Attention should be paid to the cultivation of students' ideological quality, the use of heuristics and discussion methods, and fully mobilize the initiative and enthusiasm of students to learn. To sum up, it can be seen that the overall requirements of the teaching syllabus for French majors in China are based on teaching students French language knowledge and training French language skills. The ultimate goal is to cultivate students' French communicative ability and organize and arrange teaching content according to social demand, students' employment tendencies, and the school's own characteristics. In the teaching process with students as the center, the use of heuristics and discussion teaching methods are adopted.

In terms of teaching methods, French teaching researchers have explored the perspectives of teaching AIDS, teaching models and methods, and the application of linguistics in teaching [21, 22]. The research covers a wide range of areas, and the content of the discussion is also more in-depth, which provides some specific ideas and references for the model, method, and means of French teaching in China. Since our country's French professional teaching content mainly focusses on imparting French language knowledge while ignoring the oral and listening training, especially the cultivation of student's French communicative competence, the consequences are many. The students scored better marks in grammar knowledge, but the poor performance problem in speaking and listening needs to solved. Some students have mastered the French language and have a certain listening and speaking ability, but they know little about French history and culture, local customs, social etiquette, oral habits, and so on. Their intercultural communication ability is relatively poor. Therefore, many French teaching researchers have made great efforts to change this situation and have conducted in-depth research and discussion on the contents of French teaching, including oral French teaching, French listening teaching, French culture teaching, and other aspects. At present, there are few studies on French learners in China, which mainly focus on learners' needs analysis, learners' psychological analysis, and learning effects evaluation [23, 24].

At present, most research on students' mental health problems uses questionnaires. With the rise of educational data mining, a few researchers use students' online behavior to identify students with mental health problems. In this paper, we will take a look at the current state of research on educational data mining [25, 26]. In the 20th century, many colleges and universities at home and abroad began to use data mining technology to analyze educational data and introduced the concept of education data mining (EDM) [27, 28]. Their research aims to extract valuable information from educational data so that students can better complete their studies. The above studies illustrate the application of EDM in five aspects: grant issuance, career choice, changing trend and the gender difference in students' campus behavior, students' school performance, and students dropping out. In recent years, EDM has also been studied in the field of mental health issues, which will be described in detail in the next section. EDM is a direction worth exploring. Although there is still little research on EDM at present, with the explosive growth of network data and the increasingly sound construction of digital campuses, more valuable information will be mined from EDM, and the quality of education will be better in the future at this pace. At the same time, students' physical and mental health will be further improved. Therefore, this paper proposes a method of integrating mental health education and French teaching based on artificial intelligence technology [29, 30]. The main contributions of this paper are given as follows:

(1) This paper is the first to integrate mental health education into French teaching in universities.
(2) The research in this paper not only has good theoretical results but also has great potential application value.

3. The Proposed Integrating Mental Health Education into French Teaching Method

3.1. Machine Learning Method in EDM. Machine learning is a process in which computers are used. With computers learning patterns and patterns from massive amounts of data, machine learning can infiltrate useful information to solve some problems in life. Machine learning generally includes supervised learning, semisupervised learning, and unsupervised learning according to the type of task [31, 32]. When solving a problem, the target of the problem needs to be analyzed to select the appropriate type of machine learning. The goal of supervised learning is to learn the laws and patterns of a known dataset and build a model. The characteristics of the training set can be input into the model to obtain the corresponding output. When some new samples are input, the model can be used to obtain the corresponding output results. Depending on the different output results, supervised learning can be divided into regression (continuous value) and classification (discrete value). In unsupervised learning, all samples in a dataset are unlabeled. Its goal is to observe the interrelationship between data samples by analyzing hidden patterns in the data and dividing the dataset samples into different groups or clusters. In semisupervised learning, some samples in the dataset are labeled and some samples are unlabeled. The process is to train the model with a small amount of labeled data and a large number of unlabeled datasets and find out the rules.

The process of EDM is basically the same as that of data mining, mainly including the following steps [33, 34]: (1). Data collection: Due to different educational environments and systems, the data collected for solving different problems are also different. There are many sources of educational data, including management system data, psychological counseling data, and questionnaire data. It is very necessary to collect and sort out these multisource data. (2). Preprocessing: Educational data is complex and diverse. On the one hand, to solve the same problem, different education systems generally have different storage formats, so relevant data need to be extracted according to the actual problem. On the other hand, it is critical to extract the best data structure based on the type of problem being solved. So, converting the raw data into a suitable data structure can

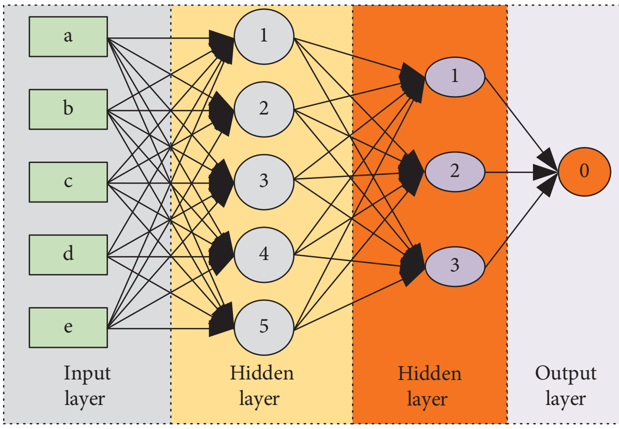

FIGURE 1: The diagram of the BP neural network.

help solve the problem. (3). Data mining: Data mining technology is used to analyze educational data. In the field of education, data mining technologies such as classification, clustering, and association analysis are usually used. Finally, the educational environment or system can be improved according to the results of the experiment. For decision-making, we can interpret models derived from data mining algorithms and then design systems that provide decisions, opinions, or recommendations to relevant educators. This automated system saves educators both time and manpower.

3.2. BP (Back Propagation) Neural Network. The diagram of the BP neural network is given in Figure 1. The network training process is given as follows:

$$E = \sum_{i=1}^{m} (x_i - c_i)^2, \tag{1}$$

where x_i is the input of the model, c_i is the bias of the model. And m is the number of the nodes, thus, the E is the training error of the model. Therefore, the training model can be iterated through cross-entropy loss. Model errors can be reduced through training and iteration to achieve the best model performance. Then, the hidden layer can be expressed:

$$E = \frac{1}{2}\sum_{\kappa=1}^{\ell} [d_\kappa - f(\mathrm{net}_\kappa)]^2 = \frac{1}{2}\sum_{\kappa=1}^{\ell}\left[d_\kappa - f\left(\sum_{j=0}^{m} \omega_{j\kappa} y_j\right)\right]^2. \tag{2}$$

When expanded further to the input layer, there is,

$$\begin{aligned} E &= \frac{1}{2}\sum_{\kappa=1}^{\ell} d_\kappa - f\left[\sum_{j=0}^{m} \omega_{j\kappa} f(\mathrm{net_j})\right] \\ &= \frac{1}{2}\sum_{\kappa=1}^{\ell} d_\kappa - f\left[\sum_{j=0}^{m} \omega_{j\kappa} f\left(\sum_{j=0}^{n} v_{ij}\chi_i\right)\right]^2. \end{aligned} \tag{3}$$

It can be seen from the above formula that the network input error is a function of the weights of each layer, so the error can be changed by adjusting the weights. Obviously, the principle of adjusting weights is to reduce errors continuously, so the weights should be proportional to the gradient descent of errors.

$$\begin{aligned} \Delta\omega_{j\kappa} &= -\eta\frac{\partial E}{\partial \omega_{j\kappa}} \\ j &= 0,1,2,\ldots,m; \\ \kappa &= 1,2,\ldots,\ell, \\ \Delta v_{ij} &= -\eta\frac{\partial E \partial}{v_{ij}} \\ i &= 0,1,2,\ldots,n; \\ j &= 1,2,\ldots,m. \end{aligned} \tag{4}$$

And weight adjustment process is,

$$\begin{aligned} \Delta\omega_{j\kappa}^{h+1} &= \eta\delta_{h+1}^{\kappa} y_j^h = \eta(d_\kappa - o_\kappa)o_\kappa, \\ \Delta\omega_{pq}^{1} &= \eta\delta_q^1\chi_p = \eta\left(\sum_{r=1}^{m_2}\delta_r^2\omega_{qr}^2\right)y_q^1. \end{aligned} \tag{5}$$

The optimization algorithm proposed in this paper is used to optimize the parameters of BP neural networks so as to achieve the best model performance. The differential evolution algorithm (DE) is used to optimize the initial weights and thresholds of the network.

$$x_{i,1} = x_i^L + \mathrm{rand}\left(x_i^U - x_i^L\right), i = 1,2,\cdots,NP. \tag{6}$$

The mutation operation can be expressed as follows:

$$\begin{aligned} v_{i,G+1} &= x_{r1,G} + F\left(x_{r2,G} - x_{r3,G}\right), \\ u_{ji,G+1} &= \begin{cases} v_{ji,G+1} & r_j \le CR \text{ or } j = \mathrm{rand}(i), \\ x_{ji,G} & r_j \ge CR \text{ or } j \ne \mathrm{rand}(i). \end{cases} \end{aligned} \tag{7}$$

Similar, the selection operations are denoted as follows:

$$x_{i,G+1} = \begin{cases} u_{i,G+1} & f\left(u_{i,G+1}\right) \le f\left(x_{i,G}\right), \\ x_{i,G} & f\left(u_{i,G+1}\right) > f\left(x_{i,G}\right). \end{cases} \tag{8}$$

Following formula is a fitness function, the range is the entire set of real numbers.

$$f(X) = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(Y_i^0 - Y_i\right)^2}. \tag{9}$$

Conventional BP neural networks cannot process complex psychological data online, especially when psychological education is integrated into French teaching in universities. Therefore, it is urgent to put forward an improved BP model to be suitable for the problem scenario in this paper.

3.3. The Framework of the Proposed Method. Based on the above discussions, the optimized BP neural network and its

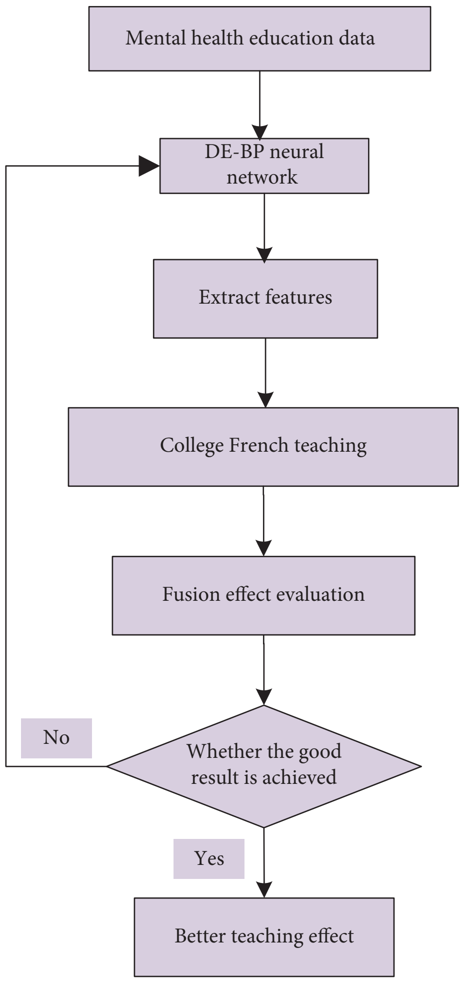

FIGURE 2: The model structure diagram of the proposed method.

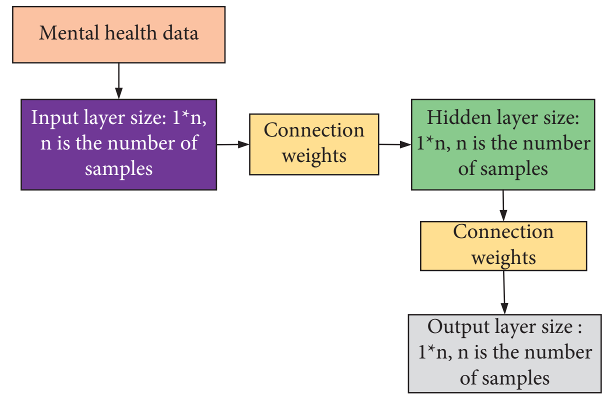

FIGURE 3: The BP neural network structure designed in this paper.

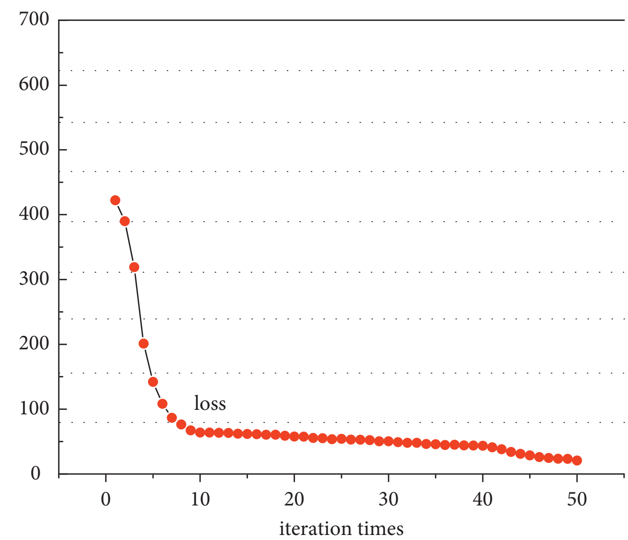

FIGURE 4: The relationship between epoch and loss during training.

application in the analysis of the integration of mental health education into French teaching in universities are shown in Figure 2.

4. Experimental Results and Analysis

4.1. Data Collection and Experimental Environment. We surveyed 300 undergraduate students at a certain university, 250 of whom were assessed as having mental health problems by experts at the school's psychological center. In our experiment, students were divided into two categories: mild, moderate and severe. Students with mental health problems reflect positive samples, and students without mental health problems reflect negative samples.

The model needs real datasets in the process of training and testing, and datasets are generally divided into training sets and test sets. The training set is used in the training process of the model, and the parameters of the model can be adjusted through labels in the training sample. During the training process, the model will adjust parameters once for every training sample. The test set is used in the testing process of the model. The model can be evaluated by comparing the labels of the test samples with the predicted values. The whole process does not change any parameters.

The details of the network model designed in this paper are shown in Figure 3. Although the structure of the BP model can be designed in many ways, the model design chosen for this article is shown in Figure 3, mainly because it can achieve the best results under these settings.

4.2. Experimental Results Analysis. During model training, the model accuracy and loss change increase as the number of iterations increases, as shown in Figure 4, where the horizontal coordinate is the number of iterations, the vertical coordinate is the loss value, and the horizontal and vertical coordinates are dimensionless values, so they have no units. With the increase in iteration times, the model loss becomes smaller and tends to be stable. When the number of iterations is 40, the loss of the model tends to be stable. Therefore, we set the number of iterations to 40. From the results of the visualization model, the whole training process is relatively stable, which shows the stability and practicability of the method presented in this paper.

Because the performance of a model can be characterized by many indicators, it is difficult to apply all indicators in one article. Therefore, only RMSE, precision, and recall are used

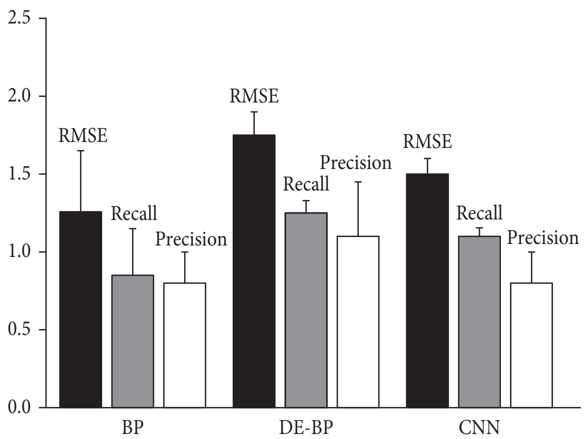

Figure 5: Comparison of model performance between different methods.

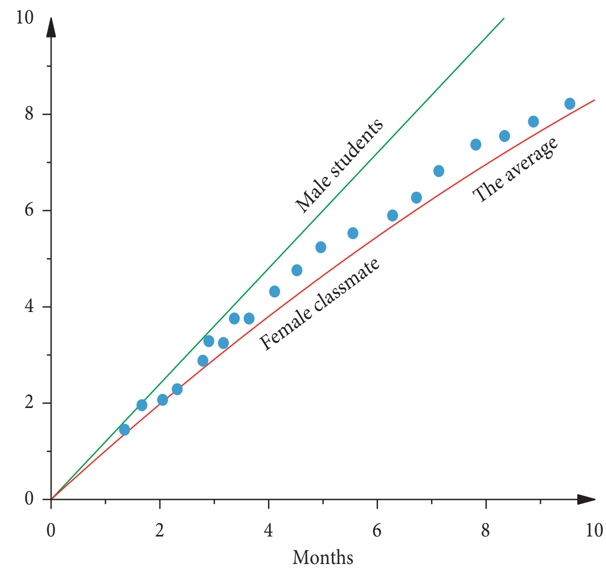

Figure 6: The development and change of male and female mental health levels during college years.

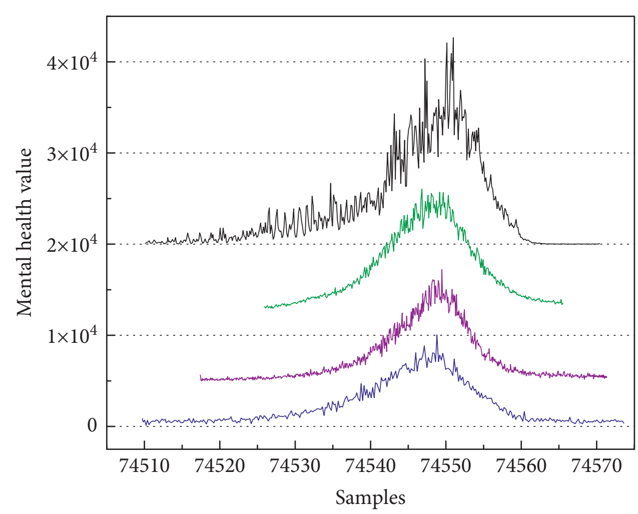

Figure 7: The psychological abnormalities of different grades in the college.

in this paper to describe the performance of the proposed method because these three indicators can comprehensively describe the performance of the model from multiple angles. In order to further verify the effectiveness of the method, the performance comparison of different methods is presented in Figure 5, in which convolutional neural networks and conventional BP neural networks are selected as the comparison algorithms. Precision is the predicted results against us. It represents the prediction of samples as to how many samples are true. The recall rate is according to our original sample. The samples predicted correctly is the denominator. The denominator is right in the prediction of the number of samples. The other one is the original sample of all of the samples. From the figure we know, the DE-BP obtained the highest recall and precision result. Though the RMSE (Root Mean Square Error) is a little higher than the contrast method, it is well within the acceptable range, at about 1.7. It is worth noting that although the CNN model is a deep learning method, its model performance is still worse than DE-BP, mainly because the DE-BP model obtains the best model parameters through an optimization algorithm, so as to achieve the best model effect. This means achieving the highest recall and precision values.

In order to show the influence of the proposed mental health education method on the mental health levels of male and female students, Figure 6 shows the changes in mental health over time. As can be seen from the figure, with the passage of time, the mental health level of all students presents the above trend, indicating that the proposed DE-BP-based mental health feature extraction method is effective. However, the rising level of boys is significantly higher than that of girls, mainly because boys may have a stronger acceptance ability or psychological ability to resist pressure. It is worth noting that Figure 6 shows the development and change of male and female mental health levels during college years. Hence, the horizontal and vertical coordinates of Figure 6 are dimensionless values; that is, they have no units.

Furthermore, Figure 7 shows the test results of abnormal mental health conditions of students in different grades. Blue, purple, green, and black represent freshmen, sophomores, juniors, and seniors. As can be seen from the graph, the frequency of psychological abnormalities is increasing with the increase in students' grades. It is worth noting that the curves in different colors in Figure 7 represent different grades. Since there are only four grades in the college, there are only four color curves in this figure.

Finally, Figure 8 shows the change in French teaching effects before and after the integration of mental health education. Different colors in the figure represent different French abilities. It can be seen from the figure that different French learning abilities have been improved to different degrees after the integration of mental health education, thus demonstrating the promotion effect of integration of mental

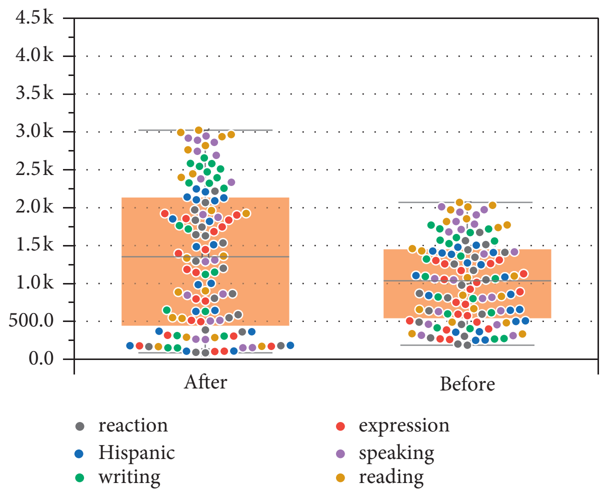

Figure 8: Comparison of French teaching effects.

health education on French teaching in universities. Therefore, the reliability and practicability of the proposed method are further illustrated. It is worth noting that k on the ordinate in Figure 8 represents units of people, i.e., thousands. Therefore, the larger the ordinate is, the more people are involved in the improvement of the French teaching effect, which indicates that the method in this paper is more effective. Thus, the right side of Figure 8 demonstrates the validity of the proposed method.

5. Conclusion

This study clarified the present research status of the infiltration of French teaching by sorting out and analyzing literature and materials and it believed that it was very important to conduct further research on the infiltration of French teaching into mental health education after the core quality of French discipline was proposed. This study investigated the present situation of the integration of French teaching and mental health education in front-line universities and used the improved BP neural network to analyze and evaluate the psychological data and apply it to teaching practice to test the effectiveness of the strategy. Although the method in this paper has achieved good performance, it is still a lightweight deep model. Thus, in the face of big data scenarios, the proposed method is not enough, and a depth-based method to integrate mental health education into French teaching will be the focus of future research.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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Research Article

Evaluation of the Practical Effects of Environmental Measures in the Conservation of Architectural Heritage in Yan'an Based on Recurrent Neural Networks

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Yan'an is one of the "two holy places" of the Chinese nation and the Chinese revolution and is one of the first cities of historical and cultural significance and an outstanding tourist city in China, as announced by the state council. The evaluation of the effectiveness of environmental conservation is one of the very important elements of the conservation of Yan'an's architectural heritage. However, the existing evaluation methods cannot provide new solutions for decision-making, the meaning of the comprehensive evaluation function is unclear, the naming clarity is low, there is less quantitative data and more qualitative components, and the results are not easily convincing. This paper proposes a method for evaluating the practical effects of environmental class measures in the conservation of Yan'an's architectural heritage based on recurrent neural networks. The recurrent neural network makes full use of the memory function in the network, considers the causal relationship of the actual effect, and efficiently evaluates the existing measures. In comparison with factor analysis and hierarchical analysis, this paper has greater applicability in evaluating the practical effects of environmental measures in the conservation of Yan'an's architectural heritage and is basically consistent with the results of the theoretical analysis. It provides a scientific basis for the construction and implementation of environmental measures for the architectural heritage of Yan'an.

1. Introduction

Architectural cultural heritage is the artifacts and monuments that humanity has conserved during historical development. It is an important part of humanity's historical and cultural heritage. In recent years, with the increasing importance attached by the state to the protection of cultural heritage, the state's financial resources for cultural heritage protection have been increasing year by year, so that various types of cultural relics, especially national and provincial cultural heritage protection units, have been effectively protected, which has strongly promoted the development of cultural heritage protection [1]. However, due to factors such as urban economic development and environmental changes, the current situation of cultural heritage protection units in China is still worrying, with some of them in serious disrepair and some on the verge of destruction, causing great difficulties for the protection of cultural heritage at the grassroot level, and to a certain extent affecting the development of urban cultural construction and the development of cultural heritage protection. The establishment of an effective evaluation system in terms of urban heritage conservation can help cities determine the future direction of development and better develop their economies, while avoiding conflicts with cultural heritage conservation work [2, 3]. The government and all facets of society have worked extremely hard in recent years to implement environmental measures for the rescue and conservation of Yan'an's architectural heritage. They have also taken numerous beneficial and efficient conservation measures to strengthen and improve this important work, which has now entered a comprehensive and holistic stage of conservation and has yielded many significant accomplishments and invaluable experiences.

While more and more attention is being paid to the conservation and heritage of Yan'an's architectural and cultural heritage, the conservation and use of revolutionary heritage is somewhat lacking, and special research into the conservation of this heritage is weak. Yan'an is also one of the three major educational bases for patriotism, revolutionary tradition, and the spirit of Yan'an and has the largest number, largest scale, longest span, highest level, and richest content of revolutionary heritage groups in the country. The architectural heritage addresses of Yan'an are the physical witness to the glorious revolutionary history of Yan'an and the material carrier of the Yan'an spirit [4]. Among the revolutionary base cities of the country, Yan'an has the largest, most numerous, most complete, and richest heritage preserved, with supremacy, uniqueness, and uniqueness [5]. However, due to the destruction of the war years, the negligence in the protection of architectural and cultural heritage in the special historical stage after the founding of the country, the damage caused by natural disasters, the preservation condition, and the preservation environment of some heritage need to be improved. The preservation of the architectural heritage of Yan'an is of great importance in remembering the past, educating the present, and reviving the future [6].

The conservation of Yan'an's architectural heritage today is inevitably impacted by urbanization, economic development, tourism promotion, and other aspects, making its preservation status and the development of environmental work in architectural heritage conservation serious challenges [7]. In the context of China's rapid urbanization, the revolutionary heritage of the Yan'an architectural heritage is also facing conservation and management problems such as natural aggression, deterioration, and environmental pollution, especially as the large-scale urban construction in Yan'an in recent years has posed a very serious threat to the preservation of the revolutionary heritage and its environment [8, 9]. Therefore, the conservation and research of the architectural heritage of Yan'an cannot be delayed. Moreover, from the perspective of cultural heritage and humanity, the conservation research of the architectural heritage of Yan'an also has certain theoretical and practical significance for the conservation and sustainable development of the revolutionary heritage. In addition, with the rise in economic power, residents are demanding a renewal of their living environment [10]. However, the socioeconomic costs of relocating residents within the heritage area are increasing, and as relocation is not possible, residents are forced to seek self-renewal in their neighborhood. However, as the heritage is only bounded by the conservation area, but not by the surrounding area, individual residents' spontaneous construction behavior is bound to destroy the landscape of the heritage area. To protect it from the threat posed by the city's rapid development, it is vital to take into account the general planning of the Yan'an architectural legacy at this time [11, 12]. The evaluation of the protection effect of Yan'an architectural cultural heritage should be based on environmental protection, and the method of comparative analysis, factor analysis, and hierarchical analysis should be adopted to comprehensively analyze the effectiveness of the evaluation measures.

The development and implementation of policies related to the implementation of environmental measures in the architectural heritage of Yan'an directly affects the heritage and development of the architectural heritage of Yan'an and plays a decisive role in the effectiveness of the conservation of the architectural heritage of Yan'an [13]. The evaluation of policy effects is in turn one of the key steps towards policy optimization and continuous improvement of policy capacity. Based on factor analysis and hierarchical analysis, a dynamic evaluation of the effectiveness of conservation of Yan'an's architectural heritage can provide a direct basis for evaluating the science and effectiveness of environmental measures in Yan'an's architectural heritage by vertically exploring the changes in the survival of Yan'an's architectural heritage and horizontally comparing the differences in the implementation of environmental measures in different regions of Yan'an's architectural heritage to explore the causes and policy differences [14, 15]. However, the existing evaluation methods do not provide new solutions for decision-making, the meaning of the comprehensive evaluation function is unclear, naming clarity is low, quantitative data is scarce, qualitative components are numerous, and the results are not easily convincing. Starting from the connotation of holistic conservation, it has become a new academic proposition and proposition of the times to scientifically evaluate the effect of the conservation of Yan'an architectural and cultural heritage and to improve the policy level, policy capacity, and conservation performance of the conservation of Yan'an architectural and cultural heritage [16, 17]. The analysis of Yan'an's architectural heritage's conservation effects can advance cultural heritage theory, serve as a foundation for the scientific preservation of architectural heritage, and improve architectural heritage direction prediction. This paper proposes a method for evaluating the actual effects of environmental-type measures in the conservation of Yan'an's architectural heritage based on recurrent neural network (RNN). In comparison with factor analysis and hierarchical analysis, the method is more applicable to the evaluation of the practical effects of environmental measures in the conservation of architectural heritage in Yan'an and is basically consistent with the results of the theoretical analysis. It provides a scientific basis for the construction and implementation of environmental measures for the architectural heritage of Yan'an.

2. Related Works

The process of conserving architectural history involves a variety of diverse substrates, highly heterogeneous sets of elements, and several distinct conservation circumstances. Due to general resource shortages and the distinctive qualities of cultural heritage assets, its sustainability has recently become a pertinent concern. Gulotta and Toniolo [18] use the creation of the test site as an appropriate example of a complex surface in their report on the design of a conservation project for the Renaissance façade of the Monza Cathedral. With the goal of identifying the most significant stakeholders and educating them about their critical role in the management of built heritage, Wang et al. [19] selected a tourist-built heritage as a study topic. The study's findings indicated that key players in the development of the built heritage of tourism's sustainability included local government, the federal government, real estate development companies, professional groups, architectural heritage conservation management, and architectural heritage construction companies. Lidelöw et al. [1] categorized and assessed the discovered research in light of two crucial components of such investigations: energy analysis and cultural heritage value analysis. The results highlight the importance of properly articulating and comparing cultural heritage values to accepted conservation principles or practices when thinking about energy improvements.

When developing solutions to reconcile the need to improve energy production using renewable energy with the requirement to conserve the built history and landscape, the designer should be guided by the features of each structure and its setting. A preliminary analysis of the restoration project can increase the building's sustainability and stop any irreparable alterations to the cultural property. De Medici [20] established evaluation standards for the installation of solar systems in preindustrial buildings using the Italian case study and recommendations for enhancing the sustainability of energy generation. Aigwi et al. [21] analyzed the distribution of significant government funding sources for their conservation, as well as the implications of this distribution for future architectural heritage conservation in provincial areas of New Zealand. They evaluate the dispersion of New Zealand's historic structures as well. In order to create sustainable societies, Salameh et al. [22] looked into and emphasized the intrinsic significance of heritage preservation from an environmental, economic, and social standpoint. From an architectural and urban standpoint, the study assesses a unique instance of historical preservation in the Palestinian city of Nablus.

3. Models and Evaluation Methods

3.1. RNN Neural Network Introduction. Traditional machine learning algorithms mainly rely on manually collected features, while fully connected neural network-based approaches have too many parameters and cannot take advantage of time series data in the data. The ability of RNN to access time series information in data and to express semantic information in depth has been fully exploited as more efficient RNN structures have been proposed, leading to advancements in speech recognition, language modeling, machine translation, and time series analysis [23, 24]. A type of recursive neural network known as an RNN accepts sequence data as input, recurs in the direction of sequence evolution, and connects all of its nodes (also known as recurrent units) in a chain. RNN is more effective in learning nonlinear characteristics of sequences because they share parameters, are remembered, and are Turing complete. RNN is first used to describe the relationship between a sequence's current output and its past information [25, 26].

A recurrent neural network, in terms of network architecture, keeps track of prior data and applies that data to affect the output of subsequent nodes. In other words, a RNN's hidden layers are interconnected, and their inputs contain both the outputs of the input layers and the outputs of the hidden levels from earlier in time [27]. The RNN complex can be conceptualized as the outcome of endless replication of the same neural network structure. A RNN delivers an output for each moment of input paired with the current state of the model. RNN shares parameters at multiple temporal positions, similar to how convolutional neural networks do, allowing sequences of any length to be processed with a limited amount of parameters [28].

The development of RNN has significant effects on the training of models. After unfolding a sequence of length N, the RNN can be viewed as a feedforward neural network with N intermediate layers, as shown in Figure 1. Since there are no circular links in this feedforward neural network, it may be trained directly using a back propagation technique without the use of any additional optimization procedures. Backpropagation through time is the name of this training technique, which is most frequently used to train the RNN.

On the basis of the aforementioned model, the forward propagation algorithm for RNN is presented. For any sequence moment t, the hidden state h^t is obtained from x^t and h^{t-1}:

$$h^t = \sigma\left(z^{(t)}\right) = \sigma\left(Ux^{(t)} + Wh^{(t)} + b\right), \tag{1}$$

where the bias term is b and is the RNN's activation function, generally tanh. The following is the expression for the model's output, $o(t)$, at sequence moment t:

$$O^t = Vh^{(t)} + c. \tag{2}$$

The final output of our prediction at sequence moment t is:

$$\hat{y}^{(t)} = \sigma\left(o^{(t)}\right). \tag{3}$$

Usually, since RNNs are classification models for recognition classes, this activation function above is typically softmax. By means of loss function $L^{(t)}$, we can determine the loss of the model at the present time using loss functions, such as log-likelihood loss functions and cross-entropy loss functions.

The RNN backpropagation algorithm can be easily derived using the foundation of the RNN forward propagation technique. The appropriate RNN model parameters U, W, V, b, and c are obtained by iterating through one round of gradient descent. RNN backpropagation is also known as BPTT because we are backpropagating over time (backpropagation through time). Since we update the same parameters when backpropagating, this BPTT is obviously significantly different from the DNN in that all U, W, V, b, and c are shared across the sequence. The cross-entropy loss function is used as the loss function in this instance; the softmax function is used as the activation function for the output, and the tanh function is used as the activation function for the hidden layer [29, 30]. The final loss L for the RNN is as follows because there are loss functions at

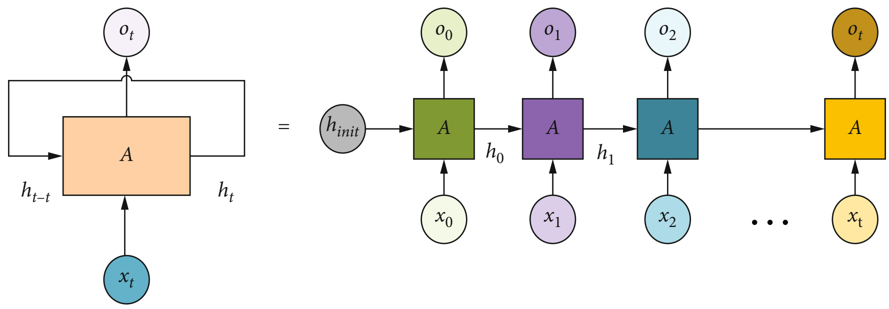

Figure 1: Schematic diagram of the RNN.

each location in the sequence:

$$L=\sum_{t=1}^{\tau} L^{(t)} \tag{4}$$

where τ is the total time step of the sequence.

The gradient is next found for V and c and can be expressed as:

$$\frac{\partial L}{\partial c}=\sum_{t=1}^{\tau}\frac{\partial L^{(t)}}{\partial c}=\sum_{t=1}^{\tau}\frac{\partial L^{(t)}}{\partial o^{(t)}}\frac{\partial o^{(t)}}{\partial c}=\sum_{t=1}^{\tau}\hat{y}^{(t)}-y^{(t)} \tag{5}$$

$$\frac{\partial L}{\partial V}=\sum_{t=1}^{\tau}\frac{\partial L^{(t)}}{\partial V}=\sum_{t=1}^{\tau}\frac{\partial L^{(t)}}{\partial o^{(t)}}\frac{\partial o^{(t)}}{\partial V}=\sum_{t=1}^{\tau}\left(\hat{y}^{(t)}-y^{(t)}\right)\left(h^{(t)}\right)^{T} \tag{6}$$

However, the gradient calculation of W, U, and b is more complicated. The gradient loss during backpropagation at a sequence location t is influenced by both the gradient loss corresponding to the output at the present position and the gradient loss at the sequence index point $t+1$, as can be shown from the RNN model [31]. It is necessary to backpropagate the gradient loss for W at a sequence location t step by step. The gradient of the hidden state at sequence index point t is given as follows:

$$\delta^{(t)}=\frac{\partial L}{\partial h^{(t)}} \tag{7}$$

$$\begin{aligned}\delta^{(t)}&=\frac{\partial L}{\partial o^{(t)}}\frac{\partial o^{(t)}}{\partial h^{(t)}}+\frac{\partial L}{\partial h^{(t+1)}}\frac{\partial h^{(t+1)}}{\partial h^{(t)}}\\&=V^{T}\left(\hat{y}^{(t)}-y^{(t)}\right)+W^{T}\delta^{(t+1)}\operatorname{diag}\left(1-\left(h^{(t+1)}\right)^{2}\right)\end{aligned} \tag{8}$$

For $\delta^{(\tau)}$, since it is not followed by any other sequence index, there is

$$\delta^{(\tau)}=\frac{\partial L}{\partial o^{(\tau)}}\frac{\partial o^{(\tau)}}{\partial h^{(t)}}=V^{T}\left(\hat{y}^{\tau}-y^{(\tau)}\right) \tag{9}$$

Thus, the expression for the gradient of W, U, and b is calculated as

$$\frac{\partial L}{\partial W}=\sum_{t=1}^{\tau}\frac{\partial L^{(t)}}{\partial h^{(t)}}\frac{\partial h^{(t)}}{\partial W}=\sum_{t=1}^{\tau}\operatorname{diag}\left(1-\left(h^{(t)}\right)^{2}\right)\delta^{(t)}\left(h^{(t-1)}\right)^{T} \tag{10}$$

$$\frac{\partial L}{\partial U}=\sum_{t=1}^{\tau}\frac{\partial L^{(t)}}{\partial h^{(t)}}\frac{\partial h^{(t)}}{\partial U}=\sum_{t=1}^{\tau}\operatorname{diag}\left(1-\left(h^{(t)}\right)^{2}\right)\delta^{(t)}\left(x^{(t)}\right)^{T} \tag{11}$$

$$\frac{\partial L}{\partial b}=\sum_{t=1}^{\tau}\frac{\partial L^{(t)}}{\partial h^{(t)}}\frac{\partial h^{(t)}}{\partial b}=\sum_{t=1}^{\tau}\operatorname{diag}\left(1-\left(h^{(t)}\right)^{2}\right)\delta^{(t)} \tag{12}$$

Depending on the RNN model, the formula for natural forward-backward propagation will be somewhat different, but the principles are basically similar. In reality, if the sequence is too long, on the one hand, it will cause gradient dissipation and explosion during optimization; on the other hand, the unfolded feedforward neural network will take up too much memory. As a result, a maximum length is set, and when the length reaches that limit, the sequence is truncated.

3.2. Based on the Assessment Framework of Environmental Measures in Yan'an Architectural Heritage Protection Work. In China's urban redevelopment process, architectural heritage, particularly tourism legacy, has been destroyed due to a lack of stakeholder protection. Therefore, identifying significant stakeholders is urgently needed in order to fulfill the duty of conservation. Based on the requirements of environmental measures in the conservation of architectural heritage in Yan'an, the basic components of the comprehensive evaluation of the conservation of architectural heritage units in Yan'an are summarized into four factors: the current state of conservation of architectural heritage units in the urban area and the environmental conditions around them, the protection of the historic and cultural style neighborhoods, the protection and support of the unique style culture, and the remediation of urban safety hazards that threaten the conservation of cultural heritage. On this basis, the framework of the evaluation index system is established. In order to provide a simple decision-making method for complex decision-making problems with multiple objectives, multiple criteria, or

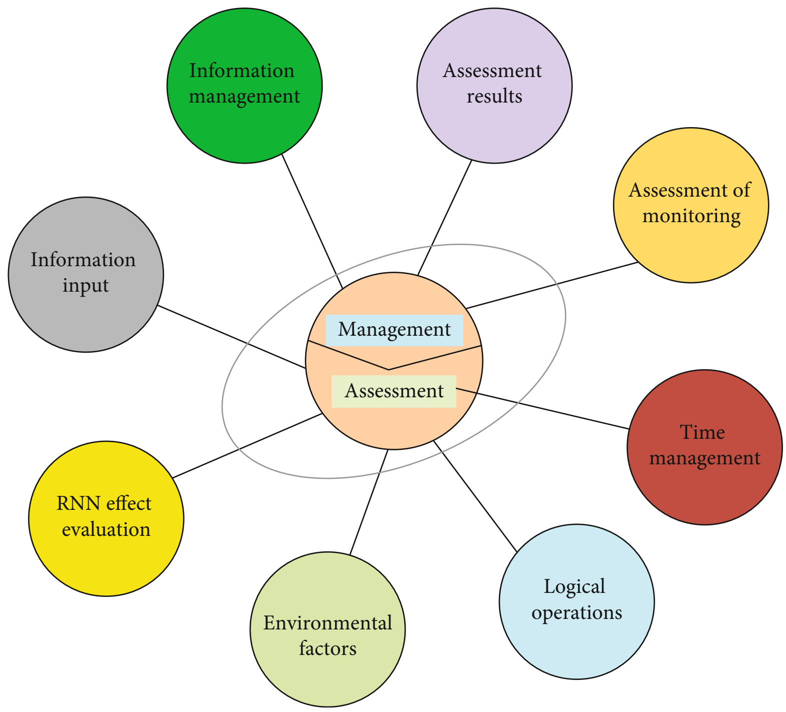

Figure 2: Actual effect evaluation framework of environmental measures in Yan'an architectural heritage protection work.

unstructured characteristics, this deep learning method uses less quantitative information to mathematically represent the thinking process of decision-making based on an in-depth analysis of the nature of complex decision-making problems, the influencing factors, and their intrinsic relationships. It is especially appropriate in circumstances where it is challenging to measure a decision's outcome properly and directly. The important details of the evaluation process are analyzed below, and the overall evaluation details are shown in Figure 2.

Firstly, the content of the evaluation should be clear. The soundness, the reasonableness, and the clarity of the evaluation content directly determine the scientific and accurate results of the evaluation. The key to evaluating the effectiveness of the holistic conservation of Yan'an's architectural heritage is to understand the meaning of "holistic" and "conservation" and to focus on these two aspects. At the same time, the content of the evaluation should be as simple and clear as possible to minimize artificial ambiguity in the evaluation process, while ensuring that the content is sound and reasonable. If the government subsidizes and invests in the preservation of historic buildings, it will save the future preservation of historic buildings and help revitalize the local economy.

Secondly, the indicators are scientific and practical. The evaluation of effects, as a scientific process of evaluating conservation results, should have a scientific attitude and a comprehensive evaluation method. Effectiveness evaluation, as a means of enhancing the conservation performance of Yan'an's architectural heritage, should change in connotation accordingly with the different types of heritage and the needs of conservation. However, the unrealistic nature of an absolutely scientific and reasonable index system, in turn, determines the relativity in the process of constructing an index system for evaluating the effectiveness of the holistic conservation of Yan'an's architectural heritage. Therefore, the indicators should be based on relative scientific rationality and strengthen their practicality.

Finally, operability of any scientific and perfect indicator system must be tested by evaluation practice. When setting indicators, the practical operability of the selected indicators should be considered, and the selection of indicators should also take into full consideration the actual needs of research and the possibility of data and information collection. Indicators that have some value but are not operational, and those that may inconvenience assessment experts and create difficulties for subsequent research on the indicator system, should be avoided as far as possible in the selection process. It is important to use as few and simplified indicators as possible to reflect the overall conservation effect of Yan'an's architectural heritage and to ensure that the evaluation process is simple, easy to follow, and operational.

4. Discussion and Analysis of Results

With the increasing attention to the protection and inheritance of architectural and cultural heritage, the protection and utilization of revolutionary heritage is still insufficient, and the special research on this kind of heritage protection is still weak; especially, the actual effect evaluation of environmental measures in the protection of Yan'an architectural heritage is still weak. The architectural heritage of Yan'an should be protected with targeted conservation techniques, while daily maintenance and conservation of Yan'an buildings should be strengthened, and regular safety treatments should be applied to the heritage body and its

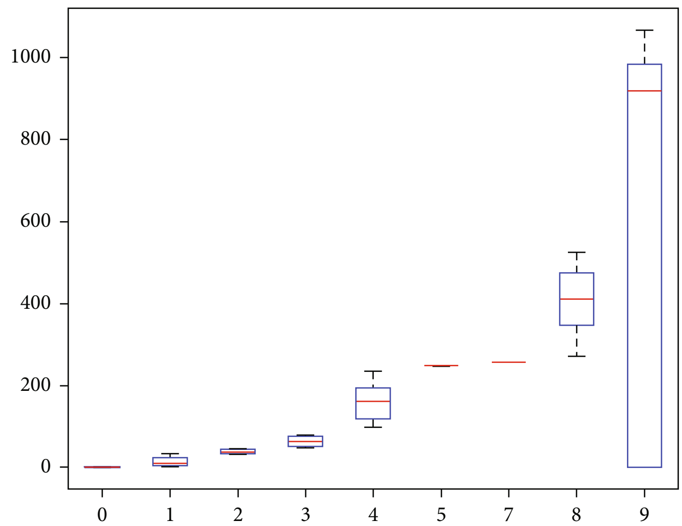

Figure 3: Hierarchical analysis box-line diagram.

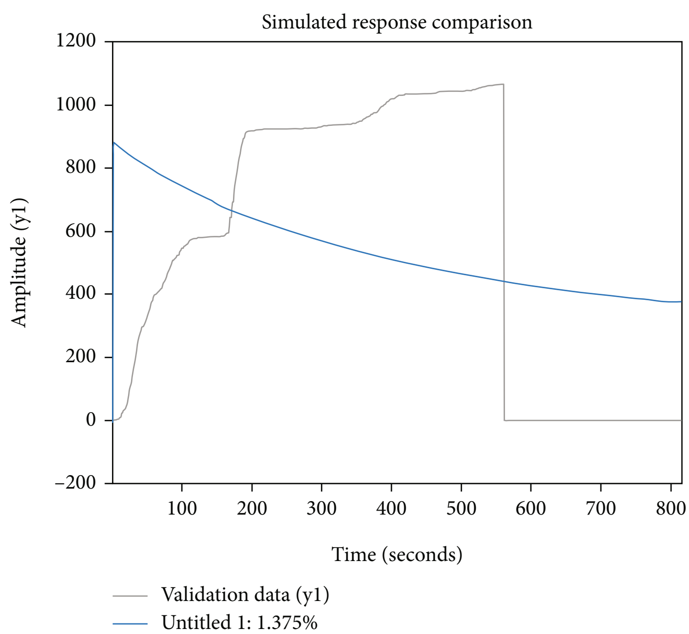

Figure 4: Diagram comparing the effects of hierarchical analysis simulation.

protective structures. In the face of rapid urban development and construction, an overall plan must be drawn up for the area around the heritage; on the basis of the current urban master plan, a scientific and reasonable protection zone should be drawn up, and in addition to setting up a protection zone, a construction control zone should be defined on its periphery, and corresponding protection management regulations and measures should be strictly formulated.

Hierarchical analysis is a comprehensive evaluation method [32]. Its essence is a process of decomposing complex problems. The process combines the basic steps that humans take when making decisions, namely, decomposition, judgement, and synthesis. To a certain extent, it reduces the subjectivity of the decision maker. The five steps of hierarchical analysis are analyzing the relationship between the factors in the system and establishing a system hierarchy, creating a comparison matrix by comparing components at the same level two by two, figuring out the relative weights of the elements in the comparison matrix at each level, evaluating the consistency of the comparison matrix, and calculating the synthetic weights under the whole system and calculating the total score of the evaluated object. A line that represents the data's median runs through the center of a box-line diagram. The box-and-line diagram is first used to portray the evaluation of the actual effect of environmental-type measures in the conservation of Yan'an's architectural heritage. The boxes contain 50% of the data since the top and bottom of the boxes correspond to the top and lowest quartiles of the data, respectively. Therefore, the height of the box partially indicates how

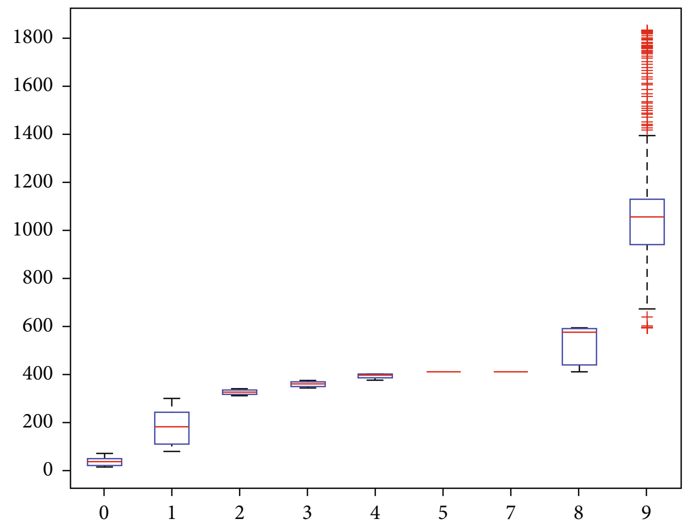

FIGURE 5: Factor analysis method box-line diagram.

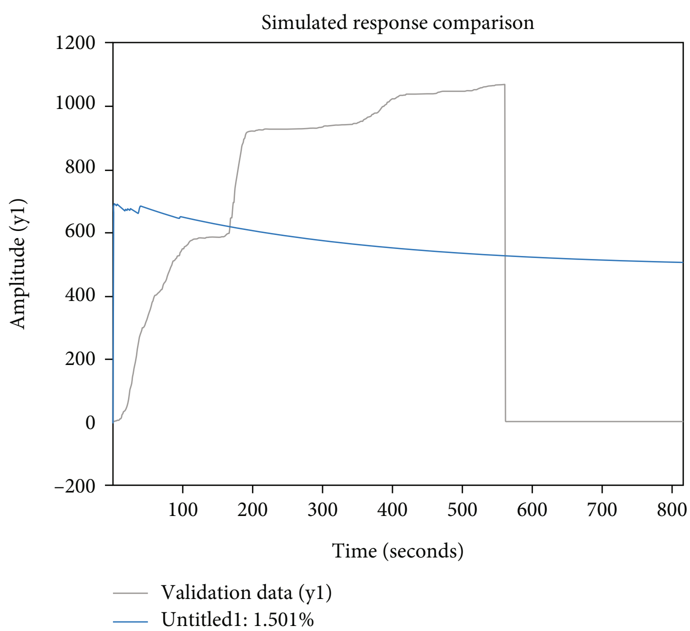

FIGURE 6: Diagram comparing the simulation effects of the factor analysis method.

much the data fluctuate. The maximum and minimum values of the data set are then represented by the top and bottom edges. There are occasionally data points outside the box that can be viewed as “outliers.” Figure 3 depicts the box-line diagram used in the hierarchical analysis method, which uses statistics like the median, 25th and 75th percentiles, and upper and lower boundaries to describe the overall distribution of the data. It finds that too many outliers reduce the effectiveness of the evaluation. These statistics are used to create a box plot, with the majority of the normal data located inside the box and the aberrant data located outside the upper and bottom box limits. No matter what policies and measures are formulated, the ultimate purpose is to better realize the protection, inheritance, and development of architectural heritage. The key is whether these policies and methods are implemented, whether they are practical, and whether they achieve the desired goals.

Hierarchical analysis does not offer fresh options for making decisions. Less quantitative information and more qualitative elements are difficult to persuade. When there are numerous indications, the data statistics are huge and it is challenging to identify the weights [33]. A comparison of the simulation responses is shown in Figure 4, which shows that the difference between the evaluation effect and the true fitted value is too large.

The study of statistical methods that separate common components from collections of data is known as factor analysis. The discovery of hidden representative components among numerous variables is made possible by factor

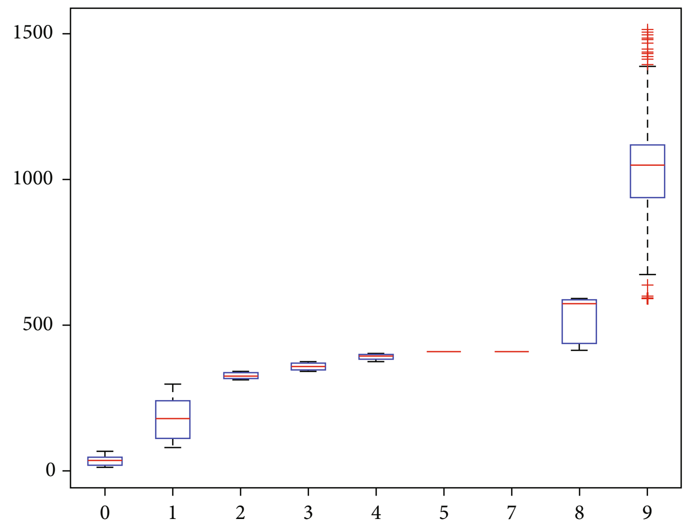

Figure 7: RNN neural network analysis method box-line diagram.

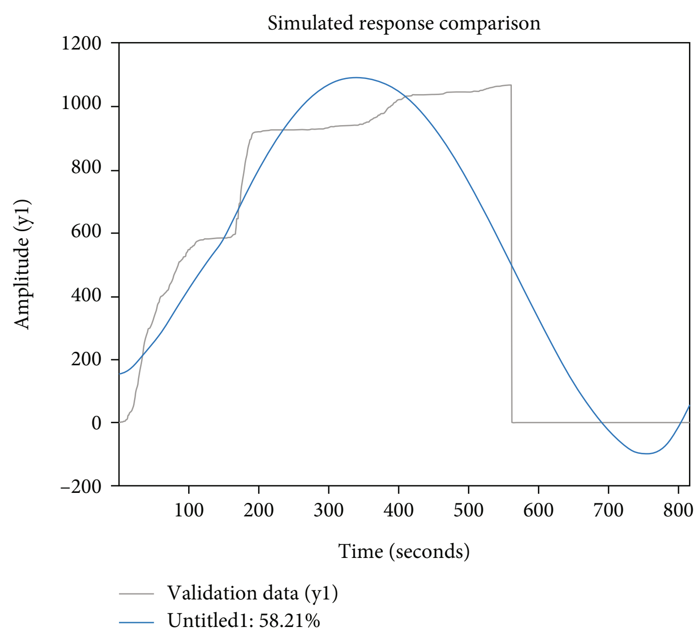

Figure 8: Diagram comparing the simulation effect of RNN neural network analysis method.

analysis. The number of variables can be decreased, and the relationship between the variables' hypotheses can be investigated by combining variables with similar characteristics into a single factor. The box-line plot of the factor analysis method is shown in Figure 5, where it can be observed that the data fluctuates considerably, which is not conducive to the evaluation of actual effects. For a large sample with a typical normal distribution, the median lies in the middle of the upper and lower quartiles, and the box plots are symmetrical around the median, providing more evidence of the skewness of the data. The distribution is increasingly skewed the farther the median is from the upper and lower quartile centers. A right-skewed distribution results from outliers concentrated on the side of larger values; a left-skewed distribution results from outliers concentrated on the side of smaller values.

When calculating factor scores, the least squares method is used, which can sometimes fail. When the sign of the factor loadings of the principal components has positive and negative signs, the meaning of the integrated evaluation function is unclear and the naming clarity is low [34]. A comparison of the simulation responses is shown in Figure 6, which shows that the evaluation effect differs too much from the true fitted value.

Finally, the RNN method was used to build an evaluation model for environmental-type measures in architectural heritage conservation work. Case line with the upper and bottom boundaries of the boxes representing the upper and lower quartiles of the data, respectively, and the boxes containing 50% of the data, Figure 7 compares the shapes of multiple batches of data. Therefore, the width of the box somewhat indicates how much the data fluctuate. The flatter the box indicates a greater concentration of data, and the shorter the endline also indicates a concentration of data, and the results show that the current state of construction of architectural heritage conservation work in Yan'an is still at a low level.

The first is the principle of objectivity. The conservation of heritage in cities involves many aspects, such as the current state of urban economic development, natural environmental factors, and urban future development planning, and the one-sidedness of the indicator orientation due to the conflict of different values should be avoided in the determination of the indicator system. The second is the principle of quantification. Architectural heritage conservation is influenced by many factors such as politics, economy, and culture, so the indicators are complex and systematic, so it is necessary to set some qualitative indicators. The final strategic principle is to be forward-looking and to formulate a long-term development plan. The RNN method is used to establish an evaluation model of environmental measures in architectural heritage conservation work, which provides a basis for the future development of architectural heritage conservation in Yan'an. The comparison of the simulation responses is shown in Figure 8, which is basically consistent with the results of the theoretical analysis and provides a sufficient analysis for the further improvement of environmental measures in architectural heritage conservation work in Yan'an in the later stage. In addition to more scientific research, best practices should be developed to open up and share knowledge about the complex interplay between environmental-like measures and historic preservation of buildings.

5. Conclusions

Architectural heritage conservation is a topical issue in today's society. How to conserve architectural heritage is a common concern, and the relevant results are extremely abundant. However, the evaluation and analysis of the environmental aspects of conservation has not yet received much attention. No matter what kind of documents, policies, tools, and measures are formulated, the ultimate aim is to better realize the conservation, heritage, and development of architectural heritage. The key question is whether these policies, measures, methods, and instruments have been put into practice, whether they are practical and scientific, and whether they have achieved the desired goals. In short, it is how effective the conservation is. Given that existing evaluation methods cannot provide new solutions for decision-making, the meaning of the comprehensive evaluation function is unclear, naming clarity is low, quantitative data is scarce, there are many qualitative components, and the results are not easily convincing. This paper proposes an RNN analysis method to evaluate the implementation effect of the environmental category of architectural heritage in Yan'an with greater applicability, which is basically consistent with the results of the theoretical analysis. It provides a basis for the construction of architectural heritage in Yan'an and provides a reference for the future development direction of architectural heritage in Yan'an. It is expected to draw more attention and discuss the theory of architectural heritage conservation effect evaluation together and provide a theoretical basis for realizing the conservation, inheritance, and development of architectural heritage.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest, financial, or otherwise.

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Retraction

Retracted: The Influence of Public Mental Health Based on Artificial Intelligence Technology on the Teaching Effect of Business Administration Major

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Y. Lu, "The Influence of Public Mental Health Based on Artificial Intelligence Technology on the Teaching Effect of Business Administration Major," *Journal of Environmental and Public Health*, vol. 2022, Article ID 5353889, 11 pages, 2022.

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Research Article

The Influence of Public Mental Health Based on Artificial Intelligence Technology on the Teaching Effect of Business Administration Major

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As an emerging technology, public mental health based on artificial intelligence engineering has broad application and development prospects in improving teaching effects, realizing high efficiency and intelligence, and improving refined education. The application of public mental health based on artificial intelligence engineering in the practice of the teaching effect of business administration has a very positive significance for accurately discovering the mental health and teaching effect of business administration students. For the sake of improving the teaching effect of business administration major, we come up with a method for the influence of public mental health on the teaching effect of business administration profession based on artificial intelligence engineering. Firstly, we collect the video and audio of the teaching of business administration, conducts data screening and cleaning, and sorts out the video and audio synchronization clips as training data. Secondly, we propose a multimodal feature extraction network and a multimodal fusion network for the extraction and fusion of video and audio clips, respectively. Then, the fully connected network structure is used to evaluate and classify the effect of business administration professional teaching, and use mental health factors for evaluation to avoid human intervention and improve the prediction effect. Finally, through intensive experimental results, we prove that the method raised by us can use artificial intelligence engineering to evaluate the teaching effect of business administration majors from the perspective of public mental health and achieve good experimental results.

1. Introduction

The continuous evolution of artificial intelligence has promoted the integration of artificial intelligence engineering and industry, spawned a large number of artificial intelligence models, and changed people's production and lifestyle [1, 2]. Society has rapidly gotten into the era of intelligence, and in many fields, including education, have undergone tremendous changes, and the content, form, and evaluation are constantly changing [3, 4]. Under the backdrop of artificial intelligence engineering, the training of business administration professionals has undergone certain changes, which makes the traditional business administration teaching more incompatible in the era. Exploring new business administration teaching modes, solving traditional business administration major teaching problems, and promoting the teaching reform of business administration have become the top priority [5, 6].

Facing an increasingly turbulent business environment and increasingly fierce competition, many companies use artificial intelligence, deep learning, cloud computing, etc. to optimize their organizational structure, improve operational efficiency, promote management efficiency, and decrease operating costs [7]. Through the internal boundaries and barriers of the organization of data, the circulation and collaboration of the supply chain are optimized, and the individual kinetic energy of the company and employees is stimulated [8, 9]. All the above-mentioned changes and developments are constantly improving and developing the theory and practice of traditional business administration [10, 11]. However, due to various reasons, the current curriculum and teaching of business administration have not kept up with the theory and practice of business management under the wave of digitalization, and the impact on the current subject teaching and student training cannot be concretely reflected. Artificial intelligence technology not only has a profound impact on the teaching of business administration but also promotes the development of teaching to some extent. The technologies represented by artificial intelligence technology and personalized or customized education are constantly expanding teaching methods, enriching teaching forms, and actively exploring the reform ideas and practical ways of applying artificial intelligence engineering to the course content and teaching methods of business administration majors [12, 13].

Although the current artificial intelligence technology has a comprehensive range of applications in the teaching of business administration, these technologies rely on manually selected influencing factors to evaluate the effect of business administration and are easily affected by human factors [14, 15]. In last years, applying artificial intelligence engineering to the field of mental health and evaluating the teaching effect of business administration majors from the field of mental health has become a new solution [16, 17]. Artificial intelligence engineering is a science that investigates and grows methods, technologies, and technique systems for imitating and visualizing human intelligence [18, 19]. Machine learning is the most important technical means of artificial intelligence, which aims to explore and model complex high-dimensional interactions between a large number of variables [20, 21]. Through the acquisition and analysis of data by artificial intelligence engineering, and the use of artificial intelligence methods to express the relationship between modeling features and mental health, intelligent mental health assessment replaces manual assessment to a certain extent, avoiding the elements of human manipulation [22, 23]. The traditional teaching method has been following the fixed talent training mode, teaching students the relevant professional basic knowledge through classes, but the teaching method is too outdated and difficult to adapt to the current era of intelligence. The current teaching methods mainly advocate individualized learning methods, teach students in accordance with their aptitude, and improve students' sense of participation.

To evaluate the teaching results of the business administration major more fairly and justly, we propose an evaluation method for the teaching effect of the business administration major on public mental health based on artificial intelligence technology [24, 25]. We adopt artificial intelligence-based mental health evaluation form and data analysis method, which enables researchers to approach the task scenario in a more simulated way, obtain multimodal data for analysis and modeling, and achieve more efficient and accurate predictions [26, 27]. The application of mental health assessment based on artificial intelligence engineering to the teaching effect of business administration has a comprehensive range of applications, and it has certain conducting significance for the investigation on the teaching effect of business administration and avoids the interference of human factors [28]. The traditional method of evaluating the teaching effect of business administration majors mainly relies on some artificially selected factors for evaluation, which will cause human influence factors, that is to say, to a large extent; it mainly depends on human factors to determine the evaluation effect. Such an evaluation method is unfair and unjust. Therefore, in this paper, the public mental health perspective is adopted to evaluate the effect of learning and avoid human interference.

2. Related Work

2.1. Public Mental Health. The evolution and expansion of society have accelerated the pace of people's life and intensified the competition in society. These rapid changes have resulted in a huge impact on individual mental health. In the context of this stressful era, how to conduct an efficient and accurate evaluation of mental health is particularly important. How to understand people's mental health status and intervene in advance is the main task. The rapid evolution and utilization of artificial intelligence engineering has spawned the field of public mental health based on artificial intelligence technology. Intelligent mental health can solve the imperfection of traditional methods and reduce the efficiency of missed diagnosis and misdiagnosis, which is of extremely magnitude for the detection of mental health.

Artificial intelligence technology has important applications in the mental health of undergraduates. Firstly, according to the analysis of artificial intelligence technology, teachers can grasp the mental health of the student group. For students with serious mental health problems, they will be the focus of public mental health education in the future. Through the design and implementation of various types of educational guidance or mental health activities, it guides college students to overcome psychological barriers. Mental health assessment, based on the background data recorded in college students, sorts out the common mental health problems such as anxiety and depression among college students and designs related public mental health education activities. So that students can gradually perceive problems and recognize the emergence of problems in continuous learning. Firstly, identify the cause of the problem and gradually overcome mental health problems. Secondly, after the public mental health system based on artificial intelligence obtains students' mental health-related data, it pushes mental health-related test reports for each student and pushes mental health guidance for each student, so that students can know what method they want to use in order to get out of the psychological predicament and achieve good development.

This year, artificial intelligence engineering has been widely used in the business field and gradually deepened into colleges and universities, making many teachers perceive and recognize the practical value of these new technologies. However, few colleges and universities realize that the practice from the perspective of combining technology with the mental health of college students does not pay much attention to this new technology. Firstly, it restricts the application of advanced scientific research results such as artificial intelligence engineering to the practice of public mental health education, which makes the education and teaching model too outdated. Secondly, insufficient attention is paid to artificial intelligence technology, which leads to the lack of relevant support for the application research and practical exploration of artificial intelligence engineering in college students' mental health, and the development of mental health education cannot be promoted.

Artificial intelligence engineering is a universal technology. Numerous research experiments have shown that these preface technologies can be applied to the field of public mental health, especially the mental health of college students. However, there is currently a lack of clear application ideas and mature content guidance, which makes artificial intelligence technology facing greater difficulties in the mental health education of college students. Simultaneously, artificial intelligence engineering in the field of college students' mental health involves artificial intelligence, big data and psychology, and other related majors, which demands researchers not only to have professional knowledge in psychology but also to have artificial intelligence technology, big data technology, and software platform development capabilities. However, professionals in this field are relatively scarce in colleges and universities, which makes the application of artificial intelligence engineering in the field of public mental health very difficult. In addition, although artificial intelligence engineering can improve the pertinence and accuracy of college students' mental health education, this effect needs to provide enough data information to make the model run with accurate data. The participation of undergraduates in public mental health education activities is the premise and foundation of the advantages of artificial intelligence technology. However, at present, the number of college students who actually participate in the activities is relatively small, which makes it impossible to obtain accurate data. The problem of poor participation results in the ineffectiveness of the artificial intelligence technology in the field of college students' mental health, which affects the application of artificial intelligence engineering.

The continuous development of the current society has led to people's life pressure and reduced psychological endurance, which can easily lead to mental health diseases. However, the traditional public mental health assessment methods are inefficient, difficult to detect mental health problems, and easy to cause misdiagnosis. The method based on artificial intelligence technology has high operation efficiency and more accurate assessment of people's mental health.

2.2. Teaching Business Administration. The continuous development of artificial intelligence engineering has led to an endless stream of intelligent technologies, which not only changed people's production and lifestyle but also brought a certain affection and impact on the education system. Artificial intelligence technology has provided new ideas for the teaching reform of business administration majors. However, the traditional education and teaching mode is the mainstream pattern of business administration majors teaching remains unchanged. Therefore, in the context of artificial intelligence, the teaching of business administration has ushered in new development opportunities and challenges. In the context of artificial intelligence technology, reforming the teaching of business administration is the trend of the development of ICBC management teaching and education. Relevant researchers actively design strategies to build a new model of business administration teaching to promote the development of business administration teaching. Export more high-efficiency business management competent people for the society.

Problems existing in the instruction mode of business administration profession:

(1) The first is that the professional goals of business administration are difficult to achieve. In the context of artificial intelligence, the requirements for high-quality business management talents are getting higher and higher, but there is a lack of relevant testing methods and technologies for students' teamwork ability and mental health evaluation. These problems have led to increasingly prominent contradictions between teachers and students, and it is far from enough to improve students' teamwork ability and mental health assessment through projects as a carrier. Cultivating students' innovative ability means that students need to master more basic knowledge, constantly have their own innovation and tear up, and be able to connect across borders. The cultivation of students' executive ability means that students need to be cultivated through decision-making and execution tests

(2) The degree of capacity building needs to be strengthened. A survey was carried out on the talent training of related business administration majors in my country. The results of these related surveys show that the talent training methods in my country's middle and high schools are relatively common. This problem causes students' foreign language skills, computer technology, business management, and other aspects to lag behind the era of artificial intelligence. In the major of business administration, the school's designated ability training plan is mainly realized through course performance. The lack of professional teachers leads to unreasonable guidance for students, which makes it difficult for students to achieve their predetermined goals after the end of education. These problems make it difficult for them to understand specific knowledge, and they have a shallow understanding of business administration in the context of the era of artificial intelligence, and they cannot apply what they have learned

(3) The module setting is unreasonable. Colleges and universities have unreasonable module settings for business administration schools and lack more detailed distinctions and definitions for business administration teaching. And the difference between the courses is big, the plates are separated from each other, and there is no clear distinction or definition. There are many modules in the teaching process of

business administration, but from the perspective of career development of students, it does not meet their needs for relevant professional knowledge. In the required courses and elective courses, the basic courses of majors are not closely integrated with mental health and core courses, which lead to the incomplete construction of the knowledge system and reduce the actual effect of the whole study. Judging from the current situation, the current stage of business administration majors has a wide variety of teaching modes and a large number of courses, but these courses are independent of each other, which cannot effectively build a complete learning framework, which reduces the overall effect of college students' learning. The improvement needs more attention from colleges and universities

Artificial intelligence technology is a research direction based on deep neural networks. It mainly relies on network models to predict or classify some data indicators and then use these technologies to evaluate the prediction effect of network models. At present, many enterprises use this technology to optimize the structure of the enterprise and improve the performance of the enterprise, so it is feasible to apply this method to the teaching of business administration.

3. Methods

The impact model of public mental health based on artificial intelligence technology on the teaching effect of business administration majors proposed in this paper is mainly composed of five parts: video and audio collection, audio feature extraction, video feature extraction, multimodal fusion, and business administration major. Teaching effectiveness evaluation: The video and audio collection module mainly collects and organizes the video and audio of the teaching of business administration, removes the noise part, and retains high-fidelity video and audio information; The feature extraction module is mainly divided into audio feature extraction and video feature extraction, respectively, proposes the corresponding audio feature vector and video feature vector, and then performs subsequent processing on these feature vectors; In the multimodal fusion process, the feature extraction within the modality and the feature fusion between the modalities are mainly performed, and the attention mechanism is used to complete this task.

3.1. Overall Network Structure. The network structure of the influence model of public mental health based on artificial intelligence technology on the teaching effect of business administration major proposed in this paper is shown in Figure 1. First of all, in order to study the effect of public mental health on the teaching of business administration majors, we need to collect video and audio data. We collected and organized the video and audio of business administration major teaching into matching data sets, namely, video content and corresponding to the audio content. Then, we use the audio feature extraction network model and the video feature extraction network model to extract features for the collected video and audio pairs, and the extracted features are expressed in the form of vectors, and then enter the next stage. Subsequently, the evaluation of school effects is carried out through public mental health based on artificial intelligence technology. In this evaluation process, the input video and audio features need to be aligned and integrated. At this stage, more attention is paid to the feature learning ability and fusion ability of the model. Finally, the teaching effect of business administration major is evaluated through the fully connected layer, and then mapped to the corresponding classification and level. In this paper, we can manually set the effect classification of learning according to actual needs. The more categories, the more accurate the classification. From these classifications, the effect of professional teaching can be evaluated.

3.2. Feature Extractor. In the feature extraction module, the feature extraction model of a single modality is mainly used to obtain effective information. In this paper, we need to perform feature extraction on video and audio to capture the effective information of input features. It mainly captures the in-mold feature information with the help of a single-modal GRU unit, and then process it in subsequent stages. The VGG network structure model used in this paper extracts information of different features and dimensions from left to right. This structure is similar to the spatial convolution network structure, that is, the features of the previous period can affect the characteristics of the subsequent time nodes. The method in this paper mainly considers the continuity of time and space.

In order to obtain long-term dependent relationships and contextual information of words in the input audio, we adopt Bi-GRU as the core module of the audio feature extractor. We adopt the Word2Vec pretrained model to initialize the audio feature extraction model. The formula for calculating Bi-GRU is as follows:

$$T = \{T_1, T_2, \cdots, T_n\}, \tag{1}$$

$$\overrightarrow{h_i} = \overrightarrow{\mathrm{GRU}}(T_i)\ ; i \in [1, n], \tag{2}$$

$$\overleftarrow{h_i} = \overleftarrow{\mathrm{GRU}}(T_i)\ ; i \in [1, n], \tag{3}$$

$$h_i = \left[\overrightarrow{h_i}, \overleftarrow{h_i}\right]\ ; h_i \in R^{2k}. \tag{4}$$

Equation (1) represents a text representation with n audio segments. For the ith time step, $\overrightarrow{h_i}$ denote the hidden representation obtained by the forward GRU, $\overleftarrow{h_i}$ denote the hidden representation obtained by the backward GRU, and h_i denote the concatenation of these two types of hidden representations. The audio feature matrix is obtained by stacking the hidden representations of n time steps in order.

Considering the long time and slow processing speed of video data in this paper, we first divide the video data into images of each frame, and then send them to the network for processing. We organize the collected video data, then divide the data with good video quality, select key frames

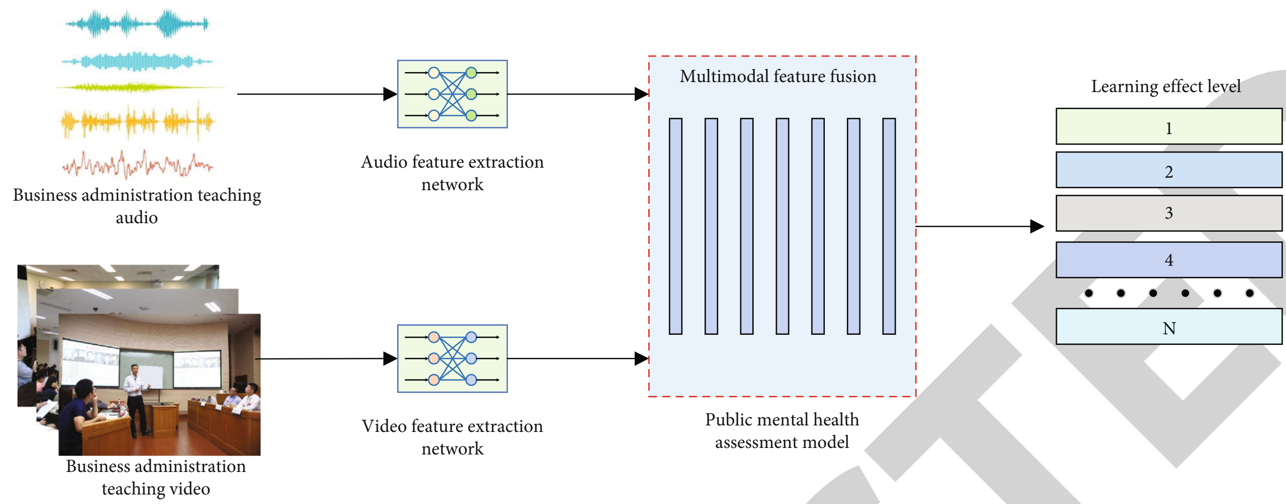

FIGURE 1: Evaluation model of teaching effect of business administration major.

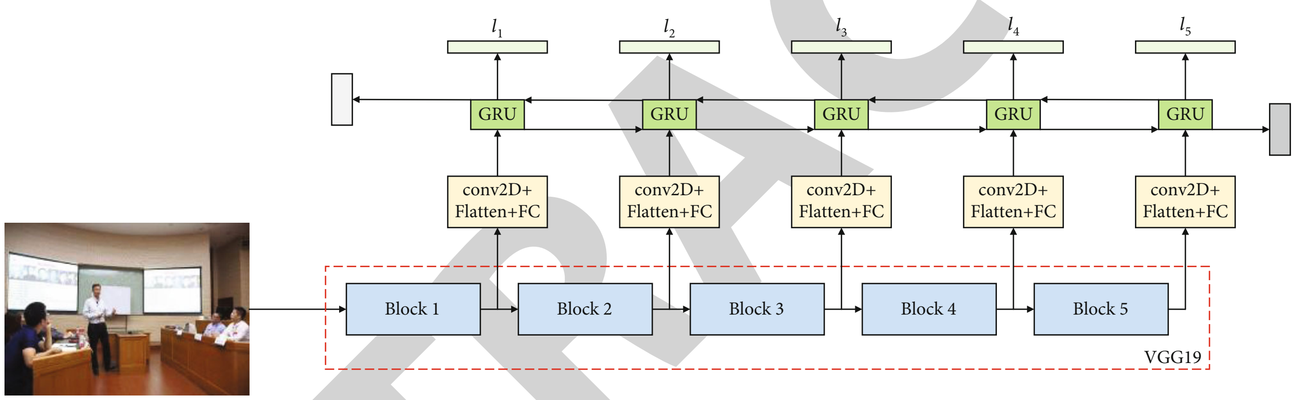

FIGURE 2: Structure diagram of feature extractor.

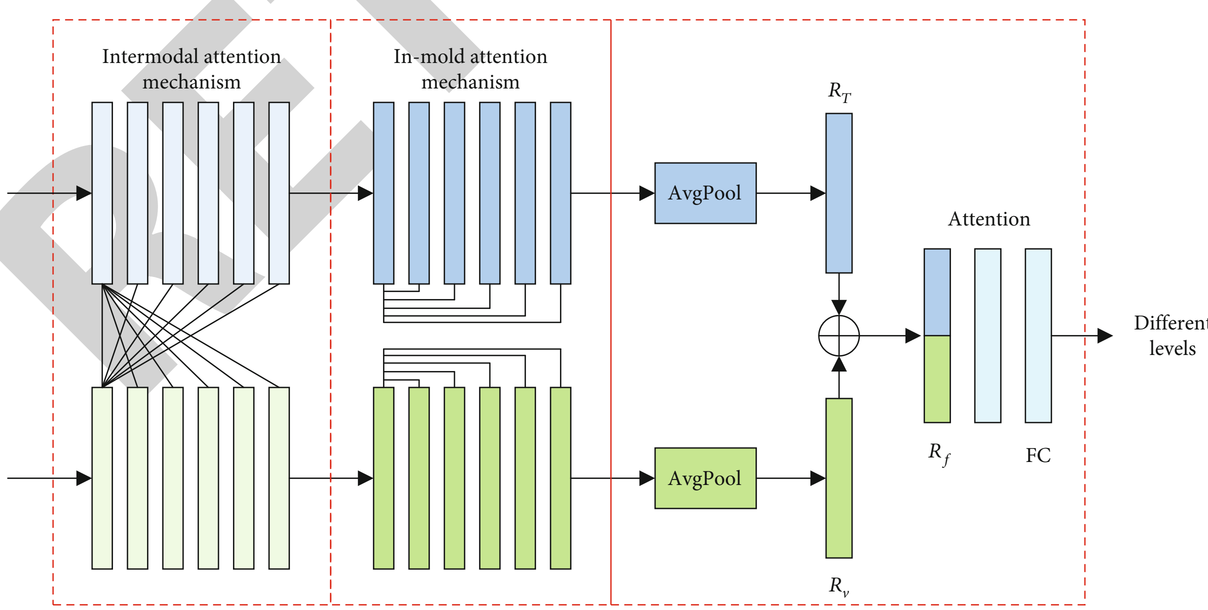

FIGURE 3: Multimodal fusion model.

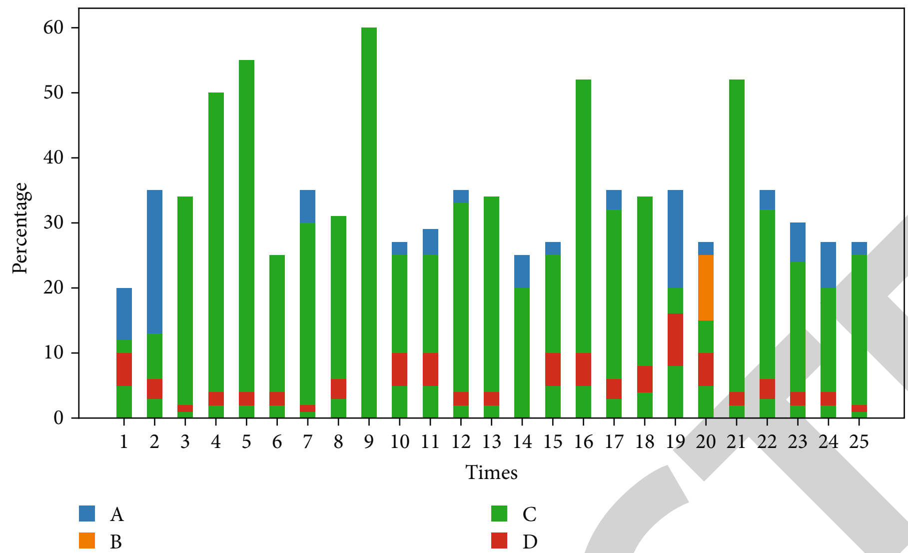

FIGURE 4: Data set collection diagram.

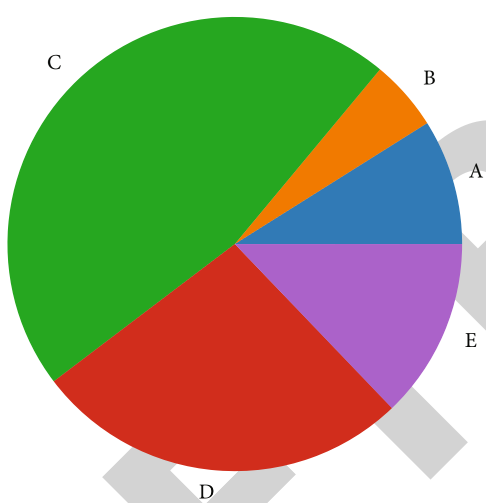

FIGURE 5: Dataset type proportion diagram.

from them, and then perform feature extraction on these inputs.

The image sign extraction mainly relies on the multi-branch CNN-RNN module, and its network model structure is shown in Figure 2. It includes 5 CNN branch structures. The block module of each branch structure corresponds to VGG19. The feature vector extracted from each branch is passed through the convolution layer, pooling layer, and fully connected layer in turn, and finally the corresponding feature vector representation is obtained., representing the feature information from local to global. Considering that there is a strong correlation between image features at different levels and time series, for example, mid-level features are composed of bottom-level features, and high-level features are composed of mid-level features, which is a sequence relationship. In addition, there is also a correlation between the input image sequences, that is, the image of the previous frame can have an impact on the image of the subsequent frame. In this paper we employ Bi-GRU units to model the sequence dependencies of these features.

$$\begin{aligned}
\overrightarrow{l_t} &= \overrightarrow{\mathrm{GRU}}(v_t)\ ; t \in [1, 5], \\
\overleftarrow{l_t} &= \overleftarrow{\mathrm{GRU}}(v_t)\ ; t \in [1, 5], \\
V_m &\in R^{5\times 2k},\ V_f \in R^{2k}, \\
V_f &= \left[\overrightarrow{l_5}, \overleftarrow{l_1}\right].
\end{aligned} \tag{5}$$

3.3. Multimodal Fusion. To obtain the interaction relationship between audio and image, we first use attention mechanism to obtain the correlation between different modalities, and then continuously update the text and picture feature matrix according to the learned correlation weight in Figure 3. The calculation formula of the intermodal attention mechanism is as follows:

$$\begin{aligned}
\mathrm{Attention}(Q, K, V) &= \mathrm{soft\ max}\left(\frac{QK^T}{\sqrt{d}}\right)V, \\
T_{\mathrm{update}} &= \mathrm{Attention}\left(T_m W_{q1}, T_m W_{k1}, T_m W_{v1}\right), \\
V_{\mathrm{update}} &= \mathrm{Attention}\left(V_m W_{q2}, V_m W_{k2}, V_m W_{v2}\right).
\end{aligned} \tag{6}$$

Among them, Attention() represents the operation function of the attention module; Q, K, and V represent the query matrix, key matrix, and value data, respectively, which is difficult; d is used as a scale factor, mainly to prevent the molecular dot product from being too large, and its value is input in the eigenvalues of the dimension.

The intramodal relationship is a supplement to the interaction between different modalities. In this paper, the intramodal attention mechanism module is used to model multiple single modalities, mainly to fully represent the

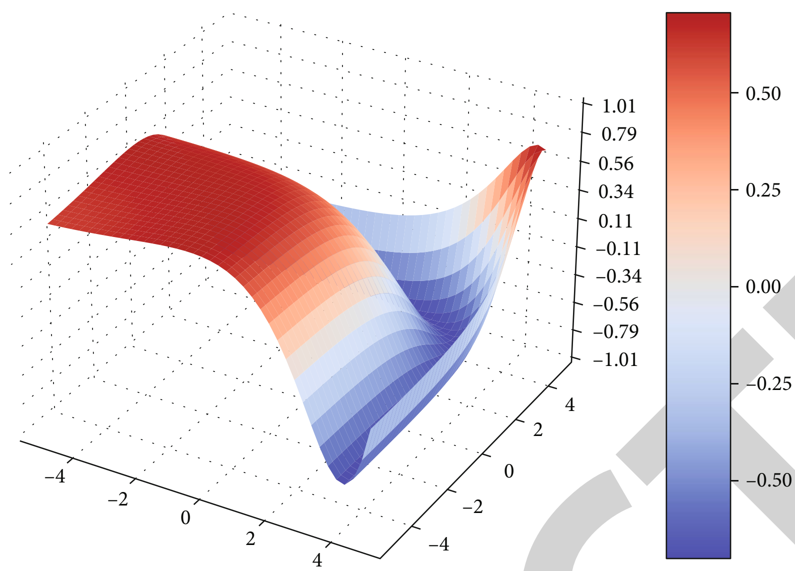

Figure 6: Network model training diagram.

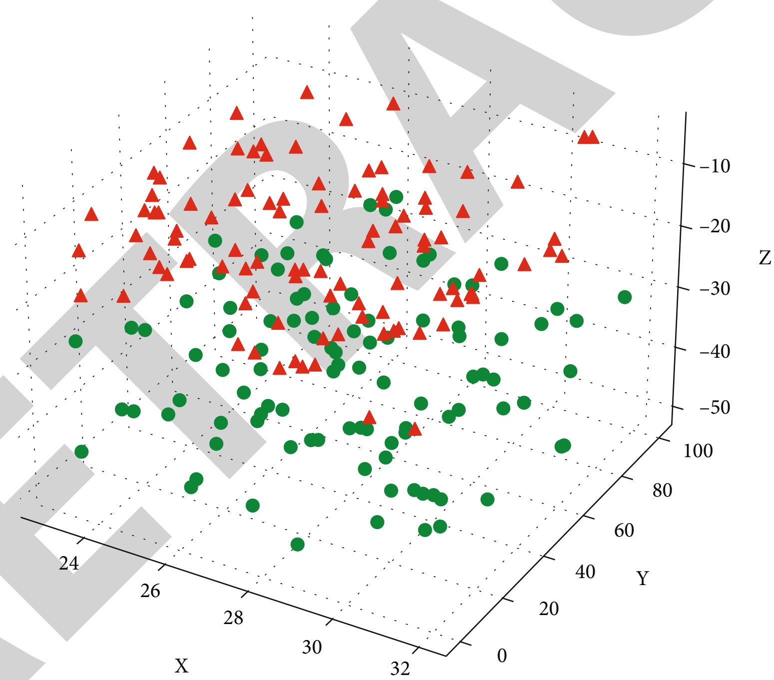

Figure 7: Distribution map of teaching effect of business administration major.

feature information of a single modality. The calculation process is as follows:

$$\begin{aligned} T_{m2} &= \text{Attention}\left(V_{m1}W_{q11}, V_{m1}W_{k11}, V_{m1}W_{v11}\right), \\ V_{m2} &= \text{Attention}\left(V_{m1}W_{q21}, V_{m1}W_{k21}, V_{m1}W_{v21}\right). \end{aligned} \tag{7}$$

After performing intramodal feature representation and intermodal feature representation on multimodal data, the next step is to align and fuse multimodal data. We average pool the feature vectors obtained above, and then combine these vectors corresponds to the data label. The audio and video representations are stitched together to obtain a joint representation of the audio and video. Then, the nonlinear transformation is realized through the fully connected layer, and finally the joint representation of the multimodality is obtained, and the classification of the learning effect is carried out.

Data from different modalities, such as video and audio data, can be aligned through the attention mechanism between modalities. The attention mechanism inside the modality considers the connection between the features of

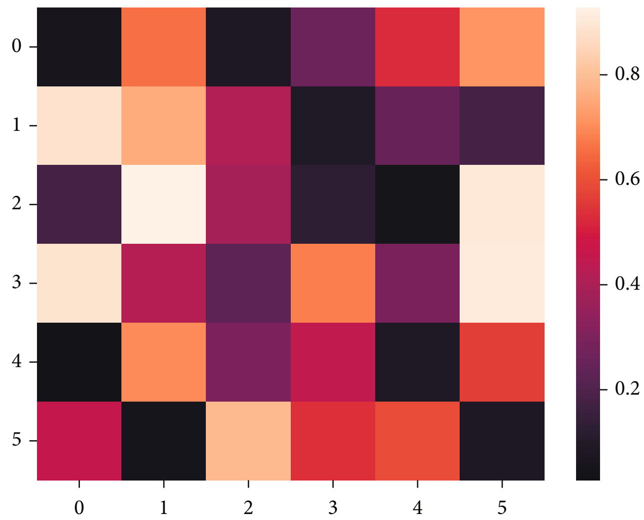

Figure 8: Confusion matrix of network model prediction effect.

the same modality data in different time and space. The aspects considered in the attention mechanism model of this paper are more comprehensive.

3.4. Evaluation of Teaching Effect. There is a problem of loss of video and audio information in the teaching evaluation process of business administration majors. The intramodule attention mechanism and the intermodule attention mechanism are established, and then the multimodal attention mechanism is fused. The purpose of this is to strengthen the role of the original information, while realizing the alignment of multimodal data. At the end of the model, a fully connected layer of softmax is used to map the learned high-level representations to the multiclass target space to obtain the corresponding probability distribution. We employed a cross-entropy loss function to detect the difference between the predicted probability distribution and the true labels. At the end of the network model, this paper uses the fully connected layer of softmax to map the dimensions of the final data features of the network model map. At the end of the model, it is necessary to continuously reduce the predicted probability distribution and the true probability distribution through the loss function.

4. Experimental Comparison and Points

4.1. Dataset. The teaching data set of business administration major comes from the teaching videos and audios of colleges and universities. On the basis of data collection, we organize the data sets corresponding to the videos and audios, and then classify these data sets, that is, to classify and analyze the effects of different schools. Annotation labels used to evaluate the predictive performance of the model. This paper firstly screens the data, deletes some video clips with severe noise and unclear video content in Beijing, and then trims the remaining videos to facilitate postprocessing. Then divide the dataset into a 7 : 1 : 2 ratio of training, validation, and test sets, and make sure they do not contain any of the same events.

The data collected by the method in this paper are all data from a fixed period of time. The invalid data is cleaned, and the real and valid data are completely retained. Although a lot of manpower and material resources are spent in this process, the integrity of the data is set and authenticity can be guaranteed, and human interference is reduced as much as possible.

4.2. Experimental Environment. The hardware environment in this article is Intel i7-8700k, 32G memory, RTX 3090 GPU, Python 3.8.8, and PyTorch 1.10. In the training of the entire network model, the batch size is set to 100, the epoch is set to 800000, the learning rate is 0.001, and the optimizer uses Adam.

4.3. Comparison of Experimental Results. Figure 4 represents the acquisition of video and audio data in this paper. The horizontal axis in the figure represents the number of times we collect data, and the vertical axis represents the proportion of various types of data collected. In the figure, *A*, *B*, *C*, and *D* represent four cases, such as video data, audio data, video and audio pair, and mismatched data, respectively. We can find that the video and audio pairs in the collected data are mostly used for model training and testing, and other data are deleted through data cleaning because they cannot be matched.

Figure 5 shows the proportion of dataset types in the collected data. From the figure, we can see that we divided the collated data set into five major types, namely, *A*, *B*, *C*, *D*, and *E* corresponding to the learning effect of business administration teaching: *A* means the best, and *E* grams are the worst. From the figure, we can find that most of the time, the learning effect is relatively general, and the excellent and poor are both occupying a relatively small proportion. From Figure 5, we can see that these learning effects from A to E indicate that the learning effect continues to decline: A indicates the best, E indicates the worst, and others indicate that the learning effect is moderate. We mainly classify according to the evaluation of the teachers in the class, the degree of students' participation in the classroom, and the scores through the relevant assessments. These data are relatively complete and valid data after filtering.

Figure 6 shows the training images of the proposed multimodal network model. From the figure, we can see that the *X* and *Y* axes represent the input video data and the corresponding audio data, and their positive and negative values represent increasing or decreasing the corresponding ratio. The Z-axis in the figure represents the prediction effect of the network model, and the larger the value, the higher the prediction accuracy.

Figure 7 shows the distribution map of the teaching effect of business administration majors. In the figure, *x* and *y* represent the input audio features and video features in the network, respectively, and the *z*-axis represents the distribution of the network model. From the figure we can see that the red triangles represent the number of positive samples in the network model, and the green circles represent the number of negative samples of the network model.

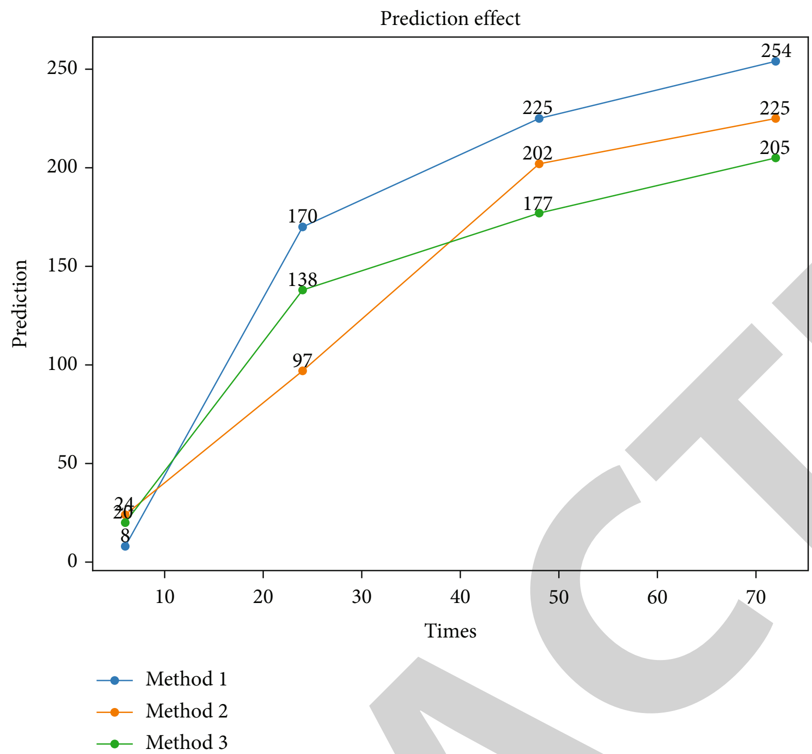

Figure 9: Comparison of multimethod prediction effects.

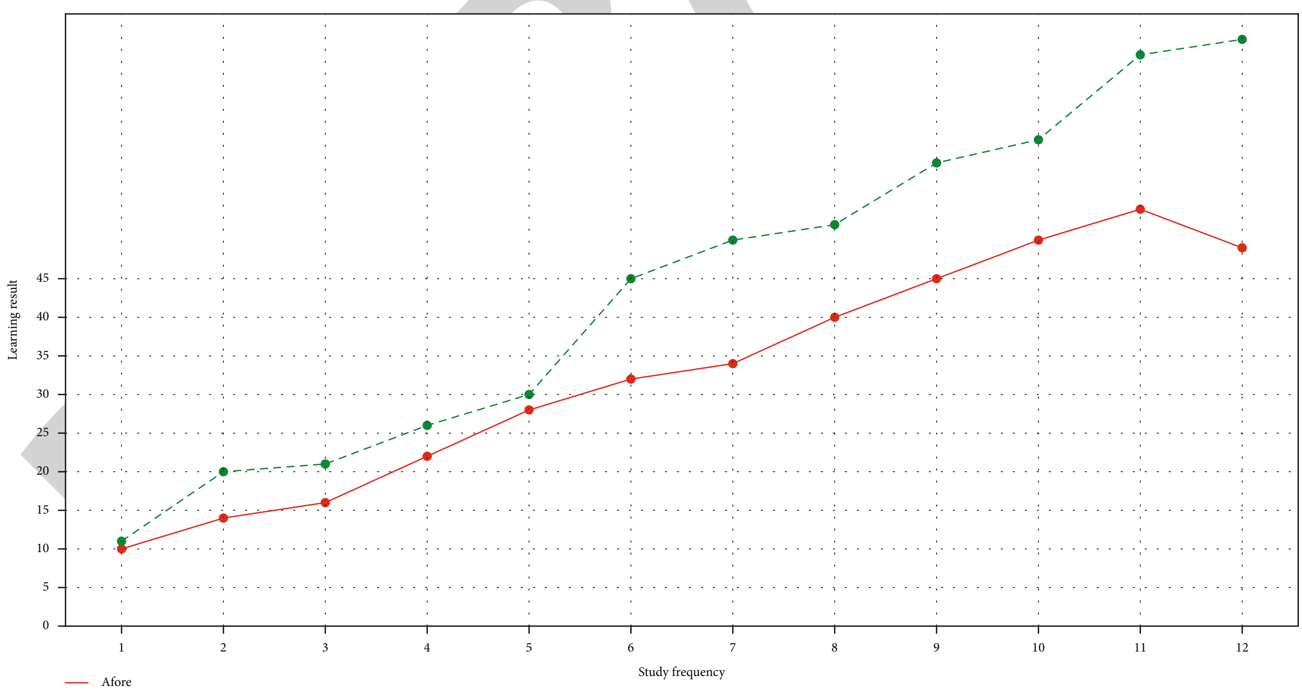

Figure 10: Comparison of the prediction effects of the methods in this paper.

On the whole, the positive and negative sample data of the network model are relatively balanced.

Figure 8 shows the confusion matrix of the predicted effect of the network model. The color from dark to light indicates that the prediction accuracy of learning gradually decreases. Only the case of darker color indicates that the prediction effect of the multimodal network model proposed in this paper is better. The categories 0, 1, 2, 3, 4, and 5 in the figure represent the successive declines in the effect levels of the teaching of business administration. It is also possible to expand the number of classifications of the network model according to the fine classification of other subsequent tasks, which can further subdivide this effect.

Figure 9 mainly compares the method in this paper with other evaluation methods. The horizontal axis represents the number of training times, and the vertical axis represents the prediction effect. The larger the value, the better. The other methods, Method 1, represent the multimodal network model proposed in this paper, and Methods 2 and 3 represent the use of the BERT network model and HRNet network model, respectively. This paper uses a multimodal method to extract the features of the data and realizes the multimodal data. Alignment and fusion improve the actual prediction effect of the network model.

Figure 10 shows the comparison between the method using the multimodal fusion proposed in this paper and not using the method in this paper. From the figure, we can see that the method in this paper is not used to evaluate the teaching effect of business administration, but the improvement of the effect is small, and due to the influence of human factors, it is prone to overfitting. The prediction effect of the multimodal network model proposed in this paper is relatively stable, and the prediction effect can be continuously improved with the increase of training times.

5. Summary

Public mental health based on artificial intelligence technology has become a key method in the field of mental health assessment. It can use artificial intelligence technology to conduct data mining and sorting technology, which can not only improve the technicality and accuracy of mental health assessment but also avoid mental health assessment. The influence of human factors in health makes mental health assessment more scientific and effective. At present, there are many methods used to evaluate the teaching effect of business administration major, and the evaluation conditions and influencing factors are many, which are easily affected by artificial factors. Evaluating the teaching effect of business administration majors from the perspective of mental health can avoid the influence of human intervention, more truly reflect the teaching status of teachers and the learning effect of students, and can effectively improve the teaching effect of business administration majors. Therefore, this paper proposes an evaluation method of public mental health based on artificial intelligence technology on the teaching effect of business administration, which avoids the influence of human operation and improves the teaching effect of business administration. At present, artificial intelligence technology is still in the stage of research and exploration, and there are many problems and deficiencies, which need to be deeply excavated and discovered according to the actual teaching of business administration. Continuous use of artificial intelligence technology plays an active role in education.

Data Availability

The labeled data set used to support the findings of this study is available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

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Research Article

Analysis of the Effect of Classroom Reform of English Literature on the Theme of Environmental Protection in Universities Based on Artificial Intelligence Technology

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Under the current theme of environmental protection, the effect of English literature classroom teaching reform cannot be analyzed qualitatively. Based on BP neural network, we present an analytical model of the impact of College English Literature Classroom Teaching Reform on environmental protection based on artificial intelligence technology. We analyze the teaching reform of English literature classrooms with the theme of environmental protection under artificial intelligence technology and explore the concept of "intelligent education" and the construction path of university English ecological teaching mode. Based on the in-depth excavation of teaching information, this paper analyzes the impact of college English literature classroom reform on the theme of environmental protection. Combined with BP neural network, a scientific analytic hierarchy process index system model is established, and the weight relationship of various reform influencing factors is given relatively objectively. The scores of the model based on the BP neural network under the six effect analysis indicators of teaching attitude, teaching tools, reform plan, reform teaching content, classroom organization, and reform rationality are 90.97, 86.3, 80.4, 95.7, 84.8, and 87.4, respectively. The results show that this model has a good ability for analysis and evaluation, which also provides some new ideas and entry points for the reform of the current English classroom teaching model. This study has a certain contribution to the breakthrough of college English teaching goals.

1. Introduction

Artificial intelligence (AI) is considered to be the most disruptive technology so far [1], and it is accelerating its landing and profoundly changing the world and human production and lifestyle [2]. The deep integration and innovation of AI in various fields are disrupting our lives and changing the face of the world [3]. AI has been closely related to education since its birth, and the changes to education will be comprehensive.

The natural environment we live in is the collective wealth given by nature to everyone. Therefore, protecting the environment and maintaining ecological balance has become a consensus that everyone should have. The goal of quality education in China points out that natural environment education should permeate all disciplines. English is the main subject of everyone's education, and it is also a part of the teaching system. Reading is a key way to master language knowledge, acquire language information, and improve language use, and the English literature classroom occupies a key position in the English language learning loop in colleges and universities [4]. In College English teaching, we should carry out literature courses with the theme of natural environment protection and integrate environmental education with artificial intelligence technology into teaching. This will not only help to cultivate students' English reading ability but also help students to pay attention to and protect the natural environment. Core literacy training is one of several critical problems in China's education innovation. Front-line English teachers should actively respond to the needs of the times, profoundly grasp the concept of English core literacy teaching, take effective measures to realize the transformation of high school English teaching from language usability enhancement to subject core literacy training, and emphasize the standardization and cultivation of students' thinking quality and cultural character while focusing on the development of student's learning ability and language ability.

In today's information age, where an era dominated by science and technology, the progress of AI technology has greatly promoted the innovation and progress of English classroom students' learning methods and English learning concepts. Literature [5] has summarized some English teaching modes combined with artificial intelligence technology, showed a cloud computing artificial intelligence model in the article, discussed the relevant characteristics of the intelligent classroom from the perspective of cloud computing, and reformed the interactive teaching mode to a certain extent. This also provides some new ideas and methods for the follow-up classroom education reform so that we can consider the direction of higher education reform from different perspectives such as big data, cloud computing, and AI. Literature [6] has combined AI to advance teaching reform research, collect data using query analysis, and analyze them given distributed technology and new processes. Literature [7] has taken AI combined with cloud computing technology as the research point, deeply analyzes and studies the role of cloud computing and big data technology in college English classroom teaching reform, and then takes cloud computing and big data as tools to deeply analyze the current situation of college English teaching reform. This model takes educational informatization as the research background, integrates the translation meaning of artificial intelligence technology into classroom teaching, and expounds on the transformation significance of artificial intelligence at the teaching level through practice and theoretical basis. Under the above circumstances, the research path of this paper is established. Among them, the ultimate translational value gained from the integration of AI with teaching is the focus of the research reviewed in this literature. Literature [8] has proposed an implementation scheme for college English auxiliary teaching systems of college based on AI technology. Based on artificial intelligence and College English teaching, some improvements have been made in some aspects of the English teaching system to make the current English teaching system more humanized and more suitable for Contemporary English teaching.

Starting from the situation of AI technology and traditional English teaching, we have deeply discussed the application of AI technology in English Teaching to improve the quality and effectiveness of English teaching. Literature [9] has used a dataset of 6.6 million entries containing 3.25 million favorable and unfavorable English texts. The model uses the normalization method to preprocess the dataset to eliminate impact noise. Based on the variable automatic encoder (VAE) [10], the relevant discriminant features are extracted, and then the random forest algorithm (RF) is used as the classifier to classify the discriminant features, to obtain accurate performance. The performance of the protocol is measured by the transmission rate, active nodes, energy consumption, and a certain number of transmission packets. Literature [11] has designed a virtual corpus-assisted intelligent English teaching model through AI technology. Part of the reading blocks in English from previous universities is text-centered and text-based. The literature adopts the DDL (data definition language) model such that teachers can break through the limitations of textbooks when they are on an entity teaching task. Literature first analyzes the meaning expressed in books and then searches for the core words of the text based on artificial intelligence technology. This method can search a large number of real corpora and provide a wide range of reading resources for students. At the same time, university teachers can also construct different teaching activities from the corpus structure, which makes it more convenient to carry out student-centered task-based and inquiry teaching activities, and better exercise students' critical thinking, cross-cultural communication ability, as well as innovative thinking. This model breaks through the most traditional "classroom + textbook" teaching situation in the past, achieves student-centered task-based exploratory teaching, nurtures new interdisciplinary engineering talents deficient in new era emerging industries and new economies with new era technology, and promotes the development and progress of college English teachers' teaching to a certain extent.

2. Related Work

2.1. AI and Education. AI has a history of more than 60 years since the Dartmouth conference put forward the concept of AI and became a discipline in 1956. AI and education is a cutting-edge interdisciplinary science involving computer science, information science, education, psychology, linguistics, neuroscience, and philosophy [12]. At present, the primary task of the development of artificial intelligence technology is to develop an intelligent information processing theory. From the beginning to the end, artificial intelligence technology has been aimed at building a computing system with human intelligent behavior. AI focuses more on the use of artificial methods and electronic technology to simulate and expand human intelligence, to achieve machine intelligence to a certain extent. Since the twenty-first century, AI technologies have breached many challenging intractable problems by combining big data processing through algorithms and deep learning, such as natural language processing, perception, moving and manipulating objects, reasoning, speech recognition, and image recognition [13, 14]. As one of the core technologies that drive the progress of modern society, AI is widely applied to agriculture, industry, medical care, and other areas, and various industries are actively using AI to crack industry problems and explore new directions and channels for industry development, and education is no exception.

We deeply study the current trend and possibility of the combination of college English and AI technology in teaching reform. First, from the perspective of English teachers, we have a deep understanding of the combination and research direction of AI and education at home and abroad.

2.2. College English Literature Classroom Teaching Model. Teaching methods and modes are the key factors that determine the effectiveness of teaching and learning; they are the structural framework that incorporates the teaching content. At present, China's College English teaching generally adopts multimedia equipment to assist classroom teaching tasks. However, this kind of classroom teaching method only helps to improve students' English listening, and students' deep understanding of the content of the textbook is not good. The current teaching mode should be combined with the four training goals of "listening, speaking, reading, and writing" in modern college English teaching. This also has considerable limitations, which usually show that the main body of classroom teaching is the teacher. This limitation makes teachers not only responsible for teaching but also responsible for designing the development and final evaluation of English teaching activities. Affected by the enrollment system of colleges and universities in China, there are a large number of college students and too large classes at present. Generally, it is difficult for teachers to get familiar with the actual situation of each student in a short time. Everyone's language ability practice takes time to accumulate, which leads to teachers' lack of objective understanding and evaluation of each student's actual learning situation at the English level, which will eventually reduce the overall quality of English teaching [15]..

With the rapid development of AI in today's era, AI technology has been integrated into college English in educational reform. Therefore, the reasonable establishment of an intelligent classroom teaching system can deepen students' understanding and change the role of teachers. It can better express the emotion carried by English words and phrases in English literature class. This enables each student to quickly understand the main idea of each work in a more complex context, master the key points of English learning, and help students improve their basic reading ability and deep English subject quality. Therefore, it is worth thinking about how to realize AI technology.

3. Scheme or Model Design

The proposed model for analyzing the effect of reforming English literature classroom teaching on the theme of environmental protection in colleges and universities is shown in Figure 1. Firstly, we input the effect analysis index data, and the effect analysis index mainly consists of six aspects: teaching attitude, teaching methods, reform program, reformed teaching content, classroom organization, and teaching methods; then, we analyze the index data layer by layer using rank sum operation and hierarchical analysis method. Finally, we design the effect analysis model of English literature classroom teaching reform on the theme of environmental protection in colleges and universities given BP neural network, and by analyzing the data layer by layer, we establish three hidden layer neurons to fit the data and get the final effect analysis prediction results.

3.1. Rank Sum Operation. The rank sum operation is a method that uses the characteristic that rank can quantitatively analyze qualitative problems and synthesizes the ranking of all judges for the importance of all indicators, which can finally determine the weight of the indicator system conveniently and effectively. Several indicators were set, and different categories of people (teachers, classmates, etc.) were called to rate the reform of English literature classroom teaching on the topic of environmental protection. The importance serial number given by each expert is the expert's rank, and the rank sum is obtained by counting all the experts' ratings of the indicators, and the rank sum weight is determined as shown in the following equation:

$$w_i = \frac{2[s(1+m) - A_i]}{ms(1+m)}. \tag{1}$$

Among them, m is the number of indicators, s is the number of experts, A_i is the ranking sum of the i-th indicator by experts, and w_i is the weight of the i-th indicator.

In this paper, we use x^2 to test whether the experts are consistent concerning the weights of the indicators, and the conformance test passes. Finally, the effect of teaching reform is analyzed. If the conformance test fails, you need to consult the expert again for a second calibration. The calculation of the conformance test is shown in the following equation:

$$x^2 = \frac{m(s-1)S}{(12)^{-1} m^2 (s^3 - s)}, \tag{2}$$

Among them, $S = (s_1^2 + s_2^2 + \cdots + s_n^2) - ((s_1 + s_2 + \cdots + s_n)/n)$.

3.2. Analytic Hierarchy Process. Analytic hierarchy process (AHP) refers to the process of complex and multicriteria decision-making problems as a system [16], decomposes the goals of solving the problem to obtain multiple small goals, and then decomposes the small goals into different subgoals at different levels. In the fuzzy quantitative method based on qualitative indicators, we calculate the hierarchical individual ranking and total ranking, and then calculate in sequence: According to the analytic hierarchy process, we decide the overall goal, sub-goals at all levels, evaluation criteria at all levels, and the order of the final specific plan. A relatively large decision-making problem is subdivided into different small hierarchical structures, and then, with the help of the eigenvector obtained by solving the judgment matrix, the weight of each level element relative to the upper-level element is calculated. Finally, the weighted summation algorithm is used to recursively calculate the final weight of each small-level scheme to the overall goal and determine the sub-scheme with the largest final weight result as the optimal scheme. The scheme with the highest weight is the best. The analytic hierarchy process is more suitable for decision-making problems where evaluation indicators are layered and staggered, and it is difficult to quantitatively describe the target value [17].

The analytic hierarchy process for the sake of resolving the objectives to be achieved into several determines the constituent factors according to the nature of the research problem, hierarchizes the factors according to their interrelationship, forms a hierarchical model and analyzes them layer by layer, and finally determines the total weight of

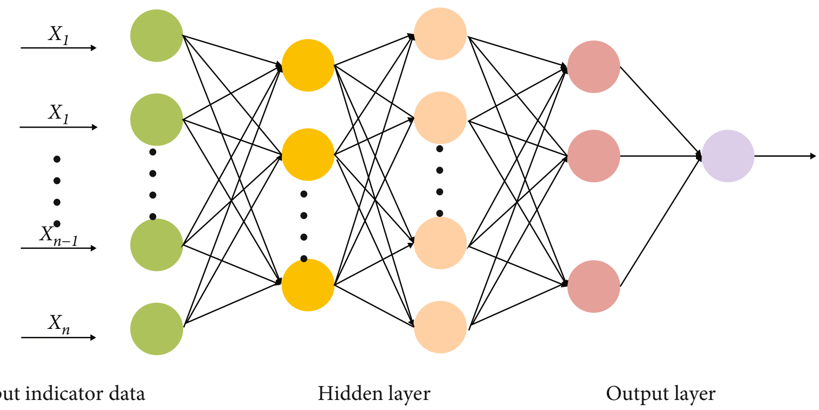

Figure 1: A model for analyzing the effect of reforming English literature classroom teaching on the theme of environmental protection in colleges and universities.

the indicator layer for the objective layer. First, a judgment matrix needs to be established, and the calculation formula is established as shown in the following equation:

$$J = \begin{Bmatrix} a_1 = 1 & a_2 = \dfrac{w_1}{w_2} & \cdots & a_{1n} = \dfrac{w_1}{w_n} \\ a_2 = \dfrac{w_2}{w_1} & a_2 = 1 & \cdots & a_{2n} = \dfrac{w_2}{w_n} \\ . & . & & . \\ . & . & & . \\ a_{n1} = \dfrac{w_n}{w_1} & a_{n2} = \dfrac{w_n}{w_2} & \cdots & a_n = 1 \end{Bmatrix}. \quad (3)$$

Based on the relevant data, we establish the judgment matrix shown in Equation (3) to choose a more stable 9 scalar assignment method; the assignment standard of this method is shown in Table 1.

Firstly, a judgment matrix is established for each expert, then a weighted calculation is performed to solve the judgment matrix of the weights, and finally, the weights $w = \{ w_1, w_2, \cdots, w_n \}$ of each layer of indicators are calculated separately, and the sum method is calculated as shown in Equation (4), and the root method is calculated as shown in Equation (5):

$$w_i = \frac{1}{n} \sum_{j=1}^{n} \frac{a_j}{\sum_{i=1}^{n} a_j}, \quad (4)$$

$$w_i = \left(\prod_{j=1}^{n} a_j \right)^{1/n} / \sum_{i=1}^{n} \left(\prod_{j=1}^{n} a_j \right)^{1/n}. \quad (5)$$

3.3. BP Neural Network Modeling. Artificial neural networks are nonlinear, input and output mapping, flexible information processing systems composed of a great number of interconnected units that mimic neurons in the brain [18]. According to the differences in network structure and learning algorithms, artificial neural networks are classified into five categories: single-layer forward networks, multilayer forward networks, feedback networks, random neural networks, and competitive neural networks. Single-layer neural networks can only solve linear classification problems, multilayer neural networks can be used for nonlinear classification questions, and BP neural networks are the result of multilayer neural network learning algorithm training form [19, 20]. The BP network includes the forward transmission, the reverse transmission of the information, and the reverse transmission of the calculation error. It was a multilayer feed-forward network trained by the reverse transmission of errors. A typical BP network has three layers: the input, hidden, and output layers.

The basic operation idea of the BP neural network is as follows: apiece nerve cell of the input layer was in charge of receiving the designated data samples and transferring them to each nerve cell of the hidden layer, and the neuron structure is demonstrated in Figure 2; the hidden layer carries out internal information processing and transformation according to the setting, which can be constructed as a single hidden node or multiple hidden layer structure, and the last hidden node can realize the transmission to the neural cells of the output network layer; after deeper information processing, the process of forwarding propagation is ended once, and finally, the output layer outputs the result. However, when the prediction result output by the network structure does not meet the error rate preset by the overall model, it will enter the error backpropagation stage. At this time, the error is back propagated to the implied layer and the input layer by using the improved algorithm of the BP neural network-gradient descent method to continuously correct the weight and threshold value of each layer. The two processes of forwarding propagation [21] and error back propagation [22, 23] are repeatedly alternated until convergence is reached; then, it is during the process of the BP intelligence network learning and training. The forward propagation calculation process is shown in Equations (6)–(7), and Equations (10)–(12) show the error backpropagation calculation process:

$$z = w_0 x_0 + w_1 x_1 + \cdots + w_n x_n, \quad (6)$$

Table 1: Scale assignment criteria.

Scale (w_i/w_j)	Meaning
1	Indicates the influence factor v_i is equally important as compared to v_j, v_i is equally important as compared to v_j
3	Indicates that the influence factor v_i is slightly more important than v_j, v_i than v_j
5	Indicates that the influence factor v_i is significantly more important than v_j
7	Indicates that the influence factor v_i is significantly more important than v_j
9	Indicates that the influence factor v_i is significantly more important than v_j
2, 4, 6, 8	The median

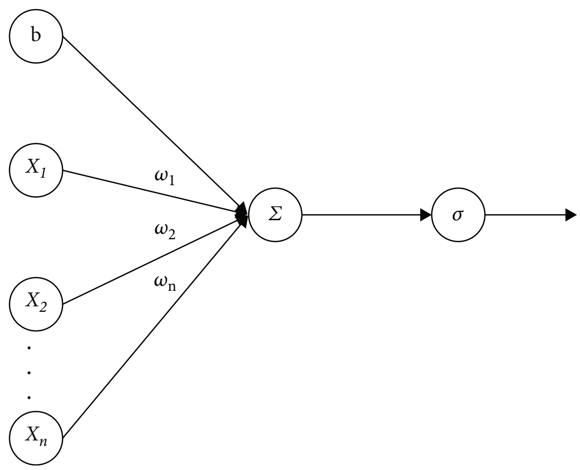

Figure 2: Neuronal structure.

$$y = f\sum_{i=0}^{n} w_i x_i. \tag{7}$$

It can be expressed in vector form, as shown in the following equations:

$$z = \sum_{i=0}^{n} w_i x_i = w^T x, \tag{8}$$

$$y = f\left(w^T x\right), \tag{9}$$

$$\Delta W = -\eta E^{'}, \tag{10}$$

$$\frac{\delta E}{\delta W} = \frac{\delta(1/2)\left[t - f\left(w^T x\right)\right]^2}{\delta w}, \tag{11}$$

$$\Delta W = -\eta E^{'} = \eta(t-y)f^{'}\left(w^T x\right)x = \eta\delta x, \tag{12}$$

where$\delta = (t-y)f^{'}(w^T x)$.

BP neural network is a supervised learning [24]. This paper adopts python as the programming language and uses the PyTorch deep learning framework developed by Facebook to establish BP neural network fitting scores to realize the analysis of the effect of English literature classroom teaching reform under the theme of environmental protection in universities.

The network model for analyzing the effect of the English literature classroom teaching reform we proposed is shown in Figure 1. First, the rank sum operation and hierarchical analysis are performed on the survey scores to verify the consistency of the index weights; then, the qualified data are used as the input of the analysis model. The amount of the input layer's node depended on the size of the input measurement. We collect data by issuing questionnaires. A total of 300 copies were released, and 247 copies were effectively recovered. Through data processing, 200 of them are finally used. The scoring data are shown in Table 2. Finally, a BP neural network was used to model and analyze the effect of English literature classroom teaching reform for the theme of environmental protection in most colleges and universities, and the output layer node was set to 1 because of the final teaching reform affect analysis results.

For the survey about classroom reform, the statistics were visualized and analyzed as shown in Figure 3. Each survey indicator was formed into a dotted line graph to observe its fluctuation trend and analyze the fluctuation of the indicator under the reform of English literature classroom teaching on the theme of environmental protection in universities.

Neural networks generally contain one or more hidden layer nodes, and several studies have shown that a single hidden layer neural network can achieve nonlinear mapping by increasing the number of neurons; for more complex data, the number of hidden layers can be increased to linear partitioning and can be better performed by abstracting the features of input data into another dimension space and displaying its more abstract features. Therefore, when designing the model structure, this paper sets the number of hidden layers to 1, 2, and 3 for experiments and finally takes the group with the best fitting effect as the number of hidden layers. The number of neuron nodes in the hidden layer also has a significant impact on the final result of the whole network model, and the number of node neurons belongs to the empirical value. If the empirical value is too large, the model training time will be too long, and too small will lead to poor model results. In this paper, the number of hidden layer nodes is obtained by the empirical value calculation formula; the specific calculation is shown in the following equation:

$$H_n = \sqrt{m + l} + a \quad 1 \le a \le 10. \tag{13}$$

Among them, H_n is the number of neuron cells in the hidden layer, and m and l are the number of neurons in the input and output layers.

Table 2: Survey on the effect of reforming English literature teaching on the theme of environmental protection in universities.

Investigator number	Teaching attitude	Teaching tools	Reform program	Reformed teaching content	Classroom organization	Reform reasonableness
1	92.5	87.6	98	97	82	87.3
2	91	89.5	92	90.9	85.4	85
3	94	82.9	88.7	96.3	90.5	89
…	…	…	…	…	…	…
198	87.2	91.3	82	85.7	91.6	82.1
199	93.5	86	91.4	90	97	91
200	89	96	99	79	70.5	92.4

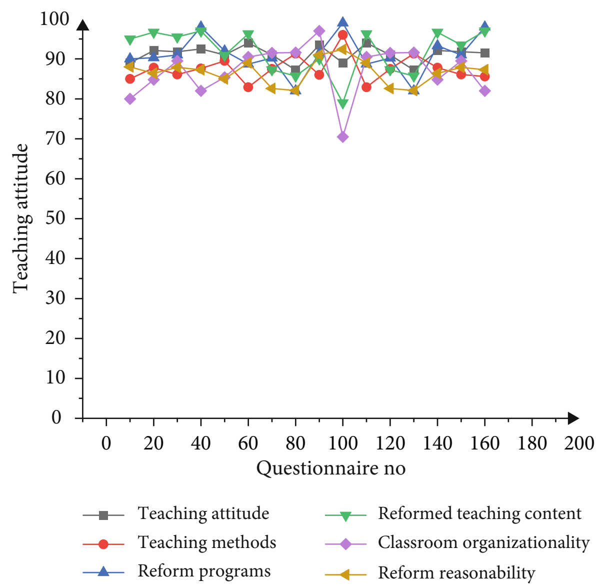

Figure 3: Trend of fluctuation of survey results.

Table 3: Experimental software environment.

Environment	Description
Python	Development languages
PyTorch1.7	Deep learning framework
Nvidia CUDA 10.1	Deep learning acceleration library
CuDNN-V7.6	Deep learning acceleration library

4. Experimental Analysis

4.1. Experimental Environment. For sake of better validating our suggested model of teaching effect analysis of English literature classroom reform on the theme of environmental protection in colleges and universities, multiple data obtained through the survey were saved as self-built datasets after data preprocessing. Table 3 shows the software environment used for model training in this paper, and Table 4 lists some hardware experimental environments.

4.2. Model Learning Process. The model structure based on BP neural network has three layers, which have the characteristics of multiple inputs, one output, and multiple neuron nodes in the hidden layer. In general, the gradient descent algorithm adjusts and modifies the connection weight of the network through the backpropagation of the output error at each step of the network structure; after multiple back-propagation derivations, the error is minimized. The whole learning process is shown in Figure 4.

Table 4: Experimental hardware environment.

Environment	Description
Windows 10	Operating system
32G	CPU memory size
Nvidia Tesla T4	Deep learning dedicated graphics card
1 T	SSD
Intel Core i7 @2.30 Hz	CPU

Firstly, the parameters are initialized for the analysis model of the effect of reforming English literature classroom teaching on the theme of environmental protection in colleges and universities, and the basic model structure is established. Then, a sample of the survey data is entered into the model, the number of hidden layer neuronal nodes in the network is calculated from the input data, and the final fitted data is exported through the cooperation of multiple neurons. The global sum of squares error of the model structure is calculated for the obtained response value, and the error is used to determine whether the model prediction is completed. If the error is large, continue to calculate the inverse error, recalculate the number of nodes in the hidden layer, output the response value, and recalculate the global sum of squares error of the model. When the minimum error tends to be flat and no longer changes, the weight information is the final model weight.

4.3. Experimental Results Analysis. The loss results of the model training process in this paper are shown in Figure 5. The model loss calculation method adopts the mean square error function, and the calculation result is shown in Equation (14). It can be seen from the figure that the analysis model of environmental protection teaching reform in College English literature classrooms is close to fitting after

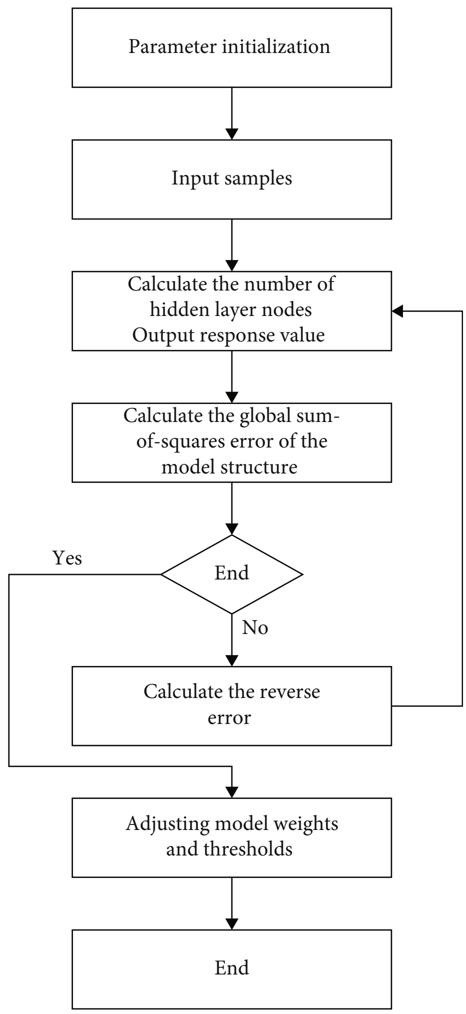

FIGURE 4: Analysis of model structure learning process.

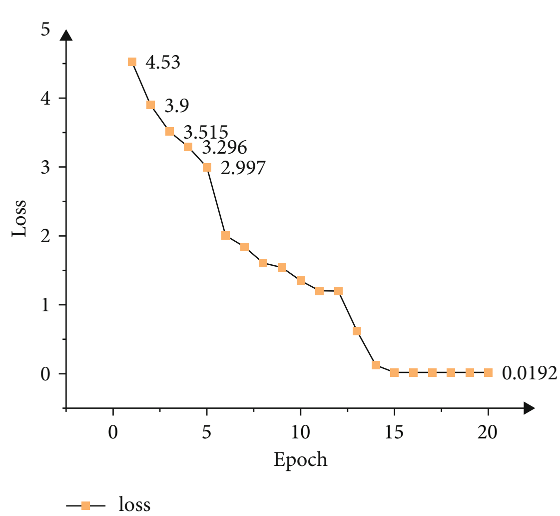

FIGURE 5: Loss curve.

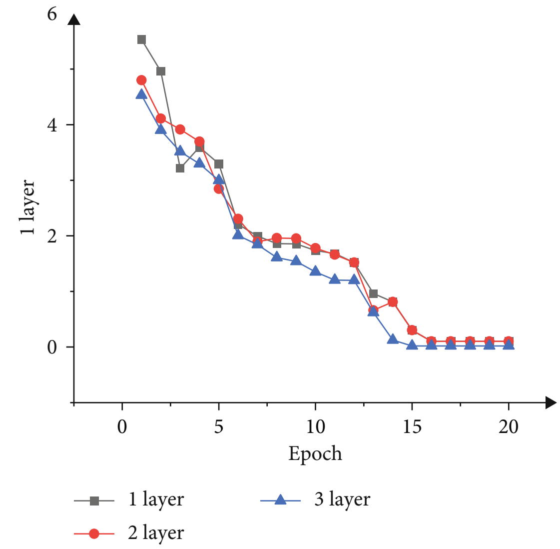

FIGURE 6: Different hidden layer loss curves.

about 15 rounds of training, and the final simulation error is about 0.0192.

$$MSE\left(y, y^{'}\right) = \frac{\sum_{i=1}^{n} \left(y - y^{'}\right)^2}{n}. \tag{14}$$

Different model structures also have a great impact on the final analysis effect of the model. We not only need to train data to get the optimal model based on data but also get the current optimal analysis model by analyzing the network model under different structures and parameters.

BP neural network can contain one or more hidden layers, and related research shows that by increasing the number of neurons, the single-layer BP network can map all continuous functions. Therefore, in this paper, three different hidden layer neural network structures are designed to fit the model, and the training loss of a different number of hidden layers is shown in Figure 6.

The final model was tested and analyzed for three times, and the final analysis on the effect of classroom teaching reform of English literature on the theme of environmental protection in colleges and universities was obtained. The results are shown in Table 5. Using the trained model weight parameters, we made three predictions in the three-layer hidden layer model, and the results are shown in the first three rows in the table. We averaged all the final test results, as shown in the last row of the table. According to the data shown in the table, we can see that the current reform of English literature teaching has brought remarkable results to AI technology, and the students and teachers are both more agreeable to the teaching model and have higher ratings. Figure 7 shows the results of model analysis of the effect of English literature teaching reform with the theme of environmental protection in colleges and universities.

Table 5: Results of the model analysis of the effect of reforming English literature teaching on the theme of environmental protection in universities.

Test NO	Teaching attitude	Teaching methods	Reform programs	Reformed teaching content	Classroom organizational	Reform reasonability
1	89	85	90	95	80	88
2	92.1	87.8	90.3	96.7	84.8	86.4
3	91.8	86.1	91	95.5	89.5	87.9
Average	90.9	86.3	90.4	95.7	84.8	87.4

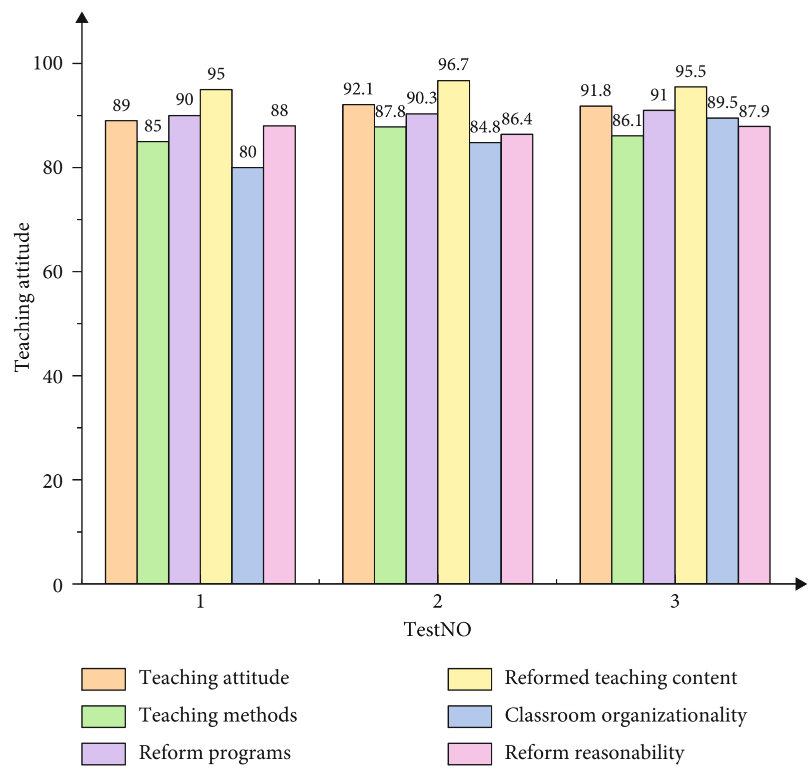

Figure 7: Visualization of model analysis results.

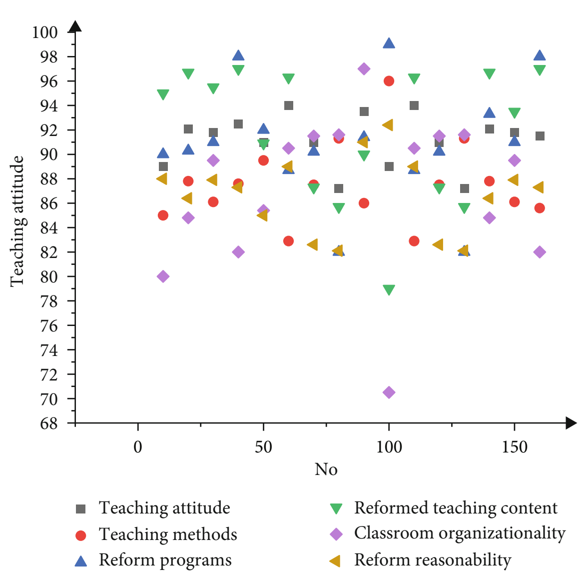

Figure 8: Point cloud visualization of survey results.

From the results of the visualization, the results of multiple tests are stable, indicating that the model is in a stable state. For each different index, it can be roughly seen that the reform of combining AI technology with English literature classroom teaching on environmental protection topics in colleges and universities has achieved good results and the model analysis scores are all above 80 points. The point cloud visualization of the results of the reformed teaching content in the classroom of English literature theme of environmental protection in colleges and universities with AI technology in Table 2 is shown in Figure 8, which shows that the reformed teaching content has a relatively high score, mostly given 90 or more, while the reform reasonability is in the reformed teaching content item is relatively high, mostly given 90 or above, while the reform reasonability item is in the middle, mostly around 85. This is also consistent with the predictions of the model presented in this paper.

5. Conclusions

Because of the teaching effect analysis of the classroom teaching reform of English literature on the theme of environmental protection in colleges and universities, this paper uses the analytic hierarchy process and BP neural network to propose a classroom teaching evaluation model and applies it to the field of analyzing the effect of the current university teaching reform. First, set up several effect analysis indicators, and establish the analysis and investigation database of teaching reform through campus investigation. Secondly, rank sum operation and analytic hierarchy process are used to preprocess the data based on expert scoring. However, when the prediction result output by the network structure does not meet the error rate preset by the overall model, the model will enter the back propagation stage again and recalculate the error rate and weight parameters. Through the survey data fitting model, the final analysis results of classroom teaching reform effect of English literature on environmental protection in colleges and universities based on AI technology are obtained.

The scores of the model based on the BP neural network under the six effect analysis indicators of teaching attitude, teaching tools, reform plan, reform teaching content, classroom organization, and reform rationality are 90.97, 86.3, 80.4, 95.7, 84.8, and 87.4, respectively. It can be seen from the results that the model can effectively analyze the situation of classroom reform and improve the time and accuracy of the current teaching reform analysis, which has a certain practical application value.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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Retraction

Retracted: The Construction of Civics in University English Courses in the New Media Environment

Journal of Environmental and Public Health

Received 8 August 2023; Accepted 8 August 2023; Published 9 August 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] X. Ding, "The Construction of Civics in University English Courses in the New Media Environment," *Journal of Environmental and Public Health*, vol. 2022, Article ID 7737504, 9 pages, 2022.

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Research Article

The Construction of Civics in University English Courses in the New Media Environment

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The traditional education system has obvious limitations, relying on civics curriculum to cultivate and spread the national spirit. By analyzing the characteristics and goals of English courses under the new media, actively forming a large-scale ideological and political education model, and encouraging the innovation and optimization of English courses, new concepts of three-dimensional development can be proposed from the microlevel, and the coverage of ideological and political education can be expanded. Intelligent information technology can realize the coordinated development and collaborative application of English curriculum and ideological and political education. The combination of implicit education and explicit education and the combination of curriculum thinking and thinking curriculum can truly build the higher education model required by the development of the times.

1. Introduction

The development of curriculum thinking education has been developed for many years, but the phenomenon of silo of thinking education still exists. The integration of English language education with the Civic Education can help to build a comprehensive education system, and the relationship between the implicit and explicit education of Civic Education can be correctly handled, which can build a three-dimensional education pattern [1]. Students have more opportunities to be exposed to diversified cultures, and the integration of Civic Education can solve the phenomenon of cultural aphasia in English education, expand educational resources, realize the reshaping of values, enhance the relevance of Civic Education and English education, and build a nurturing system and nurturing mechanism with Chinese characteristics [2, 3]. New media break the limitation of time and space, realize multimodal information dissemination such as language, text, sound, and image, break the real and virtual boundaries, and its personalized features and community characteristics allow people to create personalized learning and life styles, freely join communities of interest, and form their own learning communities and life communities [4].

New media provides powerful technical support for English teaching, teachers can use communication media to change the traditional teacher-student single interaction mode, which is mainly taught by teachers, to a multidimensional interaction mode, which is mainly for students' independent learning, adopt online and offline hybrid teaching, use multimedia information to enrich classroom teaching content, and improve students' new media literacy [5]. However, while forming a team of teachers to cope with the pressure of lesson preparation, college English teachers should avoid overusing new media, issuing excessive learning tasks to students, and avoiding the entertainment of college English classes. The main features of college English course Civics under the new media perspective are: Concealment Curriculum Civics and Civics courses have both similarities and differences. While the Civic Studies curriculum promotes students to establish correct values and moral concepts through diversified means, Curriculum Civic Studies highlight the nurturing function of the diversified curriculum through indirect forms, using the professional curriculum as a carrier, and therefore has a certain concealment [6].

Most of the teaching modes are carried out in an explicit way, but the curriculum thinking and politics will highlight the nurturing function in an implicit way, and the integration of thinking will also make the implicit thinking and politics education throughout the whole process of education to achieve the synergistic development of English curriculum and curriculum thinking and politics [7]. The combination of implicit education and explicit education, and the combination of curriculum thinking and thinking courses, can truly build the higher education model required by the development of the times.

2. Related Work

Curriculum Civics was first proposed and practiced in Shanghai universities, and it has been recognized by most universities and has become a popular topic, as in Figure 1. Many experts are engaged in the research in various professional courses, striving to comprehensively master the scientific content, grasp the theoretical basis, and systematically plan the ideological and political path of curriculum implementation, which is significant.

Since 2018, the research papers about college English and Curriculum Civics have increased significantly, as shown in Figure 2, and more and more ideological and political educators as well as college English teachers have published articles in journals, putting forward many constructive opinions on the reform of Curriculum Civics teaching of college English [11].

In today's deeply developed economic globalization, foreign languages are an important tool for young students to understand the world. The domestic research on university English courses under the perspective of curriculum thinking politics are: first, the construction of foreign language curriculum thinking politics is discussed from the macro aspect. In Reference [12], it argues that it is necessary to realize the paradigm shift from extroverted intercultural education to introspective moral education, from a one-sided focus on humanities education to both humanities and science education, and from the cultivation of cultural quality to the cultivation of discernment and communication skills, so as to contribute to the goal of comprehensive development of human education. In Reference [13], it proposed that an accurate understanding of the scientific connotation of "moral education" is the primary prerequisite for the construction of foreign language curriculum thinking and politics, and explained the specific implementation process and methods of foreign language curriculum thinking and politics from five aspects: moral, academic, technical, artistic, and benevolent. In Reference [14], it discusses the construction of foreign language "curriculum thinking politics" in terms of connotation, principles and, construction paths. Secondly, the construction of the English language course in the university is studied from the aspect of teaching materials and teaching contents. In Reference [15], it considers that the construction of teaching materials and contents is the carrier and

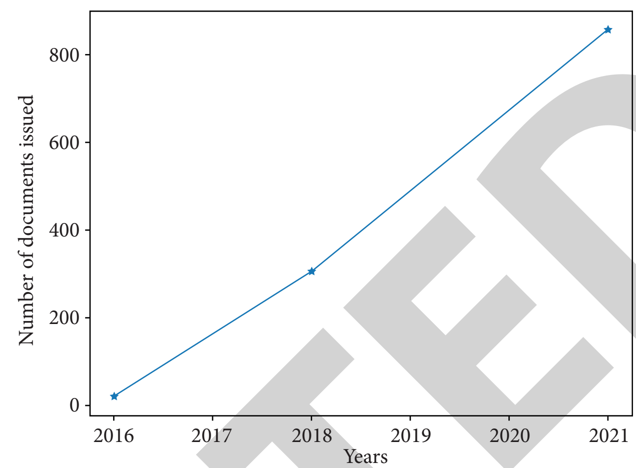

Figure 1: Overall trend analysis of the volume of papers published in curriculum civics.

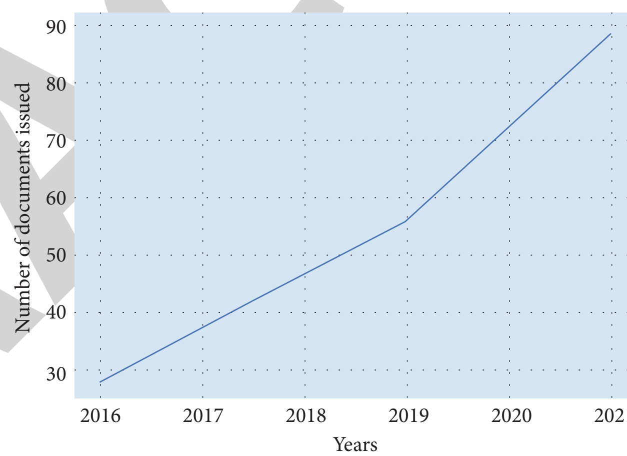

Figure 2: Analysis of the overall trend of the amount of civic and political articles issued in the course of "College English."

important prerequisite for the teaching of foreign language courses, and discusses the principles, importance and strategies of the construction of teaching materials and contents. The concept and characteristics of the revision of the "New Target College English" comprehensive course are discussed meeting the needs of "establishing moral education." In Reference [16], it proposes a discourse analysis based on the analysis of English textbooks from the perspective of thinking about politics, so as to explore the political components in nonpolitical discourse.

3. The Construction and Evaluation of Civic Politics in University English Courses

Education is a national development plan for a hundred years. As a talent training base, universities should actively take up the responsibility of nurturing people, making it their responsibility to train socialist successors, highlighting the Party's overall leadership of the school, guiding students to develop ideals and beliefs in their formative years, and

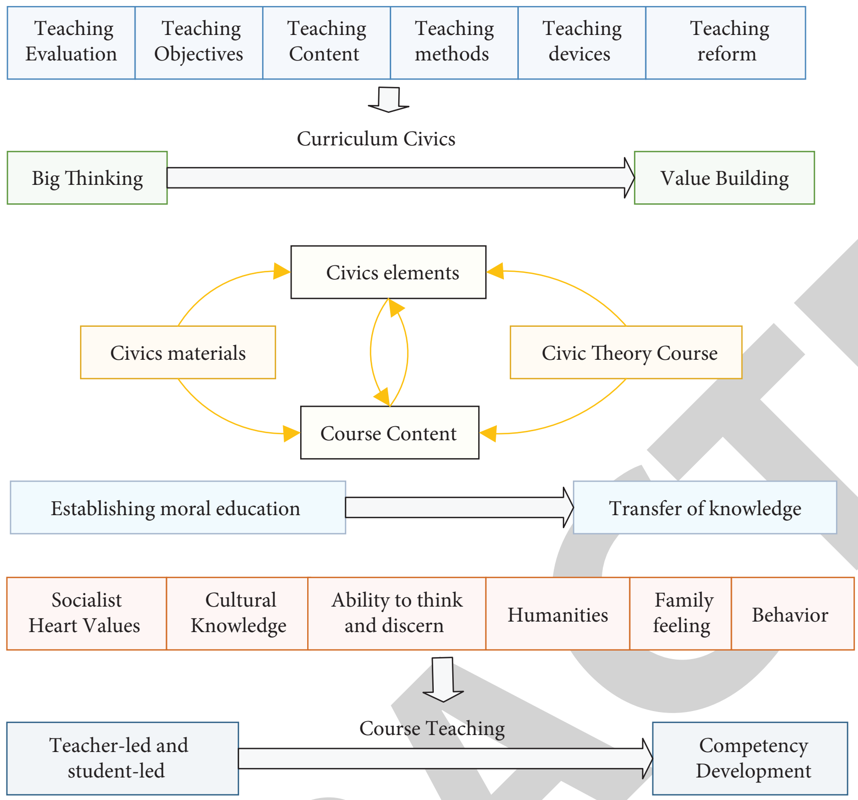

Figure 3: The goal of the construction of university English courses in thinking and politics.

enhancing their sense of patriotism and commitment. English is a language and communication tool, using language education as a carrier to strengthen ideological education, which helps college students to develop comprehensively. As China is in a critical period of reform, the education model and education philosophy are being transformed and optimized.

The construction of university English courses will form a synergistic effect, spiral upward, and play the overall effect of "$1 + 1 > 2$," and integrate the core socialist values, the spirit of thinking and discernment, national sentiment, and behavioral habits into the teaching process course in a subtle form, thus forming the design idea of university English courses' thinking and politics (as Figure 3), and achieving the construction goal of value shaping, knowledge transfer, and ability cultivation.

In the practice of college English course Civics, the traditional single instrumental evaluation (mainly examining students' English listening, reading, writing, and translating abilities) cannot reflect the Civics effect of teaching, so it is necessary to modify the course evaluation criteria and appropriately increase the proportion of process assessment, and the methods are shown in Table 1.

The textbooks are the main carriers of teaching contents. At present, the textbooks used for teaching English in domestic universities are mainly written by native English authors, which place teachers and students in foreign cultural contexts and discourse systems, and ideology is often hidden in the cultural contexts and discourse systems. In such a situation, the construction of the ideology of the curriculum requires "analysis, selection and addition" of the selected textbooks, and adherence to the principles of "student development as the center, subject attributes as the guide, and school characteristics as the basis" [17]. The principle of "student development as the center, subject attributes as the guide, and school characteristics as the basis."

"Student development-centered" means that the teaching content should be relevant to the real social context in which students live, promote student engagement, pay attention to learning effects and feedback, and focus on Chinese students' core competencies and values, as shown in Figure 4. Therefore, the content of curriculum Civics teaching should be more based on the cultural background of Chinese English learners and reflect traditional Chinese culture and the concept of scientific development in the new era.

"Guided by the attributes of the discipline" means that the construction of curriculum thinking in university English courses needs to respect and demonstrate the characteristics of the English discipline. English as a language is itself the content, way, and goal of university English teaching. And language is the carrier of culture and consciousness, which itself has value orientation.

"Based on the characteristics of the school" means the construction of curriculum thinking and political content according to local development goals, school type, and positioning, combined with the school's school characteristics. Our university is a business undergraduate institution in Guizhou, training students mainly in economics and

Table 1: Evaluation methods of "College English" courses.

	Appraisal method	Assessment content	Percentage (%)
Process assessment	Preclass group reading circles	Individual pre-reading, group reading circle task preparation, reading and thinking on the topic of Civics, asking questions	10
	In-class group reading circle task sharing	Group members share their tasks in the reading circle, discuss problems, and solve them	5
	Stage tests	Unit-related English language applications such as listening, reading, writing, and translating	20
	Others	Attendance, class participation, etc	5
Summative assessment	Final exam	Knowledge of language, reading comprehension, and thinking skills learned during the semester	60

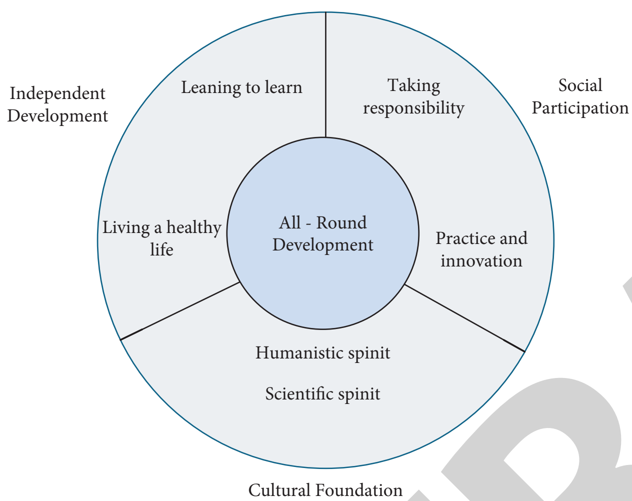

Figure 4: Core competencies and values for students in China.

management, but also including engineering and art majors; so our university English course Civics teaching can increase the Civics content of business ethics, management ethics, scientific spirit, aesthetic consciousness and so on.

The Civics teaching content of our university English courses includes the following modules: national policies, provincial conditions, Chinese culture, professional ethics and law, mental health, labor, and aesthetic education. Table 2 shows the content of the English course in our university.

4. Case Study

This study mainly adopts the interview method to conduct structured interviews with 27 teachers who teach English courses in the researcher's school. The interview questions focused on the following three dimensions: the problems and suggestions in the construction of "Course Civics." Among the interviewees, 78% were lecturers or above, 67% were teachers with more than 10 years of teaching experience, and 52% were communist party members, as in Table 3 and Figure 5.

4.1. The Current Situation of the Construction of Curriculum Thinking Politics. This section explores the respondents' awareness and implementation of the course philosophy and politics. The data show that all 27 respondents have received training related to the course thinking and politics at school level or above, and believe that all course teachers should take the responsibility of teaching students thinking and politics, and approve of the necessity of integrating thinking and politics education. 19 teachers said they would often incorporate the ideological education in the teaching of college English, and 8 teachers said they would only occasionally reflect the ideological elements consciously. As to which part of the teaching process should be integrated with political education, most of the teachers thought it should be integrated with the teaching content organically. As for the suitable elements of thinking and politics in college English teaching, the teachers expressed their views on world view, life view, political view, legal view, moral view, and excellent cultural education. Meanwhile, in the teaching methods, teachers mainly mentioned real case sharing and discussion-based teaching.

4.2. The Role of New Media on the Construction of Curriculum Thinking and Politics. When respondents were asked about the role of "new media + education" in the construction of English language courses, most of them said they had not considered this issue, but some of them said that the advantages of new media can expand the breadth and depth of the construction of courses. At the same time, it helps to innovate the means and forms of politics education, which can break the limitations of traditional classroom.

The subjects of this study: (a) 700 first-year undergraduate students of a polytechnic university who were not majoring in English. The university has stratified the teaching of English according to the first-year students' entrance English test scores. The subjects of this study covered students of different levels and majors; (b) There were 22 university public English teachers at this university, including 8 associate professors and 14 lecturers.

An online questionnaire was distributed to non-English first-year undergraduates in our university, and 700 questionnaires were received. The questionnaire consisted of 12 multiple-choice questions. Interviews were conducted with randomly selected respondents from our university English teachers. The interviewers were in teams of two, one asking questions and one taking notes. Each interview lasted about 10 minutes and was conducted in a combination of offline

Table 2: Civic and political content modules of university English courses.

Module	Main content	Parenting goals
Province	Red story of Guizhou, English promotion of Guizhou landscape, etc.	Cultivate a sense of home and country, know and contribute to their hometown
Chinese culture	Excellent Chinese traditional culture	Passing on the Chinese culture and enhancing cultural confidence
Professional ethics and law	Civil code, business ethics, management ethics, science competitions, independent thinking skills, etc.	Cultivate professional character and behavioral habits of law-abiding, dedicated to work, honest and trustworthy, and fair
Mental health	Mental health knowledge, stress relief techniques, etc.	Improving psychological quality and promoting sound personality development
Labor education and aesthetic education	English social practice, Chinese aesthetic spirit, etc.	Promote the spirit of labor, enhance aesthetic quality, cultivate sentiment, and warm the soul

Table 3: Basic information of the interviewees.

Gender	Male (7 persons)	Female (20 persons)	
Academic qualifications	Bachelor's degree (1 person)	Master's degree (23 persons)	Doctoral students (3 persons)
Title	Assistant professor (6 persons) Lecturer (10 persons)	Associate professor (10 persons)	Professor (1 person)
Communist party member	Yes (14 persons)	No (13 persons)	

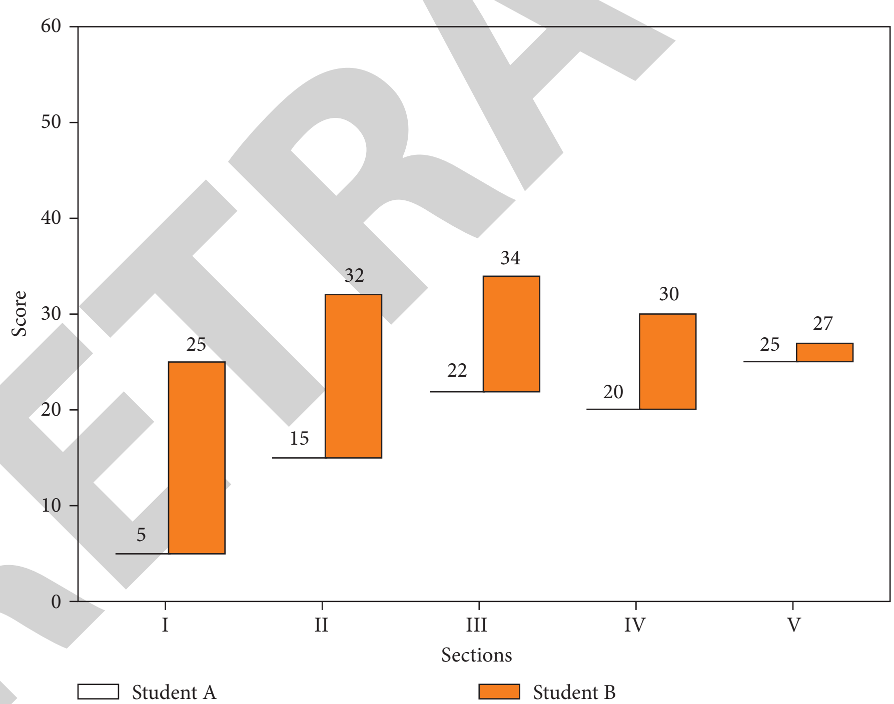

Figure 5: Students' scores in different sections.

and online formats. The actual number of interviewees was 22, and the content of the interviews was mainly about what teaching needs there are when integrating Civic education into university English teaching.

4.2.1. About the Civic Political Element in College English Courses

(1) Course Content. In order to better serve students' professional characteristics, there are two main branches of college English courses in the researcher's institution: college English for arts and sports and college English for nonarts and sports, and this study mainly focuses on the course of college English for arts and sports. University English for arts and sports consists of four sub-courses: University English 1 and University English 2 are required courses, and University English 3 (English exam training) and University English 4 (Chinese cultural English course) are optional courses. In the first semester, there are 56 class hours, and

Table 4: Civic and political elements in book 1 of the comprehensive course of university English for new beginnings.

Unit	Content	Civic elements
Unit 1	Text A: your first night at school Text B: never too old to live your dream Cultural focus confucius: the sage of sages	Never forget the original heart Stick to your dreams, never give up Chinese culture: Confucius
Unit 2	Text A: the opera singer Text B: play a violin with three strings Cultural focus: high mountain and flowing stream	Self-identification Hard work Chinese culture: Friendship, music
Unit 3	Text A: fashion forest Text B: learn to live with curly hair Cultural focus: oipao-a traditional Chinese dress	Dialectical thinking Self-confidence Chinese culture: clothing
Unit 4	Text A: dance with dad Text B: dance lessons Cultural focus: the dragon dance	Affection Affection Chinese culture: Customs
Unit 5	Text A: if the dream is big enough Text B: Michael Jordan's farewell letter to basketball Cultural focus: martial arts	Strive and never give up Strive, love Chinese culture: martial arts
Unit 6	Text A: techs best feature: the off switch Text B: online writing Cultural focus: painting	Dialectical thinking Technology, innovation Chinese culture: painting

the teaching contents are units 1, 2, 3, 4, 5, and 6 of the first book; in the second semester, there are 64 class hours, and the teaching contents are units 1, 3, 5, 6, and 7 of the second book and the English application ability test A level tutorials.

(2) Civic and Political Elements. This part analyzes the political elements and contents of New Beginnings College English Comprehensive Course, Volumes 1 and 2. Each unit of this textbook consists of three articles: Text A, Text B, and Cultural Focus, and the topics include university life, sports, culture, art, and family love. On the basis of language learning, according to the focus of each unit, members of the research team fully explored its ideological elements according to the goals of enhancing cultural confidence, cultivating patriotism, passing on the spirit of hard work, and establishing the awareness of dialectical materialism, as shown in Tables 4 and 5.

4.2.2. The Path of College English Curriculum Civics Construction. On the basis of establishing the goal of "thinking politics in courses" and analyzing the elements of thinking politics teaching, the researcher proposed the path of constructing thinking politics in university English courses in the context of new media, as shown in Table 6.

For example, when studying the article Unit 2 Cultural Focus: High Mountain and Flowing Stream in Book 1, the teacher combined the features of the article with "Chinese culture" and "friendship" and issued a preclass task: students worked in small groups to collect information about Two Springs Reflect the Moon, Ambush on All Sides, and the Chinese culture. Before the lesson, the teacher tapped into the two perspectives of "Chinese culture" and "friendship" and issued a preclass task: students worked in groups to collect information about Two Springs Reflect the Moon, Ambush on All Sides, High Mountain, and Flowing Stream according to the outline and streamed and uploaded their questions to the online discussion forum. In the lesson, students shared their results in small groups, and the teacher consolidated and summarized the information collected by students and answered their questions. Afterward, students were guided to retell the story through keyword prompts. After the lesson, students uploaded the audio and shared their stories of friendship on the online platform, while students assessed each other and the teacher uploaded related extension materials and wrote a reflection journal and evaluation.

4.2.3. Questionnaire Data and Analysis. Among the students who participated in the questionnaire, 52.16% were male students and 47.83% were female students. The purpose of the question was to investigate whether the students agreed with the necessity of integrating Civic Education into English education in college. It was found that 83.61% of the male students thought it was necessary to integrate Civic Education; 87.16% of the female students held the same opinion, as shown in Table 7.

The main purpose of the survey on students' English proficiency was to investigate whether the level of English proficiency affects students' attitudes toward integration into Civic Education. Among the students who participated in the questionnaire survey, 48.86% had passed the English IV exam for college students. Among the 357 students who did not take the Level 4 exam, 35.47% strongly agreed and 50.56% agreed with the idea, totaling 86.03%. The survey found that the level of students' English proficiency did not significantly affect their attitudes toward the integration of Civic Education, as shown in Table 8.

In this survey, 98% of the students agree that cultural communication is a two-way street, 97.72% of the students think they need to study Civic Education at the university

Table 5: Elements of civics in book 2 of the comprehensive course of university English for new beginnings.

Unit	Content	Civic elements
Unit 1	Text A: drums in space Text B: my father's music Cultural focus be there just to make up the number	Thinking differently Diligence Chinese culture: idiom stories
Unit 3	Text A: dont stop the music, I want to dance Text B: how I shamed the ballet world over "discrimination" against disabled ballerina Cultural focus: peacock dance of dai	Persistence, hard work Equality Chinese culture: dance
Unit 5	Text A: Walt Disney and Steve Jobs connection Text B: animation film frozen Cultural focus: hero is back	Innovation, stick to the original intention Break through stereotypes Chinese culture: animation
Unit 6	Text A: the last runner Text B: the true courage Cultural focus: dragon boat racing	Hard work Modesty Chinese culture: custom
Unit 7	Text A: Vincent Van Gogh: the starry night Text B: the artist of France Cultural focus: Chinese new year painting	Persistence Western art Chinese culture: art

Table 6: Paths for the construction of English language courses in the context of new media.

Before class	Online	Teachers Student	Refine the elements of Civics, publish preclass tasks, collect students' questions Work in groups to complete related tasks
During class	Offline	Teachers Student	Language + civics teaching is complementary and organic Discussion and sharing
After class	Online + offline	Teachers Student	Upload extension materials, write reflection journals, publish postlesson tasks, and evaluate Complete related tasks, share, and evaluate

Table 7: It is necessary to introduce civic education in college English teaching.

X/Y	Strongly agree	Agree	Don't necessarily	Disagree	Strongly disagree	Subtotal	Average score
Male	135 (36.47%)	173 (47.14%)	50 (13.87%)	8 (1.99%)	2 (0.57%)	368	4.19
Female	141 (41.79%)	153 (45.37%)	38 (11.34%)	4 (1.19%)	1 (0.32%)	337	4.29

Table 8: It is necessary to introduce civic education in university English teaching.

X/Y	Strongly agree	Agree	Don't necessarily	Disagree	Strongly disagree	Subtotal	Average score
Score of 600 or above	16 (38.09%)	17 (40.48%)	7 (16.67%)	1 (2.38%)	1 (2.38%)	42	4.09
Score of 550 or above	48 (39.67%)	53 (43.80%)	18 (14.88%)	2 (1.65%)	0 (0.00%)	121	4.25
Score of 500 or above	55 (45.45%)	50 (41.32%)	14 (11.57%)	2 (1.65%)	0 (0.00%)	121	4.32
Score of 425 or above	27 (45.00%)	22 (36.67%)	8 (13.33%)	3 (5.00%)	0 (0.00%)	60	4.27
Did not take the Level 4 exam	126 (35.29%)	180 (50.42%)	46 (12.89%)	2 (0.56%)	3 (0.74%)	357	4.21

level, and 84.72% of the students think they do not know enough about Civic Education.

Students showed individual differences in the content of interested Civic Education, with 73.71% choosing history as the cultural content of interest, 68.71% choosing art, 68% choosing literature, and 59.29% choosing folklore. This shows that most of the students are willing to learn and interested in the above four cultural aspects; about 30% of the students also chose politics and philosophy, and 6.86% of the students expressed interest in other aspects. The survey on students' self-assessment of their ability to express their thinking and political education in English shows that 46.43% of students think their ability to express their thinking and political education in English is average, 32.14% think their ability is not good, and 14% think their ability is very bad, which means that a total of 92.57% of students' ability to express their thinking and political education in English needs to be improved. The study found that 62.86% of the students' classes in our university English teaching have introduced the Civic Education, and 37.14% of the students' classes have not introduced Civic Education. The most popular ways of integrating the Civic Education are the comparison of Chinese and Western cultures, the introduction of Civic Education, the expansion of textbook content, the introduction of elective courses, and others, as shown in Table 9.

Table 9: Which of the following ways do you like to introduce civic education in university English teaching?

Options	Subtotal	Proportion (%)
Expansion based on textbook content	322	45.79
Introduction to the topic of Chinese culture	415	59.79
Topics on the comparison of Chinese and Western cultures	475	67.72
Introduction to English in Chinese elective course	285	40.63
Introduction to English in Chinese elective course	12	1.55

Table 10: Which aspects of civic education do you like to introduce in the teaching of English in college?

Options	Subtotal	Proportion (%)
Politics	178	25.32
History	472	67.37
Literature	485	69.42
Art	508	72.31
Philosophy	504	28.97
Folklore	414	59.43
Other	25	3.87

Table 11: Which competencies do you think will be improved by introducing civic education in college English education?

Options	Subtotal	Proportion (%)
Language use ability	547	77.87
Cultural communication ability	531	76.25
Intercultural communication ability	542	77.59
Cultural confidence	535	76.59
Other	19	2.63

Based on the fact that most students agree with the integration of Civic Education, the next question in the questionnaire concerns students' favorite content of Civic Education integration, in the order of art, literature, history, folklore, philosophy, politics and others, as shown in Table 10.

Students generally think that the integration of Civic Education in college English education can help improve language use ability, intercultural communication ability, cultural confidence, and cultural communication ability, as shown in Table 11.

5. Conclusion

Citizenship education runs through the whole process of higher education and is conducive to the construction of education with Chinese characteristics. Educators must strengthen the importance and emphasis on ideological and political elements, rely on curriculum thinking and politics, and solve the current state of separation of teaching and teaching, in order to achieve the all-round development of the new era of youth. The survey found that most students are willing to learn and are interested in learning the above four cultural aspects; about 30% of the students also chose politics and philosophy, and 6.86% of the students expressed interest in other aspects. The integration and innovation of the two help to improve the traditional English and civic education pattern, through accumulation and improvement, which has brought special education into a stage of leapfrog development.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding this work.

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Research Article

Public Health Risk Assessment and Prevention Based on Big Data

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In order to improve the ability of public health risk assessment in the context of community collaborative prevention and control, a mathematical model of public health risk assessment in the context of community collaborative prevention and control based on the integration and balanced allocation of big data features in the prevention horizon is proposed. The constraint parameter model of public health risk assessment under the background of community collaborative prevention and control is constructed, the method of dynamic feature analysis of joint prevention and control is adopted to realize the dynamic risk point detection of public health risk assessment data and the integration of constraint mechanism related feature points, and the fuzzy dynamic statistical feature matching method is adopted to carry out the adaptive dynamic statistics and resource balanced allocation analysis of public health risk assessment set under the background of community collaborative prevention and control. A public health risk parameter fusion model is established under the background of community collaborative prevention and control, the methods of balanced resource allocation and joint management and control are combined to realize balanced scheduling and prevention area block matching in the process of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control, the correlation distribution of public health risk under the background of community collaborative prevention and control is taken as the cost function, and balanced allocation is realized according to the statistical information sampling results of public health risk evaluation data under the background of community collaborative prevention and control. Combined with differential clustering analysis, the data clustering and attribute merging of public health risk assessment under the background of community collaborative prevention and control are realized, and the mathematical modeling optimization of public health risk assessment under the background of community collaborative prevention and control is realized. The simulation results show that this method has good adaptability, high degree of parameter fusion, and strong ability of matching risk prevention areas and balancing resource allocation in the context of community collaborative prevention and control.

1. Introduction

Common health risks pose a serious threat to the life, as well as health and safety of the society and people, and the harm is very serious, especially the COVID-19 epidemic situation, which makes us aware of the threat brought by public health emergencies. Therefore, speeding up the construction of early warning mechanism for public health emergencies, establishing a public health risk prevention model under the background of community collaborative control and prevention, and creating a safe and stable living and production environment are of great value to citizens' health and life safety, as well as the foundation and guarantee for promoting the harmonious development of society [1–3]. Constructing an optimized method model of public health risk under the background of community collaborative prevention and control is helpful to improve the government's ruling ability and credibility, strengthen the emergency management of public health incidents, and combine the public health risk assessment under the background of community collaborative prevention and control, which is the embodiment of people-oriented concept, the key for the government to effectively exploit its power in combination with legal provisions, and an important medium to enhance the government's credibility [4–6]. In view of public health emergencies, the government should further establish and improve the emergency management system, which will help the government to continuously improve its emergency management ability, promote the modernization of national governance system and governance ability, and establish public health risk assessment and prevention under the background of community collaborative prevention and control, which is a good proof of this aspect in promoting the emergency management and control of COVID-19 epidemic in China [2].

In short, through the establishment of public health risk assessment and prevention mechanism under the background of community collaborative prevention and control, in order to better improve the emergency treatment of public health emergencies, we should pay more attention to the emergency management of public health emergencies, strengthen the talent team, and combine big data analysis technology to build a public health risk assessment and prevention model under the background of community collaborative prevention and control. The research on related algorithms and models of public health risk assessment under the background of community collaborative prevention and control has attracted great attention [7].

It is necessary to build an optimized public health risk assessment model under the background of community collaborative prevention and control and combine the methods of risk prevention area matching and resource allocation balance control to improve the efficiency of dynamic parameter estimation of public health risk assessment data under the background of community collaborative prevention and control, so as to ensure the safety and accuracy of dynamic parameter estimation of public health risk assessment data under the background of community collaborative prevention and control. Studying the public health risk assessment model under the background of community collaborative prevention and control is of great significance to improve the security and communication stability of public health risk assessment data under the background of community collaborative prevention and control [8]. The research of public health risk assessment model under the background of community-based collaborative prevention and control has attracted great attention. In traditional methods, the public health risk assessment methods under the background of community collaborative prevention and control mainly include the public health risk assessment model based on fuzzy association rules, the public health risk assessment model based on fuzzy dynamic statistical feature matching, and the public health risk assessment method under the background of community collaborative prevention and control with balanced link control. Balanced allocation and fuzzy feature matching are adopted to achieve public health risk assessment under the background of community collaborative prevention and control, but the traditional methods have poor adaptability and weak statistical analysis ability [9].

In view of the above problems, this paper proposes a mathematical model of public health risk assessment under the background of community collaborative prevention and control based on the integration and balanced allocation of big data features from the perspective of prevention [10]. Firstly, the constraint parameter model of public health risk assessment under the background of community collaborative prevention and control is constructed, and the dynamic risk point detection of public health risk assessment data and the integration of constraint mechanism related feature points under the background of community collaborative prevention and control are realized by using the method of dynamic feature analysis of joint prevention and control, and then the public health risk parameter fusion model under the background of community collaborative prevention and control is established. Combining the methods of balanced resource allocation and joint management and control, the balanced scheduling and the matching of prevention areas in the process of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control are realized. Taking the correlation distribution of public health risk under the background of community collaborative prevention and control as the cost function, the balanced allocation of transmission efficiency is realized according to the statistical information sampling results of public health risk evaluation data under the background of community collaborative prevention and control, and the clustering and attribute merging of public health risk evaluation data under the background of community collaborative prevention and control are combined with the method of differential clustering analysis, so that the mathematical modeling optimization of public health risk evaluation under the background of community collaborative prevention and control is realized. Finally, the simulation test shows that this method has superior performance in improving the accuracy and balance of public health risk assessment under the background of community collaborative prevention and control.

2. Constraint Parameters and Balanced Control of Public Health Risks in the Context of Community Collaborative Prevention and Control

At present, the research characteristics of risk assessment of public health emergencies at home and abroad are mainly reflected in the following aspects:

(1) Major Infectious Diseases

This kind of risk assessment tends to cover the comprehensive evaluation of biology, sociology, and economics. Based on historical data and field investigation, most of the existing studies have established a risk assessment index system through Delphi method, brainstorming method, expert scoring method, and so forth, determined the index weight, and established a comprehensive evaluation model of disease occurrence risk by using comprehensive scoring method or analytic hierarchy process.

(2) Acute Physical and Chemical Exposure

This kind of research involves the types, physical and chemical properties, existing forms, exposure time, and exposure concentration of dangerous goods. It mostly adopts the combination of qualitative and quantitative analysis for risk assessment. Some scholars use data mining technology and fuzzy neural network to carry out the risk assessment research of acute physical and chemical exposure.

(3) Food-Borne Diseases

This kind of risk assessment mostly collects sufficient information through epidemiological research, toxicological research, in vitro experiments, and so forth and establishes models of exposure dose and adverse reactions so as to estimate the possible adverse effects of people exposed to a specific risk source and put forward corresponding risk response strategies. Quantitative microbial risk assessment is the main method of food-borne disease risk assessment. It mainly simulates the possibility of pathogenic bacteria infection caused by food consumption in the food chain, determines the countermeasures that can be taken in the food chain, and evaluates the effects of various measures.

(4) Major Events

This kind of risk assessment is mainly to identify all risks and their characteristics that may exist in a certain period of time and in a certain area. This kind of research mostly adopts the risk matrix method.

2.1. Constraint Parameters of Public Health Risk in the Context of Community Collaborative Prevention and Control. In order to realize the public health risk assessment under the background of community collaborative prevention and control, the constraint parameter model of public health risk assessment under the background of community collaborative prevention and control is constructed. The quantitative equilibrium scheduling model of public health risk assessment data under the background of community collaborative prevention and control is constructed by using the method of spatial equilibrium control, and the constraint parameter model of public health risk assessment under the background of community collaborative prevention and control is constructed [11]. The dynamic risk point detection of public health risk assessment data under the background of community collaborative prevention and control and the integration of constraint mechanism related feature points are realized by using the method of joint prevention and control dynamic feature analysis. The fuzzy clustering state parameter of public health risk evaluation data under the background of community collaborative prevention and control is $T = \Delta L \cdot L_m$. Firstly, a distributed data storage structure model of public health risk index distribution big data under the background of community collaborative prevention and control is constructed, and a quadruple G is used to represent the storage distribution structure of public health risk index distribution big data under the background of community collaborative prevention and control, which is

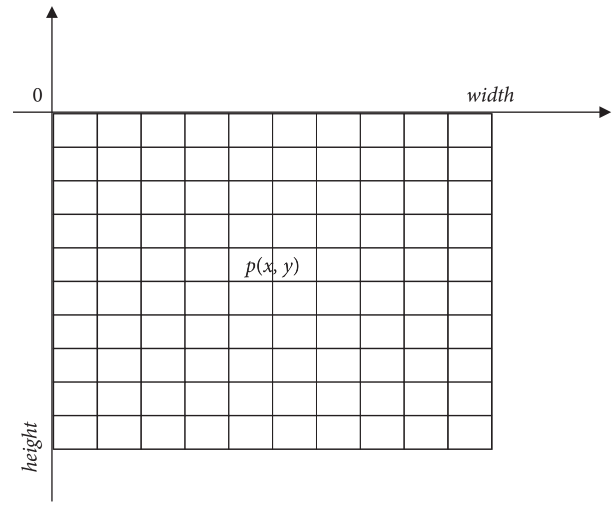


Figure 1: Public health risk control grid under the background of community collaborative prevention and control.

c, assuming that it is the detection dimension of public health risk index distribution big data under the background of community collaborative prevention and control, and $W_{ij}^{(K)}$ represents the number of public health risk evaluation distribution sets under the background of community collaborative prevention and control. It represents the activity of the first node in the data sampling of public health risk index distribution big data in the context of i community collaborative prevention and control, extracts the correlation matching feature quantity of public health risk index distribution big data in the context of community collaborative prevention and control, and adopts multidimensional information scheduling, in which $F^{2\alpha/\pi} = \sum_{i=0}^{3} a_i(\alpha)W^i$, combined with fuzzy detection method, establishing the feature distribution set of public health risk evaluation data in the context of community collaborative prevention and control. Based on big data analysis technology and discrete scheduling method [12], the grid distribution model is shown in Figure 1.

Furthermore, the conditions for stable transmission of parameters of the diversity model of public health risk evaluation data under the background of community collaborative prevention and control are expressed in the following formula:

$$0 < \Delta L < 1 + \frac{\lambda_2}{L}, \tag{1}$$

where L is the dynamic parameter of public health risk indicators under the background of community collaborative prevention and control and λ is the ambiguity coefficient. By adopting the method of full data set fusion, the efficiency evaluation model of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control is established [13], and the regression analysis model of public health risk under the background of community collaborative prevention and control is established by combining the methods of expert feedback and pattern recognition, and the risk prevention area block matching and resource allocation equilibrium control model of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control are obtained. Setting $\partial\pi_m/\partial p_1 = 0$, $\partial\pi_m/\partial A_1 = 0$, and $\eta = 2\mu_2\delta(1-\delta) - \rho_2^2$, the expression of risk prevention area block matching and resource allocation equilibrium control parameter model for dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control is as follows:

$$\begin{aligned}&\frac{2\delta^2(1-\delta)\mu_2 - 2\rho_2^2\delta - 2\eta}{(1-\delta)\eta}p_1\\&+\frac{\rho_1\cdot\rho_2^2\delta(1-\delta) - (1-\delta)\delta\mu_2\rho_1 + \rho_1\eta}{(1-\delta)\eta}A_1\\&+Q+\frac{\delta(1-\delta)\mu_2\left[\delta(1-\delta)\mu_2 - 2\rho_2^2\right] + \rho_2^2\left(\eta+\rho_2^2\right)}{\delta(1-\delta)^2\mu_2\eta}\left(c_2+c_r\right)\\&-\frac{\delta^2(1-\delta)\mu_2 - \delta\rho_2^2 - \eta}{(1-\delta)\eta}c_2 = 0,\end{aligned} \tag{2}$$

where ρ_1 and ρ_2 are the clustering centers of public health risk index distribution big data under the background of community collaborative prevention and control, A_1 is the sample amplitude of public health risk index distribution big data, p_1 is the statistical characteristic quantity, Q is the correlation coefficient, η is the ambiguity, and δ is the similarity coefficient. On the global outlier data set, combined with the ambiguity parameter identification method [14], a density grid cluster center classification set of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control is established, and the grid partition block matching by fuzzy parameter identification of data in grid object is realized. The efficiency regression analysis value of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control satisfies $e^{-L_m s} = 1 - L_m s$. Under the grid clustering model of two-dimensional data sets, the grid clustering results are as follows:

$$g_\alpha'(u) = A_\alpha\int_{-\infty}^{+\infty}\exp\left[j(u-t)^2\csc\alpha\right]g(t)dt, \tag{3}$$

where $g(t)$ is the cost function of public health risk constraint under the background of community collaborative prevention and control, $h(u-t)$ is the density value of each risk control grid object, and A_α is the deep fusion characteristic value of public health risk index distribution big data under the background of community collaborative prevention and control. The probability density y_s of $w_s s$ is calculated by $X_p(u)$, the characteristic sampling interval of public health risk evaluation data under the background of community collaborative prevention and control is A_α, and the stable characteristic solution with cluster center is automatically determined as in the two following formulas:

$$\mathrm{E}\left[\tilde{e}_{sk}\right] = 0, \quad \forall s = 1,\ldots,n,\ k = 1,\ldots,p, \tag{4}$$

$$\mathrm{E}\left[\tilde{e}_{s1k1}\tilde{e}_{s2k2}\right] = \begin{cases}\dfrac{m}{p}\sigma_s^2,\\ 0.\end{cases} \tag{5}$$

In the above formulas, s is the fuzzy closeness between big data sharing nodes, σ_s^2 is matching feature, p is the error, and m is the embedding dimension; α, β, γ, and ρ are the standardized residual learning cost factors; $D(c) \equiv c^d \bmod n \equiv (m^e)^d \bmod n$; it can be known that the constraint cost function is stable and convergent. The dynamic feature analysis method of prevention and joint control is adopted to realize the dynamic risk point detection of public health risk evaluation data under the background of community collaborative prevention and control and the integration of constraint mechanism related feature points, so as to improve the public health risk evaluation data under the background of community collaborative prevention and control [15].

2.2. Clustering Analysis of Public Health Risk Evaluation Data Fusion. Fuzzy dynamic statistical feature matching method has the advantages of good data fusion effect and fast fusion speed. The basic idea of fuzzy matching is to calculate the similarity between each string and the target string and take the string with the highest similarity as the fuzzy matching result with the target string. For calculating the similarity between strings, the most common idea is to use the edit distance algorithm. The steps of the algorithm are as follows:

(1) Construct a matrix with rows of $m+1$ and columns of $n+1$, which is used to save the number of operations required to complete a conversion, and the number of operations required to convert the string $s[1\ldots N]$ to the string $t[1\ldots M]$ is the value of matrix $[n][m]$.

(2) Initialize the first row of matrix from 0 to N and the first column from 0 to M.

(3) Check each $s[i]$ character from 1 to N.

(4) Check each $s[i]$ character from 1 to m.

(5) Compare each character of string s and string t in pairs. If they are equal, let cost be 0; if they are not equal, let cost be 1 (this cost will be used later).

(6) (a) If we can convert $s[1\ldots I-1]$ into $t[1\ldots J]$ in K operations, we can remove $s[i]$ and then do these K operations, so a total of $k+1$ operations are required. (b) If we can convert $s[1\ldots I]$ into $t[1\ldots J-1]$ within K operations, that is, $d[i, j-1] = k$, then we can add $t[j]$ and $s[1\ldots I]$, so a total of $k+1$ operations are required. (c) If we can convert $s[1\ldots I-1]$ into $t[1\ldots J-1]$ in K steps, we can convert $s[i]$ into $t[j]$, so that $s[1\ldots I] == t[1\ldots J]$, which also requires $k+1$ operations in total (cost is added here

because if $s[i]$ is just equal to $t[j]$, then there is no need to do another replacement operation, which can be satisfied; if it is not equal, there is a need to do another replacement operation, which requires $k+1$ operations). (d) Repeat 3, 4, 5, and 6, and the final result is in $d[n, m]$.

Fuzzy dynamic statistical feature matching method is used to analyze the adaptive dynamic statistics and resource balance allocation of public health risk assessment set under the background of community collaborative prevention and control. By fitting data points, the fuzzy parameters of dynamic parameter estimation of public health risk assessment data under the background of community collaborative prevention and control are $K_b^{bw}(S)$, $K_d^{cp}(S)$, $D_{a,p}$, and $M\alpha_{a,b}$. Combined with multipath time delay compensation method, the spatial fusion clustering and feature sampling of discrete time series of public health risk assessment data under the background of community collaborative prevention and control are completed by residual analysis, and the distribution concept set of public health risk assessment data under the background of community collaborative prevention and control is obtained as follows:

$$F_\alpha\left[e^{j\pi\left(2f_0t+k_0t^2\right)}\right]=\sqrt{\frac{1+i\tan\alpha}{1+k_0\tan\alpha}}\times\exp\left[i\pi\frac{u^2\left(k_0-\tan\alpha\right)+2uf_0\sec\alpha-f_0\tan\alpha}{1+k_0\tan\alpha}\right], \tag{6}$$

where G_α is the connected finite graph of the distribution of public health risk indicators in the context of community collaborative prevention and control, u is the marginal feature quantity, f_0 is the risk prevention subspace, α is the sampling frequency spectrum, k_0 is the normalized distribution error of big data of public health risk indicators in the context of community collaborative prevention and control, and $\alpha-\operatorname{arctg}(k_0)=(2j+1/2)\pi$ is the regression distribution set. In the fitting decision graph, a density grid distribution model of dynamic parameter estimation of public health risk evaluation data in the context of community collaborative prevention and control is as follows:

$$F_\alpha=\sqrt{\frac{1}{\left(1-ik_0\right)}}\delta\left(u-f_0\sin\alpha\right), \tag{7}$$

where k_0 is the recursive coefficient of public health risk assessment under the background of community collaborative prevention and control. Combined with the fuzzy optimization method and the standardized residual analysis method, the data fusion cluster analysis of public health risk assessment under the background of community collaborative prevention and control is realized [16–18].

3. Optimization of Public Health Risk Assessment under the Background of Community Collaborative Prevention and Control

3.1. Community Collaborative Prevention and Control in the Context of Public Health Risk Assessment Data Dynamic Parameter Estimation Balanced Scheduling. Combining the methods of balanced resource allocation and joint management and control to realize balanced scheduling and matching of prevention areas in the process of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control [19, 20], taking the correlation distribution of public health risks under the background of community collaborative prevention and control as the cost function, making F the limited domain of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control, it is the multipath characteristic component of public health risk evaluation data under the background of community collaborative prevention and control [21]. In the balanced allocation model of risk prevention area block matching and resource allocation, the common marker characteristic set of $H2$ and $H3$ is X. If $A=(a_{i,j})_{i,j=1}^m$ and $B=(b_{i,j})_{i,j=1}^m$ are used to fit the data points, the linear fitting model of public health risk evaluation data under the background of community collaborative prevention and control is as follows:

$$\operatorname{State}(K,N)0=-\mu p_{k,N}+\lambda p_{K-1,N}+rp_{K,N-1}, \tag{8}$$

where μ is the partition size of risk management and control and $p_{k,N}$ is the size of resource allocation grid. The fuzzy dynamic statistical feature matching method is used to analyze the adaptive dynamic statistics and resource balance allocation of public health risk assessment set under the background of community collaborative prevention and control, and the fusion model of public health risk parameters under the background of community collaborative prevention and control is established. Combining the methods of balanced resource allocation and joint management and control, the balanced scheduling and the matching of prevention areas in the process of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control are realized. In the process of resource allocation, the fuzzy identification parameter model of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control is obtained by using the method of two-dimensional data set planning. In the normalized residual diagram Q, the inverse matrix Q^{-1} is obtained, and the binary transformation of Q^{-1} is performed, and the intervariable function of public health risk estimation under the background of community collaborative prevention and control is as follows:

$$\begin{cases} Q_1(s) = M_-^{-1}(s) f_1(s), \\ Q_2(s) = M_-^{-1}(s) f_2(s), \end{cases} \tag{9}$$

where $f_1(s)$ is the characteristic vector of public health risk index distribution big data under the background of community collaborative prevention and control, $f_2(s)$ is the joint correlation distribution set, and $M_-^{-1}(s)$ is the grid block coefficient. If e_{st1} is independent of e_{st2}, the high-precision fitting model of public health risk planning under the background of noncommunity collaborative prevention and control is as follows:

$$\begin{cases} C_1(s) = \dfrac{\lambda_2 s + 1}{\lambda_1 s + 1}, \\ \\ C_2(s) = \dfrac{\prod_{i=1}^{i=n}(T_{mi}s + 1)}{K_m(\lambda_2 + L_m)s}, \end{cases} \tag{10}$$

where T_{mi} is the connected graph structure of health risk index distribution, s is the sampling characteristic point, and L_m is the fuzziness of big data of public health risk index distribution under the background of district collaborative prevention and control. In the nearest neighbor direction, the characteristic solutions of decision optimization matrix and convergence matrix of dynamic parameter estimation equilibrium configuration function of public health risk evaluation data under the background of community collaborative prevention and control are obtained. In summary, the balanced scheduling and efficiency evaluation of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control are realized, and the fusion cluster analysis is carried out according to the efficiency evaluation results [22].

3.2. Mathematical Model of Public Health Risk Assessment under the Background of Community Collaborative Prevention and Control. In the process of building the mathematical model of public health risk assessment, based on the statistical information sampling results of the above public health risk assessment data, the big data method is used to establish it. Big data technology refers to the application technology of big data, covering all kinds of big data platforms, big data index system, and other big data application technologies. Big data refers to data sets that cannot be captured, managed, and processed by conventional software tools within a certain time range. A bilevel programming hyperbolic model for dynamic parameter estimation of public health risk evaluation data in the context of community collaborative prevention and control is obtained, as shown in the following formula:

$$\begin{cases} u_{tt} - \Delta u + |u|^4 cu = 0, \\ (u, \partial_t u)|_{t=0} = (u_0, u_1) \in \dot{H}_x^{s_c} \times \dot{H}_x^{s_c - 1}, \end{cases} \tag{11}$$

where the adjacent grid size is Δu, u is the search radius, and $\dot{H}_x^{s_c}$ is the parameter fitness; it can get the characteristic points of public health risk evaluation data under the background of community collaborative prevention and control. Combined with the dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control and the distance estimation method of nonedge points of risk prevention area block matching and resource allocation, the steady characteristic solution $\beta = (\beta_1, \cdots, \beta_m)^T \in GF(2^n)^m$ is obtained, and the stable periodic solution of public health risk evaluation under the background of community collaborative prevention and control is obtained by dichotomy as follows: combining the gridding results of 2D data sets to complete feature decomposition, the output is

$$F^p = \exp\left(j\pi\rho^2 \sin\alpha\cos\alpha\right), \tag{12}$$

where ρ is the identification degree of public health risk assessment under the background of community collaborative prevention and α is the quantitative parameter allocation set. By using the finite dimensional analysis method, the reliability function of public health risk assessment under the background of community collaborative prevention and control is expressed by $s^* = \{x \in X | f(x) = \max f(x)\}$. According to the best game state parameters of public health risks obtained in the context of community collaborative prevention and control, the characteristic data of public health risk assessment in the context of community collaborative prevention and control is obtained, which satisfies formula as follows:

$$f(x_1) = f(x_2) = \cdots = f(x_n) = f^*, \tag{13}$$

where $f(x_1), \ldots\ldots f(x_n)$ are the blockchain fusion functions of public health risk management. According to the above analysis, the big data fusion scheduling of public health risk assessment under the background of community collaborative prevention and control is realized, and the fitting value Y^* of response variable Y is obtained, so that $I = \left\{i | \le s_i \ge s_j, \forall s_j \in S^1\right\}$ can meet the statistical characteristics of public health risk under the background of community collaborative prevention and control [23].

According to the corresponding observation values and fitting values, the clustering and attribute merging of public health risk evaluation data under the background of community collaborative prevention and control are realized by using the method of fusion differential clustering analysis, and the mathematical modeling optimization of public health risk evaluation under the background of community collaborative prevention and control is realized. The linear fitting results of dynamic parameter estimation and evaluation of public health risk evaluation data under the background of community collaborative prevention and control are as follows:

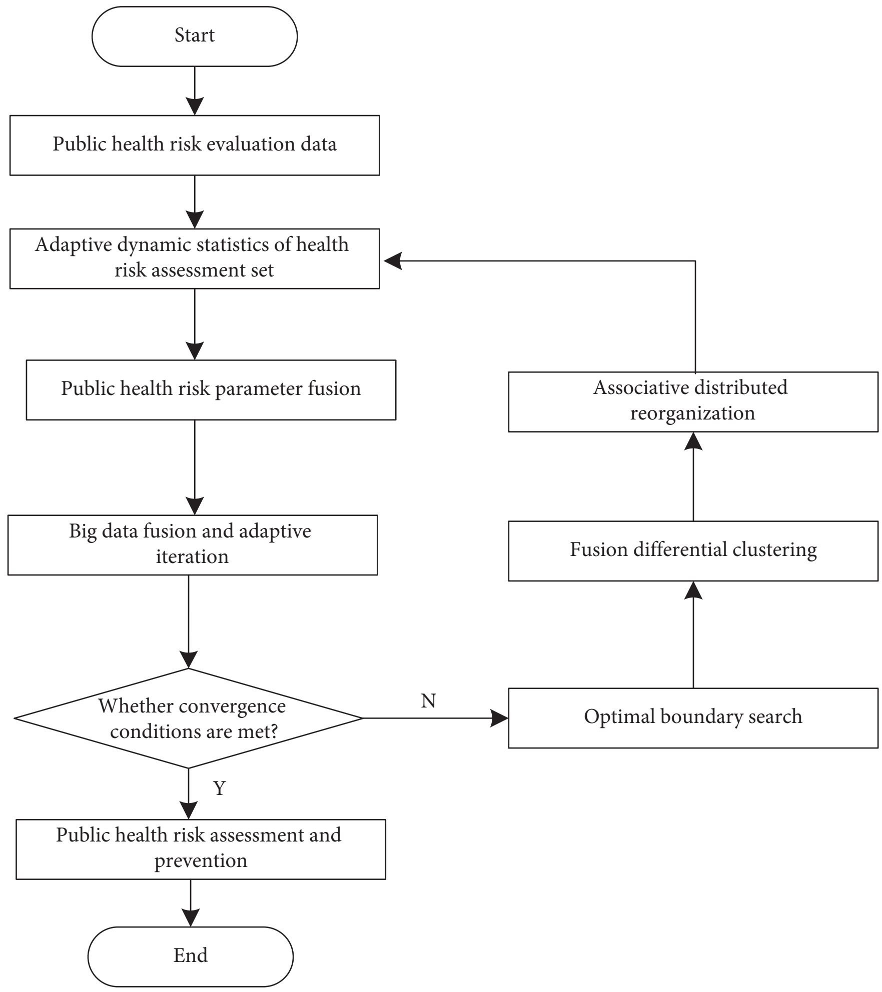


Figure 2: Implementation process of public health risk management and control under the background of community collaborative prevention and control.

$$p_{id}^{new} = \begin{cases} p_{id} + m\left(X_{\max} - p_{id}\right), & if\ m > 0, \\ p_{id} + m\left(p_{id} - X_{\min}\right), & if\ m \leq 0, \end{cases} \quad (14)$$

where $X_{\max}$ and $X_{\min}$ are the maximum threshold and the minimum threshold, respectively, and p_{id} is the probability density of public health risk assessment. To sum up, we can realize the optimal design of the mathematical model of public health risk assessment under the background of community collaborative prevention and control. To sum up, taking the correlation distribution of public health risks in the context of community collaborative prevention and control as the cost function, the balanced allocation of transmission efficiency is realized according to the statistical information sampling results of public health risk assessment data in the context of community collaborative prevention and control, and the clustering and attribute merging of public health risk assessment data in the context of community collaborative prevention and control are realized by combining the fusion differential cluster analysis method, thus realizing the mathematical modeling optimization of public health risk assessment in the context of

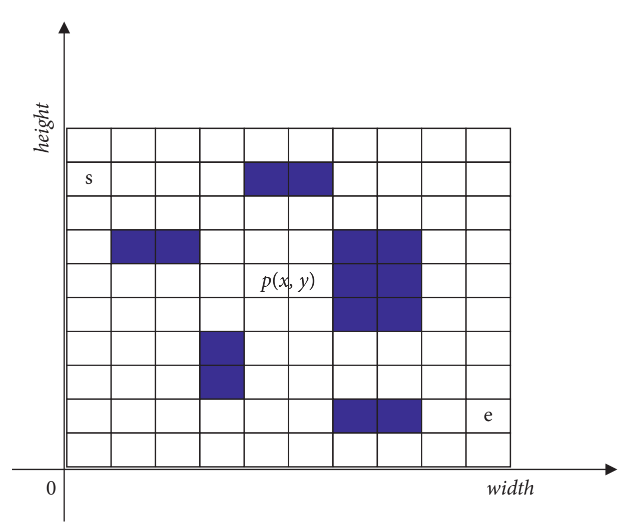


Figure 3: Optimized coordinate system of public health risk control under the background of community collaborative prevention and control.

Table 1: Variable distribution of public health risk assessment in the context of community collaborative prevention and control.

Variable	Mean value	Standard value	Minimum value	Statistical value
Similarity	0.830	0.7410	4.759	12.252
Degree of association	0.571	0.0884	4.594	12.817
Proportionality	0.413	0.9692	4.980	12.165
Reliability	0.113	0.9214	4.930	12.932
Ambiguity coefficient	0.467	0.2085	4.801	12.952
Regression analysis value	0.468	0.2383	4.931	12.703

Table 2: Block matching results of public health risk assessment.

Evaluation area	Statistical sample number	Reliability factor	Fuzzy kernel coefficient	Information entropy
1	9429	0.895	17.060	6.304
2	8756	0.961	9.006	4.026
3	5597	0.088	4.264	3.791
4	2461	0.308	8.997	7.256
5	7290	0.468	3.346	4.632
6	7694	0.820	4.780	9.172
7	9133	0.538	7.114	7.237
8	3007	0.136	7.548	6.820
9	8128	0.370	1.483	3.134
10	7176	0.457	5.028	9.184
11	6516	0.400	0.742	2.983
12	4207	0.633	6.189	0.520

community collaborative prevention and control [21, 24]. The realization process is shown in Figure 2.

4. Simulation Test

In the simulation test of public health risk assessment under the background of community collaborative prevention and control, the scale of public health risk assessment data under the background of community collaborative prevention and control is set to be 1200 Mbit, the number of iterations of assessment is 200, the prior probability density of public health risk assessment under the background of community collaborative prevention and control is 0.55, the correlation coefficient of public health risk assessment under the background of community collaborative prevention and control is 0.103, and the adaptive weighting coefficient is 0.14. The distribution of the optimized coordinate system of public health risk management and control under the background of community collaborative prevention and control is shown in Figure 3.

Dynamic feature analysis of joint prevention and control is used to realize the dynamic risk point detection of public health risk evaluation data under the background of community collaborative prevention and control and the integration of constraint mechanism related feature points. The variable distribution of public health risk evaluation under the background of community collaborative prevention and control is shown in Table 1.

According to the above parameter settings, the public health risk assessment model under the background of community collaborative prevention and control is constructed, and the block matching results of public health risk assessment are shown in Table 2.

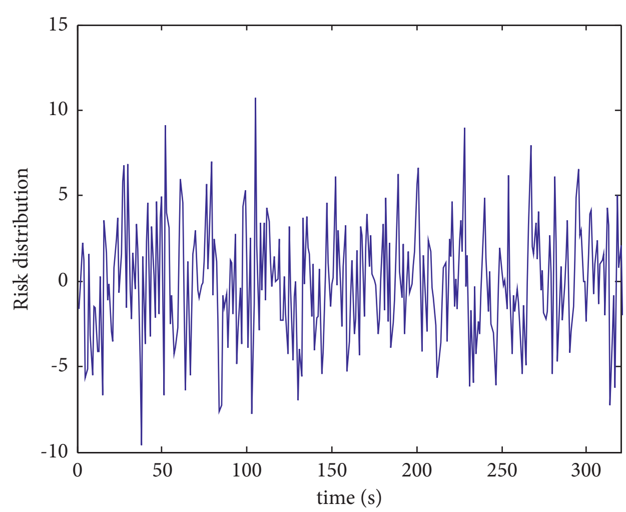
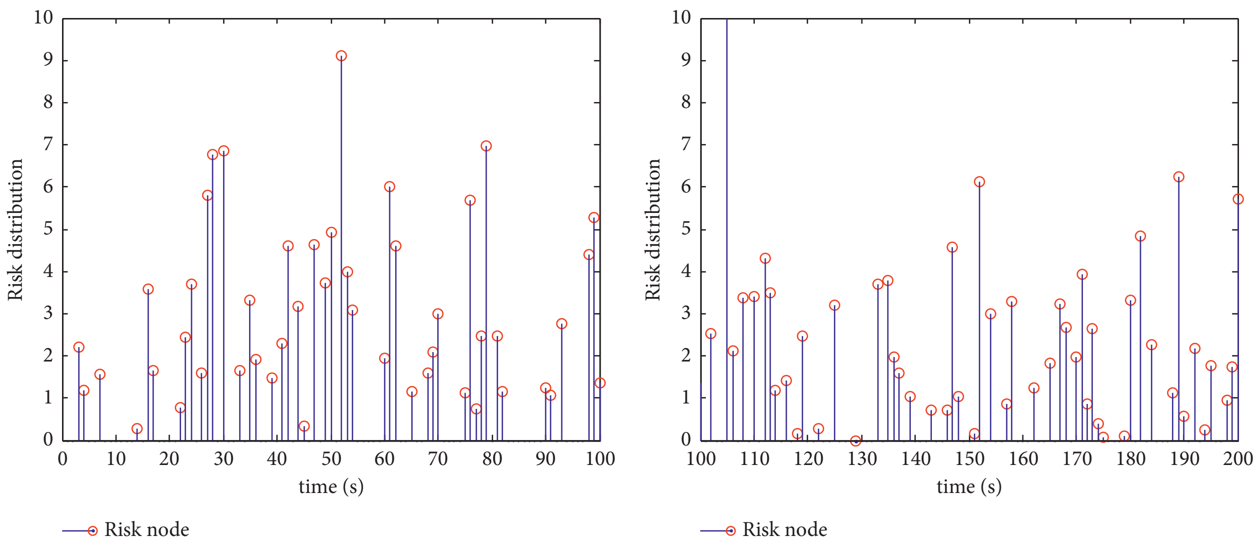


Figure 4: Public health risk evaluation data under the background of community collaborative prevention and control.

According to the above data analysis results, the risk assessment is realized, and the distribution of public health risk assessment data under the background of community collaborative prevention and control is shown in Figure 4.

According to the distribution characteristics of public health risk evaluation data under the background of community collaborative prevention and control in Figure 4, the public health risk evaluation under the background of community collaborative prevention and control is realized, and the scattered distribution diagram of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control is shown in Figure 5.



(a) (b)

Figure 5: Scattered distribution of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control.

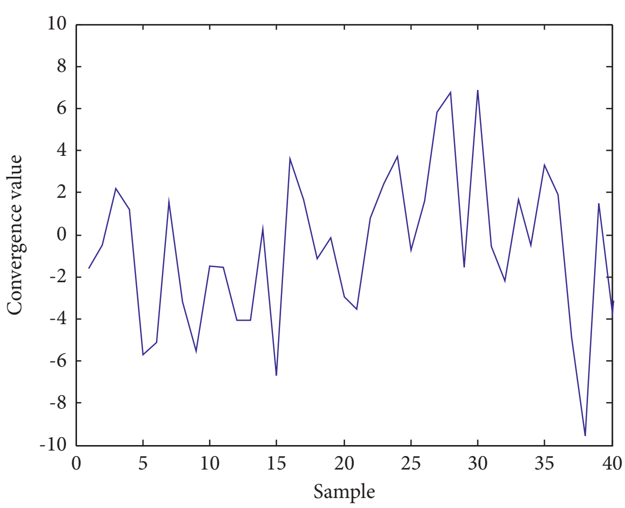


Figure 6: Convergence judgment of public health risk under the background of community collaborative prevention and control.

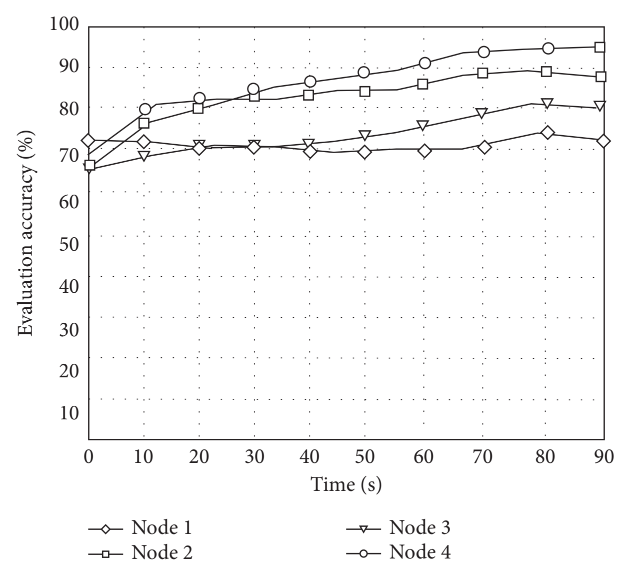


Figure 7: Evaluation accuracy.

Table 3: Accuracy test of public health risk assessment under the background of community collaborative prevention and control.

Iterations	This method	Statistical analysis	Fuzzy degree identification
100	0.942	0.821	0.814
200	0.965	0.854	0.832
300	0.991	0.904	0.854
400	0.995	0.924	0.914

According to the scattered distribution diagram of dynamic parameter estimation of public health risk evaluation data under the background of community collaborative prevention and control in Figure 5, the convergence judgment of public health risk under the background of community collaborative prevention and control is realized, and the results are shown in Figure 6.

From the analysis of Figure 6, it can be seen that the convergence of this method in public health risk assessment under the background of community collaborative prevention and control is good. The accuracy of the evaluation is shown in Table 3, and the comparison results show that the accuracy of public health risk assessment is high under the background of community collaborative prevention and control.

In order to further test the reliability of this algorithm for public health risk assessment, the assessment accuracy of the

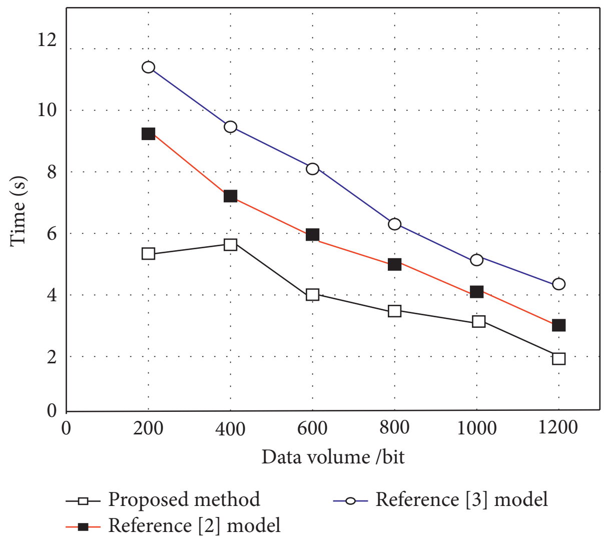


Figure 8: Comparison of evaluation time of different methods.

four characteristic nodes in public health risk assessment using this algorithm is counted, and the statistical results are shown in Figure 7.

According to the results in Figure 7, we can see that the accuracy of using this algorithm to evaluate the probability of public health risk is more than 65%, which shows that this algorithm not only can effectively evaluate the probability of public health risk but also has a high evaluation accuracy. This is because this algorithm is based on the reliability index of evaluating the probability of public health risk. The fuzzy dynamic statistical feature matching method is used to obtain all subnodes of the reliability index state vector, and the mathematical model of big data risk assessment is constructed to achieve high-accuracy assessment.

On this basis, compare the methods of literature [2] and literature [3] to calculate the computational complexity of the proposed algorithm. The shorter the time of the algorithm, the lower the computational complexity. Therefore, the experiment was carried out with the evaluation time as the test index, and the experimental results are shown in Figure 8.

As shown in Figure 8, under the same conditions, the proposed method takes the shortest time, indicating that the proposed method has the lowest computational complexity, the strongest operability, and high practical applicability.

5. Conclusions

In order to optimize the performance of public health risk assessment, this paper proposes a public health risk assessment and prevention research based on big data. On the basis of clarifying the public health risk constraint parameters, a mathematical model of public health risk assessment based on feature fusion and balanced allocation of correlated big data is constructed. The analysis shows that, after the application of this method, the accuracy of public health risk assessment is high and the convergence is good.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Research Article

Evaluation Model of Regional Comprehensive Disaster Reduction Capacity under Complex Environment

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In order to realize the evaluation of regional comprehensive disaster reduction capacity in a complex environment, an evaluation model of regional comprehensive disaster reduction capacity in a complex environment based on remote sensing monitoring and data image feature analysis is proposed. According to the geographical location and scale of disaster spots and the parameter analysis of the model of disaster-bearing bodies around the disaster spots, the remote sensing monitoring method is adopted to extract the geographical remote sensing images of regional disaster spots in a complex environment. The collected geographical remote sensing images of regional disaster points under the complex environmental background are filtered and preprocessed, and the texture parameters of the geographical remote sensing images of regional disaster points under the complex environmental background are recognized by combining the method of image texture feature extraction. Based on the method of tone mapping, the rapid filtering and feature analysis of the geographical remote sensing images of regional disaster points under the complex environmental background are carried out, and the time, position, damage, and so on in the geographical remote sensing images of regional disaster points under the complex environmental background are analyzed. By using the method of parameter analysis and gradient operator operation, a comparison model of geographical remote sensing images of regional disaster points under the complex environmental background is established, and the reliability evaluation of regional comprehensive disaster reduction ability under the complex environmental background is realized according to the method of contrast and detail significance enhancement. The test shows that this method has high accuracy in evaluating regional comprehensive disaster reduction capability under a complex environment, high accuracy in marking the geographical location of regional disaster points under a complex environment, and good fusion performance and reliability of regional comprehensive disaster reduction capability evaluation parameters.

1. Introduction

At present, most of the researches on geological disasters focus on hazard zoning and risk analysis, and most of them are static analysis, while the comprehensive loss risk analysis and dynamic assessment of geological disasters are few. However, in practice, geological disasters are uncertain and random, so it is necessary to evaluate the losses caused by geological disasters by dynamic simulation. In this study, through multisource data fusion and key mechanism research, the technical system of risk dynamic assessment of debris flow geological hazards was established, and the risk dynamic assessment of debris flow geological hazards was carried out, which deepened the research on the formation mechanism of debris flow hazards, broadened the application fields and methods of risk assessment of geological hazards, and supplemented the shortcomings and defects of the existing assessment contents [1]. It provides a new idea and method for the study of geological disaster risk in China and has certain theoretical significance. China is one of the countries with the most serious geological disasters in the world. The geological environment in the mountainous area of southeast Jilin Province is complicated, and geological disasters such as collapse, landslide, and debris flow occur frequently every year during flood season. The theoretical research on the dynamic risk assessment of debris flow geological disasters in southeast mountainous areas of Jilin Province can be directly applied to the investigation and evaluation of geological disasters, which can provide theoretical guidance and a scientific basis for the defense work in southeast mountainous areas of Jilin Province, promote the research of theoretical basis and technology of geological disaster risk analysis in Jilin Province, and improve the level of geological disaster prevention and control [2]. The application research of dynamic risk assessment of debris flow geological disasters provides a better guarantee for the monitoring and early warning system. It can provide a basis for the organization's transfer decision in advance when geological disasters occur, and it is of great significance for ensuring the safety of people's lives and property [3].

With the development of hyperspectral remote sensing monitoring image processing technology, people pay attention to the application of hyperspectral imaging technology in food comprehensive disaster reduction capability evaluation and tracking identification. In the detection of regional disaster points under a complex environment, the program model of regional disaster point geographic remote sensing image under the complex environmental background is established by combining hyperspectral technology, and the spatiotemporal distribution characteristics of disaster-causing factors in regional disaster point geographic remote sensing image under the complex environmental background are analyzed by texture distribution domain characteristics [4–6]. Using the automatic image segmentation technology, combined with the fusion of spatiotemporal distribution characteristics and texture distribution parameters of disaster-causing factors in geographical remote sensing images of regional disaster spots under the complex environmental background, the retrospective identification of comprehensive disaster reduction capability evaluation of regional disaster spots under the complex environmental background is carried out, and the accuracy and reliability of comprehensive disaster reductiaon capability evaluation of regional disaster spots under the complex environmental background are improved [7]. This paper studies the evaluation method of comprehensive disaster reduction capability of regional disaster points in a complex environment, filters the collected geographical remote sensing images of regional disaster points in a complex environment, and realizes the texture parameter identification of geographical remote sensing images of regional disaster points in a complex environment with the method of image texture feature extraction. The research on the evaluation method of comprehensive disaster reduction capability of regional disaster points in a complex environment has attracted great attention.

This paper studies the image information processing technology with the regional disaster point geographic remote sensing image processing as the core technology under the complex environmental background, combined with the image texture feature extraction and parameter analysis, to achieve the regional disaster point geographic remote sensing image parameter recognition under the complex environmental background, and finally carries out simulation test. It shows the superior performance of the proposed method in improving the ability of regional disaster spot geographic remote sensing image detection under the complex environmental background.

2. Evaluation Method Based on Hyperspectral Remote Sensing Monitoring Image Technology

2.1. Research Content

(1) Based on field survey and investigation and interpretation and analysis of satellite remote sensing data, the pregnant environment, disaster-bearing body, and disaster-causing factors of debris flow disaster in the study area are determined, and the temporal and spatial distribution characteristics of rainfall of disaster-causing factors of debris flow disaster and its correlation with debris flow disaster are analyzed.

(2) According to the results of the debris flow disaster system analysis and natural disaster risk index method, select the representative indicators of debris flow disaster risk assessment, calculate the weight of indicators based on the PSO-AH method, construct the debris flow disaster risk assessment index system in the study area, and make a dynamic assessment of debris flow disaster risk in the study area from 1956 to 2021.

(3) According to the theory of risk management, combined with the dynamic changes of risk influencing factors of debris flow disaster and the results of risk dynamic evaluation, put forward reasonable risk prevention countermeasures and implementation ways.

2.2. Hyperspectral Remote Sensing Monitoring Image Acquisition. In order to realize the comprehensive disaster reduction capability evaluation of regional disaster points in a complex environment based on hyperspectral remote sensing monitoring image technology, the method of adaptive global tone mapping was used to collect regional disaster points' geographic remote sensing images in a complex environment, and combined with the edge detection method [8, 9], an automatic segmentation model of spatiotemporal distribution characteristics and texture distribution domain of regional disaster points' geographic remote sensing images in a complex environment was established. The filtering detection and analysis model of spatiotemporal distribution characteristics texture distribution domain of regional disaster point remote sensing images under the complex environmental background is constructed, and the pixels per inch sampling structure of spatiotemporal distribution characteristics texture distribution domain of regional disaster point remote sensing images under the complex environmental background is obtained [10]. The texture distribution characteristic quantity of spatiotemporal distribution characteristics texture distribution domain of regional disaster point remote sensing images under the complex environmental background is represented, and the image is collected by using a Gaussian window with a window of 5×5, and the expression of spatiotemporal distribution characteristics texture characteristics of regional disaster point remote sensing images under the complex environmental background is as follows:

$$I(x) = A\rho x + \frac{1 - \rho_2 c_2/\rho_1 c_1}{1 + \rho_2 c_2/\rho_1 c_1}, \tag{1}$$

where A is the bottom feature, ρ is the color contrast difference of other pixels, x is the feature atlas, ρ_1 is the feature fusion coefficient, c_1 is the feature parameter of adjacent layers, and ρ_2 is the convolution operation parameter of 3×3. In the local area of $N \times N$, the spatiotemporal distribution feature texture distribution domain of regional disaster point geographic remote sensing image disaster factors under the complex environmental background is segmented, and the disaster factor of regional disaster point geographic remote sensing image under the complex environmental background is obtained.

$$J(x) = \frac{2\pi^2 f^2}{c^3 \rho} \left(\frac{4}{3}\eta + \frac{r-1}{c_p} k \right) + A, \tag{2}$$

where f is the frequency of the feature map in three dimensions: width and depth, c is the high-spectral intensity of regional disaster point quality under the complex environmental background, η is the regression parameter of regional disaster point geographic remote sensing image under the complex environmental background, k is the joint parameter, and r is the statistical characteristic quantity. By using the method of prediction probability density analysis of the model, the difference of degree of spatiotemporal distribution characteristic texture distribution domain of disaster factors in regional disaster point geographic remote sensing image under the complex environmental background is obtained. Using the Gaussian filtering method, the weighted analysis of the feature distribution domain is carried out, and the image acquisition model is established. The geographic remote sensing image acquisition output of regional disaster points under the complex environmental background is as follows:

$$a_k = \left(\sum{}_k + \varepsilon U \right)^{-1} M \Delta_s u^{(n)}(x, y) + N\Delta_t, \tag{3}$$

where $\sum_k$ is a single image enhancement coefficient, N is a tone mapping parameter, ε is a high-spectral detail adjustment parameter of regional disaster point quality under the complex environmental background, U is a multiple of detail enhancement, and Δ_t is a smooth function. According to the edge detection result of the spatiotemporal distribution characteristic texture distribution domain of disaster factors in geographical remote sensing images of regional disaster points under the complex environmental background, combined with the template matching method, fuzzy feature detection of geographical remote sensing images of regional disaster points in the complex environmental background is carried out, and the texture detection model of spatiotemporal distribution characteristics of disaster factors in geographical remote sensing images of regional disaster points in the complex environmental background is established by Re algorithm.

2.3. Hyperspectral Preprocessing and Image Feature Extraction. The collected geographic remote sensing images of regional disaster points in the complex environmental background are filtered and preprocessed, and the texture parameters of the geographic remote sensing images of regional disaster points in the complex environmental background are recognized by combining the method of image texture feature extraction [11, 12]. The texture distribution domain matching model of the spatiotemporal distribution characteristics of disaster-causing factors in geographic remote sensing images of regional disaster points in the complex environmental background is established by statistical feature analysis and similarity detection [13], and the hyperspectral preprocessing is carried out by combining the matching filter detection. Using the nonlinear filter, the nonlinear filter function of texture distribution detection of the spatiotemporal distribution characteristics of disaster factors in geographical remote sensing images of regional disaster points under the complex environmental background is obtained as follows:

$$S_m = \frac{\left(F_m^G, F_m^P \right)}{\left\| F_m^G \right\| \cdot \left\| F_m^P \right\|}, \tag{4}$$

where F_m^G is the filtered image and F_m^P is the bilateral filtering function. According to the analysis of the relevant smooth function, the texture distribution domain of the spatiotemporal distribution characteristics of disaster-causing factors in the geographical remote sensing image of regional disaster points under the complex environmental background is divided into blocks, which are expressed as follows:

$$R_w = \left| \frac{r_2 - r_1}{r_2 + r_1} \right|^2, \tag{5}$$

$$y_T = W_i^T M_T, \tag{6}$$

where r_1 is the similarity between pixels, r_2 is the correlation coefficient of brightness term, M_T is the halo that the image will produce, and W_i is the hyperspectral texture component of regional disaster point quality under the complex environmental background. After M_T projection, the spatiotemporal distribution characteristics and texture distribution domain of disaster causing factors are obtained. By using subspace mapping, a fusion model of spatiotemporal distribution characteristics of disaster causing factors in hyperspectral remote sensing monitoring images is constructed, and the texture distribution set is obtained as follows:

$$\begin{aligned} C &= \frac{\rho v_c d}{\mu} \\ &= \frac{v_c d}{\nu}, \end{aligned} \tag{7}$$

where v_c is the pixel set after the global mapping of the input image, d is the distribution distance of pixel feature points, ν

is the lost detail information, and μ is the detail compensation output. By adopting the regional template matching method, the difference of degree of the internal information of the regional disaster point geographic remote sensing image under the complex environmental background is obtained [14], and the spatiotemporal distribution characteristics of disaster-causing factors and the texture detection output of the regional disaster point geographic remote sensing image under the complex environmental background are as follows:

$$t_{Ii} = \frac{2}{\left[4 \cos^2 kD_i + (S_{21} + S_{12})\sin^2 kD_i\right]^{1/2}}, \quad (8)$$

where D_i is the brightness component, S_{12} is the brightness order error, S_{21} is the hyperspectral information entropy of regional disaster point quality under the complex environmental background, and k is the information richness. Based on Radon scale transformation, the texture feature extraction results of spatiotemporal distribution characteristics of disaster-causing factors in geographical remote sensing images of regional disaster points under the complex environmental background are as follows:

$$\begin{aligned} t_I &= \prod_{i=1}^{n} t_{Ii} \\ &= \prod_{i=1}^{n} \frac{2}{\left[4 \cos^2 kD_i + (S_{21} + S_{12})\sin^2 kD_i\right]^{1/2}}, \end{aligned} \quad (9)$$

where $\prod_{i=1}^{n} t_{Ii}$ means cascade summation of similarities. Based on the subjective quality evaluation method, the feature quantity of edge contour of geographical remote sensing image of regional disaster point under the complex environmental background is

$$\begin{aligned} K &= \frac{I^c(y)}{A^c} \\ &= \frac{2}{\left[4 \cos^2 kD_i + (S_{21} + S_{12})\sin^2 kD_i\right]^{1/2}}, \end{aligned} \quad (10)$$

where D_i is the natural image statistical model parameter and S_{12} and S_{21}, respectively, represent the joint feature quantity. Therefore, the fusion model of regional disaster point geographic remote sensing images under the complex environmental background is constructed, and the fusion output of spatial and temporal distribution characteristics of disaster factors in hyperspectral remote sensing monitoring images is as follows:

$$I(x) = J(x)t(x) + A(1 - t(x)), \quad (11)$$

where $J(x)$ is the order difference of the original image, $t(x)$ is the gradient coefficient, A is the gain, and $I(x)$ is the pixel set. According to the above feature extraction algorithm, according to the fusion results of regional disaster point remote sensing images in the complex environmental background, combined with the spatiotemporal distribution feature texture distribution domain of disaster-causing factors in regional disaster point remote sensing images in the complex environmental background, information is segmented, and hyperspectral preprocessing and image texture extraction are carried out [15].

3. Analysis of Regional Disaster Point Structure under Complex Environmental Background

3.1. Analysis of Spatial and Temporal Distribution Characteristics of Disaster-Causing Factors. The spatial and temporal distribution characteristics of disaster factors, dynamic distribution characteristics of disasters, and geographical characteristics of disaster points in geographical remote sensing images of regional disaster points under the complex environmental background are analyzed. Firstly, the spatial and temporal distribution characteristics of disaster factors in geographical remote sensing images of regional disaster points under the complex environmental background are analyzed. Combined with geographical remote sensing quality hyperspectral remote sensing monitoring images of disaster spots in frozen regions, the spatiotemporal distribution characteristics of disaster factors, and texture distribution domain, the edge fuzzy set of the spatiotemporal distribution characteristics of disaster factors is obtained as follows:

$$p(x,t) = \frac{2\pi^2 f^2 \eta}{c^3 \rho}\left(\frac{4}{3} + \frac{r-1}{k}k'\right), \quad (12)$$

where f is the sampling spectrum, k is the dynamic distribution coefficient of the spatiotemporal distribution characteristics of disaster-causing factors, η is the hyperspectral spectrum separation coefficient, and k' is the differential component of the dynamic distribution coefficient of the spatiotemporal distribution characteristics of disaster-causing factors. The low illumination image is enhanced, and the regional feature block detection method is adopted to construct the texture and configuration parameters of the spatiotemporal distribution characteristics of disaster-causing factors in the geographical remote sensing image of regional disaster points under the complex environmental background [16–18]. The output is as follows:

$$x_i(t) = I(x_i, y_i) + \left[\, I_x(x_i, y_i) \;\; I_y(x_i, y_i) \,\right], \quad (13)$$

where $I(x_i, y_i)$ is the objective measurement enhanced image, $I_x(x_i, y_i)$ is the X-axis sample component of the image, and $I_y(x_i, y_i)$ is the Y-axis sample component of the image. By using the methods of parameter analysis and gradient operator operation, a color fusion model is established, and a fine semantic segmentation method is adopted to detect the fuzzy edge and block the geographical remote sensing image of regional disaster points under the complex environmental background, which is expressed as follows:

$$\begin{cases} G_j^{\max} == -\sigma \dfrac{\partial u(x,t)}{\partial x}, \quad j \in \{1,\ldots,p\}, \\ G_j^{\max} = \max\limits_{i=1,\ldots,N}\left(G_j(\vec{x}_i)\right), \\ k' = \dfrac{k}{\eta c_p}, \quad j \in \{1,\ldots,p\}, \end{cases} \tag{14}$$

where σ is the image color difference contrast, $G_j(\vec{x}_i)$ is the saturation error, c_p is the color difference, and η is the detection efficiency. According to the above analysis, combined with the texture distribution of the spatiotemporal distribution characteristics of the disaster-causing factors in the geograaphical remote sensing images of regional disaster points under the complex environmentl background, spectral analysis is adopted to detect and analyze the spatiotemporal distribution characteristics of the disaster-causing factors [19], and the spatiotemporal distribution characteristic components of the disaster-causing factors in the geographical remote sensing images of regional disaster points under the complex environmental background are extracted. Fuzzy degree detection, combined with the distribution of dynamic feature points of geographical remote sensing images of regional disaster points, and hyperspectral remote sensing monitoring images are used to match the spatial and temporal distribution characteristics of disaster-causing factors. The output is

$$\begin{aligned} \begin{bmatrix} x \\ y \end{bmatrix} &= \frac{C_\beta}{\mathrm{Sin}\beta} \\ &= \frac{C_\gamma}{\mathrm{Sin}\gamma}, \end{aligned} \tag{15}$$

where

$$C_\gamma = U + \frac{\sin\gamma_2}{c_{\gamma_2}} + \frac{\sin\beta_2}{\beta_2}, \tag{16}$$

where C_β is color contrast difference pair, C_γ is color contrast significance, β is Gaussian blur coefficient, and γ is joint spectrum. In order to detect the texture distribution of the spatiotemporal distribution characteristics of disaster-causing factors in geographical remote sensing images of regional disaster points under the complex environmental background, the feature analysis and detection of geographical remote sensing images of regional disaster points under the complex environmental background are realized by fusing brightness and contrast [20].

3.2. Analysis of Dynamic Distribution Characteristics of Disasters. According to the texture analysis results of the spatiotemporal distribution characteristics of disaster-causing factors in the geographical remote sensing images of regional disaster points in the complex environmental background [21, 22], the disaster dynamic distribution characteristics of the geographical remote sensing images of regional disaster points in the complex environmental background are analyzed, and the subpixel parallax of the geographical remote sensing images of regional disaster points in the complex environmental background is obtained as follows:

$$g(x,y) = \frac{m\cos\theta_i - \sqrt{n^2 - \sin^2\theta_i}}{m\cos\theta_i + \sqrt{n^2 - \sin^2\theta_i}}, \tag{17}$$

where θ_i is the gray value of water parallax of geographical remote sensing images of regional disaster points in the complex environmental background, n is the significance value determined by color contrast difference, and m is the dynamic distribution characteristics of disasters. In the process of multistage downsampling, the detection matching values of the dynamic distribution characteristics of regional disaster points in the complex environmental background are as follows:

$$\begin{aligned} L &= \beta F(x,y) + Z_{s1} \\ &= \frac{\rho_1 c_1}{\cos\theta_i}, \end{aligned} \tag{18}$$

where β is a multifeature fusion point, $F(x,y)$ is a significant map detail of disaster dynamic distribution characteristics of geographical remote sensing images of regional disaster points under the complex environmental background, Z_{s1} is a threshold value of distribution of geographical remote sensing images of regional disaster points under the complex environmental background, ρ_1 is a European cluster of distribution of water-bearing characteristic points of geographical remote sensing images of regional disaster points under the complex environmental background, c_1 is a joint evaluation coefficient, θ_i is a horizontal offset, m_l is the weak texture set of the spatial and temporal distribution characteristics of disaster-causing factors in the geographical remote sensing images of regional disaster points under the complex environmental background [23, 24], and δ_l^2 is the interval of water-bearing points distribution in the geographical remote sensing images of regional disaster points under the complex environmental background.

3.3. Analysis of Geographical Characteristics of Disaster Points. The geographical characteristics of disaster points mainly investigate and verify the geographical location and scale of disaster points, investigate the disaster-bearing body around the disaster points and the relevant socio-economic data of the region, and verify whether the land use type interpreted by remote sensing is accurate, so as to provide a reference for the selection of key indicators for the dynamic assessment of geological disaster risk induced by extreme precipitation in mountain areas and provide the basis for the verification of the results of the dynamic assessment of geological disaster risk induced by extreme precipitation in mountain areas [25]. The characteristics of geographical remote sensing images of regional disaster points under the complex environmental background are analyzed, and the rainfall characteristics of inducing factors are detected. The spectral wavelength coefficient is as follows:

$$L = J(w,e) - \sum_{i=1}^{N} a\left[4\cos^2 kD_i + \left(S_{21} + S_{12}\right)\sin^2 kD_i\right], \quad (19)$$

where $J(w,e)$ is the initial wavelength, a is the geographical remote sensing spatial characteristic quantity of regional disaster points under the complex environmental background, and D_i is the remote sensing spectral reflection coefficient. The reflection coefficient of regional disaster point quality hyperspectral disaster regionality under the complex environmental background is defined, and the grayscale increase part is obtained as follows:

$$\mathrm{Dark}(x) = p_a e^{j(wt-k\cdot r)} + \min_{c\in\{r,g,b\}} R, \quad (20)$$

where p_a is the Lab spatial feature after Gaussian smoothing, $e^{j(wt-\mathbf{k}\cdot\mathbf{r})}$ is the gray rate of regional disaster points under the complex environmental background, and R is the scale. Combined with convolution scale analysis, the rainfall characteristics of regional disaster point remote sensing images in a complex environment are detected [26]. Combined with the spatial and temporal distribution characteristics of disaster-causing factors and texture analysis results, a comparison model of regional disaster point remote sensing images in a complex environment is established. According to the method of contrast and detail significance enhancement, the reliability detection of regional disaster point quality in a complex environment is realized.

4. Experimental Analysis

4.1. Experimental Preparation. The simulation experiment of comprehensive disaster reduction capability evaluation of regional disaster sites in a complex environment is based on MATLAB simulation software and SPECIM Spectral Camera hyperspectral analysis, and the remote sensing image data includes "Gaofen-1" satellite image data. It includes four types of data, including 2-meter panchromatic, 8-meter multispectral, fusion of both, and 16-meter multispectral, which are all from the geographic and national monitoring cloud platform. The DEM data used in this study comes from DLR-DEM data, one of the SRTM data provided by Deutsche Zentrum Firluft-und Raum Fahrt, with an elevation accuracy of 6–16 m.

The meteorological data comes from China Meteorological Science Data Network (https:/lcdc.nmic.cn/). According to the continuity and the longest period standard of meteorological data of each station, the daily meteorological data of all meteorological stations around the study area from 1956 to 2021 are selected. MSRA10K data set and THUR15K data set are used as test sets, and 200 figures were selected from the two datasets as training parameters. The detected regional disaster point samples under the complex environmental background were divided into 15 groups. The basic geographic data and ecological environment data such as the detailed administrative boundary and topographic contour of a county are from the geological environment department of the Department of land and resources of a province; the geological and geomorphological data are from the data provided by the geological environment department of the Department of land and resources of a province; the land use data comes from the data provided by the geographic situation monitoring cloud platform; the soil type data is from the national soil type digital map provided by the geographic situation monitoring cloud platform; the hydrogeological data comes from the geological science data sharing network of the Chinese Academy of Geological Sciences. The field investigation scene of the staff is shown in Figure 1.

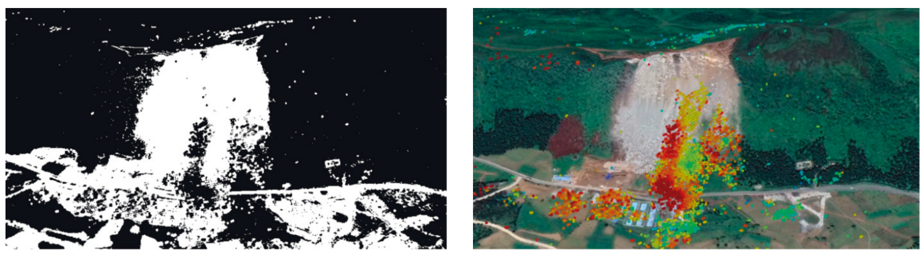
In the part of data processing, in the process of digitizing geological maps, identifying and extracting disaster points, and identifying risk factors of geological disasters, some indicators need to be obtained by remote sensing interpretation technology. In order to meet the requirements of the project, the project team adopted aerial images (scale 1: 10,000, resolution 0.5 m, Tonghua County) and DLR-DEM digital elevation data as the basic maps for digitizing geological disasters. The related data processing mainly includes digitization of geological topographic maps, extraction of geological factors, and remote sensing interpretation of land use types. Geological factors are mainly extracted and analyzed by Spatial AnalysisTools in ArcToolBox Toolbox in ArcGIS10.2, including related factors such as slope and aspect. The extraction methods are as follows.

Slope indicates the degree of inclination of a point on the ground surface relative to the horizontal plane, and aspect is a quantifier to describe the inclination of that point. The value of the slope of a point on the surface is the angle between the tangent plane of the surface and the horizontal plane, and the slope direction of the point is the azimuth angle projected on the horizontal plane by the tangent plane along the maximum inclination direction vector. In this research, ArcGIS10.2 software is used to generate data on slope and aspect.

The experimental images and data are from Microsoft Azure Data Markets Free Datasets, which provide free data sets covering everything from agriculture to weather, and the collected geographical remote sensing images of regional disaster points under the complex environmental background are filtered and preprocessed, and the collected original hyperspectral remote sensing monitoring images are obtained as shown in Figure 2.

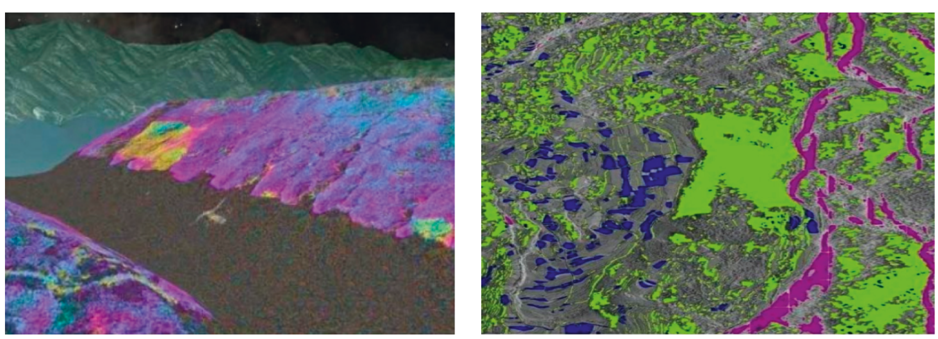
(a) (b)

Figure 1: Field investigation scene of staff: (a) scenario 1 and (b) scenario 2.



(a) (b)

Figure 2: Original hyperspectral remote sensing monitoring image: (a) binary diagram and (b) hyperspectral map.



(a) (b)

Figure 3: Extraction results of spatial map distribution of disaster risk assessment and comprehensive disaster reduction: (a) risk assessment of debris flow disaster induced by extreme rainfall in mountainous areas and (b) spatial map distribution of comprehensive disaster reduction.

4.2. Experimental Results and Analysis. According to the sampling results of the above-mentioned experimental samples, the comprehensive disaster reduction capability of regional disaster spots under the complex environmental background is evaluated. The spatial and temporal distribution characteristics of disaster-causing factors, the dynamic distribution characteristics of disasters, and the rainfall characteristics of inducing factors in the geographical remote sensing images of regional disaster spots under the complex environmental background are analyzed by using the hyperspectral remote sensing monitoring image analysis method, and the results of disaster risk evaluation and comprehensive disaster reduction feature extraction are shown in Figure 3.

According to the analysis of Figure 3, this method can effectively extract the quality correlation characteristics of regional disaster points under the complex environmental background, and the performance curve of comprehensive disaster reduction capability evaluation is shown in Figure 4.

According to the analysis of Figure 4, the accuracy of the regional comprehensive disaster reduction ability evaluation by using this method in the complex environmental background is high; the geographical location of regional disaster points in the complex environmental background is accurate; and the parameter fusion performance of regional comprehensive disaster reduction ability evaluation is good, and the reliability is high. Combined with the evaluation results of disaster risk reduction ability in this study, the different villages and towns in the study area show obvious

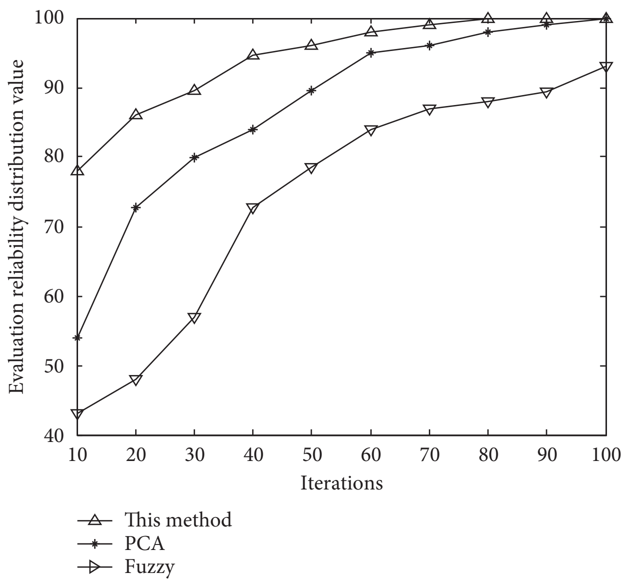


Figure 4: Performance curve of comprehensive disaster reduction capability evaluation.

differences in disaster risk reduction ability, which is determined by the social and economic conditions of each region. In the towns around an urban area, the ability of disaster prevention and mitigation against debris flow disasters has been significantly strengthened with the development of time, which is mainly reflected in the increasingly perfect establishment of disaster emergency agencies and the establishment of disaster monitoring sites from scratch. In the early stage, due to the lack of disaster-related emergency facilities, there was no effective emergency plan when disasters came, which caused a lot of losses. Because of this, these areas also continuously strengthened the publicity and construction at the level of residents' disaster cognition, but there were also shortcomings. Through the investigation, it is found that the disaster emergency plan is still not perfect, the real-time monitoring technology before the disaster, and the social and economic repair measures after the disaster are still relatively lacking, which causes the lag in disaster prevention and control and the failure to respond in time and deal with the damage caused by the disaster reasonably. For the remote towns in the study area, there are no perfect emergency plans and institutions, and local residents still have little understanding of mudslide disasters, which is not conducive to rescue work when disasters come, resulting in a significant increase in disaster losses. Therefore, it is suggested that towns with relatively perfect social economies should establish a perfect preplan from predisaster prediction to postdisaster loss reconstruction and risk sharing as soon as possible. In remote areas, it is urgent to establish disaster monitoring sites and emergency response agencies in high-risk areas, so as to make timely responses when disasters occur. At the same time, the education and publicity about debris flow and geological disasters should be strengthened to improve residents' cognitive level, improve their ability to resist disasters, and reduce casualties and property losses.

5. Conclusions

Debris flow is sudden and destructive. If there are adequate emergency plans, disaster prevention measures, and early warning and evaluation systems, the postdisaster emergency rescue capability of disaster-bearing areas will be greatly improved so that the safety of the population and economy can be protected in time, and the disaster emergency system can be quickly responded to. The postdisaster reconstruction, economic recovery, disease prevention, and disaster prevention work also need effective records. The faster the recovery from the postdisaster, the more losses and negative impacts caused by the disaster will be reduced.

In this paper, the automatic image segmentation technology is adopted, and the texture distribution parameters of disaster-causing factors in geographical remote sensing images of regional disaster points under a complex environment are fused, so as to carry out retrospective identification of comprehensive disaster reduction capability evaluation of regional disaster points under a complex environment and improve the accuracy and reliability of comprehensive disaster reduction capability evaluation of regional disaster points under a complex environment. In this paper, the quality reliability detection is realized by hyperspectral detection of quality-related parameters of regional disaster points under a complex environment, such as gloss, disaster dynamic distribution characteristics, rainfall characteristics of inducing factors, and so on. The test shows that this method is more accurate and reliable in evaluating the comprehensive disaster reduction ability of regional disaster points under the complex environmental background. According to the research, the main conclusions are as follows:

(1) According to remote sensing identification and statistical analysis of historical disaster data, the main geological disaster in the study area is debris flow. Its disaster points are distributed in a large number and range, and the scale of disasters is mainly small. The main hazards are farmland, roads, and houses, sometimes causing casualties.

(2) In the systematic analysis of debris flow disasters in the study area, the main factors affecting debris flow disasters in the pregnant environment are stratum lithology, geological structure, topography, meteorology and hydrology, vegetation conditions, and so on. The main disaster-bearing bodies in the area are population and economic property, and the disaster-inducing factor is the flood formed by rainfall entering the surface valleys, so there is a significant positive correlation between debris flow disaster and rainfall.

(3) Fully consider various factors that may affect the formation of debris flow disasters, comprehensively analyze and study the formation mechanism of regional debris flow geological disasters, and pertinently construct a comprehensive evaluation index system framework of debris flow disaster risk in localized research areas.

(4) Based on the formation mechanism of natural disasters, combined with disaster-causing factors, the coupling of disaster-bearing body and disaster-bearing environment comprehensively evaluate the risk of geological disasters and the possible losses.

The next step of research can consider the following: if the rescue channel is cut off in the event of a heavy rain disaster, the loss will increase exponentially. Therefore, the local government needs to prepare emergency materials in advance, and also strengthen the protection of road traffic, respond in time, and to increase the ability to carry out rescue work; in this process, the main focus is to improve emergency facilities and ensure the transportation network, which can be studied in depth in the future.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

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Retraction

Retracted: Analysis of the Effects of Arts and Crafts in Public Mental Health Education Based on Artificial Intelligence Technology

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] L. Ji and Z. Liu, "Analysis of the Effects of Arts and Crafts in Public Mental Health Education Based on Artificial Intelligence Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 9201892, 12 pages, 2022.

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Research Article

Analysis of the Effects of Arts and Crafts in Public Mental Health Education Based on Artificial Intelligence Technology

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Arts and crafts, with their very different styles due to many factors such as times, regions, technologies, and cultures and nationalities, have undergone an extremely long process, and it is only through continuous superimposition, development, and innovation that they have gradually formed the posture of today's arts and crafts. Public mental health education is the main way to promote the psychological health development of the public in colleges and universities at present. And among them, sound personality and good self-awareness is one of the important standards of psychological health of the large public and one of the important tasks of mental health education. As an effective psychological test and treatment method, arts and crafts analysis are an important part of mental health education. It has a certain role in improving the level of self-awareness and promoting the integration of personality. Art and craft analysis has advantages in mental health and educational group counseling that cannot be replaced by other words and activities, so it can be used in mental health education courses. It can be used in teaching self-awareness. In order to combine the development of arts and crafts with the development concept and promotion ideas of public mental health education, this article proposes an analysis of the role of arts and crafts in public mental health education based on artificial intelligence computing to enhance the development of arts and crafts from a new perspective and seek the inheritance and innovation of arts and crafts and public mental health education in the new historical period, and proves the proposed method in the relevant dataset. The validity of the proposed method is demonstrated in the relevant dataset.

1. Introduction

Arts and crafts are a unique art discipline that has a long history in China and has been explored and developed over a long period of time to become a relatively mature and complete discipline in the art field. Art and innovation have always been complementary to each other, and it is the continuous innovation and optimization from simple to complex and from rough to fine that has led to the development of arts and crafts design, which has evolved into an important factor affecting the daily production and life of human beings. In the case of arts and crafts design, its development process is the process of innovation [1–3]. Only by keeping pace with the times and synchronizing human aesthetic concepts can arts and crafts design achieve sustainable development.

First, innovation in arts and crafts design is conducive to strengthening the infectious power of artworks. In the design of art and craft works, designers should not stick to the rules and design according to the corresponding templates. Innovative arts and crafts design should be made to strengthen the artistic charm and infectious power of arts and crafts works, to obtain the favor of most audience groups [4–7]. Secondly, the innovation of arts and crafts design is conducive to meeting people's spiritual needs. At present, arts and crafts works are popular among people, which makes designers deeply feel and realize the huge potential of arts and crafts design work, prompting them to complete the design work independently and actively. However, this change in thinking has also directly increased the pressure of designers' work, and people's requirements for arts and crafts design have gradually begun to change towards deep spiritual needs. In this regard, designers must target innovation and improvement, to meet people's spiritual needs to the greatest extent. Again, the innovation of arts and crafts design is conducive to optimizing the characteristics of artworks. In the process of arts and crafts design, the introduction of innovative thinking can promote designers to analyze the value of arts and crafts works based on different perspectives and levels of deep consideration, to ensure that arts and crafts works can have both aesthetic and functional characteristics. The role of arts and crafts in public mental health education is shown in Figure 1.

Art education can cultivate people with a sense of beauty, allowing them to see beauty in the most ordinary things; it also enables them to know how to use ordinary things around them to create beauty, giving them a positive and happy attitude towards life, and it enables them to face the hardships of life with a sense of beauty. As an important component of art education, arts and crafts is precisely the purpose of self-healing and nurturing the healthy growth of the mind through the transfer and transformation of creativity and aesthetic experience by using the perception of beauty in its unique nonverbal expression [8–10]. Therefore, we should actively explore the psychological healing function of arts and crafts, that is, the healthcare of arts and crafts for the healthy psychology of the subject. The origin of art therapy can be traced back to prehistoric times, when humans felt fear and panic about many unknown phenomena such as nature and man himself, so they left many murals in caves to express their awe to relieve their inner pressure.

Today, modern medical psychologists have shown through their research that art has a significant therapeutic and healthcare effect in regulating psychological anxiety and emotional disorders in modern people. They believe that art and its educational activities are a kind of panacea for maintaining and improving physical and mental health, and a kind of nonverbal psychotherapy that is quite effective. Through arts and crafts, calligraphy, seal engraving, sculpture, architecture, etc., art and its educational activities explore, express, and create beauty, so that the subject can feel beauty, appreciate beauty and love beauty in the process of education, cultivate beautiful ideas, and use the psychological suggestion of beautiful ideas to create a lively and pleasant spiritual realm, so that life is full of health and vitality, and the mind is calm and peaceful [11–14]. The suggestiveness and creativity of this good intention can fully mobilize the psychological potential of individuals, so that their physiological functions show a good emotional reflection, the cerebral cortex, and the central nervous system to produce a positive stimulation and promote a more pleasant and strong body and mind.

As a special group of young people loaded with high expectations from family and society, the contemporary public is facing more opportunities and at the same time is under greater psychological pressure and challenges. In this sense, the public is a high-risk group for mental health problems. According to a national sample survey, 23% of the public has different degrees of mental health disorders or psychological abnormalities. Growing adults are more likely to experience more anxiety and frustration due to their unstable state of mental activity, incomplete cognitive structure, lack of synchronization between physiological and psychological maturity, and lack of identification with society and family, and are therefore more likely to have psychological problems. If temporary psychological barriers are not eliminated in time, they will produce adverse reactions and affect the healthy development of the psyche in the future and may even lead to psychological disorders that are difficult to save in the future [15].

From the development of arts and crafts in recent years, the use of artificial intelligence in the field of arts and crafts has gradually become widespread. Especially in the process of arts and crafts design education and teaching, the use of artificial intelligence helps to improve the aesthetic level and improve the quality of teaching. Arts and crafts built on artificial intelligence can show static knowledge in a dynamic mode, helping the public to understand art- and design-related knowledge more intuitively. In addition, arts and crafts design has humanistic and artistic characteristics, and the effective combination of big data, AI technology, and VR technology in the age of artificial intelligence can promote the cultivation of public aesthetic consciousness, spread public thinking, and guide them to establish correct mental health concepts. Therefore, under the era of artificial intelligence, arts and crafts design should change its own concept, integrate various technologies and advantages involved in artificial intelligence into the process of arts and crafts design, optimize teaching resources, innovate teaching mode, create a good artistic atmosphere for arts and crafts, guide the public to feel and experience the beauty of art and design, and realize the innovation and reform of art and design teaching in colleges and universities [16].

The main contributions of this article are as follows. Firstly, it analyzes that in arts and crafts design, the role of arts and crafts in healthcare for public mental health should be actively explored, and through effective aesthetic penetration and aesthetic deepening, education, and self-education that integrates knowledge, emotion, intention, and action should be implemented, and rich arts and crafts activities should be carried out to cultivate healthy aesthetic consciousness, aesthetic emotion, and aesthetic behavior of the subject to sound psychology and develop personality. This article proposes a model for analyzing the role of arts and crafts in public mental health education by artificial intelligence technology. The neural network model with deep learning can analyze arts and crafts for public mental health education quickly and accurately. The experiments demonstrate the effectiveness of the proposed method and provide a feasible solution for the analysis of the role of arts and crafts in public mental health education in batch and fast.

2. Related Work

2.1. Arts and Crafts Design. The arts and crafts industry, with its profound cultural heritage and exquisite craftsmanship, has opened a new research direction and creative field for the current cultural and creative industries. With a far-sighted

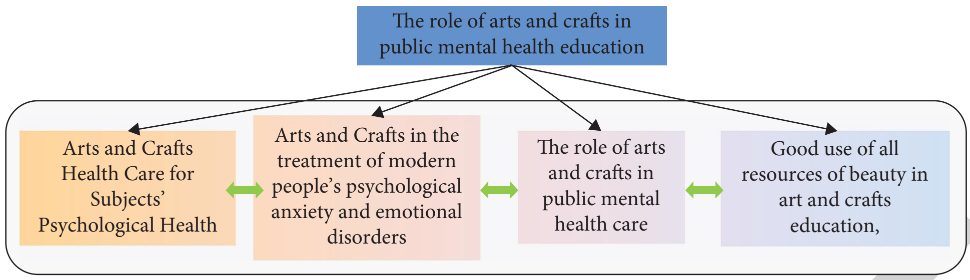

Figure 1: The role of arts and crafts in public mental health education.

view on the inheritance and innovation of traditional arts and crafts, we bring life and vitality to the development of arts and crafts by using classics as inheritance and innovation. How to make traditional arts and crafts rejuvenate is a topic that has been explored in the past few years. Designing arts and crafts that meet the needs of contemporary people, meet the aesthetic value of the public, and have practical functions has become a necessary condition for the transformation and upgrading of arts and crafts. The innovation of arts and crafts needs several aspects to complement each other, such as the improvement of the environment for the development of arts and crafts, the change of design concept, the cultivation of the innovative spirit of arts and crafts inheritors, the integration of arts and crafts with science and technology, and the cross-border cooperation of arts and crafts [17]. These changes are urgent, and only the collision of innovative thinking can give a new vitality, so that our life can be splendid because of innovation, and arts and crafts can be inherited because of innovation.

The improvement of the environment for the development of arts and crafts is the external condition for the survival of arts and crafts, as the social environment and economic environment interpenetrate each other. If we can change our perspective and our existing habitual way of thinking, we may be able to open new horizons. Unlike pure art, which is confined to the upper class and the literati, arts and crafts are directly related to the society and the people and are closely related to the social environment. A prosperous socioeconomic environment is naturally conducive to the development of arts and crafts and provides a material basis for their development. Only arts and crafts that penetrate deeply into people's lives can develop harmoniously in the social environment, so that their artistic personality can gain vitality and win people's consensus [18–21].

Nowadays, Chinese elements have become a hot spot of attention on the world stage, and Chinese arts and crafts, with their profound cultural heritage, rich historical connotation, and regional characteristics, are favored by people from all over the world, and arts and crafts as one of the elements play their due function of cultural dissemination. The last decade has been a golden decade for the development of the arts and crafts industry. Consumers' demand for arts and crafts products has been diversified and multileveled, thus driving the rapid development of the industry and providing a wide space for China's arts and crafts industry to achieve higher economic and cultural values. No matter what industry the designer belongs to, deep cultural cultivation is necessary, and the designer's taste directly affects his works. It is important for designers to open their eyes, such as traveling abroad, attending industry exhibitions, and using the Internet are useful ways [22,23]. An excellent designer should learn a wide range of knowledge, consciously accumulate knowledge, and develop their own ability to feel the beauty, so that they can be in touch with it when designing.

A designer is different from a craftsman or an artist. The creation of an artist is to a large extent a personal act, and he can create works expressing his own ideas at will. The designer's creation is a social act, holding the concept of human-oriented design and putting the needs of consumers in the first place, and his works are accepted by the public in daily life after forming products. In addition, the designer should also have sufficient understanding of the whole process of the product from design and manufacturing to the market. At present, corporate designers are subject to greater constraints because companies pursue economic benefits first and personalization later.

2.2. Public Mental Health Education. Clinical psychology research shows that emotions dominate health. Maintaining good moods and stable emotions is one of the most helpful forces for physical and mental health in the human body. As an important part of arts and crafts education, the emotional factor is always present throughout the aesthetic and creative activities, and it can be said that it is difficult to produce true beauty without emotion. Healthy and noble emotions can balance many aspects of an individual's mental activity, enabling them to treat all kinds of pressure with a calm and friendly attitude, express their emotions reasonably, and gain inner peace and positive motivation for life [24–26].

Nourishing the heart for beauty. Perceiving and appreciating beauty is the foundation and key to aesthetic education, the core of aesthetic education. Giving up this, emotions will be indifferent to any thing of beauty. The ingestion of profound aesthetic feelings requires going deep into the object of beauty or the environment it is in to observe, experience, and comprehend, and therefore, often lead the public into nature, or observation, or description, or writing, or collage, or imagination, "to the body of," first-hand experience and then taste, guide its aesthetic mind to insight into nature, to feel the spirit of nature, touch the truth of nature, perceive the beauty of all life, think about the ugliness and evil in the world, and nourish the heart of beauty, to moisten the love of beauty. Arts and crafts education is a kind of emotional education, which mobilizes various psychological functions of the subject through beautiful things and sublimates emotions, so that through rich inner experience, it is psychologically moved, emotionally resonant, and temperamentally cultivated.

When many people look at a picture, if it is an ink-painted landscape picture, they will have a sense of magnificence in their hearts; if it is a gold-blue flower and butterfly picture, they will have a sense of beauty in their hearts. Therefore, if a landscape picture is hung in a hall, people in the hall will feel more solemn and respectful; if a flower and bird picture is hung in a room, people in the room will feel happier. Plato also thought that we should look for some competent artists to portray the beautiful aspects of nature, so that our young people, like living in a windy and warm area, where everything around them is good for their health, will be exposed to beautiful works every day, like breathing a breeze from a secluded realm, to breathe their good influence, so that they will unconsciously cultivate from childhood. For the love of beauty, cultivate the habit of integrating beauty in the mind. Excellent arts and crafts work can inspire the viewer's empathy through the sensual and changing forms of artistic composition, and get infected from them, thus generating a longing and aspiration for beauty and spurning and despising ugliness, and gradually entering the realm of truth, goodness, and beauty. This sublimation of emotion can make people feel beautiful things freely and happily under the requirement of inner desire, accept the baptism of beauty, and produce the love of beauty [25].

Enriching activities for a healthy personality. One of the most important tasks of upbringing is to make people governed by forms even in their purely natural state of life. The moral man can only develop from the aesthetic man and cannot arise from the state of nature. Immortal artistic creation reflects the author's conception of art, beauty, and love for life. The process of appreciating and creating beautiful things often sublimates human emotions, and this sublimation will play a subtle role in regulating human behavior and prompting it to become a moral being.

Therefore, in arts and crafts education, we should make good use of all the resources of beauty, organically penetrate the inner world and real life of people, form a conscious rational force, and strengthen aesthetic experience and aesthetic training through various forms of arts and crafts activities, so as to shape the healthy and complete personality of the subject. Practice the eye for beauty. Beauty is everywhere, and for our eyes, it is not a lack of beauty, but a lack of discovery. But a pair of eyes good at finding beauty needs to be honed for a long time. Only when the visual object causes physiological and psychological pleasure does perception become associated with aesthetics. Arts and crafts education is to train the perceiving subject to select different perspectives in specific aesthetic activities, to use symmetry, balance, rhythm, rhyme, and other laws of beauty to observe and analyze objects, to raise daily perception to aesthetic perception, and to develop a pair of "aesthetic eyes," that is, from unconscious viewing of nature to a conscious, active, and selective observation. The "aesthetic eye" to observe things can fully mobilize the subject's imagination, association, emotion, and other psychological factors, and consciously use the laws of beauty, to test and feel the beauty of things, so as to grasp the natural objects of the original.

2.3. Artificial Intelligence Technology. The technology of recognizing the style and mental health state of arts and crafts probably emerged at the end of the 20th century, mainly through the technology of image texture generation to realize the migration of style. Research on image texture requires researchers to build models manually, the core idea of which is to generate texture through statistics of local features of images, without which models cannot be built at all, and a model can only do one style or scene [26–28]. In addition, the computer computing power was not strong at that time, so the development of arts and crafts style and mental health state recognition technology was very slow. The predecessor of convolutional neural network is the visual cortical map created by Hubel and Wiesel by recording the brain feedback formed by the stimulation of a cat in a specific mode. leNet-5 formed the prototype of contemporary convolutional neural network, and based on the LeNet-5 model, the convolutional neural network has a more systematic definition and precise structure under the research of researchers. Convolutional neural networks are a class of feedforward neural networks with deep structure and convolutional computation built after biological visual perception mechanism, which are widely used in image recognition, behavioral cognition, pose estimation, and natural language processing because of their ability to learn data stably.

Convolutional neural network-based art and craft style and mental health state recognition technology art and craft style migration is a special application of convolutional neural network (CNN) in the field of computer vision, fully demonstrating the ability of convolutional neural network representation learning, able to learn features and learn the process of extracting features to avoid the trouble of manual extraction of features. It consists of input layer, convolutional layer, excitation function, pooling layer, and fully connected layer. The convolutional layer is an important part of the CNN and is used to extract feature values. Different convolutional kernels can extract different features [29, 30]. The lower convolutional layers can only extract low-level features such as edges, lines, and corners, while the higher layers can use the lower features to obtain more complex features. The pooling layer is a down-sampling operation after feature extraction by the convolution kernel, which is mainly used to perform feature dimensionality reduction and improve computational speed by compressing the number of data and parameters, and can control overfitting and improve the robustness of the network. Based on the published structural model, the algorithm is optimized for both style and content by introducing the target content image based on texture synthesis and modifying the loss function to combine the style of any one image content to form an image with artistic style characteristics.

The visual processing is carried out by training a multilayer convolutional neural network so that the computer discriminates and learns the artistic style. However, it is obvious from the generated images that some of the image contents are distorted, details are lost, and the time consumption of the trained convolutional network is long, and the degree of migration cannot be controlled. Subsequently, the control of details in the migration of the Arts and crafts style was enhanced, but there was still no control over the image content. After that, the Fast Neural Style approach improved the drawback of the long training time of the original craft style migration, and the GPU usually only needs to run for a few seconds to generate the corresponding craft style migration results after each style model is trained, but the generated image effect is still not improved. With the continuous development of technology, the technology of arts and crafts style and mental health status recognition is becoming more and more mature, but the problems of image distortion and loss of details still exist, and the main breakthrough point of the future technology of arts and crafts style and mental health status recognition based on convolutional neural network is to get the synthetic image with the best matching degree and lower loss.

3. Methods

3.1. Model Architecture. The region-difference stylization model in this article is shown in Figure 2. After the content image passes through the DeepLabV3 semantic segmentation network, a segmentation map with n semantic regions is generated, and different styles are adopted for stylization in each of these n regions. Based on the neural style conversion algorithm, a pretrained VGG-16 neural network is used to calculate the style loss and content loss to ensure the stylization effect while reducing the computational burden. In the loss function part, the content features are represented by the high-level features of the VGG network, which are used to retain the spatial structure information of the content images.

3.2. Image Semantic Content Representation. The network is generated based on a VGG network, which is used for image object recognition and localization. The structure of the feature extraction model is shown in Figure 3. A feature space extracted from a normalized 19-layer VGG network (consisting of 16 convolutional layers and 5 pooling layers) is used. The network is normalized by weight scaling so that the average number of activations per convolutional filter over images and locations is equal to l. This move allows rescaling the VGG network without changing its output. This is because VGG contains only rectified linear activation functions without normalizing or merging the feature mappings. Let and x be the original image and the generated image, respectively, and let P^l_{ij} and F^l_{ij} represent the features in layer l. Then, the squared error loss between the two feature representations is defined as follows:

$$L_{\text{content}}(\vec{p}, \vec{x}, l) = \frac{1}{2}\sum_{i,j}\left(F^l_{ij} - P^l_{ij}\right)^2. \tag{1}$$

With respect to the activation function in layer l, the derivative of the loss function is given as

$$\frac{\mathrm{d}L_{\text{coneent}}}{\mathrm{d}F^l_{ij}} = \begin{cases} \left(F^l - P^l\right)_{ij}, & \text{if } F^l_{ij} > 0, \\ 0, & \text{if } F^l_{ij} < 0. \end{cases} \tag{2}$$

The gradient with respect to the image x can then be computed using standard error backpropagation. Thus, the initial random image x can be changed until it generates the same response in a particular layer of the convolutional neural network as the original image p. When convolutional neural networks are trained for object recognition, they form image representations so that the object information becomes increasingly clear along the processing hierarchy, referring to the feature responses in the deeper network as content representations.

3.3. Artistic Style Representation. To obtain a stylized representation of the input image, a feature space is used to capture the texture information of the image. This feature space can be built on top of the filter responses in any layer and consists of correlations between the different filter responses. These feature correlations are represented by the Gram matrix G^l_{ij}', where G^l_{ij} is the inner product between the vectorized feature mappings i and j in the lth layer:

$$G^l_{ij} = \sum_k F^l_{ik}F^l_{jk}. \tag{3}$$

A stable, multiscale representation of the input image is obtained by considering multiple layers of feature correlations. The representation captures the texture information of the image, but not the global arrangement. The information captured by these stylized feature spaces constructed on different layers of the network can then be visualized by constructing images that match the stylized representation of a given input image. This is achieved by using gradient descent from a white noise image to minimize the mean square distance between the Gram matrix terms of the original image and the Gram matrix of the image to be generated. Let a and x be the original image and the generated image, while A and G denote the styles of the original and generated image layers l, respectively. Then, the loss of layer l can be expressed as

$$E_l = \frac{1}{4N_l^2 M_l^2}\sum_{i,j}\left(G^l_{ij} - A^l_{ij}\right)^2. \tag{4}$$

The total loss function has the following form:

$$L_{\text{style}}(\vec{a}, \vec{x}) = \sum_l w_l E_l, \tag{5}$$

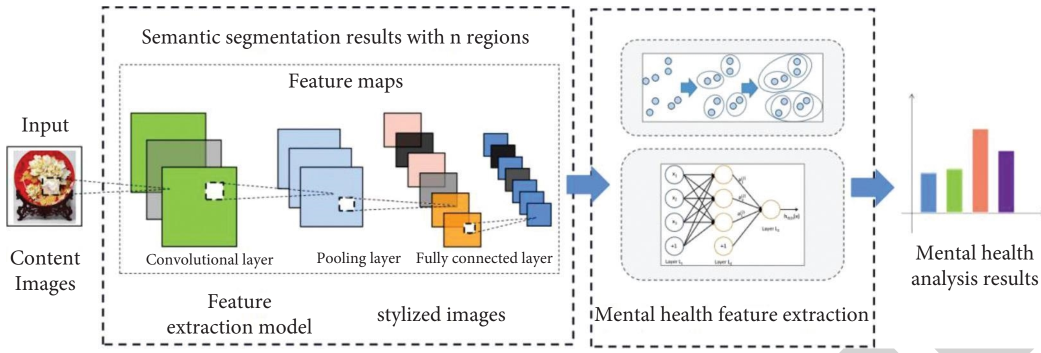

Figure 2: Model structure.

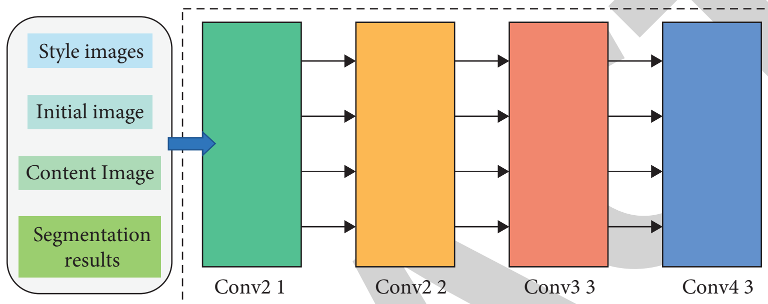

Figure 3: Feature extraction model structure.

where w_l is the weighting factor. With respect to the activation function in layer l, the derivative of E_l can be expressed as

$$\frac{\partial E_l}{\partial F_{ij}^l} = \begin{cases} \frac{1}{N_l^2 M_l^2}\left(\left(F^l\right)^T\left(G^l - A^l\right)\right)_{ji} & \text{if } F_{ij}^l > 0, \\ 0 & \text{if } F_{ij}^l < 0. \end{cases} \tag{6}$$

The gradient of E_l with respect to the pixel value x can be easily calculated using standard error back propagation.

3.4. Style Recognition. To transfer the style of the artwork to the photograph, a new image is synthesized that matches both the content representation and the style representation of a. Therefore, the distance between the feature representation of the white noise image and the content representation of the photo in one layer and the distance between the style representation of the artwork defined on multiple layers of the convolutional neural network is jointly minimized. The minimized loss function is

$$L_{\text{total}}(\vec{p}, \vec{a}, \vec{x}) = \alpha L_{\text{content}}(\vec{p}, \vec{x}) + \beta L_{\text{style}}(\vec{a}, \vec{x}), \tag{7}$$

where α and β are the weighting factors for content and style reconstruction, respectively. The gradient about the pixel values can be used as input to the numerical optimization strategy, which is employed as L-BFGS. To extract image information in comparable proportions, the style image is always resized to the same size as the content image before computing the style features.

3.5. Mental State Recognition. Through the interaction layer, k-dimensional vectors are initialized n and they are used as auxiliary vectors for the input layer x. In the embedding layer, the vectors are multiplied with their corresponding features to obtain $\mathbf{v}_i$ and then the n sets of $\mathbf{v}_i$ are input to the interaction layer, and I is obtained by the interaction mode calculation, and w is the number of neurons in the interaction layer, which is determined by the following four interaction calculation modes. The number of neurons in the interaction layer is determined by the following 4 interaction calculation methods, and the output is as follows:

$$\mathbf{I}_{\text{DA}} = \sum_{i=1}^{n-1}\sum_{j=i+1}^{n} \mathbf{v}_i, \mathbf{v}_j \mathbf{x}_i \mathbf{x}_j. \tag{8}$$

The number of interactions is $\mathbf{I}_{\text{DC}}$, and the output as

$$\mathbf{I}_{\text{DC}} = \left(\mathbf{v}_1, \mathbf{v}_2\mathbf{x}_1\mathbf{x}_2, \ldots, \mathbf{v}_{n-1}, \mathbf{v}_n\mathbf{x}_{n-1}\mathbf{x}_n\right)^T. \tag{9}$$

The interaction layer multiplies the corresponding positions of v_{ik} and adds the corresponding products and the output as

$$\mathbf{I}_{\text{MA}} = \left(\sum_{i=1}^{n-1}\sum_{j=i+1}^{n} v_{i1}v_{j1}\mathbf{x}_i\mathbf{x}_j, \ldots, \sum_{i=1}^{n-1}\sum_{j=i+1}^{n} v_{ik}v_{jk}\mathbf{x}_i\mathbf{x}_j\right)^T. \tag{10}$$

The model studied in this article takes as input data the features selected by the image style transformation, that is, $\mathbf{x} = (x_1, x_2, \ldots, x_i, \ldots, x_n)$. Then, the features are concatenated into the hidden layer together with the result after the FM module features are combined. The hidden layer has 5 layers with 128 neurons per layer, and the activation function ReLU; fully connected layers are used between the layers. Since the use of more fully connected layers and many parameters between layers makes the model complex, dropout is used in training the model. Dropout is randomly turning off some neurons so that some features are not overlearned by a certain neuron in the model, thus improving the robustness of the model. The percentage of FM-DNN using dropout to turn off neurons is 0.5. For the 4-classification task in this study, the number of neurons in the output layer is set to 4, and the output y is obtained, and the mental state recognition result y is output using the softmax layer. FM-DNN uses cross-entropy as

$$L = -\sum_{i=1}^{4} \hat{y}_i \ln y_i, \tag{11}$$

where $\hat{y}_i$ is the unique thermal coding label of the sample and y_i is the probability of category i in the predicted value of the network. Stochastic gradient descent is used to train the parameters in the network, setting the batch size to 128, the maximum number of training rounds to 10, and the learning rate to 0.001. To prevent overfitting, an early stop method is used; that is, the training will end early when the accuracy of the validation set no longer rises for two rounds.

4. Experiments and Results

4.1. Experiment Setup. The algorithms in this article were experimented on a nonpublic dataset from a domestic arts and crafts research institute in China. The proposed model is used as a model for the analysis of the role of arts and crafts in public mental health education, and experiments are conducted for a variety of styles of arts and crafts to identify the symbolic features in arts and crafts and to classify the images. The number of training sets was 4878, and the number of test sets was 2500. In order to expand the number of training sets and improve the model training effect, the training set is expanded by 4 times by rotating 90 degrees, 180 degrees, and 270 degrees for one of the arts and crafts in the training set. The Adam optimizer is used, the batch parameters are set to 16, the number of training rounds is 20, and the learning rate is 0.0001 in the first 10 training rounds and decays linearly from 0.0001 to 0 in the second 10 training rounds. The experimental environment is shown in Table 1. Keras is a higher-order application programming interface built on top of a symbolic mathematical library that supports tensor computation. The supported underlying architectures including Keras can be used to rapidly build and train networks and can be used to train networks using either CPU or GPU, with GPU training requiring an NVIDIA graphics card and configuration to install the relevant environment, while the computational speed and efficiency are greatly improved. The training process performance enhancement and loss convergence are shown in Figure 4 and Figure 5.

4.2. Experimental Results. The recognition rate of this network is 64.73%, and the total number of parameters is 58,423, corresponding to each emotion as shown in Table 2.

Table 1: Experimental environment.

Name	Versions
Python	3.7
TensorFlow-gpu	2.0.0-rc0
CUDA	10.0
CUDNN	V7.5.0
Opencv-Python	4.4.0.46
Keras	2.3.1

After incorporating the residual blocks, the recognition rate of the method in this chapter can reach 70.89%, and the recognition rate and loss function are corresponding to each emotion as shown in Table 3.

We introduce spatial residual connectivity, referred to as RN, to the separable convolutional network and keep other conditions unchanged. From Tables 2 and 3, we find that the separable convolutional network with RN shows significant improvement compared to the method without the inclusion of residuals. This is because the residual structure selects the appropriate neighbor range for each node and avoids the lack of differentiation of the nodes when the network stacks multiple layers. By introducing cross-domain spatial residual convolution, the spatial-temporal information can be enhanced, and the residuals also solve the problem of superposition of two convolutions. Next, we also we first implemented the simpler model structure of LeNet-5, and the accuracy of the model on the Fer2013 dataset was 58.3% with 1.168 million participants. Then, we performed classification experiments using VGG-16, with an accuracy of 68.81% on the Fer2013 dataset and a number of 14,754,000 parameters. While we used separable convolutional counts of only 58,000, the accuracy reached 64.17% without adding the residual network, and after adding the residual network, it brought the average recognition rate to 70.89%, an improvement of 6.72%, and both methods reached an average accuracy of 65% ± 5% on this dataset using the manual case. Better results were achieved with a smaller number of parameters and training time than the other methods. Among the recognition results, the highest recognition rate can be achieved for the happy emotion, which can reach 88.68%. The second one is normal emotion, and the recognition rate can reach 77.76%; and the third one is surprise, and the recognition rate can reach 73.61%; while the emotions with relatively low recognition rate are disgust, fear, and sadness, the facial changes of happiness and surprise are more exaggerated and disgust and sadness have less facial changes; happiness and surprise have low similarity with other expressions, while disgust and anger are more similar, and both have frown and grin, which are easy to misjudge; the number of disgust expressions in the training set is very small, only 436, which is not enough to learn enough features, making the results less satisfactory, while the number of happy is very large, so there is a high accuracy rate. To verify the superiority of this network, we also did experiments in fer2013, and the comparison results are shown in Figure 6.

In this article, we not only compare the accuracy of Bi-LSTM and CNN models, but also train the classical RNN model and LSTM model to help analyze the advantages, disadvantages, and effectiveness of the models in terms of

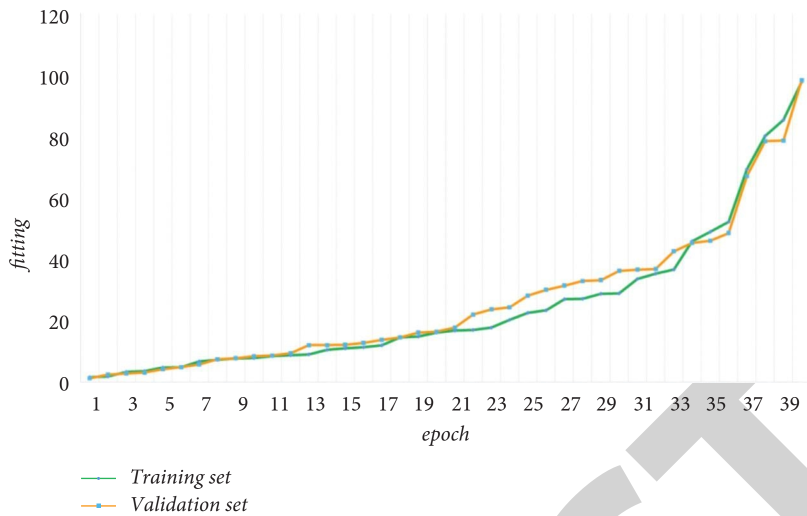

Figure 4: Schematic diagram of training process performance improvement.

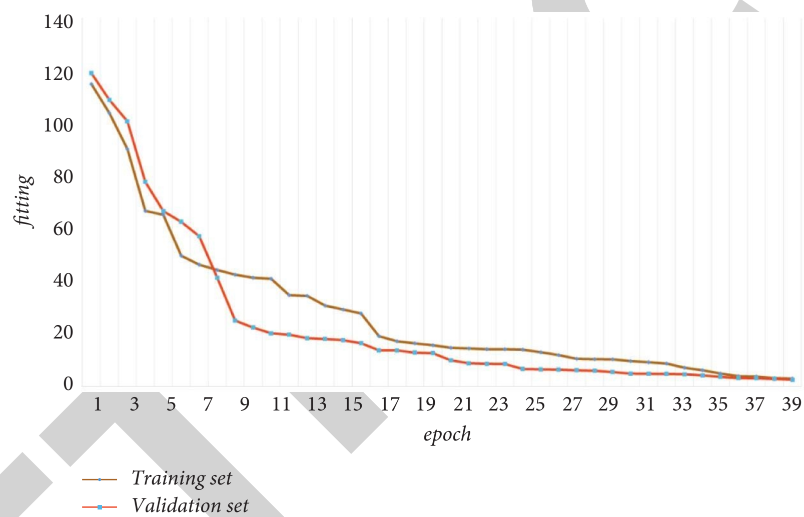

Figure 5: The training process loss convergence schematic.

Table 2: Separable convolution recognition rate.

Types of emotions	Recognition rate (%)
Anger	58.23
Disgust	55.46
Fear	49.31
Happy	87.57
Sadness	53.83
Surprised	70.03
Normal	72.68

Table 3: Experimental environment.

Types of emotions	Recognition rate (%)
Anger	61.54
Disgust	57.22
Fear	50.49
Happy	88.68
Sadness	55.35
Surprised	74.61
Normal	77.76

applications in this article. The experimental results are shown in Figure 7.

The Bi-LSTM achieves quite good results compared to the LSTM, which can be analyzed in context, and also has 5.52% higher accuracy compared to the CNN model, which is predicted to be due to the fact that the CNN does not have high accuracy in analyzing long segments due to the varying sentence lengths in the dataset. The RNN is significantly less accurate than the other three due to gradient disappearance and gradient explosion, and the LSTM is better compared to the RNN, but still cannot do accurate prediction because it cannot be combined with the following content. The results of this article indirectly illustrate the conclusion that the daily textual sentiment expressions of the Chinese public are scattered in the segments, and there is a high possibility of oversight if manual analysis is performed. 95.55% accuracy of Bi-LSTM can better achieve the ability of batch processing text.

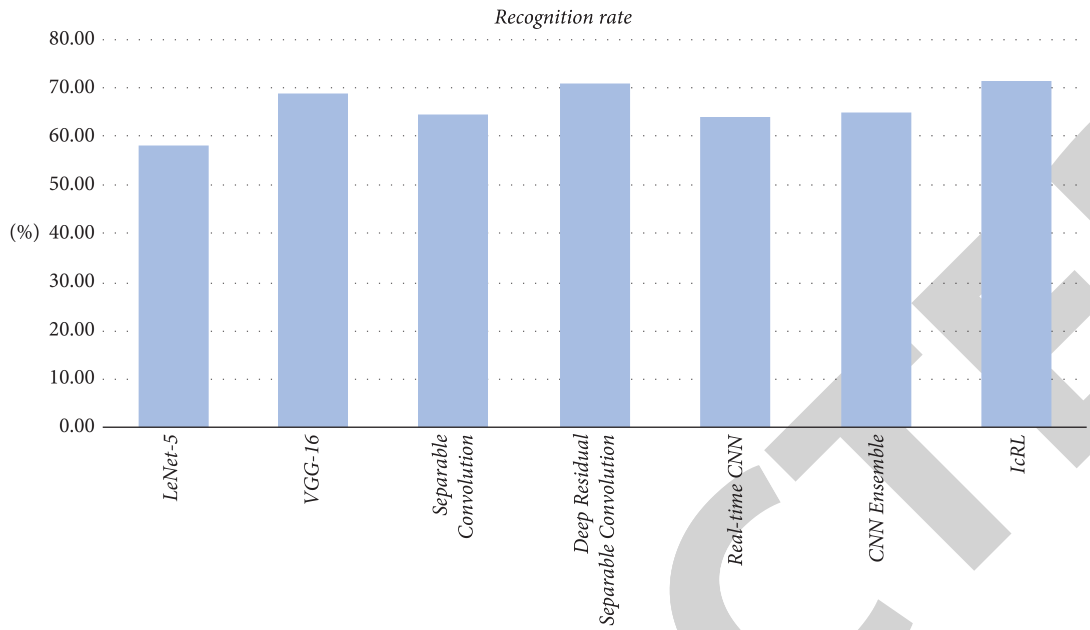

Figure 6: Comparison of recognition rate of deep separable residual convolution.

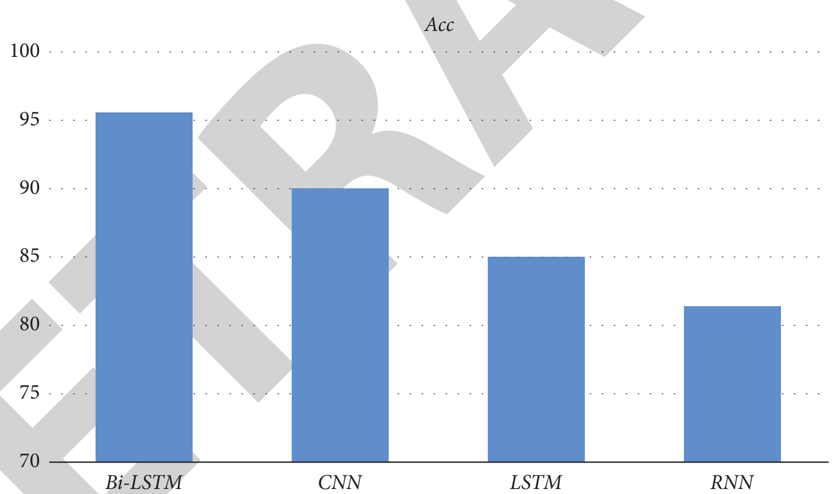

Figure 7: Performance comparison.

The $F1$-score of the four variants of FM-DNN and the control model for each mental health class classification are shown in Figures 8 and 9. As can be seen from Figures 8 and 9, the $F1$-score of the six methods in no mental health and moderate mental health did not differ much; in mild mental health, the $F1$-score of the FM model was much worse than the other models, while FM-DNN (IDA) showed a better classification; in severe mental health, the $F1$-score of FM and DNN was lower, indicating that using only FM or DNN trained PCk-means selected 22 features; that is, data containing 13 important dimensions such as interpersonal stress, academic stress, and family education are not good for mental health identification. This may be since FM cannot effectively learn the complex nonlinear relationship between mental health and its related features, or the DNN model classifies a feature independently of other features to identify mental health and lacks the consideration of feature combination in mental health identification. In contrast, the classification performance of F-DNN in this article has a significant advantage over the control group, which not only shows that the diversity of dimensions has an important contribution to mental health recognition, but also shows that F-DNNN improves the diversity and comprehensiveness of prediction dimensions by using FM to effectively combine mental health features, thus enhancing the classification effect of the model. Compared with other models, F-DNN, especially IMA, can better identify severe mental health testers more accurately, which is valuable in the screening of mental health disorders.

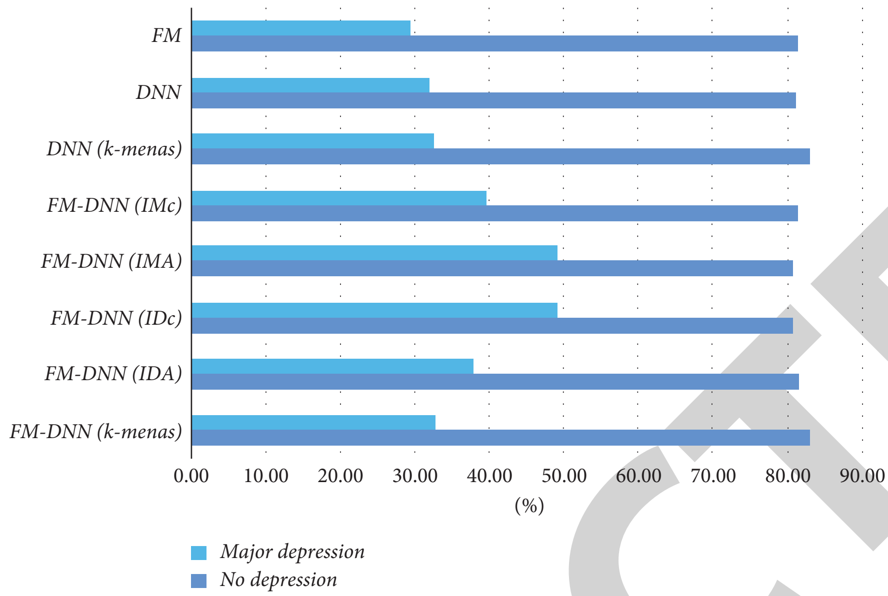

Figure 8: Comparison of $F1$-score of severe mental health grade classification.

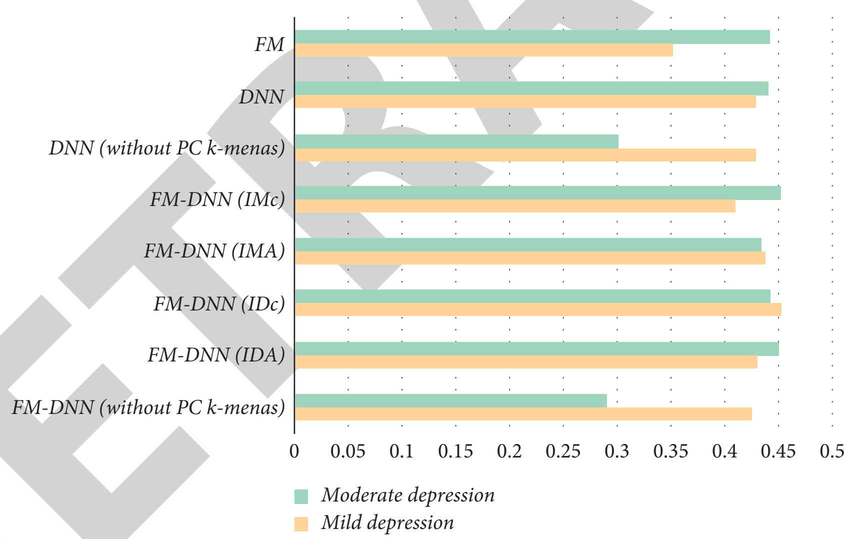

Figure 9: Comparison of $F1$-scores of mild mental health rating categories.

Therefore, the comparison with the control model shows that the DNN model designed in this study exhibits good classification ability, and the introduction of FM also has a significant effect on the optimization of the network structure.

5. Conclusion

Arts and crafts both reflect and exercise various mental abilities such as attention, observation, imagination, memory, and thinking, and also implicate various mental qualities such as interest, emotion, will, and character, as well as activate the right brain. By exploring the potential of arts and crafts education to develop brain potential and promote mental health, we can improve the public's sensibility through arts and crafts activities, prompt them to have a deeper understanding of classic works and themselves, become more sensitive to their own minds, and make their mental feelings more active and positive, so that brain potential, especially right brain potential, can be further developed, thus enriching the form of mental health education. Therefore, seeking the organic combination of arts and crafts education and mental health education should become the direction of joint efforts between arts and crafts education and mental health education in the future. The analysis of the role of arts and crafts in public mental health education based on artificial intelligence technology proposed in this article proves that arts and crafts analysis, as an effective white ego analysis technique, is an effective psychological test and psychotherapy method, and its application to mental health education courses can guide the public to think deeply about self-awareness, improve the level of self-awareness, and promote the healthy development of the personality of the general public in order to achieve the purpose of mental health education. In the future, we plan to carry out an analysis study of the role of arts and crafts in public mental health education using recurrent neural networks and knowledge mapping.

Data Availability

The datasets used to support the findings of the study can be obtained from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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Research Article

Construction of Multiobjective Planning Decision-Making Model of Ecological Building Spatial Layout under the Background of Rural Revitalization

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In order to improve the spatial layout ability of ecological buildings under the background of rural revitalization, a multiobjective planning and decision-making model for the spatial layout of ecological buildings is constructed. Based on the visual impact detection of ecological building space, a three-dimensional rendering model is established. The block matrix matching and boundary contour parameter analysis methods are used to plan and design the layout boundary feature points, and the wavelet scale decomposition method is used to analyze the mixed tone of the layout image. Based on this, a multiobjective planning decision-making model for the spatial layout of ecological buildings is established, based on which the spatial layout design scheme of ecological buildings is output to realize the spatial layout planning of ecological buildings. The simulation results show that the spatial layout of ecological buildings using this method is more reasonable, and the expression ability of ecological aesthetics is stronger, which has a good application value in rural planning and design.

1. Introduction

Under the background of rural revitalization, the spatial layout of ecological buildings is mainly embodied in: ① Respecting nature and creating ecological beauty: traditional villages are often bred under specific natural and geographical conditions, integrating mountains, water, fields, and houses, and have a good ecological environment and beautiful pastoral scenery. The planning and design of beautiful countryside should fully respect the existing natural conditions and geographical environment, and achieve the characteristics of mountains, the style of water towns, and the taste of plains [1]. ② Perfect housing construction and create architectural beauty: the quality of the building and the reasonable layout of the building directly affect the villagers' intuitive feeling of space, and the appearance of the residential houses directly determines the external image of the village. Housing planning should be in harmony with the local situation and culture, and can reflect the regional characteristics [2]. ③ Reasonably set up the industrial layout and create a beautiful life: rural landscape is the external embodiment of rural life, and life is inseparable from production [3]. Beautiful rural landscape and reasonable industrial layout are mutually integrated and inseparable [4–6]. Once rural landscape is separated from economic production, it will become an isolated "landscape" in the eyes of villagers. The planning of beautiful countryside must be based on real life, land integration through land circulation, and achieve the purpose of intensive development of collective economy. It is of great significance to study the multiobjective planning decision model of ecological building spatial layout under the background of rural revitalization [7].

Reference [8] based on the land space planning theory of "people-oriented," through the contradiction coordination mode of "self-existence coexistence" and "optimization balance," and taking the maximization of the overall interests of the society as the criterion, this paper constructs the decision-making path of land space ecological restoration planning of "determining the region, clarifying interests balancing needs, preliminary judgment game multidimensional evaluation, and coordinating contradictions." Reference [9] proposes to build the overall framework of the three-dimensional decision-making platform. With the help of the Zhengyuan three-dimensional GIS platform genius world, it realizes the integrated storage management and three-dimensional visual integrated expression of basic geography, urban geology, and underground space facility data. At the same time, according to the actual business needs, an underground space auxiliary planning platform integrating above ground and underground integrated profile analysis, large-scale building site selection analysis, underground rail transit route selection planning, and underground space suitability evaluation are studied and realized. Reference [10] constructs the main structure of high-rise buildings through workset collaboration mode and integrates different building professional models. Through BIM (building information modeling) modeling software, the three-dimensional space model of high-rise building is built, and the basic information of high-rise building is added. By dividing the internal space network nodes of high-rise buildings, the emergency evacuation objectives are determined, and the limiting factors in the process of emergency evacuation are determined. Based on reasonable assumptions, a two-level decision-making model of emergency evacuation path of high-rise buildings with the optimal emergency evacuation path and the shortest emergency evacuation time is constructed. Reference [11] takes the typical representatives of the two, "spatial equilibrium model" and "confrontation generation network" as examples, summarizes, and combs their theoretical basis, advantages and limitations, and application scenarios in urban research and practice. Urban system model is more suitable for supporting large-scale planning implementation evaluation (through counterfactual simulation) and spatial planning compilation (through scenario prediction), while artificial intelligence technology is more suitable for small-scale urban spatial form generation based on current situation cases and planning guidelines. Based on their complementary advantages, cross-scale model coupling can provide a quantifiable and interpretable scientific basis for exploring local conditions, multidimensional, and win-win urban decision-making.

In this paper, combining multiobjective planning decision-making and image visual feature fusion analysis method, the spatial layout model of ecological buildings under the background of rural revitalization is designed, and a spatial layout model of ecological buildings under the background of rural revitalization based on multiobjective planning decision-making model is proposed. The visual impact of ecological building space under the background of rural revitalization is detected by using three-dimensional multiobjective planning decision of visual space and image visual feature fusion analysis method, and the three-dimensional rendering model of ecological building space under the background of rural revitalization is established. Block matrix matching and boundary contour parameter analysis method are used to plan and design the boundary feature points of ecological building space layout under the background of rural revitalization. The wavelet scale decomposition method is used to analyze the mixed tones of ecological building spatial distribution images under the background of rural revitalization, and a multiobjective planning decision model of ecological building spatial layout is established. According to the multiobjective planning decision of ecological aesthetics and image visual feature fusion analysis method, the ecological building spatial layout design under the background of rural revitalization is carried out, and the multiobjective planning decision and image visual feature fusion analysis method are used to realize the optimization of rural three-dimensional spatial layout. Finally, the performance test is carried out by simulation experiment, which shows the superior performance of this method in promoting the optimization design of ecological building spatial layout under the background of rural revitalization.

2. Theoretical Method of Multiobjective Programming Decision Model

Linear programming can only solve the problem of the maximum or minimum value of a goal under a set of linear constraints. In the actual decision making, we should consider several objectives to measure the advantages and disadvantages of the scheme, in which there are primary and secondary objectives. There are maximum and minimum values. There are quantitative and qualitative ones. Some are complementary and some are opposite to each other, so it is necessary to build a multiobjective planning decision model [12, 13]. By determining a reasonable weight coefficient, it can reflect the importance of different objectives. The weighted coefficient method is used to assign a weight coefficient to each objective, and the multiobjective model is transformed into a single-objective model. In goal planning, the concept of optimal solution is not mentioned, but the concept of satisfactory solution is only mentioned, that is, the solution that can take care of each goal and satisfy the decision maker is sought, and the decision maker decides which solution to choose. Absolute constraints refer to equality constraints and inequality constraints that must be strictly met, such as all constraints of linear programming problems. Solutions that cannot meet these constraints are called infeasible solutions, so they are hard constraints and rigid constraints. The goal is unique to goal planning, and the right term of the constraint can be regarded as the goal value to be pursued [14]. When the target value is reached, positive or negative deviations are allowed. Therefore, positive and negative deviation variables are added to these constraints, which are soft constraints and flexible constraints. Positive and negative deviation variables can transform absolute constraints into flexible constraints by adding positive and negative deviation variables. The objective function of the planning method is constructed according to the positive and negative deviation variables of each objective constraint, and the corresponding priority factors and weight coefficients are given. When each target value is determined, the decision maker's requirement is to minimize the deviation from the target value. Therefore, the objective function of objective programming can only be the weighted sum of all deviation variables. According to the priority order, the objective programming problem is decomposed into a series of single-objective programming problems, and then solved in turn. All the objectives are solved one by one, and after the previous objective is solved, the result of the previous objective is taken as a rigid constraint in the solution of the later objective.

The principle of multiobjective decision making is a code of conduct that should be followed in the practice of multiobjective decision making. It mainly includes:

(1) On the premise of meeting the needs of decision making, we try to reduce the number of targets. We can eliminate the subordinate targets and combine the similar targets into one target, or reduce the secondary targets that only require to meet the minimum standard but not the optimization as constraints. And through the methods of summing with the same measure, averaging or forming a comprehensive function, the purpose is achieved by using comprehensive indicators instead of single indicators.

(2) decide the choice of goals according to their priorities. Therefore, it is necessary to arrange the objectives in an order according to the importance degree, and specify the importance coefficient, so as to be followed in the optimization decision making.

(3) For conflicting goals, we should coordinate with the overall goal as the benchmark and strive to comprehensively consider all goals.

Therefore, this paper uses this method to carry out the following research.

3. Image Analysis and Preprocessing of Ecological Building Spatial Layout under the Background of Rural Revitalization

3.1. Image Acquisition of Three-Dimensional Spatial Layout of Ecological Building Space under the Background of Rural Revitalization. In order to realize the spatial layout and high-resolution reconstruction of ecological buildings under the background of rural revitalization, the feature analysis model of three-dimensional images of ecological buildings under the background of rural revitalization was first constructed [15], and the visual impact of ecological buildings under the background of rural revitalization was detected by using three-dimensional multiobjective planning decision of visual space and image visual feature fusion analysis method [16], and the three-dimensional rendering model of ecological buildings under the background of rural revitalization was established. Three-dimensional template matching method is used to match the three-dimensional layout and image of ecological building space and analyze the boundary contour parameters under the background of rural revitalization, and the overall structure of multiobjective planning decision model of ecological building space layout under the background of rural revitalization is obtained as shown in Figure 1.

Let the distribution matrix of pixel sequence of ecological building spatial layout image under the background of three-dimensional rural revitalization be described as follows:

$$D = \begin{bmatrix} I_x^2 & I_x I_y \\ I_x I_y & I_y^2 \end{bmatrix}, \tag{1}$$

wherein I_x is the pixel of the divided area in the X direction, I_y is the pixel of the divided area in the Y direction, and the Radon transformation parameter space E of the ecological building spatial distribution image under the background of rural revitalization is $\mathrm{E} = \{\eta = (a, u, b)\colon a, b \in R, a > 0, u \in S^{d-1}\}$. Let $A = \{a_i\}_{i=1}^{N}$ scalars of spatial distribution images of ecological buildings under the background of rural revitalization with multiscale texture be the set, and the CHM expression of its order mixed tone factor is as follows:

$$\kappa^P(A) = \left(\sum_{i=1}^{N} a_i^P\right)^{-1/2} \left(\sum_{i=1}^{N} a_i^{P+1}\right)\left(\sum_{i=1}^{N} a_i^P\right)^{-1/2}, \tag{2}$$

wherein a_i^P is a 4×4 subarea block model parameter of ecological building spatial layout image and has the following properties:

$$\begin{gathered} s \le t \Rightarrow \kappa^s(A) \le \kappa^t(A), \\ \lim_{P \longrightarrow +\infty} \kappa^P(A) = \max_i a_i, \\ \lim_{P \longrightarrow -\infty} \kappa^P(A) = \min_i a_i, \end{gathered} \tag{3}$$

wherein a_i is the random degree of pixels, A is the spatial distribution amplitude of ecological buildings under the background of rural revitalization, and f is the average gray value of images in a 3×3 pixel block area [17]. Therefore, considering the spatial distribution image κ^P of ecological buildings under the background of rural revitalization with multiscale texture, for any pixel, let the local neighborhood of newly added seed points along the gradient direction of its texture be $B(x, y)$, and there are

$$\begin{aligned} \lim_{P \longrightarrow +\infty} \kappa_B^P(f)B(x, y) &= \max_{(s,t)\in BB(x,y)} f(s, t) = \delta_B(f)(x, y), \\ \lim_{P \longrightarrow -\infty} \kappa_B^P(f)B(x, y) &= \min_{(s,t)\in BB(x,y)} f(s, t) = \varepsilon_B(f)(x, y), \end{aligned} \tag{4}$$

wherein δ and ε, respectively, represent the color difference expansion and color corrosion operators of three-dimensional spatial distribution of ecological building space under the background of rural revitalization, $f(s, t)$ is the coordinate system of pixel distribution area, and (x, y) is the joint probability density of three-dimensional spatial distribution of ecological building space, thereby realize that

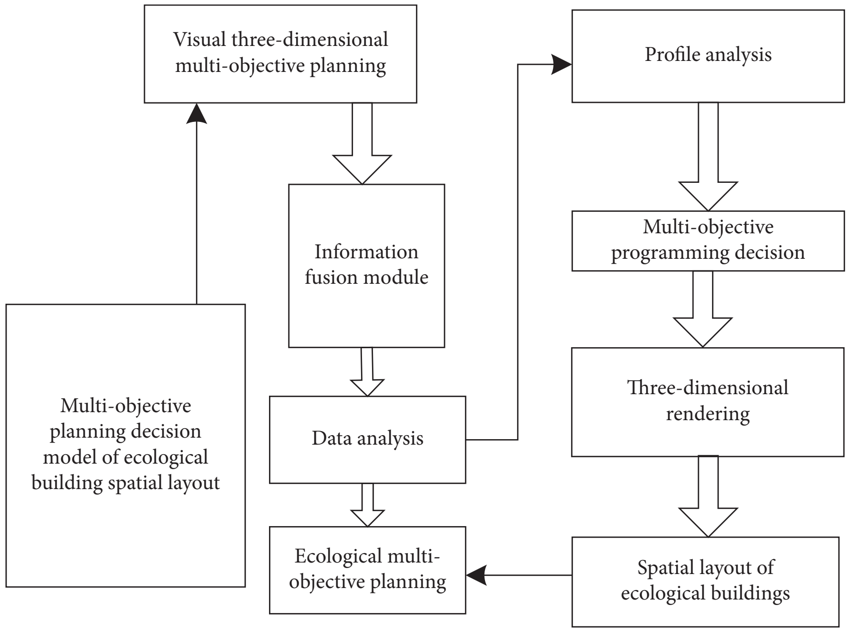

Figure 1: Multi-objective planning decision model structure of ecological building spatial layout under the background of rural revitalization.

collection of the spatial distribution images of ecological building under the background of rural revitalization [18].

3.2. Block Matrix Matching and Boundary Contour Parameter Analysis. Block matrix matching and boundary contour parameter analysis method are used to plan and design the boundary feature points of ecological building spatial layout under the background of rural revitalization [19]. $x(k)$, $k = 0, 1, 2, \ldots, N-1$ is the pixel component of ecological building spatial layout under the background of rural revitalization, and $\mathbf{A} = \{\mathbf{A}_i\}_{i=1}^{N}$ is N symmetric positive definite tensors. The definition of mother wavelet of feature scale decomposition of ecological building spatial distribution image under the background of rural revitalization is as follows:

$$\kappa^P(\mathbf{A}) = \left(\sum_{i=1}^{N} \mathbf{A}_i^P\right)^{-1/2} \left(\sum_{i=1}^{N} \mathbf{A}_i^{P+1}\right)\left(\sum_{i=1}^{N} \mathbf{A}_i^P\right)^{-1/2}, \tag{5}$$

wherein $\mathbf{A}_i^P$ is the characteristic scale of the spatial distribution image of ecological buildings under the background of rural revitalization, and the mother wavelet $\kappa^P(\mathbf{A})$ of the spatial distribution image of ecological buildings under the background of rural revitalization is positive, which can correspond to the tensor model of texture characteristic space one by one to obtain R, G, and B components of color image W. The specific process is shown in Figure 2.

According to the affine transformation relationship, and according to the rotation, translation, and scale invariance between pixels of ecological building spatial distribution image under the background of rural revitalization, the transformation relationship between two frames of color tone information distribution characteristic points of ecological building spatial distribution image under the

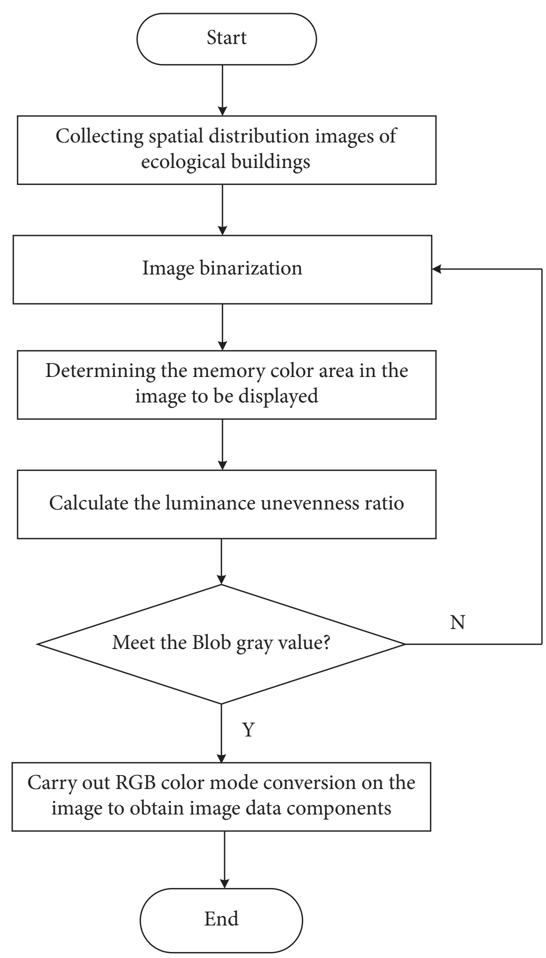

Figure 2: Process of extracting (r) g and b components of color image.

background of rural revitalization with multiscale texture can be described as follows:

$$X_t = AX_{t-1} + t, \tag{6}$$

wherein $X = [x_t, y_t]^T$ is the cluster center representing the X and Y directions in the spatial distribution images of ecological buildings under the background of rural revitalization, A is the spectral value, and t is the detection reflection peak of the spatial layout images of ecological buildings. After further transformation by using invariant moments, the results of block matrix matching and boundary contour parameter analysis are as follows:

$$\begin{aligned} A &= s\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}, \\ t &= \begin{bmatrix} t_x \\ t_y \end{bmatrix}, \end{aligned} \tag{7}$$

wherein s is the scaling factor of matching feature points, θ is the rotation angle of the image area of ecological building spatial distribution image under the background of rural revitalization with multiscale texture, and tx and ty are the horizontal displacement and vertical displacement, respectively [20]. According to the above processing, the edge contour feature detection of ecological building space under the background of rural revitalization is realized. Therefore, a three-dimensional rendering model of ecological building space under the background of rural revitalization is established, and block matrix matching and boundary contour parameter analysis are used to plan and design the boundary feature points of ecological building space layout under the background of rural revitalization.

4. Optimization of Three-Dimensional Spatial Layout Model of Ecological Building Space under the Background of Rural Revitalization

4.1. 3D Rendering Model. On the basis of detecting the visual impact of ecological building space under the background of rural revitalization by using three-dimensional multi-objective planning decision of visual space and image visual feature fusion analysis method, the image analysis and three-dimensional rendering of ecological building space under the background of rural revitalization are carried out [21]. In this paper, a spatial layout model of ecological building under the background of rural revitalization based on multi-objective planning decision model is proposed. The estimated value of the spatial distribution of ecological building under the background of rural revitalization is as follows:

$$\begin{aligned} p(x, y; t) &= -\sigma\nabla u(x, y; t) = -\sigma G(x, y; t) \\ &= -\sigma\left[G_x(x, y; t)i + G_y(x, y; t)j\right]. \end{aligned} \tag{8}$$

In the above formula, i, j is the unit direction vector, $\nabla u(x, y; t)$ is the image pixel gradient distribution operator, $G(x, y; t)$ is the spatial visual feature distribution value of the extracted ecological building spatial layout image under the background of three-dimensional rural revitalization, $G_x(x, y; t)$ is the approximate three-dimensional spatial feature distribution value of the extracted ecological building spatial layout image under the background of three-dimensional rural revitalization, and $G_y(x, y; t)$ is a statistical graph binary model parameter. By sampling the ecological building spatial distribution image under the background of multiscale texture rural revitalization, the white balance deviation compensation method is adopted to obtain the tone correction constraint function of the ecological building spatial distribution image under the background of rural revitalization as follows:

$$L(a, b_m) = \sum_{V_m \in P^{\text{res}}} \sum_{V_n \in P^{\text{true}}} S w_{i,j} \frac{|V_m \cap V_n|}{|V|} \log\left(\frac{|V||V_m \cap V_n|}{|V_m||V_n|}\right). \tag{9}$$

In the formula, S is the R, G, and B components of the image segmentation of ecological building spatial layout under the background of three-dimensional rural revitalization, $w_{i,j}$ is the adaptive weighting coefficient, V_m is the difference feature quantity between pixels, and V_n is the characteristic distribution variance of rural building planning. After three-level Radon scale transformation, the boundary feature points of ecological building spatial layout under the background of rural revitalization are as follows:

$$L(a, b_m) = \sum_{V_m \in P^{\text{res}}} \frac{|V_m|}{|V|} \log\left(\frac{|V_m|}{|V|}\right) + \sum_{V_n \in P^{\text{true}}} \frac{|V_n|}{|V|} \log\left(\frac{|V_n|}{|V|}\right). \tag{10}$$

Based on Radon scale transformation, the spatial distribution image blocks of ecological buildings in each rural revitalization background are decomposed in each direction, and the amplitude of the mixed tone mapping of the image rendering is A. The multiscale Retinex algorithm is used to detect the entropy information of the spatial distribution image of ecological buildings in the three-dimensional rural revitalization background [22], and the similarity feature quantity of the spatial distribution image of ecological buildings in the three-dimensional rural revitalization background is extracted. In the real matrix, the singular value decomposition result of the spatial distribution of ecological buildings in the rural revitalization background is as follows:

$$\begin{aligned} A &= USV' \\ &= U\begin{pmatrix} \sum & 0 \\ 0 & 0 \end{pmatrix}V', \\ U * U' &= I, \\ V * V' &= I, \end{aligned} \tag{11}$$

wherein $\sum = \operatorname{diag}(\sigma_1, \sigma_2, \ldots, \sigma_r)$, $\sigma_1 \geq \sigma_2 \geq \cdots \geq \sigma_r > 0$ is the multiscale texture information fusion feature vector of the spatial distribution image of ecological buildings in the background of rural revitalization, and $A * A'$ is the characteristic square root of $A' * A$. According to the parity quantization, the coupling coefficient of mixed tone mapping in N block templates is obtained

$$Aa_{i,j} = U_{i,j} * S_{i,j} * V_{i,j}^{T}, \tag{12}$$

wherein $U_{i,j}$ is the ambiguity coefficient of the spatial layout image of ecological buildings under the background of three-dimensional rural revitalization, $S_{i,j}$ is similarity, and $V_{i,j}$ is Gaussian distribution function. Wavelet scale decomposition method is used to analyze the mixed tones of the spatial distribution image of ecological buildings under the background of rural revitalization, and color difference correction and graphic rendering are carried out [23].

4.2. Spatial Layout Design of Ecological Buildings under the Background of Rural Revitalization. According to the multi-objective planning decision making and image visual feature fusion analysis method of ecological aesthetics, the spatial layout design of ecological buildings under the background of rural revitalization is carried out. The multi-objective planning decision making and image visual feature fusion analysis method are adopted to realize the optimization of rural three-dimensional spatial layout [24], and the wavelet scale decomposition method is adopted to analyze the mixed tones of ecological building spatial distribution images under the background of rural revitalization. The multi-objective planning decision-making model of ecological building spatial layout is established, and the image filtering model of ecological building spatial layout under the background of three-dimensional rural revitalization is constructed. The filtering function is as follows:

$$\begin{aligned} w\left(d_{ij}\right) &= f\left(\left|x_i - x_j\right|\right) \\ &= \frac{1}{\sqrt{2\pi}} \exp\left\{\frac{\left(x_i - x_j\right)^2}{2}\right\}, \end{aligned} \tag{13}$$

wherein x_i represents the filtered output of pixels on the X component, x_j represents the filtered output of ecological building spatial layout image on the Y component under the background of three-dimensional rural revitalization, and $f(|x_i - x_j|)$ represents the clustering feature quantity among pixels under the background of three-dimensional rural revitalization. The wavelet scale decomposition method is used to extract the features and map the mixed tones of the spatial distribution images of ecological buildings in the background of rural revitalization [25]. The one-dimensional wavelet transform of the spatial distribution images of ecological buildings in the background of rural revitalization with multiscale texture on the grid of the template area is as follows:

$$\begin{aligned} r_{k,l} &= F_{\mathrm{RATf}}(k,l) \\ &= \frac{1}{\sqrt{N}} \sum_{(i,j)\in A_{k,l}} f(i,j), \end{aligned} \tag{14}$$

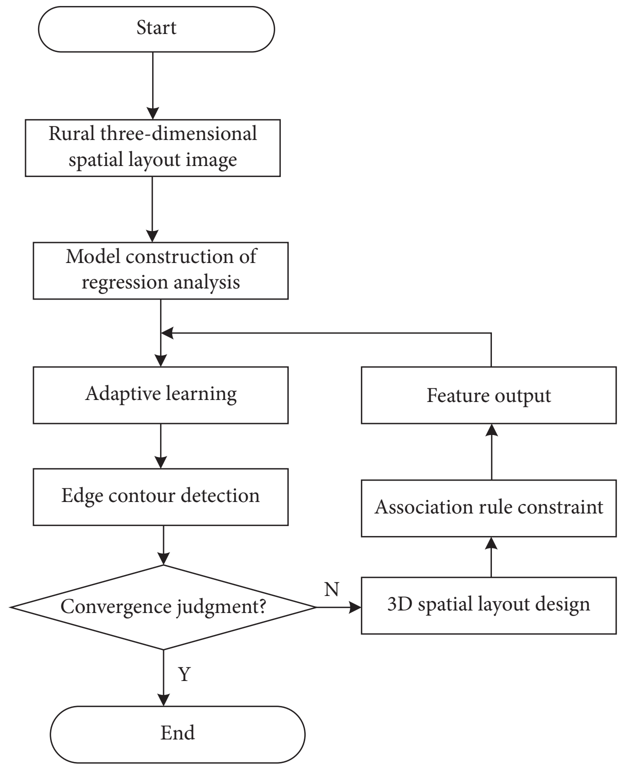

Figure 3: Implementation process of improved algorithm.

Figure 4: Multiobjective planning simulation structure diagram of ecological building spatial layout under the background of rural revitalization.

wherein $A_{k.l}$ represents multiscale contour edge feature pixels, with its slope k and intercept l. The feature sets of mixed tones of ecological building spatial distribution images under the background of rural revitalization are described as $k \in \{0, 1, 2, \ldots, N-1, N\}$, $l \in A_N$. The wavelet scale decomposition method is used to analyze the mixed tones of the spatial distribution images of ecological buildings under the background of rural revitalization, and the gray detection model of the spatial distribution images of ecological buildings under the background of three-dimensional rural revitalization is constructed. By using frame point matching and noise segmentation, the spectral characteristics of the detection reflection peak band of the spatial distribution images of ecological buildings under the

Table 1: Simulation parameter setting.

Planning sample	Statistical sample number	Edge information entropy	Equivocation	Statistical characteristics
1	3135	0.141	33.364	6.113
2	6975	0.036	5.917	1.912
3	2119	4.177	36.427	0.876
4	8901	3.812	13.091	0.394
5	2240	5.330	56.857	9.771
6	7058	7.994	8.052	4.682
7	8676	8.005	22.510	4.862
8	7134	3.905	85.661	6.863
9	8500	9.352	69.315	9.542
10	7491	4.120	10.653	6.337
11	1732	1.512	16.344	3.160
12	1316	2.380	61.151	6.203
13	1001	7.119	34.201	2.409
14	3437	4.243	60.924	4.851
15	880	8.145	50.262	0.096
16	6472	7.536	45.843	0.554
17	7825	5.766	2.291	4.574
18	4024	7.043	1.121	3.650
19	9268	3.147	0.505	0.341
20	427	0.193	0.278	5.092

background of three-dimensional rural revitalization are obtained as follows:

$$s(k) = \phi \cdot s(k-1) + w(k), \quad (15)$$

wherein

$$\phi = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}, \quad w(k) = \begin{pmatrix} N\left(0, \sigma_{\theta(k)}\right) \\ 0 \\ N\left(0, \sigma_{x(k)}\right) \\ 0 \\ N\left(0, \sigma_{y(k)}\right) \end{pmatrix}. \quad (16)$$

In the above formula, ϕ is to extract the corresponding texture component, $w(k)$ represents the deep learning weight, $s(k-1)$ is the distribution characteristic value of the spectral curve in the absorption valley, and $\sigma_{\theta(k)}$, $\sigma_{x(k)}$, and $\sigma_{y(k)}$, respectively, represent the spatial visual characteristic distribution value of the extracted ecological building spatial layout image under the background of three-dimensional rural revitalization [26]. To sum up, multi-objective planning decision and image visual characteristic fusion analysis method are adopted to optimize the rural three-dimensional spatial layout, and the implementation process of the improved algorithm is shown in Figure 3.

5. Simulation and Result Analysis

In order to test the application performance of this algorithm in optimizing the spatial layout of ecological buildings under the background of rural revitalization, a simulation experiment was carried out, and the simulation was established on the software platform of MATLAB R2009a. The multiobjective planning simulation structure of ecological building spatial layout is shown in Figure 4. The resolution of image acquisition of three-dimensional spatial distribution of ecological buildings under the background of rural revitalization is 15×200, the direction of image sampling is 38°, the resolution of feature reconstruction is 0.56 m, and the affine area of three-dimensional spatial layout is 500×800. See Table 1 for simulation parameter settings.

Figure 5: Three-dimensional layout design of original ecological building.

According to the above simulation environment and parameter settings, the spatial distributed design of ecological buildings under the background of rural revitalization is carried out, and the original three-dimensional spatial design is obtained as shown in Figure 5.

In this paper, the method is used to analyze the mixed tones of the spatial distribution images of ecological

Figure 6: Color tone optimization of three-dimensional spatial layout of rural ecological buildings.

Figure 7: Optimization design of ecological building spatial layout under the background of rural revitalization.

buildings under the background of rural revitalization, and a multiobjective planning decision model of the spatial layout of ecological buildings is established. The results of the mixed tones analysis are shown in Figure 6.

Finally, the ecological aesthetics multiobjective planning decision and image visual feature fusion analysis method are used to optimize the spatial layout of ecological buildings under the background of rural revitalization, and the optimized design effect diagram is shown in Figure 7.

From the analysis of Figure 7, it can be seen that the rationality of the spatial layout of ecological buildings is better and the expression ability of ecological aesthetics is stronger under the background of rural revitalization by using this method, which has a good application value in rural planning and design. The convergence values of multiobjective planning decision making of ecological building spatial layout under the background of rural revitalization are tested by different methods, and the comparison results are shown in Table 2.

Table 2: Convergence value of multiobjective planning decision of ecological building spatial layout under the background of rural revitalization.

Iteration steps	This method	Reference [8]	Reference [9]
10	83.52	74.49	85.02
20	78.19	72.31	82.79
30	75.71	72.30	81.76
40	79.81	73.05	83.47
50	87.43	73.98	86.65
60	85.43	72.83	85.82
70	88.48	74.54	87.09
80	80.95	73.36	83.95
90	83.14	71.56	84.86
100	81.14	72.78	84.03
110	84.48	73.55	85.42
120	89.14	73.50	87.37

Analysis of Table 2 shows that in 100 iterations, the convergence value of this method fluctuates between 75 and 90, the convergence value of [8] method fluctuates between 71 and 75, and the convergence value of [8] method fluctuates between 81 and 88. Therefore, the convergence value of this method is relatively higher. To sum up, this method has good convergence in the multiobjective planning decision making of ecological building spatial layout under the background of Rural Revitalization.

6. Conclusions

In this paper, a spatial layout model of ecological buildings under the background of rural revitalization based on multiobjective planning decision model is proposed. The visual impact of ecological building space under the background of rural revitalization is detected by using three-dimensional multiobjective planning decision of visual space and image visual feature fusion analysis method, and the three-dimensional rendering model of ecological building space under the background of rural revitalization is established. Block matrix matching and boundary contour parameter analysis method are used to plan and design the boundary feature points of ecological building space layout under the background of rural revitalization. The wavelet scale decomposition method is used to analyze the mixed tones of ecological building spatial distribution images under the background of rural revitalization, and a multiobjective planning decision model of ecological building spatial layout is established. According to the multiobjective planning decision of ecological aesthetics and image visual feature fusion analysis method, the ecological building spatial layout design under the background of rural revitalization is carried out, and the multiobjective planning decision and image visual feature fusion analysis method are used to realize the optimization of rural three-dimensional spatial layout. The research shows that the rationality of the spatial layout of ecological buildings is better and the expression ability of ecological aesthetics is stronger under the background of rural revitalization, which has a good application expression in rural planning and design.

Data Availability

The raw data supporting the conclusions of this article can be obtained from the corresponding authors without undue reservation.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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Retraction

Retracted: Accident Liability Determination of Autonomous Driving Systems Based on Artificial Intelligence Technology and Its Impact on Public Mental Health

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Y. Xiao and Z. Liu, "Accident Liability Determination of Autonomous Driving Systems Based on Artificial Intelligence Technology and Its Impact on Public Mental Health," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2671968, 12 pages, 2022.

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Research Article

Accident Liability Determination of Autonomous Driving Systems Based on Artificial Intelligence Technology and Its Impact on Public Mental Health

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With the rise of self-driving technology research, the establishment of a scientific and perfect legal restraint and supervision system for self-driving vehicles has been gradually paid attention to. The determination of tort liability subject of traffic accidents of self-driving cars is different from that of ordinary motor vehicle traffic accident tort, which challenges the application of traditional fault liability and product liability. The tort issue of self-driving cars should be discussed by distinguishing two kinds of situations: assisted driving cars and highly automated driving, and typological analysis of each situation is needed. When the car is in the assisted driving mode, the accident occurs due to the quality defect or product damage of the self-driving car, and there is no other fault cause; then, the producer and seller of the car should bear the product liability according to the no-fault principle; if the driver has a subjective fault and fails to exercise a high degree of care; the owner and user of the car should bear the fault liability. This paper analyzes the study of the impact of autonomous driving public on public psychological health, summarizes the key factors affecting the public acceptance of autonomous driving, and dissects its impact on public psychological acceptance. In order to fully study the responsibility determination of autonomous driving system accidents and their impact on public psychological health, this paper proposes an autonomous driving risk prediction model based on artificial intelligence technology, combined with a complex intelligent traffic environment vehicle autonomous driving risk prediction method, to complete the risk target detection. The experimental results in the relevant dataset demonstrate the effectiveness of the proposed method.

1. Introduction

Technology changes life; due to the rapid development of intelligent science, human life and work have become faster and more convenient with it. The arrival of the artificial intelligence 5G era and the continuous optimization of roads make the development of self-driving cars more rapid. New things always bring a variety of new problems, self-driving cars are no exception, relevant industry regulations and industrial services should be prepared in advance, and in the context of the rule of the law society, self-driving cars are also subject to the regulation of all aspects of the law. Traffic accidents are the first major safety hazard of motor vehicles. Under the development trend of artificial intelligence, cars are gradually automated to reduce the risk of traffic accidents, and the subjects involved in self-driving cars have also changed, so if they are involved in traffic accidents; the determination of liability subjects in accidents cannot be based entirely on traditional motor vehicle-related legal provisions. This paper discusses the issue of determining the subject of tort liability for traffic accidents involving self-driving cars. The diagram of automatic driving system accident liability determination is shown in Figure 1.

There is a real necessity of studying the issue of determining the subject of liability for traffic accidents of self-driving cars. The first is that the car in the self-driving mode is different from the control subject of ordinary cars in the market [1–3]. The control subject of ordinary cars is the

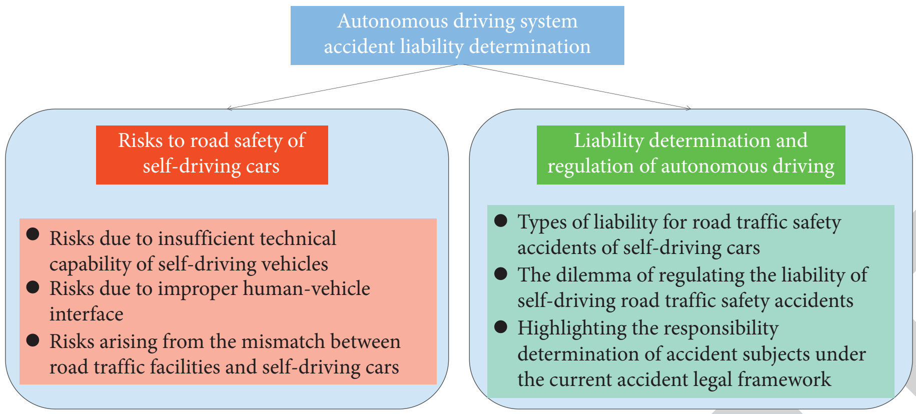

Figure 1: The diagram of automatic driving system accident liability determination.

human driver by observing the driving environment to make acceleration, deceleration, and other operating instructions. In traffic accidents that occur in ordinary cars, except for rare car manufacturing defects, operational failures, or road problems, the responsibility for the accident is basically attributed to the human driver who is at fault, and the responsibility for the accident is more direct. Self-driving cars, on the other hand, are not only controlled by humans but also have an autonomous driving system that dominates the car's driving pattern. The self-driving car system designed by technicians can not only drive the car based on the original design but also has the learning ability of artificial intelligence, and there is the possibility of being out of human control. When a self-driving car is involved in a traffic accident, it is unfair to attribute responsibility to the human driver, while the feasibility of attribution is controversial if attributed to the self-driving system. Second, self-driving cars are different from ordinary cars in terms of the subjects involved [4].

In the process of ordinary car operation, generally, only four subjects are involved: car owners, car users, car manufacturers, and car sellers, and the division of labor is relatively simple and clear. In addition to the above-mentioned subjects in the operation of ordinary cars, there are also designers of self-driving systems, software and hardware suppliers, Internet operators, and so on. For example, the designer of the self-driving system must ensure that the design is safe and reasonable; the manufacturer of the car must ensure the quality and safety of the self-driving car; the owner or user of the car must regularly maintain the car to avoid unnecessary safety hazards during the operation of the car. Therefore, in traffic accidents involving self-driving cars, there are many combinations of damage results and causes of action, making it difficult to specify them. Thirdly, there are differences between self-driving cars and traditional motor vehicles in the identification of both the subject of product liability and the subject of tort liability [5–8].

The subject of tort liability in traditional motor vehicle traffic accidents is the actual driver of the motor vehicle or pedestrians on the road, but the driving system of self-driving cars is programmed software, which is only used as a tool and does not have civil rights or capacity to act, but it has the ability to drive intelligently, and these make it difficult to identify the subject of tort liability in traffic accidents involving traditional motor vehicles [9]. As a processed and manufactured product, the damage caused by product defects can be applied to product liability, with the producer and seller of the car bearing the responsibility for damages, but it is different from ordinary products. The determination of product liability requires the user to prove that the product is defective, but because of the high-tech nature of self-driving cars, it is undoubtedly more difficult for consumers to determine that the self-driving system is defective, and the product is dangerous, requiring a great deal of time and some understanding of the profession. In the event of a product defect, consumers may be unable to prove it, making it difficult to determine product liability and the responsibility of the producer of the self-driving car. Based on this, China's current laws and regulations cannot solve the problem of determining the subject of product liability in self-driving car traffic accidents.

The impact of autonomous driving on public mental health is defined from the perspective of psychology, and autonomous driving acceptance refers to the degree to which people express approval or agreement with the situation, process, or conditions of autonomous driving. In studies on public acceptance of autonomous driving, different scholars have elaborated on the meaning of acceptance from a variety of perspectives. To enable comparative analysis among studies, this paper divides public acceptance of autonomous driving into five categories: likelihood and attitude of accepting autonomous driving, level of understanding and trust, perceptions and concerns, willingness to pay, and usage preferences. The likelihood and attitude of accepting autonomous driving refer to the likelihood of accepting autonomous driving and the positive or negative attitudes of different groups in different situations and are usually measured by asking respondents directly whether they are willing to accept autonomous driving or by using an attitude scale. Understanding and trust refer to the public's understanding of and trust in autonomous driving technology and are usually measured by means of scales [10, 11].

In terms of understanding, most studies show that people are not unfamiliar with the concept of autonomous driving and have a certain level of understanding of the functions of autonomous vehicles. Residents who have learned about the features of self-driving but have little experience with riding in them have large differences in their knowledge of self-driving cars from different regions, with residents from South Australia and provincial capitals showing higher acceptance of self-driving relative to residents from other regions. In terms of public trust in self-driving cars, virtual proxy driving similar to that of passengers increases trust in self-driving cars. Perceptions and concerns mainly refer to the benefits people perceive that using autonomous driving can bring, the possible risks, and the technical or social issues that people will actively focus on when discussing autonomous driving [12–14]. The researchers drew conclusions by collecting appropriate information through direct questioning, on the one hand, and by modeling technology acceptance, on the other hand, to investigate the relationship between perceptions and trust/willingness to use. Perceived risk was found to be the main barrier preventing them from using autonomous driving and making the public aware of the benefits that autonomous driving offers is expected to increase acceptance of autonomous driving. From the perspective of concerns, existing research shows that public concerns about autonomous driving include safety, control modes, privacy, and legal liability, with safety being the number one concern in many studies; there are significant differences in the level of safety concerns about autonomous driving among different groups, where older, developed country-dwelling, and female respondents had significantly higher levels of safety concerns about autonomous driving than younger, developing country and male respondents were significantly more concerned about self-driving safety. While fully autonomous vehicles are effective in reducing the number and severity of traffic accidents and responding more sensitively in special emergencies, they also expressed concerns about the ability of autonomous driving systems to handle unexpected situations, legal liability in traffic accidents, and personal privacy.

The main contributions of this paper are as follows. First, it analyzes that with the rapid development of artificial intelligence and information technology, self-driving cars are ushering in a revitalized development in social life. The problems that arise from the identification and assumption of tort liability for damage caused by self-driving cars are increasingly prominent. There are many differences between self-driving cars and traditional cars, so the determination and assumption of tort liability for harm caused by self-driving cars also differ greatly from traditional ones. It is of far-reaching significance to address the determination of liability for accidents caused by self-driving systems and their impact on public mental health, which can promote the efficient resolution of tort disputes caused by self-driving cars, reduce the cost of rights protection, protect the legitimate rights and interests of victims, and maintain social justice, as well as promoting the improvement of the corresponding legal norms and the healthy development of the self-driving car industry. This paper proposes a risk prediction model for autonomous driving based on artificial intelligence technology, combined with a complex intelligent traffic environment vehicle autonomous driving risk prediction method, to complete the analysis of autonomous driving system accident liability determination and its risk to public mental health. The experimental results in the relevant dataset prove the effectiveness of the proposed method.

2. Related Work

2.1. Autonomous Driving System Accident Liability Determination. The self-driving car is a kind of intelligent robot, which refers to the installation of an artificial intelligence system inside the car, and the installation of a location sensor that senses geographic location outside the vehicle. When the person inside the car enters the destination, the artificial intelligence system automatically decides the driving route according to the relevant program algorithm implanted by the developer in advance and then controls the vehicle by controlling the chassis and steering wheel, replacing the natural human driver in the traditional sense, to realize the position transfer in the body space. Self-driving cars through artificial intelligence, information networks, and other high-tech products and drivers will be liberated to varying degrees, to reduce the probability of motor vehicle traffic accidents, ease traffic congestion, reduce some drivers' driving barriers, and reduce automobile exhaust pollution [15–18]. According to the current international classification standards according to the degree of automation of driverless cars can be divided into L0 to L5 six stages: L0 and L1 stages of self-driving cars and traditional cars are basically close in nature, and driving is mainly completed by the driver; L2 to L4 stages of self-driving cars belong to the "human-machine hybrid driving;" L5 stage will fully realize autonomous driving, and the role of human will dominate the operation of motor vehicles from the driver into a passenger without any driving tasks.

According to the current international standards issued by the American Society of Automotive Engineers, the L0–L4 stages all require varying degrees of driver involvement in the driving process, so the L0–L4 stages of self-driving car damage may be related to the driver's fault. If the accident is caused by the driver's improper operation, the self-driving car as a means of transportation is subject to the same road traffic accident liability as ordinary cars, and the driver, i.e., the user of the self-driving car, is liable for the tort according to the degree of fault. In this paper, we believe that the identification of the tort liability subject, in this case, can be accomplished through the allocation of the burden of proof and the installation of a data recording and monitoring system inside the self-driving car. In case of an accident, the injured party only needs to prove the existence of illegal driving conditions of the self-driving car without the specific improper operation of the driver, while the driver needs to prove that he or she is not negligent in the process of the driving task and has fully exercised his or her duty of care in order to save himself or herself from being liable for the product defects of the self-driving car itself or the runaway accident [19].

The tort liability subject of a self-driving car's product defect is found to be harmful when the self-driving car has a product defect, and the relevant subject shall bear the product tort liability according to the product liability law. Product defects refer to the existence of products that endanger the safety of persons and property other than the product is unreasonably dangerous, including defects in the design, manufacture, storage, and other links. Therefore, in the design, manufacture, sale, and use of different stages, the product designer, product manufacturer, and product seller of self-driving cars are required to exercise due care and attention, and their responsibility is determined according to the extent of their obligations, and then the tort liability subject of self-driving car product defects causing harm is determined. The most essential difference between self-driving cars and traditional cars is that they can learn independently and form experiences to apply according to the algorithms and procedures written by the designer. Through learning, self-driving cars obtain data and information from the surrounding environment, summarize the laws, generate new system rules, and self-adjust according to the rules, resulting in the possibility of their decisions and behavior deviating from the initial procedures and algorithms. It is even more difficult to predict and control the decisions and behaviors that will be made based on the new rules generated by autonomous learning. Because the risk of damage caused by the autonomous driving behavior of self-driving cars is difficult to predict and control, it should not be included in the scope of the designer's, producer's, sellers, or even driver's duty of care and should not be used as the basis for determining the subject of tort liability.

In general, the tort liability of self-driving cars cannot be determined simply by fault liability, strict liability, or vicarious liability but must be determined according to different causes of damage such as driver's fault, product defects, or autonomous driving behavior of self-driving cars. In the field of traditional motor vehicles, Chinese law requires every car owner to purchase compulsory liability insurance for motor vehicle traffic accidents, in addition to a commercial insurance policy. However, in the case of self-driving cars, the self-driving system replaces the driver as the driving subject, and the tort liability of natural persons should be transferred to the self-driving car, and it is obviously unfair if only the car owner purchases insurance [20]. However, the insurance parties, liability limits, and other internal liability mechanisms should be different from the mandatory motor vehicle traffic accident liability insurance. In short, the compulsory liability insurance system can share the risk of damage caused by the autonomous driving behavior of self-driving cars within the society, so that the victims can get timely relief and at the same time can well balance the obligations and responsibilities between the designers, producers, sellers, and drivers and protect the development of the self-driving car industry.

2.2. The Impact of Autonomous Driving Systems on Public Mental Health. As an emerging technology, there are still many problems with autonomous driving in terms of laws and regulations, ethics, and other aspects. Therefore, many studies are yet to be conducted on the development of autonomous driving. On the one hand, it is important to fully develop safe and efficient self-driving car technology and continuously improve laws and regulations related to self-driving to promote technological progress and improve the level of traffic intelligence; on the other hand, at the early stage of self-driving car development, we fully investigate the impact of the public's cognitive level and psychological health on self-driving and explore the publics [21, 22]. In addition, from the theoretical aspect, under the current situation that the state strongly supports the research and development of technologies related to self-driving cars and various industries are continuously laying out self-driving, there is very limited research on the Chinese public's perception and acceptance of self-driving cars. Therefore, it is important to explore the public's acceptance and perception of self-driving cars, establish the theoretical basis, and explore the influence of related factors, which is important for the future development direction of self-driving. Second, by comparing the differences in public acceptance and perception of fully self-driving cars and highly self-driving cars, it is an important guideline for the future development direction of autonomous driving.

For self-driving cars, the level of user acceptance determines whether the technology can be used in practice. General acceptance and attitude is the key manifestation of autonomous driving acceptance and application. In contrast to self-driving technology, human definitions of it (e.g., public views, beliefs, attitudes, and acceptance) are a necessary concern for the purchase and payment of the technology; without people buying and using self-driving cars, more investment and production will be futile. As mentioned earlier, there are several scholars who have studied the public's views on self-driving cars in general. There are also studies that have measured the acceptability of self-driving cars in different dimensions [23–25].

The research on the acceptability of self-driving cars was synthesized to construct a model that can explain and predict the acceptability of driverless cars to users. The study addresses different levels and dimensions of driverless car acceptability, including user acceptability, satisfaction needs, attitudes, willingness to use, and actual use. As an emerging technological innovation, self-driving cars have attracted a lot of attention. For a nascent technology, it is common to evaluate the technology by assessing public perceptions, trust, attitudes, and acceptance of the technology. Again, these factors will determine the future direction of self-driving cars, and society is able to shape the technology. Although fully self-driving cars are not yet in human use, it is urgent and necessary to fully understand people's perceptions of them. Foreign research on public perceptions of autonomous driving started early and has a solid research base. Among them, early studies on public perceptions of autonomous driving focused on public opinion, perception, and acceptance, generally using descriptive analysis. They found that the public was attracted to some aspects of autonomous driving, such as safety gains and economic benefits, but had high concerns about the safety, confidentiality, legal liability, and management regulation of autonomous driving.

As autonomous driving has taken off and evolved, research on autonomous driving has emerged, with many studies on public perceptions of autonomous vehicles, and in recent years, more studies have attempted to explore the psychological and socioeconomic factors that determine the public's acceptance of autonomous vehicles and the additional costs they are willing to incur for this technology. Models have also been developed to understand user preferences for vehicles with different levels of automation, as well as preferences for different modes of automated vehicles and their determinants. Regarding public attitudes toward self-driving cars, studies have shown some mixed results. Some studies show that public attitudes toward autonomous driving are positive, while others indicate that respondents show negative attitudes toward self-driving cars.

2.3. Autonomous Driving and Artificial Intelligence. As an integrated embodiment of the frontier technologies of the times, such as advanced communication technology, cloud computing technology, and vehicle manufacturing technology, autonomous driving is the future direction of driving technology development and has now been incorporated into the Made in China 2025 plan as an important part of the manufacturing power strategy [26, 27]. Along with the maturity of autonomous driving technology, it can not only assist the driver to complete the driving behavior but also eventually replace the driver to complete the driving independently and solve the driving problems caused by the driver's inexperience, physiological state, personality differences, etc. While fuzzy reasoning can explain and express the process of human choice, an artificial neural network overcomes the subjectivity of fuzzy rules based on the difference in the knowledge base of each person in fuzzy reasoning and completes the inference by objective extraction rules. The fuzzy neural network produced by the complementary advantages of the two can objectively reflect the choice process and give physical meaning to each step, which has a better effect on imitating human behavior, and this approach provides a broader application prospect for autonomous driving [28–30].

Automatic driving technology refers to the use of satellite positioning technology, sensors, cameras, and other devices to collect information about their own environmental conditions and the state of the vehicle and bring the information together to the central processor, through computer technology to analyze and process the vehicle information and calculate the best way to drive the vehicle. Meanwhile, according to the degree of intelligence, automatic driving technology is divided into five levels, and the research object in this paper is fully automatic driving, where the driving right is completely transferred to the driving control system of the vehicle. The driving behavior of the vehicle can be divided into lateral driving behavior, i.e., changing lanes, and longitudinal driving behavior, i.e., driving with the speed. At this stage, the research on the lane changing strategy of autonomous driving is mainly divided into two categories, one is based on real data, with the lane changing prediction accuracy as the goal, to achieve lane changing trajectory control and lane changing decision; the second is to apply the characteristics of autonomous driving in the classical simulation method or driving model and study the driving model suitable for autonomous driving. In the model and simulation for autonomous driving, how to interact and game with the surrounding vehicles through lane change and achieve safe lane change and comfortable lane change are the mainstream research ideas, such as the cooperative lane change of multilane vehicles with the goal of safe spacing between vehicles after lane change, the lane change warning proposed by comprehensive surrounding multivehicle information, and the mixed traffic flow lane change rules considering the impact of automatic truck queues on ordinary vehicles. However, there are few automatic driving lane change rules with the main goal of lane change, higher driving speed, as a consideration, especially on highways where transportation efficiency is pursued.

Neural networks are also known in academic circles as artificial networks or neural-like networks. It is a mathematical model that draws on the structure and function of the biological and human brain and uses computers to process information in the engineering field. Neural networks use the results of modern neuroscience research to simulate the process of data processing by the human brain's activity of remembering and recognizing information. It is a research category of artificial intelligence. Along with the development of science and technology, especially the development of biology, people understand more and more about the brain, and thus neural networks have a broader scope of development. The following recognize some inherent characteristics of neural networks.

Distributed storage of information neural networks stores information in different locations and generally uses many processing units connected to each other to represent specific information, so when the local network is damaged or the input signal is partially distorted, the correct output of the network can still be guaranteed, thus greatly improving the fault tolerance and robustness of the network. Information processing and storage are combined into one neural network. Each processing unit of the neural network has both information processing and storage functions, and the processing units reflect the information memory through the successive intensity changes between them, and the intensity changes and their response to the excitation reflect the information processing function. The ability that parallel coprocessing information neurons can process the received information in parallel is demonstrated by its ability to perform independent operations and processing of information, and the neurons in the same layer can calculate the results simultaneously and pass the output results to the neurons in the next layer. The function of a single processing unit is simple, but the function achieved by a large number of processing units working together is very powerful. The processing of information is self-organizing and self-learning neural networks can improve themselves in the process of continuous learning and can achieve innovation. A neural network can obtain its connection weights and connection structure through learning.

3. Methods

3.1. Model Architecture. The traditional method for predicting the risk of autonomous vehicle driving cannot extract the characteristic parameters of autonomous vehicle driving behavior, which leads to a large deviation of risk prediction results. Therefore, we propose a complex intelligent traffic environment vehicle autonomous driving risk prediction method. The 3D LIDAR can effectively detect and track the target 360°. The 3D LIDAR is mounted horizontally on the top of the vehicle to ensure that it is on the same level as the vision. The camera and lidar are placed together to avoid the problem of a long target detection process. The target consists of a rectangular frame in a unit space and a collection of obstacle points within the frame. The main purpose of text clustering is to divide the obstacles into several different points, form a collection, and at the same time regulate the collection of points with the help of a rectangular model and then realize the construction of a new target. In the initial three-dimensional point cloud to obtain the initial detection targets, the detection targets will be clustered, while the same type of targets will be divided into a collection; the collection is the target set.

At the same time, the initial point cloud information is collected by sensors and converted into target objects, which effectively simplifies the subsequent processing process and provides convenient targets for analysis, estimates the motion state of the vehicle target, analyzes the driving speed and target behavior, and provides target-level results for planning decisions. The proposed model is shown in Figure 2. (1) *Preprocessing*. Because there is a large gap between 3D LIDAR layers and layers, the farther the distance, the larger the gap will be, and the number of reflected radar points will be reduced accordingly. (2) Connected domain analysis mainly refers to the region consisting of target images with the same pixel values and neighboring pixel values. Among them, connected domain analysis refers to the search of each continuous area in the image, which can represent different connected areas by contours. (3) The minimum envelope area rectangle models the detected target vehicle by the square box model while connecting all the contours of the target to form the minimum rectangular envelope. The minimum envelope area is obtained by rotating the rectangle.

3.2. Data Association. Based on this, the complex intelligent traffic environment vehicle target detection also needs to be achieved by data association, through the form of a data association matrix to analyze the target association between the front and back frames, to build the association between the current detection of the acquired target and the previous frame target, and then through the current to drive the already tracked target filter, to update the target motion state. In the following, we mainly use the maximum matching idea of the bipartite graph to optimize the data association matrix into one-to-one matching and obtain the maximum number of matching pairs for the optimized target, in which the optimization of the target is mainly realized by the Hungarian algorithm. The operation flow chart of data association is given in Figure 3.

The detected vehicle targets of each frame are placed into the corresponding target chain table, and the correlation between the two frames before and after the target is analyzed to effectively maintain the motion target chain table and obtain the trajectory of the target vehicle. The trajectory of the motion target is obtained by means of the correlation matrix, in which the data correlation value is calculated as

$$C_{n-\text{detect-track}}(t) = \begin{bmatrix} C_{1,1} & C_{1,2}, & \cdots & C_{1,n-\text{track}-1} & C_{1,n-\text{track}} \\ C_{2,1} & C_{2,2} & \cdots & C_{2,n-\text{track}-1} & C_{2,n-\text{track}} \\ C_{n-\text{detect}-1,1} & C_{n-\text{detect}-1,2} & \cdots & C_{n-\text{detect}-1,n-\text{detect}-1} & C_{n-\text{detect}-1,n-\text{track}} \\ C_{n-\text{detect},1} & C_{n-\text{detec},2} & \cdots & C_{n-\text{detec},n-\text{detect}-1} & C_{n-\text{detec},n-\text{track}} \end{bmatrix}, \tag{1}$$

where $C_{n-\text{detect-track}}$ represents the data correlation value; n-track represents the total number of targets on all tracks; n-detect represents the total number of targets after filtering. The similarity value of the data can be calculated by

$$C_{i,j}(t) = \frac{1}{|x_t - \hat{x}_t| + 1} + \frac{1}{|y_t - \hat{y}_t| + 1} + \frac{1}{|H_t - \hat{H}_t| + 1}. \tag{2}$$

In this equation, $\hat{x}_t$ and $\hat{y}_t$ represent the estimated position and vehicle width of the moving target at time t. $\hat{H}_t$ represents the estimated position and vehicle length of the moving target at time t–1. x_t, y_t, and H_t represent the true values of different parameters, respectively; after the calculation of association values, the association matrix is optimized by using the maximum matching and Hungarian algorithms. A one-to-one correspondence is constructed between the currently detected targets and the already tracked targets while abstracting it as a bipartite graph maximum matching problem. A_m is set to represent the set of detected targets; B_n represents the set of tracked targets, the elements in the two sets do not have any connection, there is a one-to-one link, and there can also be a one-to-many link. At the same time, the obtained relationship matrix is converted into a one-to-one correspondence matrix to satisfy the set constraints and finally achieve the target detection.

3.3. Feature Parameter Extraction. For the natural driving data attributes and the main factors affecting the risk of automatic vehicle driving, the following parameters are extracted as the feature indicators of vehicle automatic

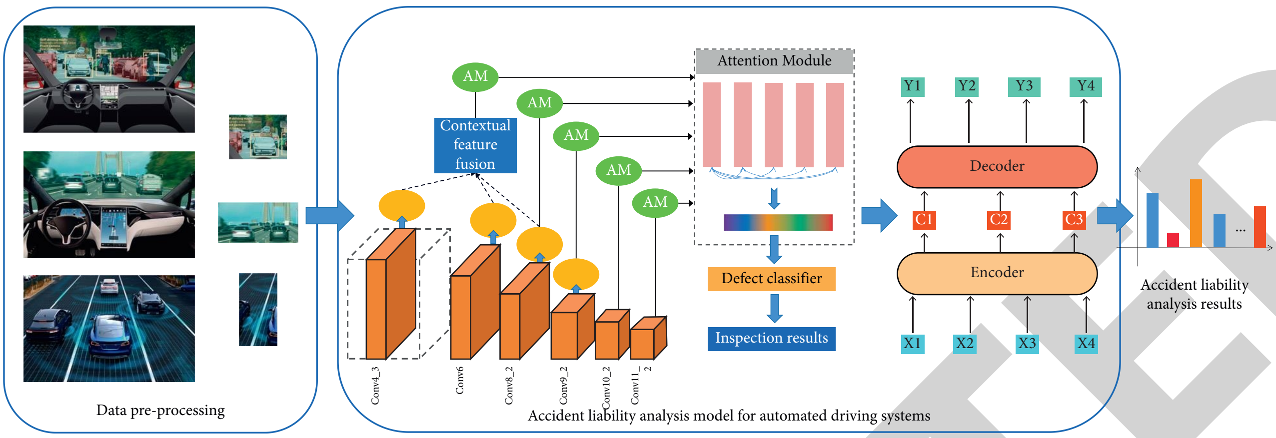

Figure 2: Model structure.

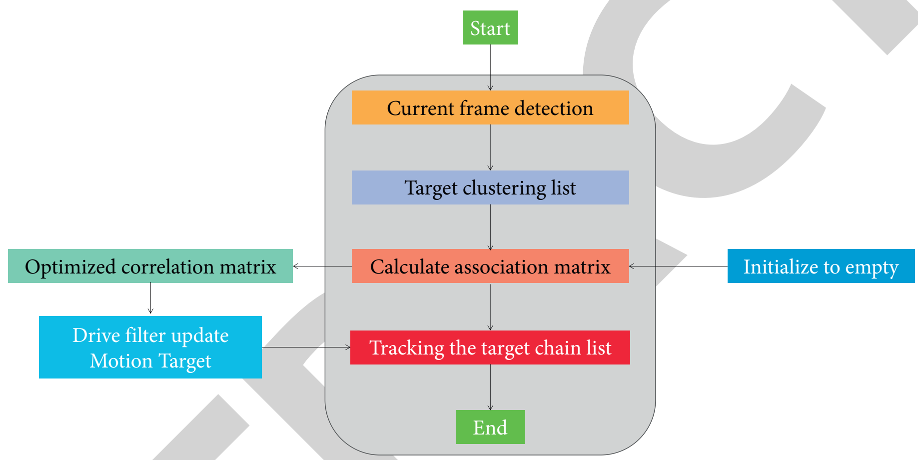

Figure 3: Schematic diagram of data correlation.

driving classification clustering: the proportion of time when the vehicle driving speed exceeds 80% of the speed limit η: vehicle driving speed is an important factor affecting vehicle safety. If the speed is too high, it will reduce the driver's ability to pass curved surfaces or curved paths and also reduce the driver's reaction time to dangerous situations, increasing the probability of accidents. When the speed exceeds 80% of the speed limit, the driver is considered to tend to travel too fast, and the corresponding formula is

$$\eta = \frac{T_{180\%}}{T} \times 100\%, \tag{3}$$

where T represents the total duration of the vehicle driving on the road; $T_{180\%}$ represents the total accumulated time of the vehicle driving speed over 80% of the set speed limit value of the road. The average value of vehicle speed $\overline{v}$ and standard deviation σ_v: the relevant research results show that there is a close correlation between the average value of vehicle speed and traffic accidents; the higher the value of $\overline{v}$, the greater the probability of traffic accidents. The standard deviation of vehicle speed represents the dispersion of vehicle speed distribution, and the probability of an accident is positively correlated; the following is the detailed calculation formula:

$$\begin{aligned}\overline{v} &= \frac{1}{n}\sum_{m=1}^{n} v_m,\\ \sigma_v &= \sqrt{\frac{1}{n}\sum_{m=1}^{n}\left(v_m - \overline{v}\right)^2},\end{aligned} \tag{4}$$

where v_m represents the m-th speed value of the vehicle in the natural driving process; n represents the total number of samples of speed values in the vehicle driving process. The standard deviation of acceleration σ_a, the mean value of positive acceleration $\overline{a}^a$, and the standard deviation of positive acceleration σ_{a^+} are calculated as follows:

$$\begin{aligned}\sigma_a &= \sqrt{\frac{1}{n}\sum_{m=1}^{n}\left(a_m - \overline{a}\right)^2},\\ \overline{a}^a &= \frac{1}{n}\sum_{m=1}^{n}\left(a_m - \overline{a}\right),\\ \sigma_{a^+} &= \sqrt{\frac{1}{n}\sum_{m=1}^{n}\left(a_m^+ - a^{a+}\right)},\end{aligned} \tag{5}$$

where a_m represents the m-th acceleration value in the vehicle driving process; $\overline{a}^a$ represents the overall acceleration value taken in the vehicle driving process; σ_{a^+} represents the overall acceleration average value of the vehicle; am + represents the m -th positive acceleration value of the vehicle in the driving process.

3.4. Risk Prediction. Since it is impossible to accurately obtain information about the surrounding environment and driving behavior of the vehicle during driving in the video, the multisource heterogeneous data involving vehicle collision risk are organized and quantified and reasonably converted into the initial input parameters of the complex intelligent traffic environment vehicle automatic driving risk prediction model. The driving parameters corresponding to vehicle crash risk are quantified and converted into corresponding driving targets by data-driven technology, while a large amount of historical data is selected as the driving source. A part of the data is set as training samples for training and analysis of the subsequently established model; the remaining part is mainly used to test the accuracy of the model prediction results. To fully exploit the quantitative or qualitative information of uncertainty, the data are modeled and analyzed with the help of the confidence rule base inference method. In the confidence rule, the input X is used to obtain the weight of the k-th rule:

$$w_k = \frac{\theta_k \prod_{i=1}^{M} \left(\alpha_i^k\right)}{\sum_{k=1}^{L} \theta_k \prod_{i=1}^{M} \left(\alpha_i^k\right)}, \tag{6}$$

where w_k represents the weight value, α_i^k represents the matching degree between the i-th input x_i and the reference value α_i^k in the k-th rule, θ_k represents the weight value of the k-th rule, M represents the number of antecedent attributes, and L represents the total number of confidence rules. When the calculation of w_k is completed, the posterior confidence structure of the k-th specification is discounted and the posterior terms of all the rules are fused using the evidence inference method to obtain the confidence output shown in

$$O(X) = \left\{D_j, \beta_j\right\}, \tag{7}$$

where D_j represents the posterior term, β_j represents the confidence level of D_j, and the specific expression is shown in

$$\beta_j = \frac{u\left[\prod_{k=1}^{L}\left(w_k\beta_{j,k} + 1 - w_k \sum_{i=1}^{N}\beta_{j,k}\right) - \prod_{k=1}^{L}\left(1 - w_k \sum_{i=1}^{N}\beta_{j,k}\right)\right]}{1 - u\left[\prod_{k=1}^{L}\left(1 - w_k\right)\right]}, \tag{8}$$

where N represents the total number of posterior terms; $\beta_{j,k}$ represents the confidence level of the assigned result as D_j; u represents the range of values of the input variables, which is calculated as follows:

$$u = \left[\sum_{j=1}^{N}\prod_{k=1}^{L}\left(w_k\beta_{j,k} + 1 - w_k\sum_{i=1}^{N}\beta_{i,k}\right) - (N-1)\prod_{k=1}^{L}\left(1 - w_k\sum_{i=1}^{N}\beta_{i,k}\right)\right], \tag{9}$$

where $\beta_{j,k}$ represents the confidence level of the assignment result D_i. The main purpose of the confidence rule base for learning model optimization is to continuously and dynamically adjust the parameter set P so that the optimization objective function can reach the minimum value.

4. Experiments and Results

4.1. Experiment Setup. In addition to the test methods introduced above, designing reasonable and perfect evaluation schemes and indicators is also a key point when conducting autonomous driving vehicle testing and algorithm evaluation. At present, there is no unified standard for the performance evaluation of autonomous vehicles, and various R&D institutions and research scholars have given evaluation indexes and schemes from different dimensions and focuses. The simulation test evaluation system is shown in Figure 4.

Simulation is a digital virtual testing method consisting of scenarios, vehicle dynamics models, sensor models, algorithms, etc., which allows computer numerical simulation of the system and the whole vehicle of the self-driving vehicle. It uses digital modeling to model the mathematics of the real physical world and validate algorithmic strategies without the need for real-world testing, which has the advantages of high efficiency, low cost, and high freedom partially or fully. Depending on the degree of control of the test object, the simulation can be subdivided into the model in the loop, software in the loop, hardware in the loop, and vehicle in the loop which is further integrated on the basis of HIL. Among them, MIL/SIL is generally used in the software detailed design and unit testing stage to test the single function of the autonomous vehicle; subsequently, HIL testing is used to complete the integration testing of subsystems (including hardware, underlying, and application layer software) and simulate some electrical characteristics; finally, VIL simulation is used to simulate road and traffic environment under laboratory conditions to complete software acceptance and carry out the whole vehicle MIL/SIL/HIL/VIL with the deepening of the integration of test objects, the confidence of test results gradually increases, but the cost also increases accordingly; the comparison of the characteristics of the above different simulation methods is shown in Table 1.

The predicted and real risk levels of each method are compared, and the results of the experiments are shown in Table 2. Analyzing the experimental data in Table 2, we can see that in the process of predicting the risk of automated vehicle driving for 10 different road sections, the prediction results of the proposed method match the real risk level, while comparison methods 1 and 2 have incorrect predictions. The main reason is that the proposed method effectively extracts the characteristics of different vehicle autopilot behaviors in the prediction process, which lays a solid foundation for the subsequent risk prediction, and increases the prediction accuracy of the whole method, which can better grasp the vehicle operation status.

This experiment was written in Python 3.8, using TensorFlow to implement deep learning and using third-party libraries such as TA-lib to calculate technical indicators. The specific configuration is as Table 3.

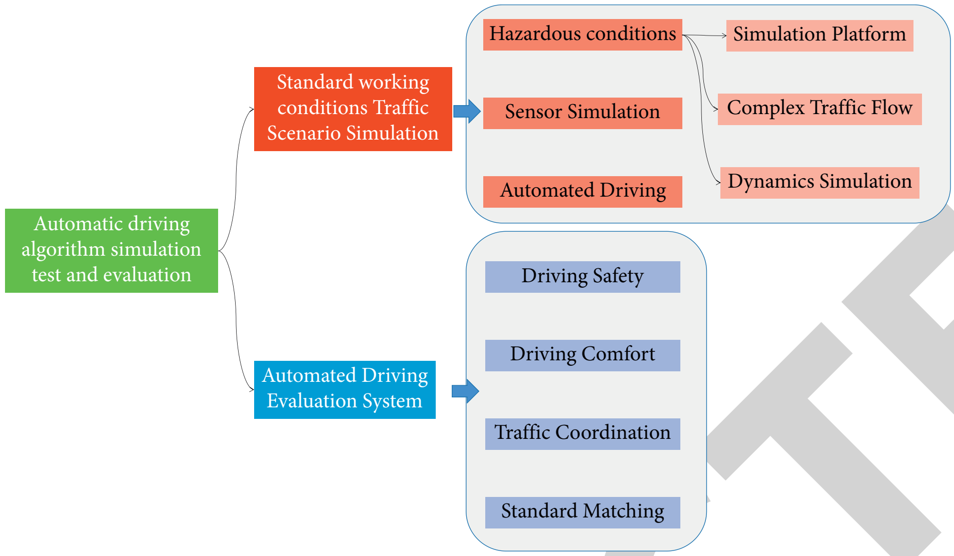

Figure 4: Simulation test evaluation system.

Table 1: Comparison of simulation test methods.

Simulation method	Model in the loop	Software in the loop	Hardware in the loop	Complete vehicle in the ring
Object under test	Algorithmic models	Target software	Target subsystem	Whole car
Number of test cases	Many	Code	More	Less
Running environment	Design host	Many	Target hardware	Target vehicle
Real-time	Accelerated, real	Design host	Real-time	Real-time
Driver	Time, slow	Accelerated, real	Virtual	Real
Vehicle dynamics	Virtual	Time, slow	Virtual	Real
Sensors	Virtual	Virtual	Virtual or partially	Real
Controllers	Virtual	Virtual	Real	Real
Driving environment	Virtual	Virtual	Virtual or real	Partially real

Table 2: Comparison of simulation test methods.

Test road section number	Vehicle autopilot real risk level	Results for predicting the risk of automated vehicle driving		
		Literature of the proposed method	Comparison method 1	Comparison method 2
01	II	II	II	III
02	III	III	III	IV
03	IV	IV	II	IV
04	III	IV	III	IV
05	IV	I	I	I
06	II	II	IV	II
07	III	III	II	I
08	IV	IV	IV	V
09	IV	I	IV	II
10	II	II	II	III

The training process loss convergence curve and performance improvement are shown in Figures 5 and 6.

4.2. Experimental Results. In order to verify the comprehensive effectiveness of the proposed complex intelligent traffic environment vehicle autopilot risk prediction method, the main road of a city was selected as the test site, and the test time was daytime, mainly including cloudy, rainy, and sunny weather conditions. The experiment collected nearly three months of vehicle driving data for experimental analysis, of which the dark curve is the experimental route. Vehicle speed control/(km/h) is in the same road section, using three different methods to predict the vehicle's driving speed, compared with the best driving speed within the road section; the specific experimental results are shown in Figure 7. The analysis of the experimental data in Figure 7 shows that the prediction results of

Table 3: Experimental environment configuration.

Python	3.8
TensorFlow	2.5.0
Pandas	1.2.4
Numpy	1.19.5
Matplotlib	3.4.2
Scipy	1.6.3
Tushare	1.2.62
TA-lib	0.4.24
Y Finance	0.1.59

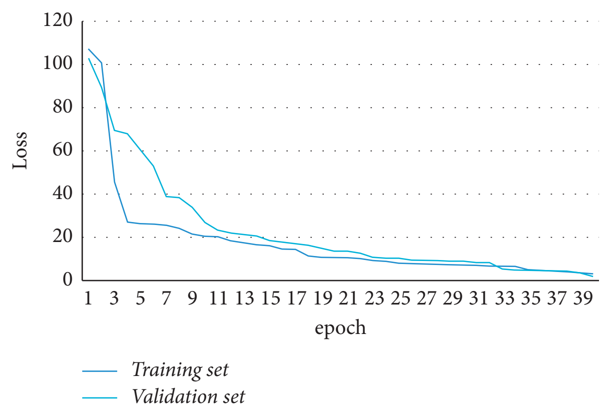

Figure 5: Training process loss convergence curve.

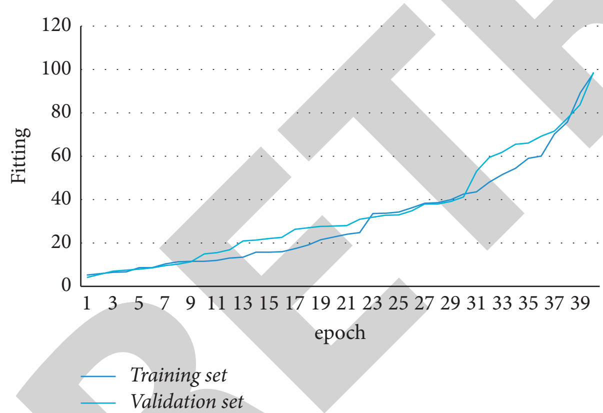

Figure 6: Training process performance improvement diagram.

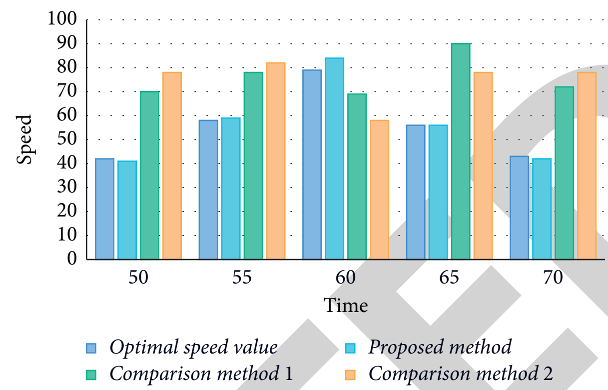

Figure 7: Vehicle travel speed prediction results of different methods.

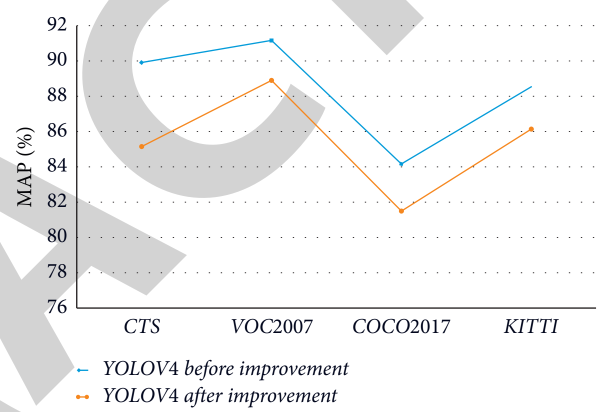

Figure 8: Algorithm improvement performance comparison.

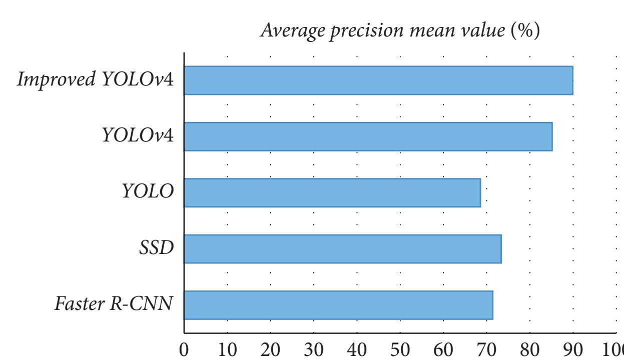

Figure 9: Comparison of average accuracy of different target detection algorithms.

the vehicle driving speed of the research method and the value of the best speed are basically the same, which fully verifies the superiority of the proposed method.

Figure 8 shows the change in the average accuracy of the YOLOv4 algorithm for common road target detection on different data sets before and after the improvement. On the CTS dataset proposed in this paper, the mAP value improves from 85.15% before improvement to 89.91%, an improvement of 4.76%; on the simpler VOC2007 dataset, the detection accuracy can reach a higher level, with the mAP value of 88.90% before YOLOv4 improvement, reaching 91.16% after improvement, an improvement of 2.26%. On the more complex COCO2017 dataset, the detection accuracy did not drop much compared with the CTS dataset, with the mAP value of 81.50% before the improvement of YOLOv4 and 84.16% after the improvement, an improvement of 2.66%, and 88.53%, an improvement of 2.36%. These experimental results show that the improved YOLOv4 algorithm can solve the problems of poor detection of small targets and occluded targets and high miss detection rate so that the algorithm still has a high comprehensive detection ability in complex traffic

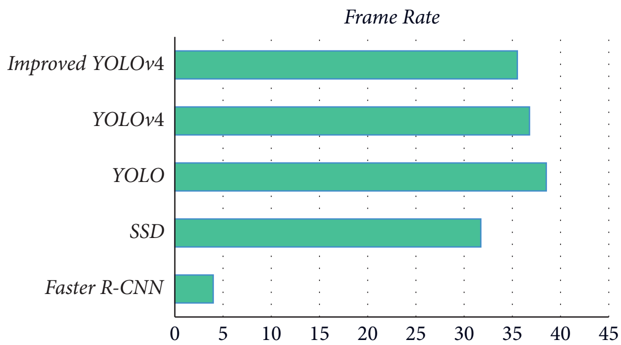

Figure 10: Comparison of frame rates of different target detection algorithms.

scenes and is suitable for different traffic scenes and can meet the practical requirements of self-driving cars.

In this section, the improved YOLOv4 algorithm is compared with Faster R–CNN, SSD, YOLO, YOLOv4, and other target detection algorithms on the CTS dataset for experiments, and the selected evaluation metrics are mAP as well as frame rate. The evaluation results of target detection for different algorithms are given in Figures 9 and 10. From the analysis of the evaluation results, the improved YOLOv4 target detection algorithm is far ahead of other algorithms in terms of accuracy rate, reaching 89.91%; in terms of detection speed, the detection speed reaches 35.52 f/s, which is lower than YOLO and YOLOv4, but still meets the real-time requirement of 30 f/s for automatic driving, fully demonstrating the effectiveness of the YOLOv4 improvement algorithm proposed in this paper.

5. Conclusion

Self-driving cars follow the trend of artificial intelligence development and have a large economic market and social and cultural influence in the intelligent technology industry. For the legal relationship problems faced in the process of putting this new thing, self-driving cars, into market use, this paper analyzes the determination of the tort liability subjects when self-driving cars are involved in road traffic accidents among them. Since the issue of auto traffic accidents is closely related to the economic interests, personal safety, and rights protection of the people involved in the accident, the determination of the subject of liability is naturally an important part of the resolution of the incident and the protection of human rights. The types of torts that may arise in the event of a traffic accident in the future use of self-driving cars that are identical to and different from those of traditional car accidents have been studied and discussed. The introduction and use of self-driving cars is not only a breakthrough in smart technology but also a challenge to laws and regulations that maintain a stable balance in society. In order to ensure that the accountability of self-driving car traffic accidents in the future can be based on the law, it is imperative to revise the road traffic laws and regulations. This paper investigates the impact of the determination of tort liability subjects and public mental health in self-driving car traffic accidents and proposes a deep learning-based risk detection model for autonomous driving. By revising the relevant laws, we formulate legal norms that are in line with the development of artificial intelligence technology, protect the legal rights and interests of consumers, and ensure the personal and property safety of car users. In the future, we plan to conduct research on the determination of accident liability of autonomous driving systems using graph convolutional neural networks and their impact on public mental health.

Data Availability

The datasets used during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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Retraction

Retracted: The Mining Method of Ideological and Political Elements in University Public Mental Health Courses Based on Artificial Intelligence Technology

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] F. Li, L. Gu, and H. Xu, "The Mining Method of Ideological and Political Elements in University Public Mental Health Courses Based on Artificial Intelligence Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 2829974, 12 pages, 2022.

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Research Article

The Mining Method of Ideological and Political Elements in University Public Mental Health Courses Based on Artificial Intelligence Technology

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Artificial intelligence technology has become an important part of the development of Internet technology. Artificial intelligence technology can help colleges and universities optimize the network ideological and political teaching system. Artificial intelligence technology provides more accurate data resources and rich and reliable educational technology means for online public mental health education in colleges and universities. This paper comprehensively uses a variety of methods such as qualitative and quantitative analysis, case and empirical analysis, literature analysis, and artificial intelligence technology. Artificial intelligence technology has been closely integrated with online public mental health education in colleges and universities. The model systematically analyzes the optimization methods of artificial intelligence technology methods for the online public mental health education system in colleges and universities, and constructs an innovation system for online public mental health education in colleges and universities. Based on the comprehensive analysis of artificial intelligence and public health in colleges and universities, this paper further proposes the application of artificial intelligence technology in online public mental health education in colleges and universities. On this basis, the model conducts an in-depth analysis of artificial intelligence technology and the online public mental health innovation system. The model supports the development of ideological and political teaching in colleges and universities through various forms such as idea innovation, path innovation, carrier innovation, and mechanism innovation.

1. Introduction

The artificial intelligence technology has a great impact on public mental health education in colleges and universities. Under the wave of globalization, multicultural thoughts widely exist in the Internet space [1, 2]. The narrow liberalization ideology of Western anarchists has a greater impact on China. Western ideology is strongly impacting China's socialist ideology on the Internet. In the era of artificial intelligence, student groups have a high ability to obtain information. Student groups engage in a process of ideological debate with different ideologies [3, 4]. Therefore, the online public mental health education in colleges and universities in the era of artificial intelligence must be reformed. Artificial intelligence technology can comprehensively centralize data sets with diverse structures, a wide range of types and a large number of data sets, and can also process them with the help of cloud computing data processing and application modes. The public mental health education in colleges and universities must be established on the basis of advanced political culture. This advanced political and cultural communication system can maintain the political mechanism of online public mental health education in colleges and universities. In general, artificial intelligence technology can provide educational decision makers with a quantitative, visual, three-dimensional, and comprehensive global vision [5, 6]. Allow decision makers to fully consider all variables. At the same time, decision makers can use computer simulations to check the results of artificial intelligence calculations. Decision makers avoid wrong decisions by checking and verifying the calculation results. Artificial intelligence provides new opportunities for online ideological and political education in colleges and universities. In the era of artificial intelligence, participants of network ideology and politics in colleges and universities must establish artificial intelligence awareness and learn to use artificial intelligence resources and technologies. Colleges and universities need to apply artificial intelligence technology to specific work. In addition, relevant school administrators can influence the allocation of educational resources and policy implementation through data analysis results. Data can help schools carefully develop development plans [7, 8]. Finally, artificial intelligence technology has the advantages of real-time, scientific, and accurate. This technology can help college administrators to improve the overall quality of online public mental health education in colleges and universities. The above studies mainly focus on the application of multiple intelligence model in the field of education. In view of the problems existing in the literature teaching platform, based on the theory of multiple intelligence, this paper adopts the methods of data optimization and fuzzy replacement to optimize the original model [9, 10]. Thus, a modified multi-intelligence model can be obtained, which can carry out targeted calculation of relevant literature teaching platforms, and analyze the accuracy of the model by using data verification method. This research can provide theoretical support for the application of multiple intelligence models.

The artificial intelligence technology is also the guarantee for the realization of the value of ideological and political teaching. Artificial intelligence technology has put forward higher requirements for the ideological and political education of psychology in colleges and universities. Specifically, it includes the pertinence, timeliness, sensitivity, and effectiveness of college education. The life and study habits of college students are changing accordingly. Online public mental health education in colleges and universities needs to be brave enough to meet the impact of the era of artificial intelligence [11, 12]. Public mental health education needs to change the traditional value dimension and realization method. Artificial intelligence technology can enhance the pertinence and effectiveness of online public mental health education. At the same time, artificial intelligence technology has also brought severe challenges to the online public mental health education in colleges and universities [13–15]. The online public mental health education in colleges and universities must conform to the needs of the times and show its own value from more aspects. Specifically, the public mental health education of college psychology needs to maintain the safety value of students' ideology. Political education can achieve the overall goal of comprehensive education in colleges and universities. Moral education in colleges and universities needs to adhere to the political value in psychology education. In the era of artificial intelligence, online public mental health education in colleges and universities needs to pay full attention to the social goal value of educating people [16–19].

The online public mental health education need to follow the development of the times. Through information methods such as artificial intelligence, the school can fully grasp the growth laws of college students. Schools can further carry out positive value education and guidance for college students [20–23]. Schools can train college students to become qualified successors to the cause of socialism with Chinese characteristics. The online public mental health education in colleges and universities based on artificial intelligence technology should carry the mainstream ideology of the society. In the ideological and political classrooms of colleges and universities, the teachers need to teach the core socialist values to students. Schools need to carry out various educational activities in a way that is easy for college students to understand and accept. School education needs to reflect the value demands of "students" self-growth. The Internet is an educational tool and educational carrier [24, 25]. At the same time, the Internet is also a living and educational environment that supports the growth of college students. Higher education can promote the comprehensive and free development of college students. In the era of artificial intelligence, the ideological and political education of psychology in colleges and universities should strengthen the interaction between teachers and students. This method can shape the spiritual character of students. This method can also improve the literacy of the student population in terms of network information [26–29]. The goal of school education is to cultivate students' noble pursuit of values. Schools should grasp new ideas and new perspectives in cyberspace in a timely manner, so as to meet the diverse demands of college students' all-round development and personality development.

2. The Changing Characteristics of Public Mental Health Education in Colleges and Universities Based on Artificial Intelligence Technology

2.1. The Development Process of Public Mental Health Education in Colleges and Universities Based on Artificial Intelligence Technology. The emergence of artificial intelligence technology has its inevitability. The development of information technology has entered a new era, and the accumulation of technology in the industry has developed to the extent that it has triggered changes in the times. This change can produce results from quantitative to qualitative changes. Artificial intelligence can achieve tasks that are difficult to accomplish by traditional methods, and the technology has great scientific and social value. Faced with such a situation, the ideological and political education system of psychology in colleges and universities should make positive improvements and actively adapt to the changes and development in the era of artificial intelligence. In the age of artificial intelligence, information technology can help us do many things that were not possible in the past. Due to the lack of dynamic characteristics of traditional educational resources, resource allocation cannot be adjusted according to real-time changes. Artificial intelligence technology uses data sampling and mathematical statistics to process educational resource data. Analyze the overall and dynamic data to obtain statistical conclusions. It fully reflects the growth process and evolution of educational data, and greatly improves the accuracy of micro-level analysis. We realize that the world is essentially made up of information [30–32]. The components of the world consist of a series of natural elements or social events. Information technology can accomplish many complex jobs. Under such a changing environment, the ideological and political education of psychology in colleges and universities needs to adapt to the requirements of the development of the times. On the one hand, the ideological and political education of psychology in colleges and universities needs to establish data awareness and build the data thinking of student groups.

Formula (1) constructs the correlation analysis model of public mental health and ideological and political teaching. All the evaluation factors are combined into the evaluation index system set of fuzzy comprehensive evaluation method, and the corresponding factor set is shown as follows:

$$U = \{u_1, u_2, \cdots, u_n\}, \tag{1}$$

where U is the factor set of the model and u_n is a set of specific different types of factors.

This paper adopts the fuzzy comprehensive evaluation calculation model. A corresponding evaluation level is set for the evaluation index, wherein the higher the evaluation level, the more obvious the quantitative effect of the evaluation result. In addition, the classification of comprehensive evaluation level is also a very important link in the fuzzy comprehensive evaluation method. The set of all evaluation levels is called the evaluation level set, and the corresponding formula is as follows:

$$V = \{v_1, v_2, \cdots, v_n\}, \tag{2}$$

where V is the set of evaluation factors and v_n is a set of specific levels of different types.

The ideological and political element index (ER) is used to express the integration mode and effect of ideological and political elements in the mental health teaching environment of colleges and universities. The ER values are based on the relationship coefficients in the regression model β. The calculation formula is:

$$\begin{aligned} RR &= \exp(\beta x) \\ ER &= (RR - 1) * 100 \\ ER(95\%CI) &= [\exp[(\beta \pm 1.96se)x] - 1] * 100. \end{aligned} \tag{3}$$

The artificial intelligence technology is the direction of the development of the times, and teachers and students in colleges and universities need to actively adapt to this change. In addition, the ideological and political education of psychology in colleges and universities has formed a relatively complete teaching system after a long period of development. A large amount of data have also been accumulated in various stages such as school classroom teaching and students' after-school practice [33–35]. At the same time, every college and every student is generating massive amounts of data every day. In educational work, these data are increasingly valued by all sectors of society. Data analysts conduct in-depth mining and use of this data. Artificial intelligence methods have incomparable advantages over traditional methods in data collection, platform construction, information processing, and public opinion research and judgment. Colleges and universities need to fully recognize the significance of artificial intelligence methods in data mining, and use them in the construction of incentive mechanisms for ideological and political education in colleges and universities. At the same time, more and more people fully realize the impact and change brought by artificial intelligence technology to education. Talents from various industries began to enter this field of research. In addition, relevant research results have been gradually promoted and applied in the field of ideological and political education. For example, the successful implementation of the online course MOOC platform has enabled education practitioners to understand the impact of artificial intelligence technology on the education system from a new perspective.

The function of mental health education in the ideological and political education of college students is obtained as shown in Figure 1. It can be seen from Figure 1 that the framework for the impact of artificial intelligence technology background on public mental health education in colleges and universities. Specifically, colleges and universities carry out ideological and political education in the field of public mental health through new ideas, new concepts, new paths, and new methods. Specifically, the methods of carrier innovation, path innovation, mechanism innovation, and concept innovation are used to analyze the impact of artificial intelligence technology on the reform of ideological and political education in the field of psychology in colleges and universities. On this basis, this paper further analyzes the effect of different influencing factors on the ideological and political courses of mental health in colleges and universities.

This paper uses a multi-factor linear regression model to measure the impact of different indicators on the effect of ideological and political teaching in public health teaching in colleges and universities. The model specifically treats each monomial as m input models in the original structure of the modeled network, and the model expression formula is as follows:

$$\begin{aligned} &v_1 = a_0, v_2 = a_1 x_1, v_3 = a_2 x_2, \ldots, v_6 = a_5 x_1 x_2 \\ &V = r_j \times B. \end{aligned} \tag{4}$$

Among them, v_1 represents the teaching effect of health psychology, and x represents the different components of ideological and political factors. The final information $i_t \times C_t'$ is expressed as the value that can be obtained C_t from the output information of the comprehensive evaluation model:

$$C_t = f_t * C_{t-1} + i_t * C_t'. \tag{5}$$

The calculation method is:

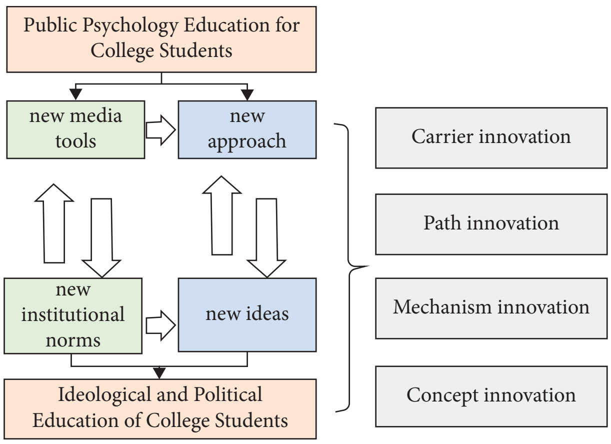

Figure 1: The function of mental health education in the ideological and political education of college students.

$$O_t = \sigma\left(W_o \cdot \left[h_{t-1}, x_t\right] + b_o\right)$$
$$h_t = o_t * \tanh\left(C_C\right). \quad (6)$$

Among them, C represents the comprehensive index of the psychology teaching system, O represents the specific performance effect of ideological and political factors, and h represents the teaching effect produced by different ideological and political teaching modes. In the formula, B_1 represents the membership degree vector corresponding to the index evaluation set A. Assumptions:

$$B = \left(B_1, B_2, B_3, B_4, B_5\right). \quad (7)$$

Self-organizing process adaptively forms the first-level intermediate model:

$$z_k = f_k\left(v_i, v_j\right), i = 1, 2, \ldots, 6. \quad (8)$$

In the above model, z_k represents the final result of the ideological and political element expression model, f_k represents the collection of different ideological and political influencing factors, and v represents the ideological and political teaching indicators of different dimensions.

2.2. The Reform Method of Ideological and Political Education in College Psychology Based on Artificial Intelligence Technology. The artificial intelligence technology can support ideological and political education practitioners to make scientific decisions. Artificial intelligence technology is a new technology revolution following the Internet, Internet of Things, and cloud computing. Especially after the Fifth Plenary Session of the Eighteenth Central Committee of the Communist Party of China, the state proposed an artificial intelligence development strategy. Artificial intelligence technology has been integrated into various industries in society and has become an important factor of production. At the same time, artificial intelligence technology has gradually become an important technical means of modern production management. Artificial intelligence technology is closely related to our work, study, and life. Academicians of the Chinese Academy of Engineering also believe that the era of artificial intelligence has arrived and will profoundly change our work and life. Artificial intelligence technology has been integrated into all walks of life in today's society. Artificial intelligence naturally has 4V characteristics (large number, diverse data, real data, fast input, and processing speed). Therefore, this paper adopts the multivariate linear statistical model to carry out statistical analysis on the relevant data generated in the teaching process of health psychology in colleges and universities. Various industries attach great importance to the application of data mining related technologies. Educational decision-making based on artificial intelligence technical analysis technology has also entered a new stage. Artificial intelligence technology has gradually demonstrated its own potential and advantages in the development boom of education information. Educational decision-making involves many complex issues. In addition, the demand for scientific decision-making in ideological and political psychology education has also gradually increased. All walks of life are also increasingly dependent on artificial intelligence technology.

The curriculum system and implementation framework of public psychological education in colleges and universities based on artificial intelligence is shown in Figure 2. As shown in Figure 2, this paper constructs an artificial intelligence-based public psychological education curriculum system and implementation framework, which specifically includes student groups, academic and engineering departments, community organizations, and cultural construction departments. The curriculum system links multiple departments to realize an integrated operation mechanism between departments. The curriculum system further develops accurate learning situation recognition and image drawing, refined teaching content customization and push, accurate teaching activity design, accurate learning content tracking and prediction, accurate teaching content evaluation, accurate teaching decision making, accurate teaching achievement display, and wonderful teaching effect. Colleges and universities need to use artificial intelligence to analyze the problems in the current public mental health teaching work. On this basis, colleges and universities need to further excavate the rules, and innovate new methods, new means and new mechanisms for network ideological and political education in colleges and universities. Promotion and other specific measures in eight aspects. Through these measures, the curriculum system promotes the intelligent innovation of the mental health education system in colleges and universities.

It can be seen from Figure 2 that when college teachers use the information-based lesson preparation system, the artificial intelligence resource library can actively provide teachers with teaching resources related to specific courses. This provides two conveniences for teachers and students. On the one hand, the system provides a broader network platform for teachers and students to work and study. On the other hand, the system helps teachers and students to obtain rich resources of public psychological teaching, promotes instant interaction between teachers and students, conforms to the current trend of Internet learning, and reflects the value of public psychological education to the greatest extent.

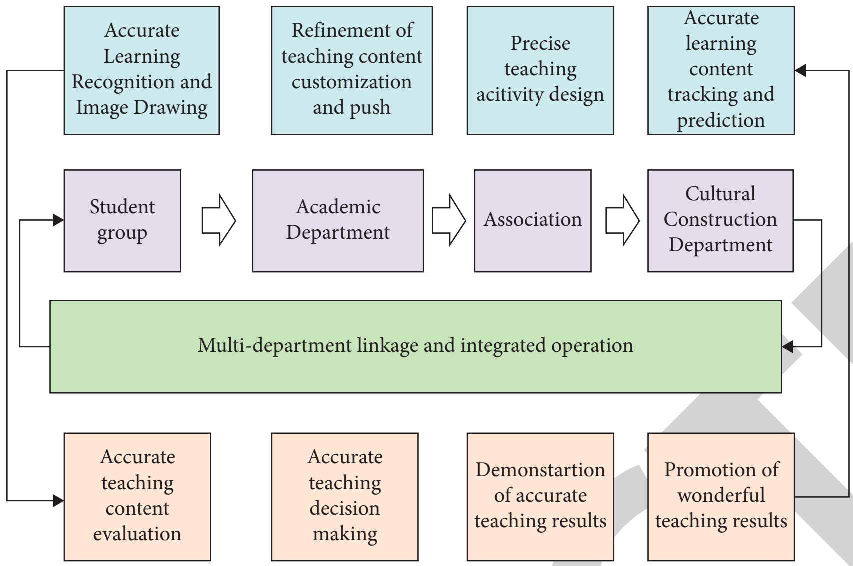

Figure 2: The curriculum system and implementation framework of public psychological education in colleges and universities based on artificial intelligence.

2.3. The Thinking Change of Internet Public Mental Health Education Based on Artificial Intelligence Technology. First of all, college students need to establish "Internet +" thinking. The advent of the era of artificial intelligence provides a new "Internet +" thinking paradigm for the development of psychological ideological and political education in colleges and universities. "Internet +" thinking is a scientific and technological revolution, which promotes a change in the way people's think. Based on the "Internet +" thinking, the students have shaped new concepts of openness, equality, collaboration, and sharing. The online public mental health education in colleges and universities can reshape the teaching concept and improve the learning methods of the student group. This method can build a new teaching platform and optimize the teaching management evaluation system. This method can continuously update teachers' teaching mode, so that more advanced teaching concepts can be effectively disseminated among students. This method can make teachers' teaching concept more concrete. Through the "Internet +" platform, schools can strengthen the guidance and behavioral shaping of educational objects by teaching subjects. Relying on the Internet platform, the school can realize all-round changes in teaching, curriculum, learning, teachers, and evaluation. Secondly, ideological and political teaching can strengthen students' personalized education. Individualized education is the education model that most respects individual demands in the modern education system. Personalized education teaches students with different personalities according to their personality characteristics. This educational model can respect and serve students to the greatest extent, so that students' potential can be fully realized. The premise of implementing individualized education in schools is to fully understand students. Through the continuous in-depth application of new technologies, artificial intelligence technology has been fully reflected in the public mental health education work. Through the analysis of massive data, artificial intelligence technology further supports colleges and universities to carry out personalized ideological and political education for student groups.

The integration mode of ideological and political elements in the psychology teaching system of colleges and universities needs to be systematically sorted out. Artificial intelligence technology is fully applied to ideological and political elements and public mental health education. It can be seen from Figure 3 that we systematically analyze the integration mode of ideological and political elements in the college psychology teaching system based on artificial intelligence technology. The system analyzes the integration methods of ideological and political elements in the public psychology teaching system of colleges and universities through the methods of refined management, precise evaluation, and refined service. Specifically, the teaching system includes five aspects: student network hot events, student learning psychology, student public opinion early warning, psychological dynamic analysis, and psychological stress test. This system corresponds to the ideological and political education system in colleges and universities, and involves five aspects: the ethical system, the moral system, the theoretical system of the rule of law, the value system, and the political theoretical system of the ideological and political education of students. The system systematically integrates college psychology teaching system and ideological and political education system through multiple subsystems such as public opinion management system, customized service platform, and artificial intelligence management system.

3. Artificial Intelligence Technology Promotes the Improvement of Public Mental Health Teaching Structure in Colleges and Universities

3.1. Relevant Policies of the State to Promote the Promotion and Application of Artificial Intelligence Technology. In 2016, China released the National Action Plan for Promoting the

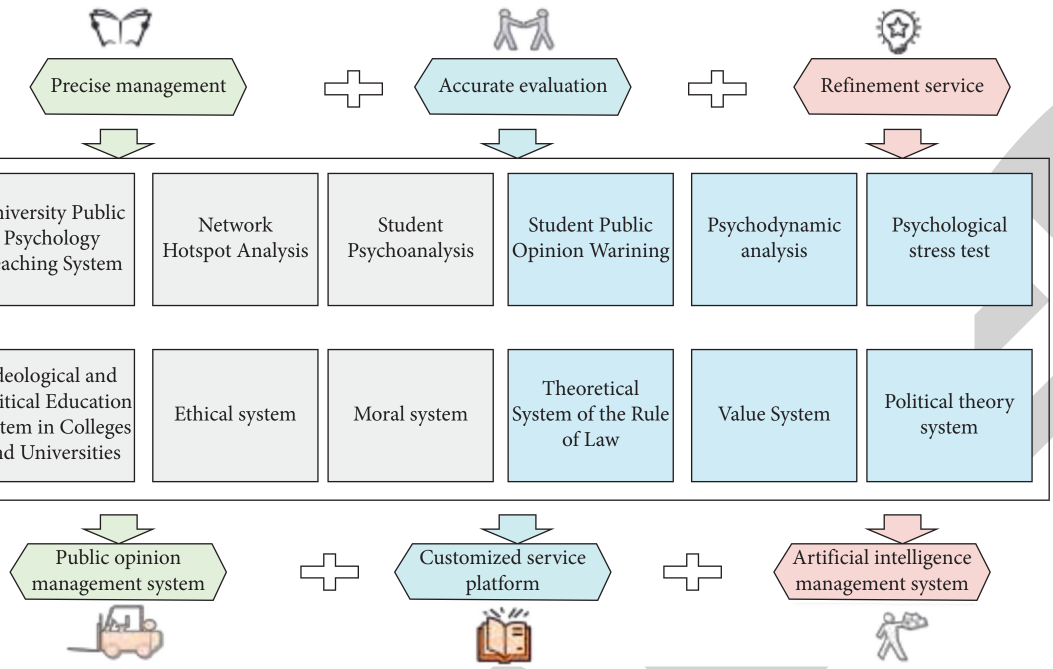

Figure 3: The integration mode of ideological and political elements in college psychology teaching system based on artificial intelligence technology.

Development of the Artificial Intelligence Industry. The document puts forward detailed requirements for the development of artificial intelligence technology in the field of education. The document requires colleges and universities to further explore the role of artificial intelligence technology in college teaching. Specifically, schools need to carry out systematic research on reforming educational methods, promoting educational equity, and improving educational quality. Artificial intelligence technology has brought revolutionary changes to the online public mental health education work. Artificial intelligence technology has further optimized the teaching methods of public mental health education. This technology supports teaching workers to accumulate knowledge and teaching experience in practice, and then makes the teaching effect better and better. However, poor path dependence may make public mental health education develop in a negative direction. Artificial intelligence technology can not only expand the scope of educational evaluation and change the concept of educational evaluation, but also provide technologies and methods for educational evaluation. When colleges and universities use artificial intelligence technology to integrate educational resources and ideological and political curriculum education, they need to adhere to the principles of specialization, integrity and standardization. The public mental health education in colleges and universities in my country has formed a relatively traditional path in the past. China's existing political and economic environment has played a very positive role in the public mental health education of college students. Under the effect of the incentive mechanism of ideological and political education in colleges and universities, public mental health teaching workers in colleges and universities can gain a sense of accomplishment, satisfaction, honor, and recognition. Participants of ideological and political education in colleges and universities can gain more sense of value existence. However, with the development of market economy and democratic politics, the phenomenon of "path dependence" has hindered the innovation of public mental health education in colleges and universities. The traditional teaching mode has imprisoned the thinking innovation of college students. Therefore, to realize the leap-forward development of public mental health education in colleges and universities, the phenomenon of "path dependence" must be eliminated.

Artificial intelligence technology can affect the teaching process of public mental health in colleges and universities through a variety of factors. Among them, factors such as student psychological analysis, students' daily public opinion warning, and student group psychological dynamics are all related to public mental health education in colleges and universities. From the result in Figure 4, it can be seen that the distribution curve of the impact of artificial intelligence technology on the mental health of the public in colleges and universities presents the characteristics of a normal distribution. By analyzing the proportion of different indicators in the figure, it can be seen that the psychological analysis of students accounts for the highest, about 35%. And student public opinion analysis accounted for about 25%. The acceptance level of students' ideological and political courses accounts for about 20%; the corresponding student group's learning mentality accounts for the same proportion, both 20%.

3.2. The Overall Characteristics of Ideological and Political Education in College Psychology Based on Artificial Intelligence Technology. First, the current society is generating

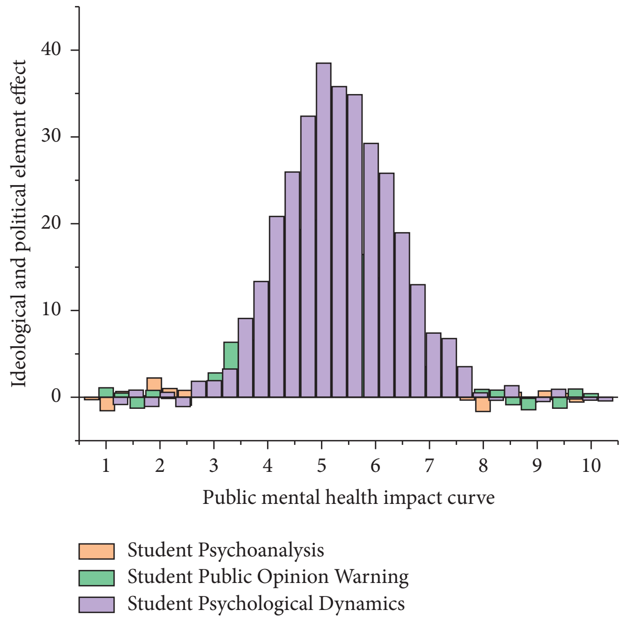

Figure 4: The distribution curve of the impact of artificial intelligence technology on public mental health in colleges and universities.

massive amounts of data every day, which are generally unstructured. Especially in the era of artificial intelligence, the order of magnitude of data storage shows a geometric growth trend. Artificial intelligence technology has many manifestations. There are also many types of artificial intelligence technology for processing ideological and political teaching data. These data include highly structured financial data, text file data, multimedia file data, and types of gene mapping maps. Artificial intelligence technology can systematically analyze and process these data. The presentation of this data is generally not structured, usually semi-structured or unstructured. From the current trend of computer technology and information network development, 80%–90% of future data structures will be semi-structured data. In general, structured and unstructured data require specific technical tools for processing and analysis. Second, the current data structures are characterized by complexity and imprecision. In the life cycle of artificial intelligence, data collection and preprocessing belong to the first link. The core content of this link is to rely on various equipment to collect all data. It can be seen that the open source data of psychological ideological and political education in colleges and universities exists in this link. In the era of artificial intelligence, people are more willing to quickly collect complex data, rather than obsessed with the accuracy of data. Generally speaking, traditional statisticians have difficulty in tolerant of the existence of erroneous data. In the current environment, companies use certain methods to reduce the chance of error when collecting samples. But no matter the amount of data, data analysts need to take appropriate measures to avoid errors.

Analyze the impact of artificial intelligence management system on ideological and political teaching system through statistical model. Through the analysis of different indicators in the calculation process, the calculation results of the current ideological and political education platform under the action of the diversified intelligent model are obtained, as shown in Figure 5. It can be seen from the calculation in Figure 5 that different indicators have different trends. Specifically, with the gradual increase of the sample, the curve corresponding to the ethical system first rose slowly, then gradually flattened, and finally showed an approximate linear upward trend. The legal system index also shows a gradually increasing trend of change. It is worth noting that the change trend of the index is basically consistent with the overall change of the topic system. It can be seen from the change curves of the moral system and the value system that the index firstly rises steadily, and then gradually becomes stable in two stages. The following phenomena can be found through model analysis. Colleges and universities use artificial intelligence technology to carry out precision teaching, and it is necessary to carry out stratified teaching according to the differences of student groups. In the era of artificial intelligence, new teaching ideas and teaching methods have also been applied to the evaluation and reform of the ideological and political teaching system. This shows that the matrix change results corresponding to different indicators have different manifestations. Therefore, the above indicators can be used for targeted analysis and description of model changes.

Data analysts spend a lot of effort and cost in avoiding mistakes. In general, large-scale data analysis requires appropriate requirements for data standards. Artificial intelligence technology has high requirements for the consistency of data standards. When data analysts carry out data processing work, analysts need to grasp the main laws of the development of things. In this case, the accuracy of the data is not the most important thing. Under the conditions of socialist market economy, ideological and political education and psychological education in colleges and universities are very important. Artificial intelligence technology can effectively promote the task of network ideological and political education in colleges and universities. Massive data resources are not absolutely accurate and perfect, but these data can satisfy people's predictions about the future. In general, data will be inaccurate, but this is not inherent in artificial intelligence itself. Massive amounts of data are just the way people use to keep track of how things are going and predict the future. Institutions of higher learning can gain greater benefits by processing massive amounts of information. These benefits far outweigh the general benefits of improved data accuracy. Therefore, this artificial intelligence dissemination mode allows the student group to obtain a better ideological and political learning environment.

The expression effect of ideological and political elements in the teaching content of public mental health is analyzed through statistical models. Specifically, there are generally four types of factors that affect ideological and political teaching in the field of public psychology, including the judgment and analysis of hot events, the tracking of students' psychological dynamics, the monitoring of public opinion, and the monitoring of student groups'

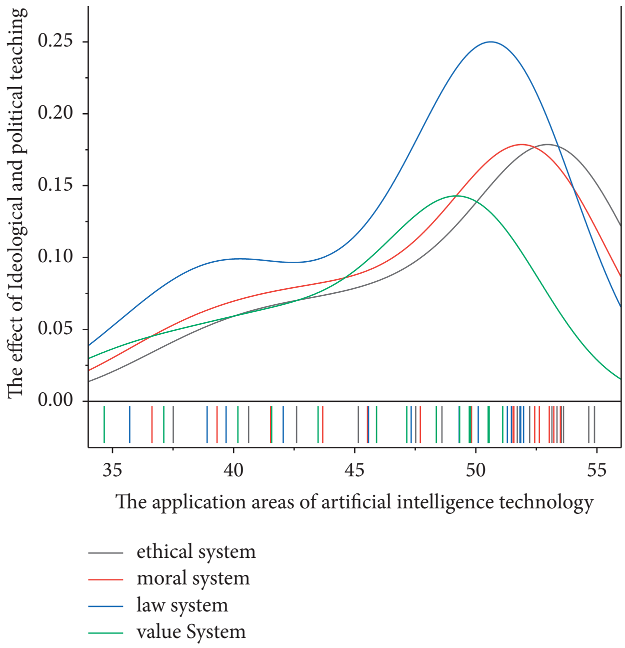

Figure 5: The impact of artificial intelligence management system on the ideological and political teaching system.

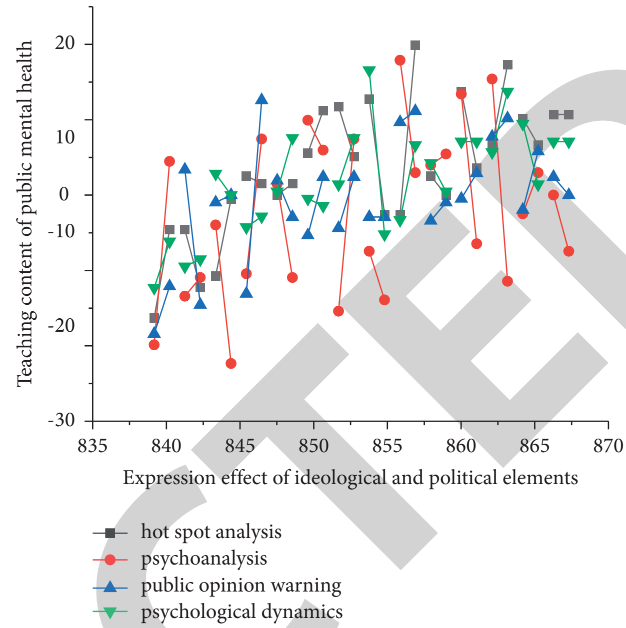

Figure 6: The expression effect of ideological and political elements in the teaching content of public mental health.

psychological dynamics. The results of the statistical model analysis are shown in Figure 6. From the results of the model analysis, we can see that the judgment results of hot events in ideological and political education show an overall upward trend of fluctuations, and the trend of students' psychological dynamics shows a trend of steady fluctuations, the results of public opinion monitoring show a downward trend of fluctuations, and the psychological changes of the students are in a state of high and small fluctuations as a whole. In terms of the intelligent perception layer, colleges and universities need to strengthen the key research on data collection. The specific content includes the use of distributed technology for data collection and crawling in colleges and universities. These results of the model analysis show that the above-mentioned indicators can represent the overall characteristics of the model changes, and the above-mentioned indicators can be applied to the expression analysis of ideological and political elements in the teaching of public psychology.

3.3. The Innovation Path of Ideological and Political Education in College Psychology Based on Artificial Intelligence Technology. In general, colleges and universities need to use artificial intelligence technology to carry out cluster screening of psychological ideological and political education content. The traditional college psychology ideological and political education often lacks systematisms and flexibility in the process of cluster screening. The ideological and political teaching courses of traditional colleges and universities often adopt sporadic and decentralized cooperation methods in terms of inter-school cooperation. The school takes online public mental health education as the main body and lower-grade college students as the object, lacking the overall concept and overall consciousness. First of all, colleges and universities need to break through the barriers of front-end data collection. Secondly, colleges and universities need to optimize and upgrade the existing data collection technology. On the one hand, artificial intelligence collection technology uses questionnaires and databases of information systems to obtain structured data. On the other hand, artificial intelligence technology also uses web page text data obtained by web crawlers and log data collected by active log collectors. Psychological ideological and political education in colleges and universities based on artificial intelligence technology and focus on clustering and screening of information.

This paper analyzes the integration of ideological and political elements in public mental health education through mathematical statistical models. The model analysis results are shown in Figure 7. It can be seen from the results that the integration of ideological and political elements into the analytical model can take many forms. These forms include classroom teaching, after-school reading, collective education, and ideological and political outdoor teaching practice. The technology focuses on socially focused events. In general, college administrators need to use smaller economic investment to achieve better results in online ideological and political education in colleges and universities. This technology pays more attention to the ideological and political field than the traditional college psychology ideological and political teaching content. In the clustering and screening of psychological ideological and political education in colleges and universities based on artificial intelligence technology, the first thing to do is to reasonably classify various events in public mental health education. In general, the technique can be classified according to the properties of various events. The key research directions of data collection in

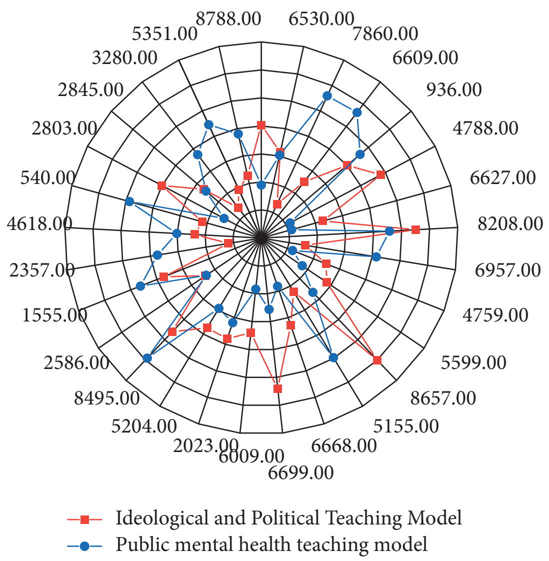

Figure 7: The multidimensional correspondence model analysis between public mental health ideological and political teaching models.

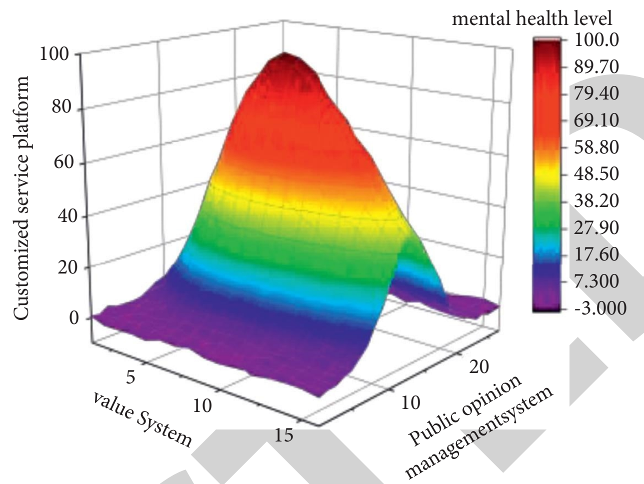

Figure 8: The results of the correlation between the teaching effect of mental health course and students' mentality in colleges and universities.

artificial intelligence technology colleges are: providing virtual servers required for artificial intelligence service platforms, databases of structured, semi-structured and unstructured data, and basic support environments such as Internet of Things resources. This technology can decompose the content of ideological and political education in college psychology into different teaching fields. In this paper, the content of ideological and political education in college psychology can be divided into two levels. The first level is to cluster and filter according to the main content of online public mental health education courses. Specifically, it is divided into four categories, including social events directly related to students' interests, social events not directly related to students' interests, campus events directly related to students' interests, and campus events not directly related to students' interests. The second level is to cluster and filter according to the content of online public mental health education. It is divided into five categories, including online ideological education, online political education, online moral education, media literacy education, and online cultural education.

Through the statistical model, it can be found that the teaching effect of mental health courses in colleges and universities has a significant correlation with students' mentality. The model analysis results are shown in Figure 8. Specifically, the mental health level of students is affected by three factors, including the health psychology teaching platform, the student health value system, and the student ideological and political management system. With the emergence and development of artificial intelligence technology, students' way of thinking and learning and living environment have been greatly improved. At the same time, the organizational structure of the public mental health education environment in colleges and universities has also undergone certain changes. Colleges and universities need to actively explore innovative methods of psychological ideological and political education based on artificial intelligence technology. This kind of path innovation is conducive to enhancing the effectiveness of public mental health education in colleges and universities. Artificial intelligence is not only to collect complex and huge data information, but more importantly, to process data. For example, a pile of raw materials can only add value after being processed, packaged, and processed.

The content of ideological and political education in college psychology in the era of artificial intelligence has undergone new changes. In the context of the new era, online public mental health educators must establish data awareness and be good at using data technology and thinking to combine online education with the physical and mental development of college students. The school serves the comprehensive development and personality growth of students through new technologies. Secondly, educators in colleges and universities must consciously integrate resources within the school and share social resources. The management departments of colleges and universities need to organically integrate all kinds of information on campus and build an information sharing platform. Colleges and universities should fully open the sharing platform to students and effectively carry out intelligent campus management. Third, education and teaching also need to introduce a network coverage management model. Colleges and universities need to further explore the key combination of new technology and traditional ideological and political education, and concentrate on construction. Organizations where students work can also employ artificial intelligence technology to develop high-level talent. Colleges and universities need a large number of high-quality talents who can use artificial intelligence technology. This training method enables students to participate in the construction of the online public mental health education system. Finally, online public mental health education needs to combine science and operation. Education needs to combine individual evaluation and comprehensive evaluation, and combine macro and onlookers. On this basis, colleges and universities need to build a scientific and reasonable online public mental health education quality evaluation system for college students.

4. Conclusion

The allocation of educational resources means that the state allocates limited educational resources among various educational platforms at all levels. This distribution method can ensure that the educational resources that have been invested can be fully utilized. Generally speaking, the total amount of social resources is fixed. The state should allocate resources reasonably among various fields of society and within educational institutions, and allocate them rationally in terms of total amount and structure. The allocation of educational resources needs to play the macro-control function of the government. In the era of rapid development of Internet and cloud technologies, both the form and quantity of media have grown rapidly. The amount of data that media generates every day is enormous. Artificial intelligence is often used to process the vast amounts of data generated by the Internet. It has the characteristics of huge data volume, rich variety, high dissemination timeliness, high reliability of data quality, and many source channels.

(1) The integration of artificial intelligence in public mental health education in colleges and universities is necessary. This technology mines new knowledge and creates new value through the integration and analysis of massive data. The technology can bring big knowledge, big technology, big profit, and big development. Artificial intelligence technology will have a great impact on many industries in the future through continuous evolution. The application direction of artificial intelligence technology in teaching is relatively diversified. Artificial intelligence has a broad application space in colleges and universities. The technology will be the next frontier of innovation, competition and efficiency gains. Colleges and universities are carrying out technology and innovation all the time. Colleges and universities are also places with extremely rich information resources. In today's era of rapid development of artificial intelligence, colleges and universities share teaching resources together, and maximize benefits through rational allocation of college resources. These behaviors of colleges and universities are very effective ways to deal with them. Artificial intelligence technology can effectively manage and configure the school's information resources. This technology can help schools to scientifically update and develop ideological and political teaching. Artificial intelligence can play a role in promoting the reform of higher education, promoting the information of higher education, and improving the quality of higher education in the work of public mental health education in colleges and universities. At the same time, colleges and universities realize their own strategic goals by meeting students' needs for artificial intelligence application resources.

(2) The allocation of educational resources under artificial intelligence is very precise. Traditional educational data reflect the overall and macro educational situation, which inevitably creates an imbalance in data distribution; at this time, "artificial intelligence" that obtains dynamic, real-time, comprehensive, and reliable data can make up for traditional educational data. Defects. For example, artificial intelligence can dynamically reflect the distribution of educational institutions in a certain area, the use of educational funds, etc. Using these data, taking into account the level of economic development, population age characteristics, and population mobility, schools are more effective when integrating educational resources. Can reflect rationality and fairness. Artificial intelligence has demonstrated unique accuracy across the vast majority of fields and industries. Artificial intelligence technology also shows broad applicability and adequate fit. Driven by artificial intelligence technology, ideological and political education in the teaching environment of public mental health in colleges and universities is also facing the impact of information reform. Ideological and political education has shown a trend of information in terms of education and teaching management and scientific research. All aspects of public mental health education and teaching management will generate massive data. Artificial intelligence technology can refine the classification of public mental health education resources. The data analysis function in artificial intelligence technology also involves all aspects of educational resources. Artificial intelligence is crucial for the sharing of higher education resources and the construction of digital education information platforms. This technology can greatly reduce the cost of communication between teachers in various colleges and universities, and reduce the time cost and economic cost of students' contact learning. Artificial intelligence technology has further gathered various public data resources in the Internet field, and further broadened the boundaries of ideological and political teaching in colleges and universities.

(3) The era of artificial intelligence is very conducive to the optimization of the ideological and political education system of psychology in Chinese colleges and universities. Artificial intelligence technology has also broken the limitation of time, space, and region in the teaching work of colleges and universities. On the one hand, the technology enables the comprehensive sharing of teaching resources, and on the other hand, it also makes the connection between regions closer. Artificial intelligence technology has strengthened the integration of educational resources among countries, regions, schools, and departments. The ideological and political

education work in colleges and universities is an integrated analysis of the existing public mental health teaching resources, and it is also a reference to the unique resources of other countries or regions. The application of artificial intelligence technology makes the limitation of time and space no longer an obstacle, and the global sharing of educational resources becomes possible. Schools can use the analysis function of artificial intelligence to build a digital platform, and collect data generated by students in the process of ideological and political teaching in colleges and universities through the platform. On this basis, the school teaching platform designs reasonable test questions and constructs a curriculum system that is adapted to the level of students' cognitive development. The digital education platform should have the function of teacher feedback, so that teachers can know where students encounter obstacles in their learning. At the same time, the digital platform also provides teachers with an overall analysis of student performance.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Retraction

Retracted: Closed Home Physical Education Teaching Model and Response Strategies Based on Big Data Technology

Journal of Environmental and Public Health

Received 19 September 2023; Accepted 19 September 2023; Published 20 September 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] G. Xu, "Closed Home Physical Education Teaching Model and Response Strategies Based on Big Data Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 7670725, 11 pages, 2022.

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Research Article

Closed Home Physical Education Teaching Model and Response Strategies Based on Big Data Technology

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Online teaching is carried out nationwide in the context of the new crown epidemic prevention and control, and physical education, as one of the compulsory courses in schools and universities, is included within the content of online line lessons. Online physical education teaching is a new approach and attempt to switch from an auxiliary teaching tool to the main teaching tool. The subject matter, target audience, teaching methods, and content of physical education classes have changed dramatically. The development of online physical education has played an important role in popularizing the concept of "sports for life" and establishing the concept of lifelong exercise. Through the analysis and research on the characteristics of online physical education, we propose the measures to promote the overall online teaching ability and level of physical education teachers in the post-epidemic period, gradually promote the reform of online and offline physical education, and promote the integration of school physical education and social sports, as well as to build a physical education teacher training system that integrates online and offline development and improve and strengthen the management of Internet physical education resources. Since the teaching effect of online teaching is limited by the teaching means and content, which leads to the low accuracy of the evaluation of online sports teaching effect, for this reason, this paper designs a model based on big data technology and artificial intelligence algorithm for enhancing closed home sports teaching, obtains the overall situation of online physical education by using convolutional neural network to process physical education video sequences, and improves the system performance by embedding the algorithm into the big data framework, to avoid the interference of teaching environment and complete the evaluation of high precision online sports teaching effect. The experimental results show that the proposed method evaluation can improve the computing rate based on ensuring the high accuracy evaluation of physical education online teaching effect.

1. Introduction

In 2020, in the face of the sudden new crown pneumonia epidemic, China's Ministry of Education reacted quickly according to the real-time situation and issued a notice about the postponed start of the spring semester of 2020, deciding to postpone the start of schools of all levels and types, encouraging localities to use the Internet and information-based educational resources to provide learning support for students, ensuring that classes are suspended without stopping, doing everything possible to reduce the negative impact of the epidemic on students and giving out guidelines for online teaching. A nationwide online teaching campaign was quickly launched [1–3].

Although physical education as a basic, compulsory subject has its own subject-specific, conditional, and geographical requirements, it is also important to overcome external objective factors to ensure the smooth conduct of physical education classes within the limits of our ability, so that students can perform physical exercises and meet physical fitness standards as much as possible within their home environment. The outline of building a strong sports nation states that fitness activities for all should be widely carried out and that they should be carried out according to time and place and according to need. Therefore, online physical education is in line with the general policy of the country and is conducive to the gradual penetration of physical exercise and health awareness into people's daily life and work, and the realization of sports for life. The significance of home-based online physical education is shown in Figure 1.

With the development of the epidemic prevention and control war, the Party and the State are highly concerned about people's life and health safety, and a series of epidemic prevention measures are being carried out, among which "home quarantine" is one of the important measures, which requires residents to purchase daily necessities and seek medical care, and other residents are required to stay at home and not go out, except for basic activities such as purchasing necessities and seeking medical care [4–7]. During home isolation, the Ministry of Education requires schools of all levels and types to carry out teaching tasks and home study guidance online. China has 518,800 schools of all levels and types, 16,728,500 full-time teachers, and 276 million students. The education system's large-scale online education for the nation's hundreds of millions of students during the epidemic's prevention and control is an unprecedented initiative in history and the first of its kind in the world.

The nationwide online physical education is also a precedent in the history of physical education in China, which shows that online physical education, as a new teaching method, is an inevitable product of today's network information era and is a necessary path for China's teaching to become technological and modernized. Online physical education is converted from teachers and students sharing the same space to teachers and students belonging to different spaces under the conditions of epidemic prevention and control, from 3D three-dimensional teaching by word and body to 2D flat teaching and physical education action skills video display through online teaching platforms (Tencent Conference APP, Tencent Classroom APP, Nail APP, and so on), from face-to-face teaching in the same place and space at the same time to live classes or prescribed time periods for learning [8–12].

The video class is converted from teaching aids to main teaching means. The above five conversions are the passive development of online physical education in response to the new epidemic, which has accumulated valuable experience for the development of online physical education in China, while responding to the Ministry of Education's policy of "suspending classes without stopping school" and minimizing the impact of the epidemic on students. Online teaching is the result of the accumulation of basic resources of education informatization, which accelerates and reconstructs an all-media physical education learning ecology.

The connotation and performance of lifelike sports are the penetration of sports and fitness activities into daily life and their close integration with daily life, becoming the fifth element of life in addition to clothing, food, housing, and transportation, becoming a new way of life and an important feature and an important way to achieve high quality of life. The lifestyle of sports is a social phenomenon that emerges along with the process of modern civilization, and people establish a healthy and active lifestyle, which is a concrete manifestation of people taking sports activities as an organic part of their lives and making them an important part of their lives. Sports lifestyle means the integration of sports factors into the way of life and production, where sports factors do not refer to simple sports skills but to sports habits, sports ways, etc. For example, daily trips are mainly cycling and walking, family members regularly organize sports or watch sports competitions together, sports expenses and sports closely related expenses as fixed expenses in the daily production expenses of the family, essential physical fitness exercise. The diversification of sports information dissemination is an important manifestation of the living of sports. Along with the rapid development of science and technology and the arrival of the era of self-media for all, sports information, as a kind of information resource, quietly penetrates people's daily life and influences their lifestyles and attitudes [13]. The dissemination of sports-related information ranges from the initial mainstream media such as TV, newspapers, and radio to sports-related applications nowadays. Sports groups range from professional athletes to mass amateurs and from children to the middle-aged and elderly.

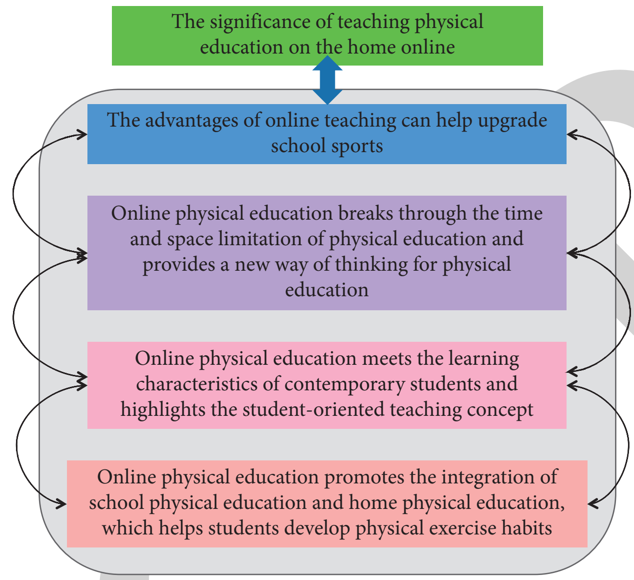

Figure 1: The significance of teaching physical education on the home online.

Many examples prove that the diversification of sports information dissemination is also one of the important features to promote the popularization of sports life. Nowadays, the living standard of Chinese residents has been improved substantially, the people's demand for material and cultural life is increasing, the number of people participating in physical exercise has increased significantly in recent years, and the people's demand for a healthy life and a high quality of life is getting higher and higher. From participation in sports activities in previous years under the call of unit organizations, to the emergence of a large number of social sports group organizations such as running teams, teams, mountain climbing teams, and the rise of related events, from passive participation to active seeking exercise, people's mass participation in sports is increasingly active, and the frequency of participation has gradually developed from random irregularity to stability, periodization, and normalization.

The era of big data has opened a major transformation and social change. As an information technology and service industry that discovers new knowledge, creates new values, and enhances new capabilities, big data technology not only gives new meaning and value to many basic data, but also gradually becomes the main driving force for deep-level adjustment and optimization of social structure, social functions, and social actions. Under the influence of this background, the school education field, which is closely related to big data, has also accelerated the pace of turning to the smart education model. In the era of smart education, physical education still faces many bottleneck problems, which seriously limit the effective release of the value benefits of physical education series [14]. It is particularly worth studying whether we can use the advantages of big data technology to crack some difficult problems faced by physical education, improve and optimize the quality and effect of physical education, and further deepen the pace of physical education reform in Chinese schools.

The evaluation of the teaching results in traditional physical education classrooms is mainly through the comprehensive evaluation of students' usual homework completion and regular examinations and assessments, which has one-way and closed characteristics. Through scientific analysis of accurate and effective big data, we can not only observe single students' mastery of the knowledge system of this course vertically, but also compare the learning situation of students of the same major horizontally and compare and judge students' ability in listening, reading, writing, and translating in all aspects. It breaks the limitation of the traditional teaching evaluation system, which mainly relies on exam scoring, and through data analysis and collection, it can customize personalized learning reports for each student, inspire students to establish goals and make learning career plans, which truly reflects the directivity and guidance of teaching evaluation. The influence of big data in the teaching process: the sports classroom in the postepidemic era integrates big data analysis into the three links before, during, and after class, breaking the closed-loop operation of traditional teaching and shaping a new open and interactive teaching platform, allowing teachers and students to communicate unhindered and showing infinite vitality [15, 16, 17].

The main contributions of this paper are as follows. Firstly, we analyze that although online physical education in higher education institutions is extremely important for maintaining students' physical and mental health during the new crown pneumonia epidemic, the narrow home space, difficulty in effectively monitoring course learning and insufficient preparation for online teaching, low IT literacy of physical education teachers, and unclear objectives of online physical education have made online physical education fail to achieve the expected teaching effectiveness. To this end, this paper proposes a closed home-based physical education teaching model based on big data and artificial intelligence algorithms for improving online physical education model, improving physical education teachers' IT literacy, and clarifying physical education goals, which provides a reference for better promoting the development of online physical education and the construction of a new physical education model.

2. Related Work

2.1. Enclosed Home Physical Education. Traditional physical education is mainly outdoor, students are engaged in physical activities under the guidance of teachers, and the natural teaching environment affects the quality of physical education and teaching effect impact. The most important feature of physical education teaching is that the teacher in the classroom is organized to guide the students' learning and practice, and the teacher's face-to-face explanation of techniques, movement demonstration, and error correction are the main features. During the epidemic, the teaching site was transferred from outdoor to home, and the learning environment of students changed. Teachers became online video instructors across the air, and students became online observers and offline independent practitioners [18, 19]. The change in the teaching venue, the passive acceptance of home online physical education by individuals, the psychological environment of student learning needs to adapt, and teachers and students cannot intuitively grasp the learning effect like traditional physical education. Then again, the limited space at home, the traditional sports venue equipment, and sports equipment cannot be used properly, which makes many physical sports teaching activities with high demand for venue cannot be carried out normally, such as group co-court confrontation projects basketball and soccer, which also affects the actual teaching effect.

The teaching method of physical education under the new crown pneumonia epidemic changes the traditional physical education teaching mainly in the way of teachers transmitting verbal information to teach students theoretical knowledge of sports and instruction of sports technology in verbal language, which can effectively grasp the stage of skill learning, and timely error correction and explanation and demonstration [20–22]. This way of transmitting verbal information is also an important way of communication between teachers and students. The traditional way of teaching physical education has the use of organizing mutual communication and collaboration between students in the practice process to develop their collectivism. In sports where competition is the main activity, teamwork can be developed. Online physical education is clearly different from traditional physical education.

Online physical education is based on students' independent learning style, which places higher demands on teachers to organize teaching online, anticipate students' learning progress, correct errors online, and teach at different levels. The transition from skills-based teaching and basic fitness-based content to traditional martial arts and basic fitness-based online teaching at home requires students to exercise at home consciously, which is conducive to personalized teaching and the development of students' independent thinking skills. Outdoor face-to-face becomes online teaching across the screen, which cannot control the effect of students' independent learning. The adoption of online teaching combined with offline teaching will increase teachers' personal workload, and the preparation of lessons should be more adequate. Compared with the traditional offline teaching method, online teaching requires more preparation for lessons, online live teaching and recorded teaching videos, online Q&A, and online homework correction after lessons, which invariably increases teachers' teaching difficulty [23].

Table 1 shows that 88.37% of teachers took online live and recorded teaching. As one of the teaching contents in secondary schools, physical education is also an examination content, and in the context of the epidemic, it is especially important to develop physical exercise and enhance physical fitness. Under the requirement of the Ministry of Education to suspend classes without stopping school, physical education is carried out in an orderly manner, and most of them take online live or recorded online teaching forms. The development of online physical education at home is shown in Table 1.

The large-scale online home physical education practice is not only an emergency measure in the face of the epidemic, but also a test of "Internet+" physical education, and an effective means to promote the information of education and teaching and help students develop lifelong physical education learning. To understand the situation of online physical education at home for junior high school students, this paper investigates the current situation of online physical education at home for students and uses a questionnaire to study the basic situation of online physical education, the impact of online physical education at home on teachers' teaching and students' learning, and teachers' and students' self-evaluation of physical education at home and learning [24–27]. While online physical education during the epidemic effectively expanded the content, time, and space of university public physical education courses, online physical education courses can effectively update and deliver the physical education knowledge needed by university students in response to the problems of insufficient hours of university physical education theory courses and teachers' shortage in theory teaching. During this epidemic, some universities have incorporated a part of the knowledge of immunity boosting against the epidemic, sports, and health into the online sports courses and enriched the teaching content by providing students with health education related sports theory knowledge and project related physical fitness exercises as a necessary supplement to the online courses. This also makes the teaching of physical education theory classes clearer, more graphic, and vivid and also greatly stimulates students' interest in online learning.

2.2. Big Data Technology. In the era of rapid development of big data, big data technology is widely used in all aspects of society, and the data information in the Internet is now exploding [28]. At present, with the intelligent development of big data technology, the data of home online physical education continues to grow exponentially with positive correlation, and the frequency of using home online physical education sharing platform also continues to grow. Faced with the situation of massive data of home online physical education, how to manage these massive data efficiently and explore the value of home online physical education has become the current problem faced by the home online physical education sharing platform [29, 30]. To make the home online physical education sharing platform meet the needs of users and provide them with accurate services, it is obvious that traditional technology can no longer meet its application. In the current big data environment, the technical processing based on Hadoop cloud platform can maximize the mining of massive data and provide clear data information for the home online sports teaching sharing platform using MapReduce parallelization model, thus meeting the current demand of archival users for both simplified retrieval procedures and precise access to online sports teaching that needs to be found.

Hadoop cloud platform core technology of MapReduce: Hadoop is a distributed system open-source framework developed by the Apache Foundation. Hadoop is a theoretical framework with good high performance, high reliability, and fault tolerance realized based on Google cloud computing. Hadoop system is a system specifically for large-scale data processing; the system can effectively understand users' feedback information about information resources, meet users' requirements of finding and using information resources in a distributed space, and form a good interactive model. Hadoop, as a storage and computing platform for large-scale data, can not only integrate heterogeneous data distributed in different domains on a single platform, but also store data effectively, improve retrieval efficiency, and avoid useless retrieval and MapReduce is one of the core technologies of the Hadoop cloud platform, and Hadoop is based on Google's development of an open-source MapReduce computing framework for handling parallel computing of big data. In the operation of MapReduce, its simplification parallel computing can be very useful for high-performance application requirements, reducing the difficulty of use when the user retrieves and speeding up the data analysis and processing capabilities, so it is widely used in the field of data mining [31, 32]. MapReduce divides data processing into two parts: the first part is the mapping Map, and the second part is the simplification Reduce. In simple terms, MapReduce big data technology first decomposes the user input data into M small data sets in the Map mapping part, and these M small data sets correspond to M Map tasks, which are processed separately for the decomposed data, and the results are finally obtained by aggregating the results in the second part of Reduce. In the large-scale home online physical education data, the use of MapReduce big data technology of Hadoop cloud platform can not only improve the performance and reliability of the sharing platform, but also meet the user's grasp of the accuracy of the acquired data, and most importantly, Hadoop makes up for the deficiency of the home online physical education sharing platform in the integration of data and information resources.

The establishment of the home online sports teaching sharing platform needs to meet the characteristics of its own platform and meet the use of different browsers such as PC, cell phone, and mobile end, so the optimization of data processing and data mining technology of the home online sports teaching sharing platform is crucial. According to the continuous optimization of big data technology, the home-

Table 1: The development of home online physical education format.

Format	Live %	Videocast %	Communication software %	Other %
Percentage of	37.25	51.12	8.96	2.67

based online physical education sharing platform realizes efficient interoperability of home-based online physical education with the help of the current optimized technology and personalizes the service method of the home-based online physical education sharing platform. Therefore, the home online physical education sharing platform must meet its own development needs based on big data technology.

The structure deployment of the home online physical education sharing platform: the goal of the home online physical education sharing platform is to facilitate the use of archival resources, diversify online physical education services, efficiently manage online physical education resources, and optimize archival data processing and mining technology. The construction of the platform will be efficient, interconnected, interoperable, and shared. At the beginning of the construction of the home online physical education sharing platform, due to the incomplete application of technology, limited users, and low level of resource management, the users are only limited to internal users, for which the comprehensive performance of the platform is not high enough, and its application server, database processing and mining server, and resource management server all run on one server. However, with the development and continuous maturity of big data technology, the range of users is expanding, causing the length of access to the server to lengthen and slow down. As the shared platform stores more and more data resources, this requires the application server, database server, and information resource management server to be deployed independently. The application scope of the platform cannot be limited to PC users, but to meet different user needs to enhance the diversity of online physical education services, which requires the performance of the platform to be improved accordingly and requires the introduction of advanced big data technology and the use of Distributed system to solve the problem of the increase of big data resources and the performance of high concurrent data, from the traditional single structure deployment to the efficient structure deployment of multiple distribution.

3. Methods

3.1. Model Architecture. The overall framework of the closed home physical education model is shown in Figure 2. The framework mainly consists of two steps: part 1, segmentation recognition of continuous action sequences by using a fixed length sliding window, to circumvent the disadvantage of poor recognition of transition actions by sliding windows, only nontransition actions are trained for recognition here, and finally, the dynamic actions and physical education actions in complex continuous actions are calibrated. In the second part, the boundaries of physical education actions (sitting, standing, and lying) are detected, the transitional actions existing between the two types of physical education actions are calibrated, and then, the class of transitional actions existing between action states can be determined according to the finite state machine.

3.2. Big Data Technology. The establishment of a home online physical education platform requires a database adapted to the big data environment. At present, Hadoop is the most common data storage technology, which is suitable for large-scale data storage and management. The improvement of data storage and management technology is paving the way for data retrieval. In the retrieval function of the home online physical education platform, the data storage and statistical analysis of home online physical education are the foundation of the platform. The analysis and calculation stage in the data retrieval function can be realized by using MapReduce, which is to divide the data to be processed into individual small data and process them separately in parallel, with the following operation process: there are two types of nodes in MapReduce, namely, the management task *JobTracker* and the execution task *TaskTracker*. *JobTracker* is the manager and is responsible for scheduling and monitoring the execution of *TaskTracker*, which assigns tasks and gives Map and Reduce functions to idle *TaskTracker* for execution. The parallel algorithm of MapReduce is to achieve the clustering of Map and Reduce, the system will plan the input data into a certain size of file blocks, Mapper will process each file to achieve the first stage of clustering, and then, a single Reduce processes the data from the first stage of clustering to achieve the second stage of clustering, an algorithm executed with several Mappers and a single Reduce.

3.3. Key Frame Extraction. The behavioral states described by key physical education actions in video sequences are more meaningful for analyzing and recognizing human behavior and for reducing data redundancy and computational load. This paper proposes a key frame extraction method based on an improved Gaussian mixture model. In the traditional Gaussian mixture model, the learning rate is fixed during the learning process, so the weights of the Gaussian distribution corresponding to the motion target will rise after a certain time and gradually update to the background distribution, which will lead to the appearance of holes and then disappearance of the motion target, especially the target with slow motion speed. Therefore, in this paper, the velocity v of the moving target is associated with the learning rate $a_{x,y,t}$ of the pixel points, which is dynamically adjusted as a dynamic variable. The motion velocity $v_{x,y,t}$, defined in this paper, of the mathematical expression is shown in equation. Using this method for

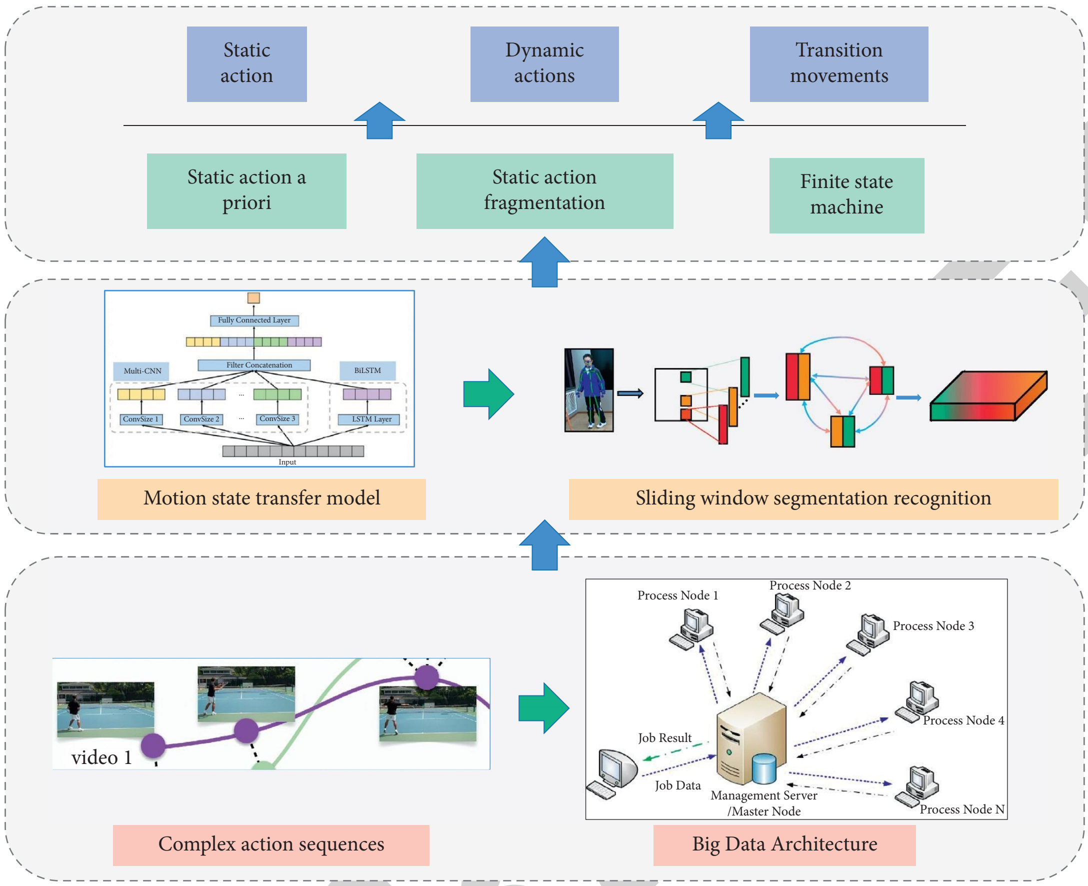

Figure 2: Model structure.

motion target detection effectively improves the operation speed and enhances the dynamic environment ground adaptivity. The coarse segmentation flow chart is shown in Figure 3.

$$\begin{cases} u_{x,y,t} = O_{x,y,t} D/\Delta t \\ \sqrt{(y_t - y_{t-1})^2 + (x_t - x_{t-1})^2} \end{cases}, \tag{1}$$

where Δt represents the time interval and is a fixed value. x_t and y_t refer to the rank order of the center pixel points of the smallest outer rectangle of the set of moving target points in frame t. For the set of foreground pixel points composing the moving target, the velocity $v_{x,y,t}$. y of each of these points is represented by the same velocity value. To prevent a fixed update rate from recognizing low-speed targets as background, the learning rate $\alpha_{x,y,t}$ needs to be dynamically adjusted with the change in velocity $v_{x,y,t}$. For a high-speed target, it does not stay in a fixed region, and there is no gradual conversion of the foreground distribution to the background distribution, so the pixel points need to maintain a stable, high learning rate; the exact opposite is true for a low-speed target. The formula that defines the learning rate $\alpha_{x,y,t}$ is shown as follows:

$$\alpha_{x,y,t} = \begin{cases} \dfrac{U_{x,y,t}}{u_{x,y,t} + \gamma}, \\ \alpha_{x,y,t-1}. \end{cases} \tag{2}$$

In the equation, v_0 denotes the velocity critical threshold, which is used to distinguish the motion target with high speed from low speed. A pixel point's learning rate is initialized to the initial value $\alpha_{x,y,t}$ when it satisfies the following conditions: (1) the distribution model matched at moments t-1 and t has changed; (2) the velocity is zero for 5 to 10 consecutive frames.

3.4. Null Convolutional Neural Network.

MIMU measurements have noise, and different operating temperatures bring bias error, the MIMU measurements are modeled as u_n^{IMU} subscript n is the time window, and the angular rate ω and acceleration measured at high frequencies are modeled to introduce noise and bias error:

$$\mathbf{u}_n^{\mathrm{IMU}} = \begin{pmatrix} \omega_n^{\mathrm{IMU}} \\ a_n^{\mathrm{IMU}} \end{pmatrix} = \mathbf{G}\begin{pmatrix} \omega_n \\ a_n \end{pmatrix} + b_n + w_n, \tag{3}$$

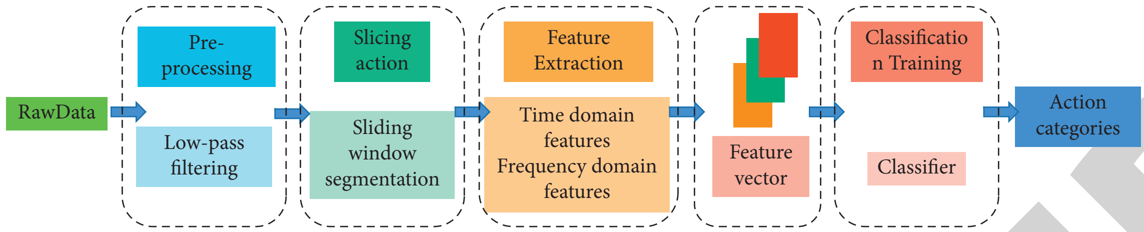

Figure 3: Coarse segmentation flow chart.

Table 2: Convolution block parameter values.

Convolution block parameters	Serial number 1	Serial number 2	Serial number 3	Serial number 4	Serial number 5
Inner core size	7	7	7	7	1
Expansion gap	1	4	16	64	1
Number of channels	16	32	64	128	1

where b_n is the constant bias error, w_n is the Gaussian white noise with zero mean, and ω is the gyroscope measurement:

$$a_n^{\mathrm{IMU}} = \mathbf{C}_n^{bT}\left(\frac{(v_n - v_{n-1})}{dt - g}\right), \tag{4}$$

where a_n^{IMU} is the linear acceleration excluding gravity in the navigation coordinate system, v_n is the MIMU measured velocity value in the navigation coordinate system, and G is the intrinsic calibration matrix:

$$\mathbf{G} = \begin{pmatrix} \mathbf{S}_\omega \mathbf{M}_\omega & \mathbf{A} \\ 0_{3\times 3} & \mathbf{S}_a \mathbf{M}_a \end{pmatrix} \approx I_6. \tag{5}$$

DCNN injects voids in the convolutional layer compared with the standard CNN, which can perceive more information and reduce the number of operations while keeping the parameters of the convolutional layer unchanged. A DCNN is studied and constructed to compensate the angular velocity of the gyroscope output to eliminate errors and drift. The input of the DCNN is the data collected from the MIMU in the window N; i.e., $\sum_{N=0} u_{n-N}^{IMU}, N$, N is defined as the convolution kernel size multiplied by the maximum value of the expansion gap, the sampling rate is $100\,Hz$, and the output is the gyroscope correction ω_n. The model is cascaded with five convolution blocks, and the parameters of each convolution layer are set in Table 2.

The DCNN flow chart is shown in Figure 4. A batch normalization (BN) operation layer and a smooth Gaussian error linear unit (GELU) activation function are inserted before and after the two convolutional layers of the CNN. The main role of the BN layer is to eliminate the error accumulation of singular samples, and the input data distribution in each layer of the CNN will be affected with the training parameter update of the previous layer. The BN layer GELU is a high-performance neural network activation function whose nonlinear variation is a kind of expected stochastic regular transformation, and the random errors inherent in MIMU MEMS accelerometers and gyroscopes are approximately Gaussian distributed. U activation function can enhance the model learning capability more effectively.

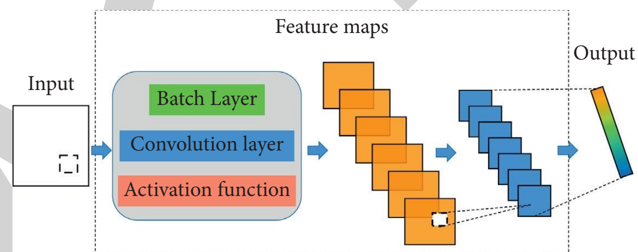

Figure 4: DCNN.

Table 3: Training parameters.

Training parameters	Value
Momentum	0.9
Initial learn rate	0.005
Learn rate drop factor	0.5
Learn rate drop period	10
L2 regularization	0.004
Max epochs	50
Minibatch-size	64
Validation frequency	30

3.5. Fusion Data. The fused gyroscope P.E. action angle estimate: $\alpha_g = [\theta_g \gamma_g \psi_g]$, and accelerometer and magnetometer P.E. action angle estimates: $\beta_g = [\theta_a \gamma_a \psi_a]$, with the initial yaw angle determined by the magnetometer. Using the estimated gyroscope P.E. action angle after DCNN correction as the predicted state value and the angle obtained from the accelerometer and magnetometer as the measured value, the established EKF state equation and measurement equation are as follows:

$$\begin{cases} \mathbf{x}_k = \Phi \mathbf{x}_{k-1} + \Gamma \mathbf{W}_{k-1}, \\ \mathbf{Z}_k = H \mathbf{x}_k + \mathbf{V}_k, \end{cases} \tag{6}$$

Table 4: Home online platform format meets basic physical education requirements assessment (%).

Title \ options	Fully satisfied	Satisfied	Basically satisfied	Not satisfied	Did not try
Attendance	46.25	40.78	8.77	0.28	3.92
Explain the knowledge point	65.37	29.27	4.50	0.86	0
Demonstrate movements	89.51	3.21	6.25	1.03	0
Guided practice	55.24	35.30	6.22	1.49	1.75
Online error correction	11.71	24.66	35.45	23.04	5.14
Online interaction	8.22	12.75	31.03	30.25	17.75
Online test and rating	2.50	5.27	18.89	28.60	44.74
Overall rating	9.54	39.48	47.33	3.65	0

where k is the moment value, $\mathbf{x}_k$ is the state value, $\mathbf{Z}_k$ is the measurement value, Φ is the state transfer matrix, Γ is the noise driven matrix, H is the measurement transfer matrix, W_{k-1} is the system noise driven matrix, and V_k is the measurement noise matrix, satisfying the mean value of zero and the variance array of uncorrelated white noise Q and R, respectively.

4. Experiments and Results

4.1. Experiment Setup. In this paper, the behavior recognition dataset NTU-RGB + D established by a physical education laboratory in China is used as the experimental data. The dataset consists of 60 physical education action categories (divided into three categories of daily physical education actions and two-player interaction behaviors) and 56,880 video physical education action samples, and each video contains one physical education action, including single physical education actions (e.g., sitting) and two-player physical education actions (e.g., shaking hands with each other). There are also four different forms of PE teaching action data: RGB video, 3D skeleton data, depth map sequence, and infrared video. In this paper, 3D skeleton data is chosen for the study of behavior recognition based on skeletal information.

The experimental environment is Windows l0 operating system; CPU is Intel(R) Core (TM) i7-9750H; GPU is GeForceGTX1650. Design network is implemented using PyTorch deep learning framework. The big data nodes are configured as follows: in the experiments, the data cluster used is composed of 27 nodes, including one main node, one scheduling node, and one backup node, and 24 data computing nodes. In addition, the corresponding dual-core CPUs with a frequency of 2.5 Ghz and memory up to 8 GB were installed and configured within each node hardware, and the configuration information of the computer software was Hadoop 0.23.0. The training settings are shown in Table 3.

4.2. Experimental Results. To verify the effectiveness of the dual-stream network structure and improved residual structure designed in this paper, the subjective evaluation of whether the model of this paper is online teaching form is shown in Table 4.

Table 4 shows that the home-based online teaching format meets most teachers' basic requirements for teaching but is slightly worse in online error correction, interaction, and testing and needs to be improved. Ablation experiments were conducted in the CSL dataset to compare the dual-stream GCN network, GCN+2D-ResNet network, and SCR-GAN network, respectively, with the base GCN network as the baseline, and the experimental results are shown in Figures 5 and 6. The dual-stream GCN network structure has better recognition effect compared with the ordinary GCN network, and the recognition rate is increased by 8%. There is also a considerable increase in accuracy after adding the improved residual structure to the base GCN network, with an increase of 7.3%. Therefore, the improvement of the network in this paper is effective, and the combination of the two approaches greatly improves the recognition accuracy of the network.

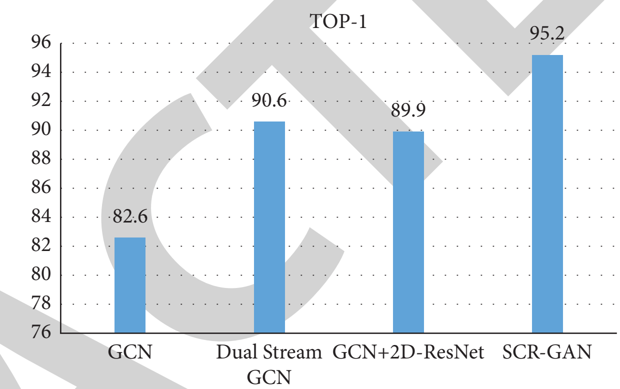

Figure 5: Network improvement effectiveness Top-1 verification.

To further verify the effectiveness of the proposed SCR-GAN network in gesture recognition, the method is compared with other mainstream methods on two datasets, CSL and DEVISIGN-L, and the results of the comparison experiments are shown in Figures 7–10. From the data in the table, in gesture recognition, the recognition accuracy of the GCN network-based method is significantly higher compared with the CNN network-based method and the RNN network-based method, and the accuracy of the SCR-GAN network on the CSL and DEVISIGN-L datasets reaches 96.2% and 69.3%, respectively, with the highest recognition accuracy and the best recognition effect. The recognition accuracy of both the residual-based DSTA-Net and the dual-stream structure-based 2s-AGCN network is higher, reaching 93.2% and 95.6%, respectively, second only to the network in this paper. The experimental results prove that

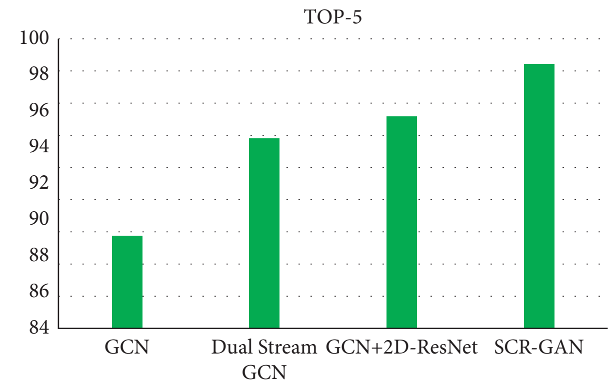

Figure 6: Network improvement effectiveness Top-5 verification.

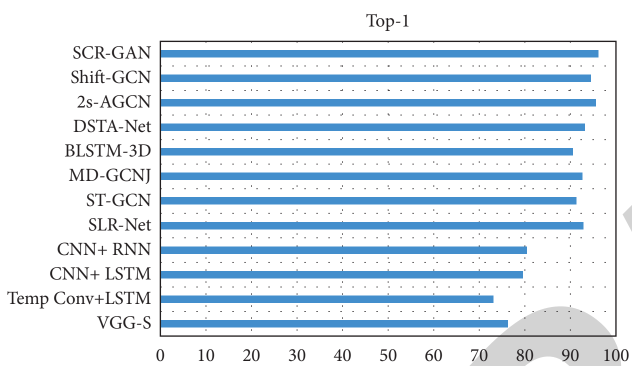

Figure 7: Top-1 comparison of different methods on CSL dataset.

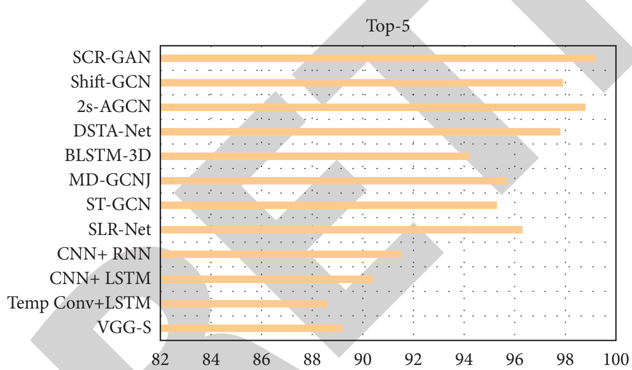

Figure 8: Top-5 comparison of different methods on CSL dataset.

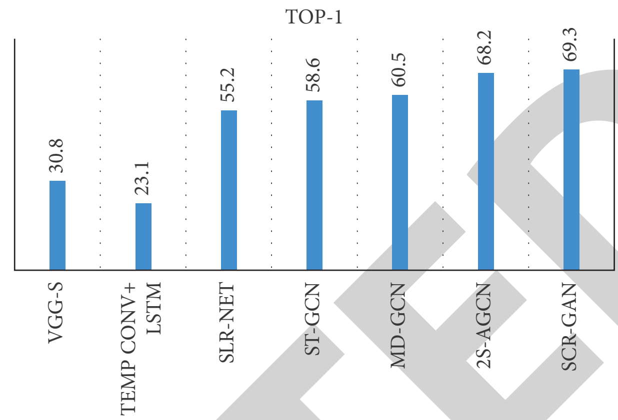

Figure 9: Top-1 comparison of different methods on DEVISIGN-l dataset.

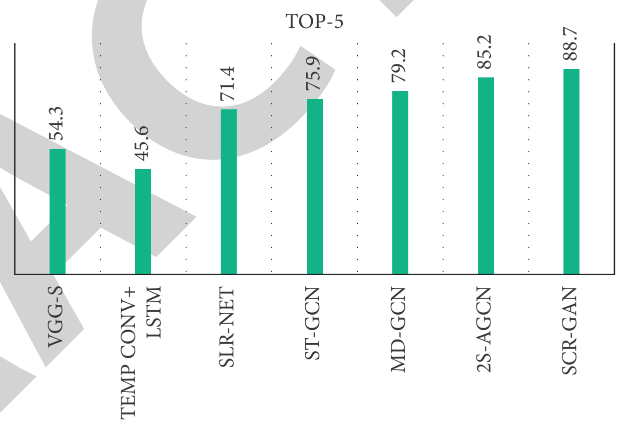

Figure 10: DEVISIGN-L Top-5 comparison of different methods on the dataset.

the combination of residual structure and dual-stream structure can enhance the image sequence extraction ability and make the whole network framework have better generalization ability and recognition effect.

The constructed spatial and temporal maps are used as the input of spatial and temporal flow channels, respectively, to speed up the network training speed, embedding the improved residual structure to increase the network depth and avoiding the problems such as gradient disappearance and converting the sequences output from the two channels in series and feeding them to the input SoftMax classifier to get the final results with good recognition effect. In the future work, we will conduct in-depth research on how to perform accurate recognition under complex conditions such as partial occlusion of hand gestures and continuously optimize the recognition performance of the network.

5. Conclusion

The new crown pneumonia epidemic is raging, and overcoming the epidemic is at the same time an opportunity for self-improvement. For the future development trend of online physical education, frontline physical educators should give full play to the advantages of online teaching, learn lessons, and improve deficiencies to further improve the school physical education system and meet the development needs of students in special periods. Online physical education classes are taught with the help of Internet information technology, which breaks the constraints of traditional physical education limited by time and space. Students can choose the right time and place for physical education classes in combination with their own learning arrangements and actual conditions, which improves the autonomy and convenience of physical education class learning. From the perspective of teachers' teaching, online teaching has changed the dilemma that physical education could not be carried out in rainy and snowy weather in the past. In particular, the development of online physical education during the epidemic prevention and control period highlights the necessity of physical education development in special times and triggers thoughts on online physical education in the postepidemic era. The method proposed in this paper effectively addresses closed home physical education, and in the future, we plan to conduct research on closed home physical education models and coping strategies using graph convolutional neural networks.

Data Availability

The datasets used during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares that he has no conflicts of interest.

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Retraction

Retracted: Analysis of News Dissemination Path and Impact of Big Data Technology in Public Health Emergencies

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Z. Zhang and J. Tang, "Analysis of News Dissemination Path and Impact of Big Data Technology in Public Health Emergencies," *Journal of Environmental and Public Health*, vol. 2022, Article ID 4436232, 9 pages, 2022.

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Research Article

Analysis of News Dissemination Path and Impact of Big Data Technology in Public Health Emergencies

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Throughout the past public health early warning work, there is still a lack of early warning. Therefore, starting from the reform of the public health early warning mechanism, this paper sorts out the design and development of our country's public health early warning mechanism and its legal framework and further analyzes the unresolved problems that exist in early warning work. At this stage, our country's public health departments have put forward targeted suggestions for improving the early warning mechanism for emergencies and stabilizing public order. In this context, the following data are obtained: (1) The timeliness under the big data model is 73.81%, the prudence is 84.25%, the sustainability is 96.28%; the timeliness under the data mining model is 61.98%, prudence is 77.58%, sustainability is 83.24%; and the timeliness of the intelligent computing model is 53.44%, prudence is 65.58%, and sustainability is 96.28%. (2) During public health emergencies, the path of news dissemination includes 54 people for radio and television communication, accounting for 13%; 98 people for digital communication, accounting for 24%; 73 people for digital TV communication, accounting for 19%; the number of public relations companies was 63 people, accounting for 16%; the number of people who reprinted and spread was 52 people, accounting for 12%; the number of people who searched and spread was 73 people, accounting for 19%; the number of people who spread mobile phone messages was 32 people, accounting for 9%. At this stage, according to the characteristics of public health emergencies, the problems existing in the early warning work are analyzed, and specific suggestions for improving the early warning mechanism of public health emergencies in our country are put forward to stabilize the "public order." Research in this area is ongoing.

1. Introduction

As a hot technical field, big data technology has received extensive attention and research, emphasizing the concept and nature of big data, development at home and abroad, as well as data collection and perception, storage and processing, data visualization and data analysis. Articles provide general information. Security and privacy practices, key technologies, and innovative technologies, identify the latest research directions of these technologies, summarize the technical and policy challenges of big data technologies, and review the application of their technologies to educational research and design applications [1]. Our country is currently focusing on the research on smart grid big data technology which has achieved many research results that mark the development of our country's power industry. So, once you understand the meaning of big data in smart grid, you will understand the concept of big data in smart grid, understand the key technologies and development trends of smart grid big data, put forward your own ideas and suggestions, and promote the correct application of smart grid big data [2]. The generation of big data brings new challenges to massive computing technology. In order to have a more comprehensive and in-depth understanding of the meaning of big data, this paper will examine the conceptual characteristics of big data, the overall processing process, and key technologies. The creation of this article is based on a brief description of the basic concepts of big data, a summary of the overall process of big data processing, and an introduction to the basic process and organizational structure of key technologies [3]. Big data is coming to us, and we are rapidly entering the Big Data Era. Big data requires freedom, transparency, and information sharing. Our time is also known as "shared time," but we are also constantly under the control of a "third eye," and with it comes intimacy. In the age of big data, mystical concerns about conservation raise questions of freedom and human responsibility, posing new challenges to traditional ethics [4]. The rapid development of big data technology provides operators with fast and massive computing solutions for traditional services (such as network design and optimization), and lays a solid foundation for operators to develop new services (such as credit scoring, personalized recommendation, and Internet services). This has important implications for the development of the industry. Research-related big data technologies provide background design best practices and key challenges for operators to apply big data technologies in the enterprise [5]. Rapid detection of public health events and rapid and effective reduction of morbidity and mortality have always been the work of public health focus. Loss or no financial loss, the current requirements become clear and necessary. Counting every second is required to respond to public health emergencies [6]. Public health emergencies have caused severe psychological stress and emotional problems for many people. In emergencies, psychosocial factors become increasingly important in guiding the investigation and emergency management process. Manifestations of emotional problems in emergencies include hypochondria, panic, anxiety, depression, and obsessions. Unexpected events provide ample opportunities to explore emotional issues [7]. The use of early warning to prevent and minimize emergencies such as natural disasters, accidents, and welfare events has a long history, but early warning of public health emergencies has not yet been carried out. Emergency regulations will monitor and give early warning to the business requirements of the content of the public health emergency plan [8]. A health emergency is a public emergency that causes or may cause serious harm to public health. These include, in particular, serious phenomena such as infectious disease pandemics, unexplained diseases, and major food and industrial poisonings. They affect public health (such as major environmental pollution, radioactive pollution, and major animal diseases), maintain public order and stability [9], learn more about developing public health emergency mechanisms, establish an effective management system for public health emergencies, develop a comprehensive online direct reporting system, strengthen the construction of grass-roots disease prevention and control systems, and establish a series of sensitive early warning mechanisms and reagents. They also strengthen on-the-job training and continuously improve the ability to respond to public health emergencies [10]. Understanding the characteristics of the online dissemination of alert messages is critical to managing alert situations and facilitating the dissemination of critical information, we will create a systematic and comprehensive analysis system combined with existing knowledge, to explore the unique evolution, dissemination, and common patterns of emergency knowledge dynamic [11]. Currently, the rapid development of online media and the continuous integration of traditional media has brought changes to the news dissemination mechanism. Although the communication efficiency has been greatly improved, there are still many problems. In particular, the dissemination of hot and negative news often brings controversy and negative impacts. This paper analyzes the current hotspot negative news dissemination mechanism, and proposes intervention paths, in order to provide a certain reference for monitoring the dissemination of negative news. It firmly grasps the positive direction of news dissemination [12] and describes a multi-channel dissemination system for online news articles on the Internet. This paper proposes the "value" of online news relative to the topic-time relationship, and a method for judging the topic expansion of the list of subsequent articles. Furthermore, we describe a method for reconstructing and presenting lists of time-series documents with high newsworthiness. Finally, a prototype system based on this method is described [13]. Globalization has had a profound impact on the news communication and news communication education in our country. In order to meet the requirements of the new era, our country's journalism and communication education needs innovation. This paper analyzes the influence of globalization on China's news dissemination and its influence on the cultivation of news talents. Some countermeasures for innovation in journalism and communication education in our country are analyzed from the aspects of changing educational concepts, adjusting curriculum settings, strengthening students' quality education, and strengthening the construction of teaching staff, providing a reference for the innovation of journalism and communication education [11]. China's modern information and communication enterprises are information and communication enterprises with Chinese characteristics. Politically, it is a part of the socialist cause led by the Communist Party of China; ideologically, it is derived from Marxist journalism; and economically, it is a commercial operation based on market operation to achieve hierarchical management and legalization [14].

2. Public Health Emergencies

2.1. Overview of Major Public Emergencies and Their Handling. It can be seen from the data that our country's netizens are large in scale, spend a long time online, and have a high usage rate of new media such as short videos. The Internet has been deeply integrated into the public's life and work, affecting all aspects of public life. Our country has entered the Internet era. In recent years, public emergencies have occurred frequently. With the development of self-media, many public emergencies have been spread very quickly on the Internet, and they are very easy to ferment. Due to improper handling, many public emergencies have been used by some people with ulterior motives and become tools to intensify negative emotions, thus triggering online public opinion and even evolving into new public incidents, causing secondary harm. From the public reports in recent years, the author has sorted out the major public emergencies that occurred and their handling process, the network public opinion they caused, the consequences of the incident, and the results of accountability. Many incidents have learned a lot. Judging from the causes of major public emergencies in the past 20 years, the process of handling them, and the Internet public opinion caused, public health incidents, safety production incidents, social security incidents, natural disasters, etc. These incidents are easily handled improperly, leading to the spread of Internet rumors and public opinions.interact with each Although rumors have been refuted, information has been released, and illegal criminals have been cracked down, the cracks between the government and the public have to be closed through many efforts, and may even cause irreversible losses. Public emergencies are very likely to cause casualties and property losses, with great impact and harm. The "National Emergency Response Plan" defines general emergencies as: emergencies that cause heavy casualties, property losses, environmental damage, and serious social damage, and pose a threat to public safety. Public emergencies are mainly divided into four categories: natural disasters, accidents, public health events, and welfare events. Public emergencies are easily spread on the Internet, and their influence has gradually attracted people's attention. For a long time, all sectors of society have paid close attention to network security, strongly calling for the strengthening of cyberspace governance in accordance with the law, and calling for the introduction of laws related to network security. On June 1, 2017, our country's first cybersecurity law came into effect, clearly requiring that in the event of a cybersecurity breach, a cybersecurity emergency plan should be formulated immediately, an incident should be investigated and assessed, and network operators should take action to deal with potential security risks, prevent damage, and keep the public informed. At the same time, the law clearly stipulates the legal responsibilities that offenders and institutions need to bear. A series of relevant national laws and regulations provide a legal basis for dealing with public emergencies in the Internet era. In the Internet age, from the perspective of content, the focus of public attention often becomes the stimulus for the emergence of public emergencies; the activities are characterized by online and offline group communication; online group activities have great influence and are difficult to manage.

2.2. Emergency Preparedness for Public Health Events

2.2.1. Emergency Prevention

(1) Awareness of emergency prevention: colleges and universities should pay special attention to emergency prevention, and establish a college emergency management team headed by the party secretary and chairman. Rescue operations should be carried out in a controlled manner, as quickly and efficiently as possible, to minimize accidents and minimize impact on victims and the emergency. (2) Strengthen control and management: on the other hand, it is necessary to further strengthen supervision and assessment, give full play to the role of the Disciplinary Committee in the inspection and control mechanism, and finally incorporate the special work of employees in emergencies into the employee assessment system. On the other hand, it is necessary to relieve pressure, share responsibilities, clarify task boundaries, establish and improve the accountability system, and express sincere congratulations to those who dare to take responsibility, dare to take responsibility, and dare to take responsibility in emergency situations to fulfill their obligations. For the relevant management departments or individuals who do not assume responsibility or do not act, they should conduct systematic screening and assign responsibility based on the best.

2.2.2. Emergency Preparedness

(1) Strengthen emergency preparedness: establish and improve the guarantee reserve system for life-saving materials, training materials, training tools and equipment, and disposal facilities and equipment, improve the reserve system, and do a good job in the distribution of necessary medical equipment. The emergency facilities shall strengthen the management and control of the camp, ensure the complete supply of materials and equipment at reasonable prices, and ensure the timely delivery of valuables and valuables. (2) The safety of the program needs to be improved. When developing a rescue plan, the actual situation of the school should be considered, and coordination, safety, and accessibility should be fully considered. On the other hand, experts and researchers in the fields of safety management, emergency management, safety education and other fields inside and outside the school should be invited to conduct feasibility studies on the proposed scheme. On the other hand, it is necessary to further calibrate the effectiveness of rescue courses, carry out rescue plan drills in a timely manner, constantly find problems, correct the wrong, inaccurate and inappropriate parts of the rescue plan.

2.2.3. Emergency Response

(1) Improve the emergency response mechanism: adhering to the principle of "people-oriented, prevention first" will greatly strengthen the establishment of social emergency measures, and truly develop an emergency response system, including "collaboration of the school, extensive participation of teachers and students, and strict prohibition on campus." Work objective management. The second is the continuation of the "two shifts" in emergency management, that is, the whole process of management from one service to prevention, from disaster prevention and relief to post-disaster recovery. E-mail-based disaster response *H* mechanism from management to comprehensive management revises the emergency management system, and gradually establishes and improves a long-term emergency management mechanism. The third is to actively communicate with relevant ministries and commissions. Higher initiatives are based on the provincial emergency management system It is up to the government to establish a streamlined, systematic, and effective emergency management system in colleges and universities. (2) Improve the information exchange

mechanism: the availability of information is a key factor in emergency situations. On the other hand, there is a need to create a single information platform through a coordinated emergency information system to effectively support information acquisition by universities and colleges. Feedback and monitoring procedures. On the other hand, technical tools such as information technology, artificial intelligence, and data analysis need to be strengthened to analyze, evaluate, and continuously monitor different situations. Identify areas of emergency and risk that may lead to social events and conduct accurate and timely analysis. As well as in the short-term emergency situation, the event carries on the monitoring, the forecast and the early warning forms the emergency processing mechanism. It is shown in Figure 1.

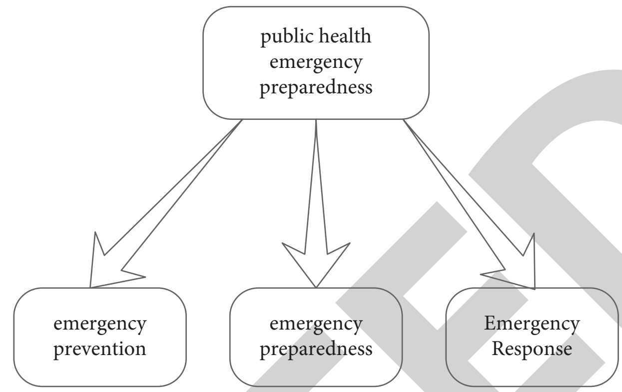

FIGURE 1: Emergency preparedness for public health events.

2.3. Countermeasures for the Government to Properly Handle Public Emergencies. The Internet plays an important role in monitoring public opinion and provides a platform for ministries and commissions to effectively respond to emergencies. When dealing with emergencies, the government is in charge. In the Internet era, the government should properly handle public emergencies and focus on the following aspects.

2.3.1. Mastering the Rules of News Release and Grasping the Initiative of the Right to Speak in the Process of Disposal. In the process of disposal, government departments should promptly announce the progress and truth of the incident. Public emergencies can easily arouse the public's strong demand for information. Only by truthfully releasing the progress of the incident to the public and satisfying the public's right to know to the greatest extent can the government firmly grasp the initiative of public opinion and occupy the mainstream public opinion field. At the same time, when government departments release information, they should try their best to use plain language and introduce them from the public's perspective. The practice of being arrogant and official will only arouse public disgust.

2.3.2. Making Friends with the Media, Treating the Media Well, and Correctly Using and Guiding Public Opinion. Government departments should focus on mastering timeliness when dealing with the media. In an incident, the more scientific, professional, and transparent the government department handles the case, the more the mainstream media can get in touch with the case, and the ministries and the media can properly handle the case, deal with negative impacts, and actively communicate. Government departments should do a good job in information disclosure, improve information systems, and ensure smooth communication channels with the media; after public emergencies occur, government departments should promptly and proactively disclose to the media and society the dispositions at all stages, provided that they do not violate regulations situation, actively respond to media concerns, and consciously accept the supervision of public opinion.

2.3.3. Being Familiar with the Laws of Online Public Opinion and Cracking Down on Cyber Crimes in accordance with the Law. Practice has proven that open and transparent information is the best way to combat the root causes of the Internet. Therefore, government agencies need to establish mechanisms for timely information release and disclosure, relevant information release, online gossip monitoring, content verification, filtering, and technical means to deal with them to reduce negative public opinion.

2.3.4. Enhancing the Sense of Responsibility of All Parties in Public Emergencies. The first is to establish a sense of responsibility of the government, the media, and the public "Trinity." The government should clarify the identity of its own responsible subject and assume the main responsibility; the media should also shoulder the responsibility of disseminating information in the event; the public should understand their responsibilities in public emergencies, and do not believe or spread rumors. The second is to improve the accountability system. According to the responsibilities of each subject in the incident, legal procedures are initiated for irresponsible behaviors, it also strengthens accountability for relevant responsible persons and plays a warning role

3. Big Data Algorithms

3.1. Decision Unit Input and Output. We refer to inputs as "resources" consumed by political entities, such as inputs to factors of production. Instead, the output is the output of the decision unit, which represents the "efficiency level" after consuming a particular "resource." Quantity, quality, and economic benefits of products. In general, when assessing the relative validity of data decay analyses, input and output variables should be out of bounds, free to omit, negative inputs, and positive outcomes. These two variables are initially independent variables, but in the binary data block analysis system, the same variable can be input or output, but belong to different stages and different decision-making units. Results and outputs are collectively referred to as the dimensions of the data model. Suppose there are n decision units in the evaluation system, each of which consumes m distinct inputs and produces s distinct outputs. Each decision unit is considered as a reference point, and the reference set is the collection of all reference points.

$$\begin{aligned} T &= \{(x_j, y_j) | j = 1, \ldots, n\}, \\ T &= \{(x, y) | x \in x_j, j \in (1, \ldots, n)\}. \end{aligned} \tag{1}$$

According to the axiom of triviality, different reference sets derived from different axiomatic assumptions are subsets of the possible output set. Satisfying all the above axioms is expressed as a continuous benchmark set:

$$T_{\text{crs}} = \left\{ (x, y) | \sum_{j=1}^{n} \lambda_j X_j \le X, \sum_{j=1}^{n} \lambda_j Y_j, \lambda_j \ge 0 \right\}. \tag{2}$$

Another general assumption of the axiom is that the scaled return is a variable that satisfies the axioms of convexity, invalidity, triviality, and minima, and the corresponding reference data is represented as follows:

$$T_{\text{VRS}} = \left\{ (x, y) | \sum_{j=1}^{n} \lambda_j X_j \le X, \sum_{j=1}^{n} \lambda_j Y_j \ge Y, \sum_{j=1}^{n} \lambda_j = 1 \right\},$$

%
$$\begin{aligned} E_0 &= \text{Min}\theta_o, \\ E_0 &= \text{Max} \sum_{r=1}^{s} u_r y_{r0} + u_o. \end{aligned} \tag{3}$$

Both of the above models are result-oriented BCC models, they keep the output constant and reduce the input as much as possible. When evaluating DEA performance, a DEA model is computed for each test unit and the DMUs that achieve different scores are ranked. Powerful units can also be divided into powerful and mild units, and the efficiency of each unit is calculated using the DEA model.

$$\begin{aligned} E(p, E) &= \text{Min}\theta, \\ E(\text{k}, \text{s}) &= \min \theta_k, \\ \phi(r, k) &= \text{arcos}\left(\frac{(-x_k, o), (x_r - x_k)}{(-x_k, o) \times \|(x_r - x_k)\|} \right). \end{aligned} \tag{4}$$

3.2. Optimization Check. After choosing the initial sample S and solving the model, it is also necessary to check whether the obtained efficiency is the value of the global efficiency, that is, whether the sample S already contains all the control points of the erroneous unit.

$$\begin{aligned} u^* y_r - v^* x_r &\le 0, \quad \forall r \in s, \\ \lambda_t^* (u^* y_r - v^* x_r) &= 0, \quad \forall r \in s. \end{aligned} \tag{5}$$

If, after solving the model, the selected sample finds that two of its dual factors do not satisfy the constraints, then we have not chosen its reference point for sample S, and the algorithm must redefine sample S. Therefore, we have to choose a new decision unit that is fairly comprehensive and will serve as a reference point for evaluating units, and insert S into the sample, removing the specific decision unit from the original sample to preserve sample size.

$$\text{s.t.} \quad AX = b, \ x \ge 0. \tag{6}$$

The constraints are divided into two parts:

$$\begin{aligned} &\text{Min} C^T X \\ &\text{s.t.} A_1 X_1 = b_1. \end{aligned} \tag{7}$$

If the feasible region of the LP problem is bounded, we can represent S as a set of poles of a convex polygon. In the limiting case, we can convert LP to LP due to the convex joint principle.

$$\text{Min} \sum_{j \in J} C^T X^j \lambda_j. \tag{8}$$

Use a column-generating algorithm to solve problems where there are far more such variables than the number of constraints. Usually there are many nodes in wholesale linear scale programming problems, and due to the large number of node elements in the convex complex set S, it is difficult for us to get these elements completely.

$$\begin{aligned} &\text{Min} \sum_{k=1}^{p} \theta_1^k \lambda_j x_{ij} \le \theta_i^1 x_{io} \\ &\sum_{j=1}^{n} \lambda_j = 1, \quad \lambda_j \ge 0, \ j = 1, \ldots, n. \end{aligned} \tag{9}$$

Based on this lemma, we solve LP, and the optimal solution obtained is also the original optimal LP solution. Therefore, we transform the original shell model into a diagonal structure LP and solve it with the DW decomposition algorithm.

$$\begin{aligned} &\sum_{j=6}^{10} \lambda_j x_{ij} \le \theta_i^2 x_i, \ \sum_{j=6}^{10} \lambda_j y_{rj} \ge y_r^2, \quad i = 1, 2, \ r = 1, 2, \\ &\sum_{k=1}^{p} y_{ro}^k = y_{ro}, \quad r = 1, \ldots, s. \end{aligned} \tag{10}$$

This is basically the same as the DW decomposition algorithm, the only difference is how our algorithm is performed. We can get multiple poles of a subproblem to run the whole DW algorithm, but we use the Big-M method (penalty factor method) to execute the whole algorithm. In fact, in models to which DW decomposition algorithms can be applied, we usually take a few poles from each subproblem using heuristics or simple observations, and we use these poles to create the main program and its obstacles and solve them.

$$\begin{aligned} &\begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} D_1 D_2 \\ F_1 O \\ 0 F_1 \end{bmatrix}, \\ &\text{Min} \quad (C^T - \pi A_1) X^J - a_i = \begin{bmatrix} A_1 \\ A_2 \end{bmatrix}. \end{aligned} \tag{11}$$

Table 1: Validation performance of public health events under different models.

Methods	Macro-P average	Macro-R average	Macro-F1 average
Plain SVM	0.446	0.357	0.397
BOW-BIGRU-Att	0.54	0.439	0.484
WORD2VEC-BIGRU-Att	0.502	0.511	0.507
FastText-BIGRU-Att	0.542	0.52	0.531
GloVe--BIGRU-Att	0.56	0.517	0.538
ELMO--BIGRU-Att	0.577	0.537	0.561
FT-GPT-FC	0.598	0.549	0.572
FI-BERT-FC	0.619	0.561	0.589

4. News Dissemination Paths and Impact Analysis of Big Data Technology in Public Health Emergencies

4.1. Public Health Events under Big Data. Looking at the early warning work of previous public health crises, we can find shortcomings in early warning. At this stage of the early warning work, it is necessary to take targeted measures in the light of the specific circumstances of public health emergencies to improve the early warning mechanism for public health emergencies in our country and to improve work efficiency and hygiene accuracy. Early warning of emergencies can better protect citizens rights and interests and strengthen public order through early warning and the public interest. It is shown in Table 1.

From the data in Figure 2, FT-BERT-FC has the best average performance at 10-fold cross-validation. The macro-average P, macro-average R, and macro-average K are 0.619, 0.561, and 0.589, respectively. The second best performer is FT-GPT-FC with 0.598, 0.549, and 0.572 for P-mean macro, R-mean macro, and K!-mean macro, respectively. The better performance of FT-BERT-FC is due to the fact that BERT models with left-to-right and right-to-left transform structures are more efficient than GPT models with left-to-right transform structures.

From the data in Figure 3, we can see that the performance tests are different under different models. Under the big data model, the timeliness is 73.81%, the prudence is 84.25%, and the sustainability is 96.28%. Under the data mining model, the timeliness is 61.98%, the prudence is 77.58%, and the sustainability is 83.24%. The timeliness of the intelligent computing model is 53.44%, the prudence is 65.58%, and the sustainability is 96.28%. It can be seen that the timeliness, prudence, and sustainability of the big data model are compared with other models and performance has improved.

As we can see in the data in Figure 4, the total number of public health events has been increasing from 2015 to 2021. In 2015, there were 132 public sound events, with an increase of 8.9%; in 2016, there were 191 public sound events, with an increase of 12.3%; in 2017, there were 284 public sound events, with an increase of 15.79%; 368 cases with a growth rate of 17.21%; 473 cases of public sound events in 2019 with a growth rate of 19.87%; 501 cases of public health incidents in 2020 with a growth rate of 22.63%; and 573 cases of public health incidents in 2021 is 25.98%.

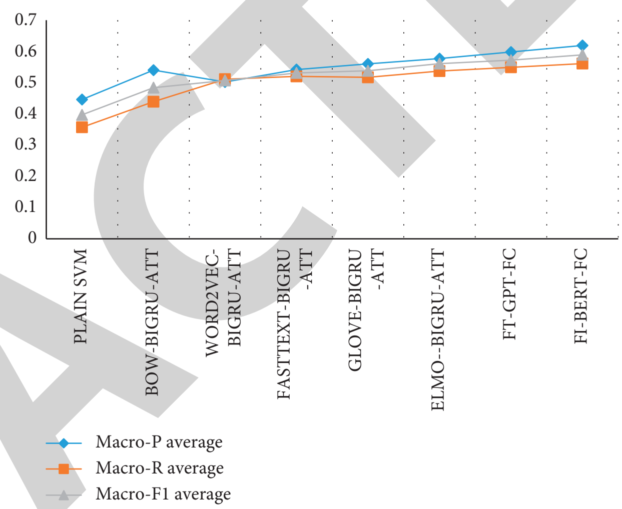

Figure 2: Validation performance of public health events under different models.

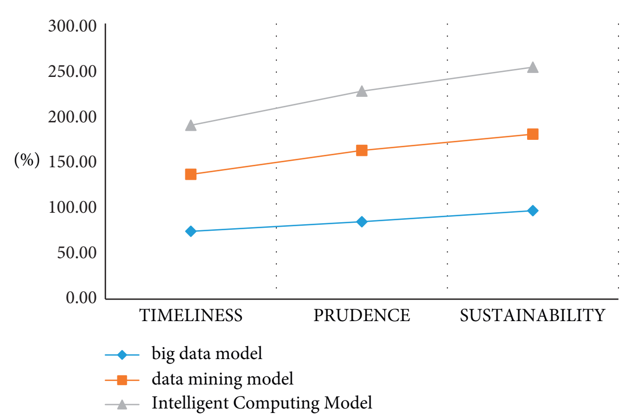

Figure 3: Performance testing of public health events under different models.

4.2. Analysis of News Dissemination Paths and Impacts in Public Health Emergencies. Public health emergencies are sudden major infectious diseases, large and unexplained diseases, serious food poisoning and occupational poisoning, etc., which have a serious impact on public health and may cause serious harm to public health. The new crown pneumonia epidemic first occurred in Wuhan City, Hubei

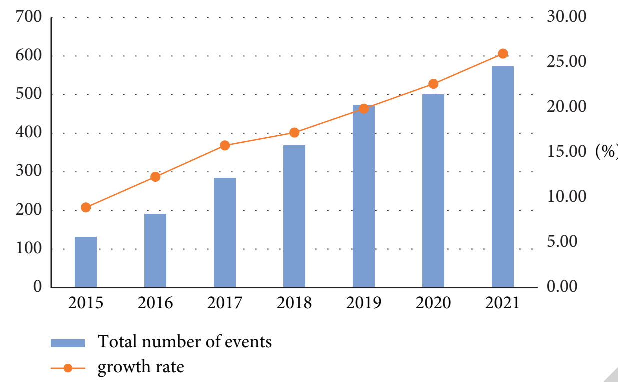

FIGURE 4: The total number of public health events and their growth rates from 2015 to 2021.

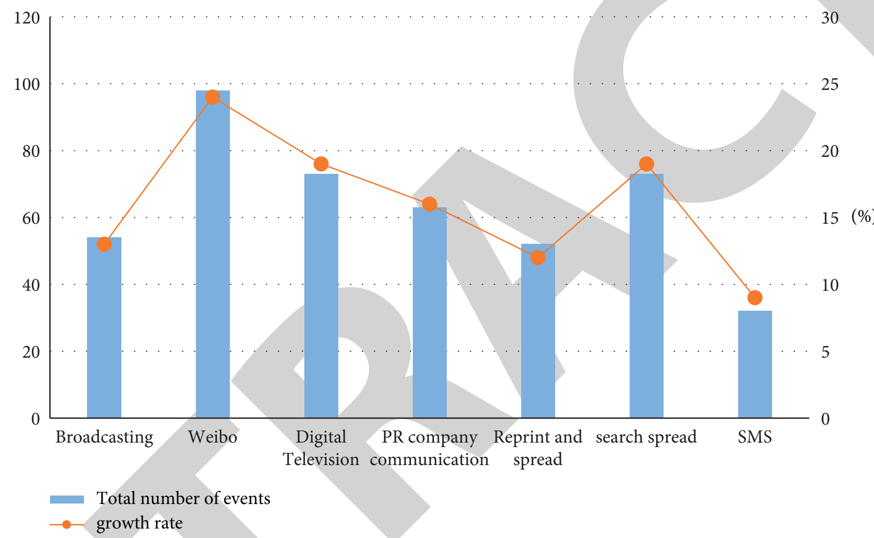

FIGURE 5: News propagation paths and their proportions in public health events.

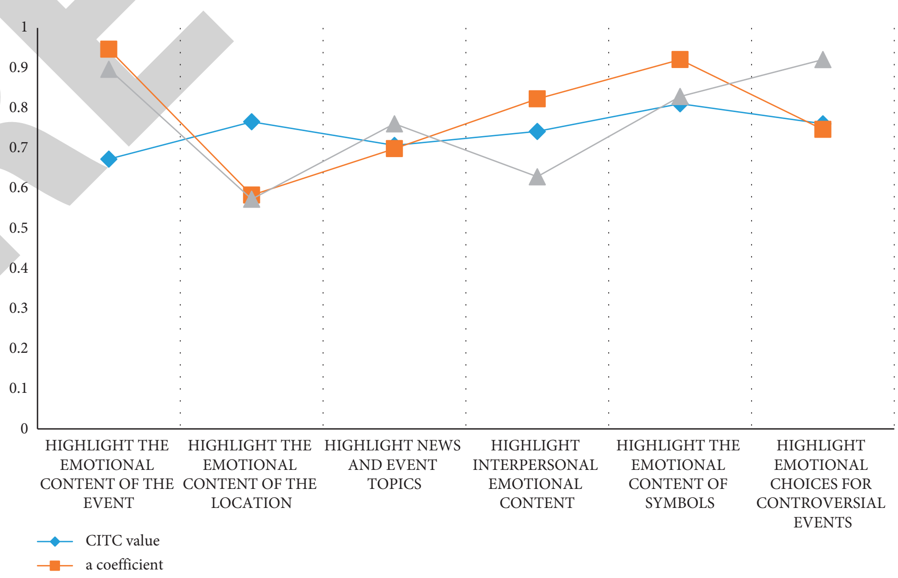

FIGURE 6: Analysis of the trust degree of news dissemination paths in public health events.

Table 2: Analysis of the trust degree of news dissemination paths in public health events.

	CITC value	a coefficient	Cronbach coefficient
Highlight the emotional content of the event	0.673	0.947	0.897
Highlight the emotional content of the location	0.766	0.583	0.573
Highlight news and event topics	0.707	0.699	0.761
Highlight interpersonal emotional content	0.742	0.823	0.629
Highlight the emotional content of symbols	0.811	0.921	0.829
Highlight emotional choices for controversial events	0.761	0.747	0.921

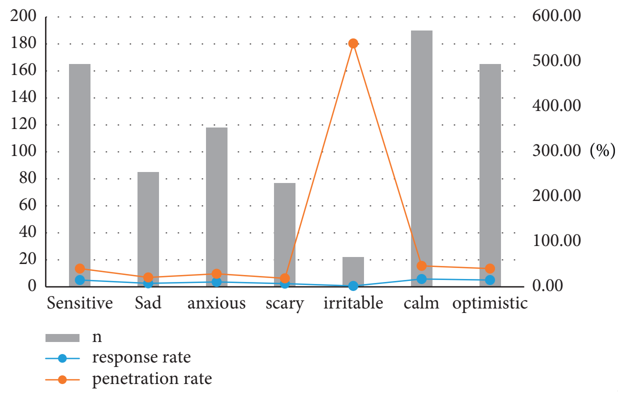

Figure 7: Summary graph of the influence rate and penetration rate of news dissemination.

Province, our country in late January 2020, and quickly spread to the whole country, and then to many countries around the world. It is a public health emergency. Public health emergencies are classified into four levels according to the nature, severity and extent of the emergency.

From the data in Figure 5, we can see that in public health emergencies, the number of news dissemination paths including radio and television communication is 54 people, accounting for 13%; the number of digital TV broadcasters is 73 people, accounting for 19%; the number of public relations companies is 63 people, accounting for 16%; the number of people who reprint is 52 people, accounting for 12%; the number of people who search for communication is 73 people, accounting for 16%. It is 19%; the number of people who spread mobile phone text messages is 32, accounting for 9%.

The reliability coefficient of the data in Figure 6 is 0.950, which is greater than 0.9, indicating that the above survey data has high reliability for CITC analysis. A CITC score of 4 indicates a good level of confidence. Therefore, all the safety factors of the above study data are greater than 0.9, and the combination of different index values indicates that the data is highly reliable and can be used for further analysis. It is shown in Table 2.

As we can see in the data in Figure 7, the skill test was significant ($\text{chi} = 425.364$, $p \leq 0.001 < 0.05$), which means that the selection ratio varied widely for each subject, and performance is compared based on differences in resonance or wear and differences in penetration levels. In particular, the response rate and prevalence were significantly higher for the 4 items of responsiveness, calmness, optimism, and hypervigilance.

5. Conclusion

By reviewing the previous work on early warning of public health emergencies, it is still possible to find gaps in early warning. Therefore, this paper takes the improvement of the early warning mechanism for public health emergencies as the breakthrough point, and combines the development and advancement of the early warning mechanism for public health emergencies in our country and the relevant legal framework to conduct a more detailed investigation of the current problems. This is a step forward in early warning and public health emergencies. According to the characteristics of public health events, we should improve the early warning mechanism of public health crisis in our country in a targeted manner, and improve the efficiency and accuracy of public health events. Public health emergencies are notified, and public order is consolidated through early warning to better protect public interests and individual rights.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

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Retraction

Retracted: Analysis of the Impact of the Development Level of Aerobics Movement on the Public Health of the Whole Population Based on Artificial Intelligence Technology

Journal of Environmental and Public Health

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] W. Ji and X. Qiu, "Analysis of the Impact of the Development Level of Aerobics Movement on the Public Health of the Whole Population Based on Artificial Intelligence Technology," *Journal of Environmental and Public Health*, vol. 2022, Article ID 6748684, 12 pages, 2022.

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Research Article

Analysis of the Impact of the Development Level of Aerobics Movement on the Public Health of the Whole Population Based on Artificial Intelligence Technology

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With the enhancement of China's comprehensive national power and the improvement of people's living standards, health has become the goal that people pursue. While people are thirsty for extensive knowledge and a healthy body, they also pay more attention to the cultivation of elegant temperament and the enjoyment of beauty, and aerobics has become a hot spot for national fitness with its advantages of coordinated and beautiful movements, bright and cheerful rhythm and obvious fitness effects. Aerobics is a new popular fitness sports, from the beginning of development by most fitness enthusiasts, especially it is a women's favorite. To this end, the characteristics, value, status, and role of aerobics in the public health of all people are discussed, and the problems of poor recognition effect in the existing aerobics difficulty aerobics action recognition methods are proposed to apply the graph convolutional neural network to the aerobics difficulty aerobics action recognition. The video of aerobics is divided into several images, and the background of the aerobics difficult aerobics action image is eliminated, and the gray scale co-generation matrix is set to estimate the local area blur kernel of the difficult action image to correct the visual error of the difficult action image. "change to" The aerobics action is divided into several difficult action images, and the gray-scale symbiosis matrix is set to estimate the local area fuzzy core of the difficult action image, and correct the visual error of the difficult action image. On this basis, the graph convolutional neural network is pre-trained to construct a human-directed spatial-temporal skeleton map, and the human-directed spatial-temporal map representation is modeled with temporal dynamic information to achieve aerobics difficult aerobics action recognition. The experimental results show that the recognition time of the difficult aerobics movements based on the graph convolutional neural network is shorter and the number of false recognitions is less in complex and simple backgrounds, which proves that the proposed method improves the recognition of difficult aerobics movements to achieve the goal of promoting the development level of aerobics and improving the public health of all people.

1. Introduction

With the development of China's economy and the improvement of cultural living standards, the national demand for amateur cultural and sports activities has become more and more urgent, and fitness, leisure, and entertainment have gradually become the needs of people's daily life. Therefore, more and more people are actively involved in sports. At the same time, as China's national fitness program continues to promote and deepen, as well as by the influence of the Olympic Games, the enthusiasm of the masses to participate in sports activities has become unprecedentedly high [1–4]. As an emerging sport with a wide mass base, aerobics stands out among many traditional sports with its unique charm and is loved by more and more people. Its exercise intensity and movement difficulty are relatively low, and rich in content, diverse forms, easy to exercise, line effect is remarkable, can be used for different ages, levels, gender, occupation of the community. Whether in the public, scientific, or in the social, lifelong, diversity, etc., aerobics have

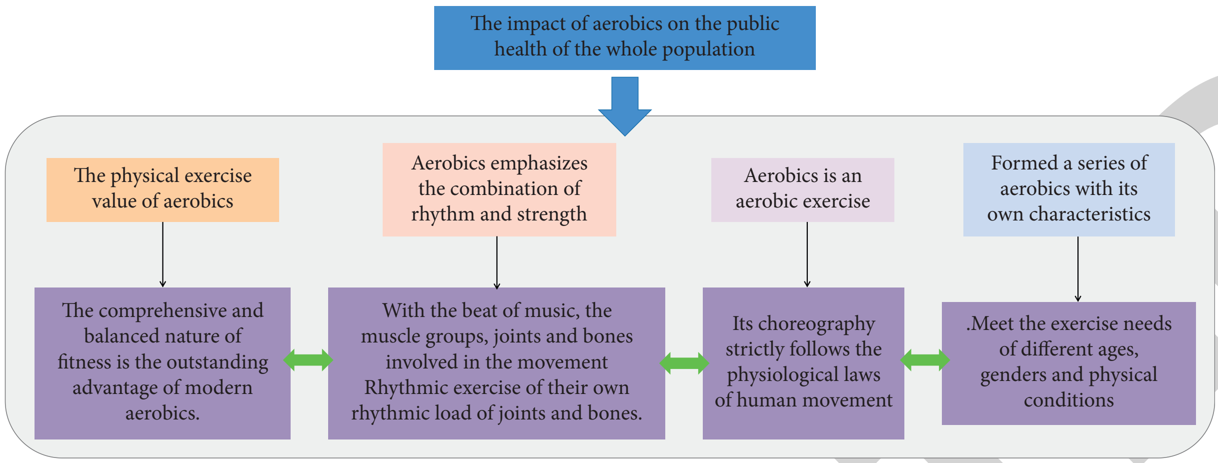

Figure 1: The development level of aerobics and the public health of the whole population.

incomparable superiority over other sports, and is the best way of public fitness. The development level of aerobics and the public health of the whole population are shown in Figure 1.

The role of aerobics in the national fitness movement, fitness role for the 21st-century Chinese sports advocate “people-oriented, health first” idea, pay attention to the health of the individual is the basis of public health, aerobics is in line with this multi-dimensional health values of the public sports and fitness projects [5–7]. Practice has proved that aerobic exercise can mostly develop the body’s cardiorespiratory function, aerobics is a typical aerobic exercise, due to aerobics scientific and reasonable arrangements, so that all parts of the body through the exercise, to achieve a certain amount of load and practice density, the practitioner in a certain stage to maintain the intensity of exercise, and heart rate of 150 times/min, to get the effect of aerobic exercise. And it is rarely single joint local activities in each section of the exercise, mostly for multi-joint exercise, intensity from weak to strong, gradually increase the body load to maintain a certain amount of exercise and then gradually reduce so that the change in the heart rate of the exerciser from low to high, wave-shaped gradually rise, and then return to a calm state, so that the cardiovascular system, respiratory system, and other internal organs improve and strengthen the function and effective regulation of the body’s internal environment.

Fitness comprehensive is the outstanding advantage of aerobics, and it is strictly in accordance with the anatomical parts of the human body, purposefully to achieve body proportion, coordination, bodybuilding development, and action design and choreography [8]. The whole set of movements is arranged from top to bottom, from left to right, both small joint movements, but also the day muscle group exercises, the body of the joints, various parts in the non-stop exchange of movement, so that people thoroughly do a whole-body exercise, to achieve the purpose of improving physical fitness. Most of these exercises are multi-joint synchronization, such as the waist, knee, ankle and head. Multi-joint synchronous movement not only increases the number of activities of the body joints but also can freely change the combination form and form a variety of movements, which is conducive to improving and enhancing the coordination of the body and achieving the effect of comprehensive exercise. A load of aerobics, mainly relies on the body parts of their own weight, through repeated exercises to achieve, so that the overall development of muscle strength, speed, and flexibility, improves the flexibility and flexibility of the joints, but also absorbed many hip movements in disco and jazz dance, both to improve the flexibility of the hip joint, but also to strengthen the often-neglected abdominal movement. The development of various qualities such as endurance and sensitivity also have a good impact on the human body’s ability to adapt to the natural world and resistance to disease [9–11].

It can be said that aerobics is currently a more ideal exercise to improve the overall quality of the body. Practitioners can according to their different stages, different fitness purposes need to be targeted, sequential development of various parts of the body, so there are many fitness enthusiasts, aerobics as their lifelong sports activities. Cultivating people to develop the habit of lifelong physical activity is the goal pursued by national fitness. The realization of this goal will further promote the implementation of the national fitness program [12–15]. As the national fitness movement continues to deepen, people do not only pursue the recent fitness effect, but also pursue long-term multifaceted lifelong benefits. The content of aerobics is rich and inclusive. It does not stick to a certain dance material, where the healthy development of the body and the form of the dance can be compatible and order to blend into one.

It not only absorbs Chinese classical dance and martial arts movements but also boldly uses ballet movements, taking the beneficial components of the clever combination, in the beautiful music and rhythmic melody to do a large amplitude, strong sense of movement, and modeling of beautiful movements. Aerobics has a special effect on shaping the beauty of the body. Since the exercise intensity is small, exercise time is long, and the energy of long-time exercise mainly comes from the oxidation and decomposition of fat in the body, and often participate in the practice, it can effectively eliminate the body’s excess fat, promote muscle firmness and plumpness, clear contour, soft and beautiful lines. The integration of national fitness and public health for all is the result of the development of the national economy and its compliance with the development of the trend of the times. The effective integration of national fitness and national public health can improve the physical and mental health of the public and meet the long-cherished wish of the public to increasingly pursue a better life. It is necessary to promote the effective integration of national fitness and national public health, and to integrate national public health into the development of all policies with the development goal of great health [16].

Sports aerobics action recognition is a research hotspot in the field of computer vision, which is widely used in visual surveillance, content analysis, paramedicine, intelligent human-computer interaction, and other fields. Among them, the field of aerobics also applies the recognition method of human body movements to improve the standard degree of aerobics movements, but the recognition is easily affected by the change of scene, the change of lighting, the difference of viewpoint and other factors, which leads to the poor recognition of aerobics movements in aerobics difficulties. For this problem, related researchers have conducted many studies [17–19]. The adaptive recognition method of aerobics decomposition action image based on feature extraction. The method uses the background small cut method for human target extraction, constructs binary image sequences of human contours, and uses the similarity detection method to decompose and match aerobics images to achieve the recognition of aerobics actions. Deep learning-based method for human aerobics action recognition in video. The method uses images and optical flow fields as inputs in the space and time domains and employs a decision fusion strategy for aerobics action recognition.

The main contributions of this study are as follows. For the analysis of the impact of the development level of aerobics on the public health of the whole population, the accuracy of aerobics action recognition can be improved by aerobics difficulty aerobics action recognition, and a method of aerobics difficulty aerobics action recognition based on graph convolutional neural network is proposed. The graph convolutional neural network is a feedforward neural network, artificial neurons in its coverage area of part of the surrounding units will produce a response, the texture, color and other features into the random forest and other classifiers, and then use the neural network to classify and complete the target feature extraction, based on this advantage of this network, it is applied to aerobics difficult aerobics action recognition, improve the recognition of aerobics difficult action, achieving an accurate analysis of the impact of the development level of aerobics on the public health of the whole population.

2. Related Work

2.1. The Current Situation of the Development of the Aerobics Movement. Aerobics is a kind of fitness exercise with high popularity in modern society. It is a combination of physical exercises and aerobic activities with a certain rhythm in a dance form accompanied by cheerful music. The sport of aerobics does not require a high degree of professionalism from the participants, so the public can quickly master the skills of aerobics through learning. Nowadays, people's requirements for physical health and quality of life are getting higher and higher, and the enthusiasm of the public to participate in social and cultural activities is also increasing. Aerobics has a certain role in improving body coordination, strengthening cardiorespiratory function, and exercising muscles, and the school is simple, so it is also loved by the people and widely carried out in social and cultural activities. The fitness value of aerobics exercise, aerobics exercise on the influence of physical beauty aerobics has an obvious bodybuilding function, through the training of aerobics, can help dancers form a good physical beauty, and can be effective in shaping and improving their body [20–22].

Compared with ordinary dance, aerobics has a stronger sense of rhythm and rhyme, and it incorporates a certain concept of movement, in the process of participating in aerobics, every joint of the body can get enough movement, which is in line with the current requirements of sports and fitness. When participants adhere to a period of aerobics exercise, limbs will be more flexible, the body's reaction speed will also become faster, through the aerobics exercise can make the body fat burning, help slim body. Long-term participants in aerobics exercise, their waist, and back more strength, and almost no fat and belly, not only the shape becomes more beautiful, but also the body will become healthier [23]. Nowadays, the pace of life is accelerating, young people work under pressure and have little time to participate in fitness training, making many young people generally have lower physical fitness. By regularly participating in aerobics, the flexibility of dance movements and the balance of sports can be used to promote the improvement of the dancer's body coordination ability. Aerobics has a variety of forms of movement, which can make dancers' waist, back, shoulder, knee joints, cervical spine, etc, whole-body joints exercise at the same time. Aerobic exercise can effectively improve the body flexibility of dancers.

At present, Chinese residents generally decline in physical quality, the incidence of arthritis and rheumatic bone pain diseases is very high, and not limited to the elderly, many young people have different degrees of cervical spondylosis, rheumatism, etc. Therefore, to actively promoting the concept of national fitness, more people should participate in aerobics, as it increase the flexibility of the limbs and improve the quality of life, so that we can feel a more beautiful life [24]. Under the heavy work pressure and life stress, insomnia, dreaminess, neurasthenia, and other diseases seem to have become the typical diseases of modern people, and the incidence of Alzheimer's, stroke and other brain function diseases are increasing year by year. Aerobics requires learning different dance movements, and to follow the rhythm of the music for body movements, in order to ensure coordination with the rhythm and the standard of body movements, it is necessary to remember and coordinate through their own brain, this process can be through frequent brain activity, exercise the brain function of dancers, so that their brain to maintain vitality, and to maintain a fast reaction speed, in this case, it will be less prone to memory loss, neurasthenia and other degenerative phenomena.

To exercise the brain function more effectively, improve the coordination ability between brain and body. You can use cardio as a daily exercise to get a healthy body. The whole-body exercise promotes blood circulation, and improve the oxygen supply capacity of the blood, as well as tbrings a a good impact on the brain to a certain extent. The flexibility of the brain thinking and memory, learning ability, and other aspects of people who exercise regularly will certainly be much better than those who do not exercise regularly.

2.2. Public Health for All People. Health is an inevitable requirement for the promotion of all-around human development, a basic condition for economic and social development, an important symbol of national prosperity and national wealth, and a common pursuit of the public. To achieve the strategic goal of a healthy China, prevention should be the focus, indicating the important position of preventive health care in the improvement of the public health of the whole population, and also putting forward higher requirements for the improvement of national health literacy [25].

Health literacy, as an important component of human capital, contains both cognitive and non-cognitive abilities related to health. The improvement of health literacy not only significantly improves the health status of individuals, but also enhances the health benefits of the surrounding people and the whole society, with positive spillover effects. Therefore, in the long term, health literacy is an important determinant of improving the health behaviors of a country's population and enhancing overall health. In the context of the global pandemic of New Coronary Pneumonia, health literacy as a long-neglected determinant of health has attracted widespread attention worldwide. Studies have found that residents with higher health literacy are able to understand virus knowledge and epidemic prevention information more accurately, establish correct knowledge of the epidemic, and take effective epidemic prevention measures. Therefore, as China implements a normalized epidemic prevention and control policy, improving national health literacy is important to continuously consolidate the prevention and control achievements of the new crown pneumonia epidemic [26]. Meanwhile, as China's population ages and people's lifestyles change, the burden of chronic non-communicable diseases such as cardiovascular diseases and cancer continues to increase, and health literacy plays a crucial role in disease prevention and control, chronic disease management, and effective use of medical resources. Based on the above research findings, the author makes the following policy recommendations to improve the health literacy of Chinese residents and serve the health China strategy.

Emphasize health education in schools and further strengthen health science in primary and secondary school campuses. Education is important for improving health literacy, and the questionnaire results show that individual education level has a significant positive effect on health literacy scores, and this effect is reflected in all dimensions of health literacy. This is because education plays an important role in the formation and early accumulation of health literacy. On the one hand, education can enhance individuals' cognitive abilities in word reading, mathematical calculation, and other aspects, thus providing a cognitive foundation for the acquisition, recognition, understanding, and application of health knowledge; on the other hand, education has an important role in shaping minors' behavioral habits, interpersonal communication, and other non-cognitive abilities, thus bringing about a healthy lifestyle and medical habits when individuals become adults important impact. By organically integrating health science with knowledge learning in schools at an early stage of students' growth, we can help minors establish correct health concepts and develop good health habits early on, thus having a better foundation for health literacy. Paying attention to the importance of preventive health care in the improvement of the public health level of the whole population, it is especially necessary to pay attention to and strengthen the scientific popularization of disease prevention among middle-aged groups [27].

Currently, sub-health problems and a high risk of chronic diseases are prevalent among workers in major Chinese cities. The high-intensity work pace, unhealthy lifestyle, and the high prevalence and youthfulness of chronic diseases have put considerable pressure on the health benefit improvement of the whole society. In addition, insufficient awareness of infectious disease prevention can lead to difficulties for individuals to respond effectively to sudden public health events such as the New Coronary Pneumonia outbreak, leading to increased load on medical institutions and crowding out of medical resources, to the detriment of overall prevention and control. With the overall development of China's economy and the continuous promotion of the commonwealth, the central and western regions are bound to pay more attention to disease prevention and health care in the future, and the demand for and attention to health literacy will gradually grow. Therefore, increasing health promotion and popularization in the central and western regions (especially the less developed regions) is of great significance to narrow the gap in health literacy levels between regions and achieve the common improvement of public health.

2.3. Artificial Intelligence Technology. Nowadays, aerobics action recognition technology is widely used in various fields, such as surveillance, games, and human-computer interaction. Among different aerobics action recognition methods, human skeleton-based aerobics action recognition has the characteristics of small data set size, unaffected by lighting, good structural information compared with RGB video-based human aerobics action recognition, and the former can be combined with the latter mutually [28–30]. Therefore, human skeleton-based aerobics action recognition has also gradually become a hot spot for current research. Among them, human skeletal data is a skeletal sequence consisting of 2D/3D coordinates of joints in several frames and is temporal in nature. In the task of aerobics movement recognition, how to extract more distinguishing features is the focus and the difficulty.

In the field of human skeletal aerobics movement recognition, deep learning methods have certain superiority over manual feature methods. Therefore, human skeletal aerobics movement recognition based on deep learning methods, such as convolutional neural network, recurrent neural network, and graph convolutional neural network, has been widely used in human skeletal aerobics movement recognition tasks. The early network frameworks for human skeletal aerobics movement recognition are mainly CNN and RNN. a hierarchical co-occurrence network based on CNN to achieve the extraction of global joint co-occurrence features and achieved good results at that time; the importance of joint spatial configuration, a dual-stream recurrent neural network based on RNN is proposed to extract joint spatial features and time-dependent features respectively. Although both CNN and RNN can be used for aerobics movement recognition tasks based on human skeleton, the important information of the graphical structure of the human skeleton is neglected. With the rise of GCN, GCN has started to be combined with human skeletal aerobics movement recognition.

GCN is applied to the human skeletal aerobics movement recognition task, using the physical structure features of human skeleton for spatial-temporal modeling, proposing a spatial-temporal graphical convolutional neural network and providing ideas for the next research. Action structure graph convolutional neural networks are proposed for how to capture potential joint correlations, and the skeleton graph is extended on top of that so that higher-order joint dependencies can be represented. The fixed graph topology of the human skeleton affects the training and performance of the model, so a dual-stream adaptive graph convolutional neural network is proposed, which uses a combination of fixed and non-fixed graph topologies to increase the graph flexibility and introduce second-order skeletal information.

The multi-scale aggregation of cross-temporal graphs is used to learn joint features and skeletal features separately in a dual-stream network with a multi-scale unified spatial-temporal graph convolutional network with dual streams. Considering the importance of potential information in the 3D skeleton and how to encode it, a spatial-temporal converter network is proposed to capture the correlation of different factions within frames by a spatial converter and inter-frame correlation using a temporal converter, and a dual-stream network model is constructed to combine both converters. The non-physical correlations between joints are captured by regionally correlated graph convolution and the second-order skeletal information is used to propose a regionally correlated adaptive graph convolution neural network. Although all the above methods achieve good results, they generally pay attention to the recognition accuracy of the model and ignore the efficiency problem of the model. Therefore, the semantic-guided neural network with one-hot encoding introduces high-level semantics to reduce the number of parameters and computation of the model. The Ghost module is introduced to reduce the number of parameters and computation of the model, and the single-stream network is used to further reduce the number of parameters of the model, and multiple information is introduced into the model by direct merging fusion, and the non-local Ghost graph convolutional network is proposed.

3. Methods

3.1. Model Architecture. The assisted virtual training motion detection system designed in this study consists of three layers: the logic layer, the technology layer, and the application layer. The overall structure of the system is shown in Figure 2. As can be seen from Figure 2, the logic layer of the system is mainly responsible for collecting training behavior data and processing them accordingly to obtain action detection results; the technology layer mainly includes relevant technologies applied for processing training action techniques; the application layer is mainly responsible for storing the initial image data and processed image data, and the interactive interface displays the virtual training actions. This system uses intelligent services as the carrier of framework construction, which can effectively improve the detection performance of the system.

3.2. Aerobics Action Pre-Processing. To realize the recognition of aerobics difficult movements, the video image of aerobics movements needs to be analyzed first. The video contains many aerobics movements, the length of the movements varies, and the same movements can have differences. Therefore, the aerobics video needs to be divided into several images. The divided action images are pre-processed using the energy pyramid method. In this process, the multilayer pyramid structure of action images is constructed, the temporal pyramid energy histogram is obtained, and then the pyramid of each layer is solved, and the calculation formula is expressed as:

$$Q(i) = \frac{\sum_{i}^{j=1} \sum r\left|L_r^i/L_r^i + \delta\right|}{\sum_{n}^{j=1} \sum r\left|L_r^i/L_r^i + \delta\right|}. \tag{1}$$

In formula, r represents the amplitude threshold of the aerobics motion image, L_r^i represents the aerobics difficulty action depth image sequence, and δ represents the aerobics action angle value. The above processing method can store the aerobics image sequence into each level of the pyramid, based on which the inter-frame differencing method is used to eliminate the background of the image. The specific algorithm of the inter-frame difference method is to subtract the two frames after grayscale transformation to obtain the difference between each pixel point, which is calculated as follows:

$$D(x, y) = \begin{cases} 1, & \text{if}\left|f_{k-1}(x, y) - f_k(x, y)\right| > T, \\ 0, & \text{others}. \end{cases} \tag{2}$$

In the formula, 1 corresponds to all the pixel points that changed during the calculation, 0 represents the pixel points

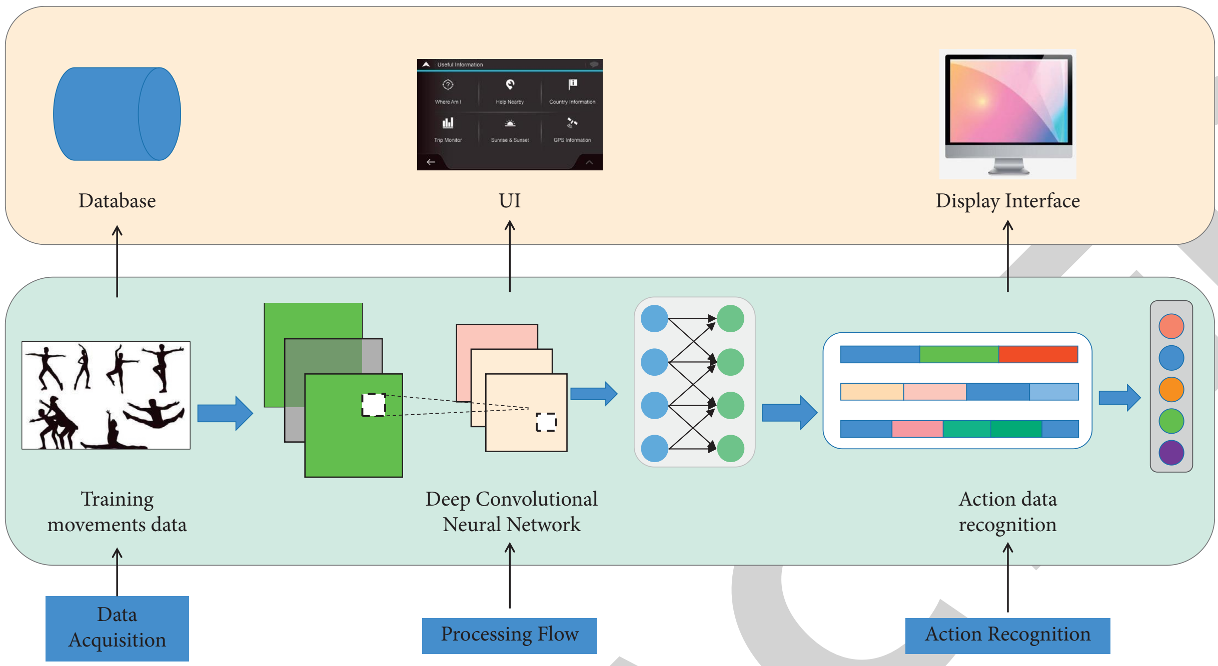

FIGURE 2: Model structure.

that did not change during the detection process, $f_{k-1}(x, y)$, $f_k(x, y)$ both represent the detection image, and T represents the threshold value. Through the above process, the aerobics video is divided into images and the background elimination process is done on the images, which provides the basis for aerobics difficulty aerobics movement recognition.

3.3. Image Visual Error Correction. Based on the pre-processing of the above aerobics action video images, the visual error correction of the aerobics difficult action images is done as follows. The grayscale co-generation matrix is set to analyze the aerobics action image texture, and the spatial distribution state of image pixels is described to obtain.

$$f(x, y) = f_{ij}(x + a, y + b). \tag{3}$$

In equation, f_{ij} is the i, j pixel proximity state, a represents the length in the x direction, and b represents the length in the y direction, respectively. Estimating the local region fuzzy kernel of the aerobics image, after the above processing, the action image pixel intensity and gradient are used as the a priori knowledge of the fuzzy kernel to solve the degree of recovery of the whole action image, and the calculation formula is expressed as:

$$P(x) = \sigma P_t(x) + P_t(\nabla x). \tag{4}$$

In equation, $P_t(x)$ represents the number of non-zero-valued pixels, $P_t(\nabla x)$ represents the gradient value of pixels, $P(x)$ represents the prior knowledge, and σ is the weighting factor. Motion image visual error correction. There is a certain error between the visual image and the original aerobics image, which needs to be further processed, i.e.

$$I = \hat{I} + E. \tag{5}$$

In equation, $\hat{I}$ represents the visual image and E is the error image. On this basis, the optimal estimation is performed, and the expression is expressed as

$$\hat{E}_K = g_b(E). \tag{6}$$

In equation, g_b is the difference operator and E represents the image error. The error correction of the aerobics action image by the above process provides the basis for the identification of aerobics difficult aerobics actions.

3.4. Convolutional Neural Network. The graph convolution structure is shown in Figure 3. The convolution layer, as the core part of the network, mainly performs the convolution calculation of the aerobics difficulty action feature map to obtain more abstract image features. The method obtains different output feature maps by performing convolutional calculations on the input data of the previous layer within this layer, which is expressed by the formula:

$$y_{mn} = f\left(\sum^{Q-1}\sum^{P-1} x_{m+i,n+j} w_{ij} + b\right). \tag{7}$$

In equation, $x_{m+i,n+j}$ represents the image pixel value of point, w_{ij} represents the weight value of the convolution kernel size on point (i,j), b represents the bias size of this layer, f represents the network activation function, and Q and P represent the image resolution size parameters, respectively. Pooling layer: This layer mainly reduces the resolution of the feature map and accelerates the speed of aerobics difficulty aerobics action recognition, and the pooling operation process is as follows.

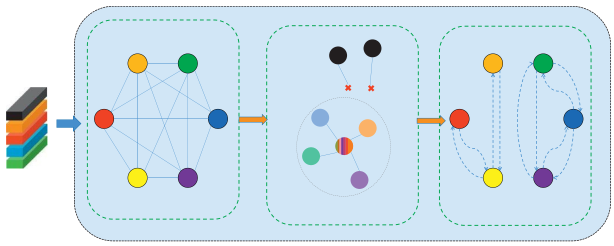

Figure 3: Graph convolution structure.

$$y_{mm} = f\left(w \frac{1}{S_1 S_2} \sum_{S_2-1}^{j=0} x_{m\times s_1+i, n\times S_2+j} + b \right). \tag{8}$$

In equation, $x_{m\times s_1+i, n\times S_2+j}$ represents the pixel value of the input data at the point, and y_{mm} represents the output value after the pooling operation. To achieve the best fit for parameters such as weights and biases in the network, it is also necessary to construct a multi-level computational model with the following formula.

$$h_{w,b}(X) = f\left(\sum_{n}^{i=1} w_i x_i + b \right). \tag{9}$$

In equation, X is the input vector, w_i and x_i represent the bias parameters of the ith data, respectively, and b represents the activation function. Then, multiple consecutive frames are superimposed in the convolution layer, and multiple consecutive frames are sequentially passed through the convolution layer to generate multiple sequences of adjacent consecutive frame strings in the previous layer.

$$v_{ij}^{xyz} = \left(b_{ij} + \sum_{m} \sum_{K}^{p=0} \sum_{p}^{r=0} \right). \tag{10}$$

In equation, b_{ij} represents the deviation of the j-th feature map in the ith layer, m represents the number of feature maps, K represents the spatial dimensional size parameter, and p represents the convolutional kernel weights. The above process pre-trains the network so that the neural units in the network are connected, which in turn can be directly input to the image and facilitate the processing of image data.

3.5. Directed Spatial-Temporal Skeleton Map of Human Body. The original skeleton data are column frames, each frame contains a set of human joint coordinates, to accurately identify the difficult movements of aerobics, the human body is constructed as a directed spatial-temporal skeleton map. The skeletal information is extracted according to the 2D or 3D coordinates of the joints to construct an adaptive directed acyclic map. Taking the 3D skeleton data as an example, the joints sitting in the original data are labeled as (x, y, x), and given a skeleton, and the target joint is represented as v, the vector of the skeleton is represented as:

$$E_{v_s, v_s'} = \left(x_s - x_s', y_s - y_s', z_s - z_s' \right). \tag{11}$$

Traditional methods of modeling skeletal data ignore the kinematic dependence between joints and bones, and in this study, the human skeleton is represented as a directed acyclic graph. The points of the joints are used as vertices, the bones are used as edges, and the direction of each skeletal edge is determined by the relationship between the joint point and the root node. The above process represents the skeleton structure as a directed graph, which provides the basis for extracting the information in the graph.

3.6. Human Directed Spatial-Temporal Graph Representation. A directed graph is constructed using a directed graph neural network, which consists of multiple graph layers populated with graphs with vertex and bone attributes between each layer, capable of propagating information in adjacent joints and bones, and capable of updating their association information between layers and outputting graphs with updated attributes. In each layer, attributes are updated based on adjacent edges and vertices, and in each layer, vertices and edges receive attribute information from adjacent edges or vertices. Two aggregation functions are mainly used for the expression of multiple incoming and outgoing edge attributes of the vertex, due to the existence of more centripetal and centrifugal points in the root node, that is, there are multiple input and output edges as well as multiple sources and target nodes, for this reason, the propagation formula of information is established according to the input and output edges of the root node, the calculation formula is expressed as:

$$\begin{aligned} e_i^{\text{in}} &= \sum_{k}^{k=1} \left(\frac{\alpha_k}{\sum_k^{k=1} \alpha_k} \right) g^{\text{in}}\left(R_{ik}^{\text{in}} \right), \\ e_i^{\text{out}} &= \sum_{k}^{k=1} \left(\frac{\alpha_k}{\sum_k^{k=1} \alpha_k} \right) g^{\text{out}}\left(R_{ik}^{\text{out}} \right). \end{aligned} \tag{12}$$

In equation, α_k represents the correlation of samples between the root node and centripetal and centrifugal points, i.e., the human skeleton action co-relation parameter; g^{out} represents the aggregation function of the output edge, R_{ik}^{out} represents the aggregated output result, and R_{ik}^{in} represents the aggregated input function. To learn the co-occurrence relationship between human skeleton adaptively, α_k is represented by two fully connected layers of learning, the first one is activated by a nonlinear function, and the second one is a SoftMax layer, which is used to learn the correlation between root nodes and centripetal points. If both co-occurring root nodes and noncooccurring correlation nodes are present in an action, the correlation nodes between these two actions are calculated.

$$\begin{aligned} A_v &= \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}, \\ A_r &= \begin{bmatrix} \alpha_{i1} & 0 & 0 \\ 0 & 1 & 0 \\ \alpha_{i4} & \alpha_{i5} & 0 \end{bmatrix}. \end{aligned} \tag{13}$$

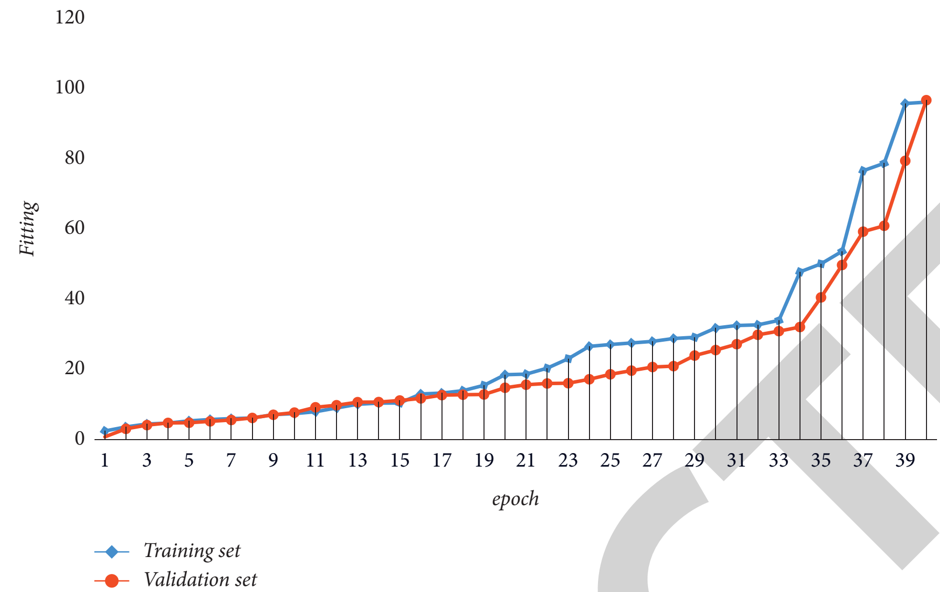

Figure 4: Schematic diagram of training process performance improvement.

There are three rows in the nodal-directed matrix A. The first row is the group of centripetal nodes, where 0 represents no connection and 1 represents the source node; the second row is the root node and the third row represents the group of centrifugal nodes, where 1 represents the target node and 0 represents no connection.

4. Experiments and Results

4.1. Experiment Setup. The experimental data was obtained from non-public data of an aerobics research institute in China, and was conducted in two scenes, the first part of the experiment was shot in a fixed background with aerobics movements; the second part was shot in an actual scene, which contained lighting information, partial occlusion, camera movement, and other situations. A total of 100 images are selected from the captured videos, respectively, and a total of ten experiments are conducted, with 10 images recognized in each experiment and their averages were taken. The recognition effects of the proposed method, recognition method based on feature extraction and recognition method based on deep learning are compared in the two scenarios. Experimental platform. The graphics card is a single NVIDIA RTX 2060 Super, the processor is Intel i5 9400F, the memory is 32 GB, the operating system is Ubuntu 19.04, the language is Python 3.7, the CUDA version is 10.2, and the PyTorch 1.4.0 framework is used. The relevant parameters are set. To make the feature map size of each layer convolution match the multi-channel adaptive map size, the number of frames of the skeletal sequence is set to 25 in this paper, and the number of channels in the network C1 to C4 are 64, 128, 256, and 512, respectively. In this paper, in order to compare the baseline method more fairly, other hyperparameters are set the same as the baseline method, and the Adam optimizer is used, with the initial learning rate of 0001, a weight decay value of 0.0001, a number of loaded data threads of 16, a training period of 120 epochs that decreases by a factor of 10 at 60, 90, and 110 cycles, respectively, and a batch size of 64 for training and 32 for testing. dataset settings. The dataset was set up using two recommended evaluation settings, namely CS (cross-topic) and SS (cross-setting number). To make the model more generalizable, the same data setup method as the baseline method is adopted in this paper, where the 3D skeletons in each sequence are randomly rotated by a certain angle around the X, Y and Z axes, respectively. For the data pre-processing part, the random pool data pre-processing method proposed in this paper is used. Training time. The model was trained on a single NVIDIA RTX 2060 Super graphics card using the NTU RGB + D 120 dataset, and the total time taken to train the full 120epoch in each evaluation setup was more than 2 hours. The training process performance enhancement and loss convergence are shown in Figures 4 and 5.

4.2. Experimental Results. The results of the comparison of the aerobics movement recognition effect in simple backgrounds, the results of the comparison of the aerobics movement recognition time of the three methods in simple backgrounds are shown in Figure 6. By analyzing Figure 6, we can find that the studied method spends less time on aerobics movement recognition than the other two methods.

The number of aerobics movement recognition errors for the three methods in a simple context is compared, as shown in Table 1. Analyzing the data in Table 1, it can be found that the studied method of aerobics difficult aerobics movement recognition based on graphical convolutional neural network does not have any false recognition in the simple background. Both the feature extraction-based recognition method and the deep learning-based recognition method have different numbers of false recognition cases. In

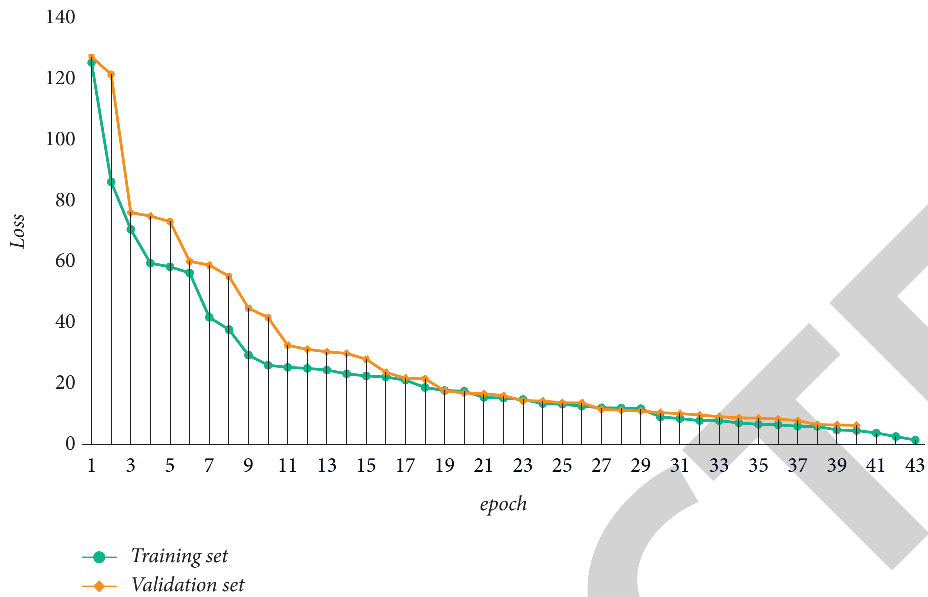

Figure 5: The training process loss convergence schematic.

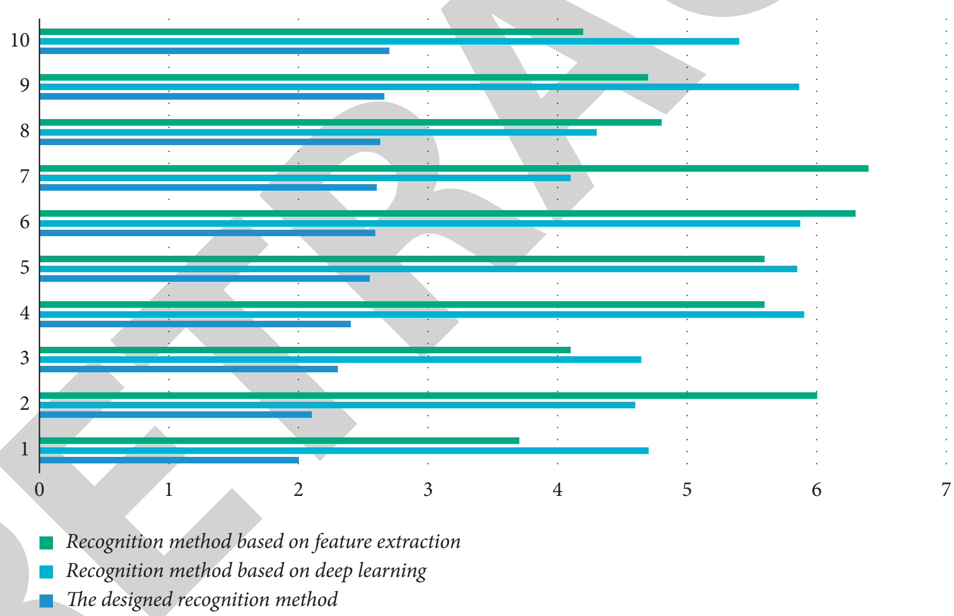

Figure 6: Action recognition time comparison in simple background.

contrast the recognition effect of the studied recognition method is better.

The results of the comparison between the proposed aerobics difficulty aerobics recognition method and the other two methods in the complex background are shown in Figure 7. Analysis of Figure 7 shows that the proposed aerobics difficulty aerobics recognition method takes the least time, while the other two methods take more recognition time, which is significantly more than the simple background aerobics movement recognition time. The recognition time is significantly more than that of the simple background aerobics movements, and the recognition efficiency is poor.

Analyzing the data in Table 2, the number of recognition errors of the three aerobics movement recognition methods in the complex background is significantly more than that in the simple background, but the studied aerobics movement recognition methods have fewer cases of false recognition. The recognition methods based on feature extraction and recognition methods based on deep learning increase the number of recognition errors more, and the recognition effect is worse.

In summary, the studied aerobics difficulty aerobics movement recognition method has less error recognition in simple and complex backgrounds and takes less time, which is better than the application of the other two methods. The

Table 1: Comparison of the number of action recognition errors in a simple context.

Number of experiments/ times	Number of times the recognition method studied in a simple context was incorrectly recognized (time)	Number of false recognitions of recognition methods based on feature extraction in a simple context (time)	Number of false recognitions of recognition methods based on deep learning in a simple context
1	0	2	3
2	0	2	2
3	0	2	2
4	0	1	2
5	0	3	2
6	0	2	4
7	0	3	2
8	0	3	0
9	0	4	0
10	0	2	1

Table 2: Comparison of the number of action recognition errors in complex backgrounds.

Number of experiments (times)	Number of times the recognition method studied in a simple context was incorrectly recognized (time)	Number of false recognitions of recognition methods based on feature extraction in a simple context (time)	Number of false recognitions of recognition methods based on deep learning in a simple context
1	1	5	8
2	0	6	8
3	0	5	9
4	0	6	6
5	1	6	8
6	0	8	7
7	0	9	7
8	0	9	8
9	0	6	8
10	0	4	7

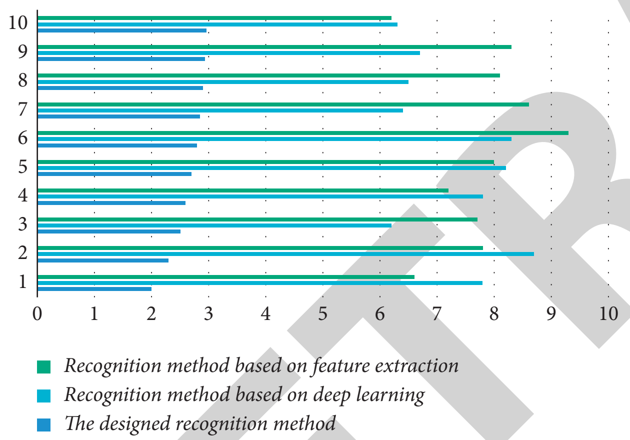

Figure 7: Action recognition time comparison under complex background.

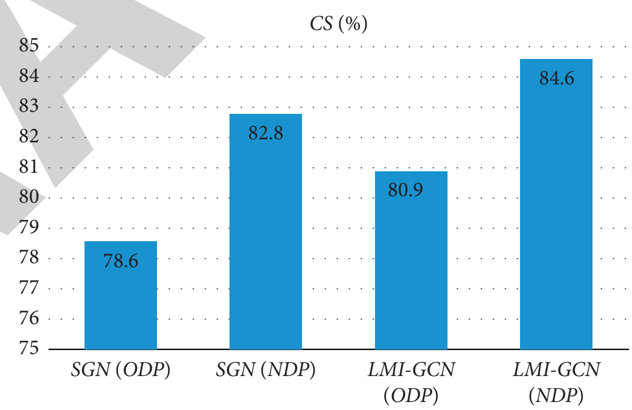

Figure 8: CS comparison of random pool data pre-processing methods.

reason is that the aerobics difficult aerobics action recognition method in this study preprocesses aerobics images and uses graph convolutional neural network to do multi-step recognition of actions, thus improving the recognition of aerobics difficult actions.

To verify the effectiveness of the random pool data pre-processing method proposed in this study, both the method and SGN model are experimented with using different data pre-processing methods. For a fair comparison, the skeletal sequence length was set to 25 in both data pre-processing methods. ODP indicates the use of the data pre-processing method, and NDP indicates the use of the random pool data pre-processing method in this paper. The experimental results in Figures 8 and 9 show that the recognition accuracy is improved by 4.2% on the CS evaluation settings and 3.1% on the SS evaluation settings when the SGN model is used, and by 3.7% on the CS evaluation settings and 3.4% on the SS evaluation settings when the LMI-GCN model of this paper is used. The reason for the improvement of model recognition accuracy is that the random pool data pre-processing method in this paper can effectively solve the problem of losing some skeletal sequence frames caused by data pre-processing, avoiding the loss of some important information, and further increasing the randomness of the data set, so that the model can learn more important distinguishing features and increase the model generalization.

In Table 3, (-G) indicates that no multi-channel adaptive map is used. The experimental results in Table 3 show that eliminating the multi-channel adaptive map causes the graph convolution in the model to degenerate into ordinary convolution, which is unable to aggregate the nodal features with relevance, thus leading to the degradation of the model performance. Compared with the model with the elimination of multi-channel adaptive map, the recognition

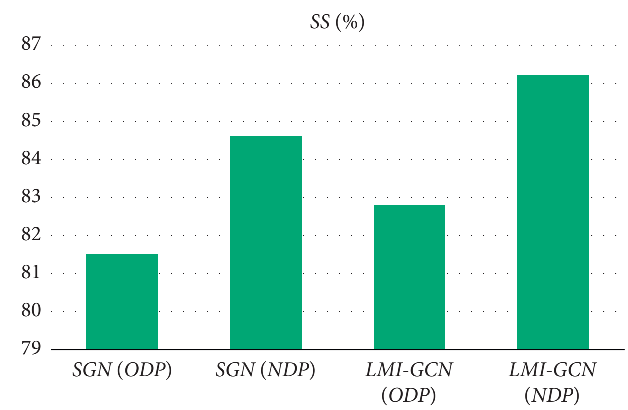

Figure 9: SS comparison of random pool data pre-processing methods.

Table 3: Comparison of the effectiveness of multi-channel adaptive maps.

Algorithm	Param (*M*)	CS (%)	SS (%)
LMI-GCN (-G)	0.57	83.6	82.2
LMI-GCN	0.61	84.6	86.2

accuracy of the model with multi-channel adaptive map is improved by 2.4% on CS evaluation settings and 2.6% on SS evaluation settings.

5. Conclusion

In summary, aerobics has distinctive features and comprehensive effectiveness, and has many favorable conditions for the promotion. Aerobics has low requirements for venue equipment, which is suitable for the current situation of China's stadium facilities and for the current situation of China's national and personal sports investment, in line with the national conditions; it is easy to disseminate and instruct, simple to learn and easy to promote; it is suitable for different groups, with a wide promotion area and easy to popularize; it has a high exercise value, which can comprehensively enhance people's physical fitness, regulate their psychology and improve their mental outlook, in line with the public's coordinated physical and mental development It meets the needs of the public's pursuit of beauty and is liked by the public. Aerobics in China already has a certain mass base, if you strengthen the propaganda, correct guidance, accelerate the training of aerobics instructors, pay attention to the creation of aerobics, through television and other means of comprehensive promotion. Aerobics can definitely play a special role in China's national fitness movement.

Aerobics is an important way and means to achieve the public health of all people through reasonable and scientific sports to promote the public health of all people. Residents' universal public health literacy is influenced by multiple factors such as age, gender, work, income, and education, showing different levels, respectively, and there are significant differences in the mastery of three aspects: basic knowledge and concepts of universal public health literacy, universal public health lifestyles and behaviors, and universal public health skills. In this study, we proposed an AI-based analysis model of the influence of the development level of aerobics on universal public health to determine the path of universal public health literacy improvement and effectively guarantee the physical and mental universal public health of residents. In the future, we plan to carry out research on the analysis of the impact of the development level of aerobics on the public health of the whole population using recurrent neural networks.

Data Availability

The datasets used during the current study are available from the author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Research Article

Blockchain-Based Encryption Method for Internal and External Health Privacy Data of University Physical Education Class

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In order to improve the security of the storage and scheduling of health privacy data inside and outside the university physical education class, a storage and scheduling method based on blockchain hybrid encryption is proposed. The distribution structure model of health privacy data blockchain inside and outside the university physical education class is established, arithmetic coding and quantitative feature analysis methods to schedule and adaptively control health privacy data blockchain inside and outside the university physical education class are adopted, public key coding configuration and vector quantization coding methods are combined to design encryption keys in the process of health privacy data transmission inside and outside the university physical education class, and blockchain hybrid encryption algorithm is adopted to design encryption keys for health privacy data inside and outside the university physical education class. The arithmetic coding is embedded in the encryption system, and the bit sequence output by the blockchain hybrid encryption is circularly shifted, so as to realize the encryption of health privacy data inside and outside the university physical education class and optimize the storage scheduling. The simulation results show that this method has good security encryption performance, strong antiattack ability, and balanced storage space allocation, which improves the security storage and transmission ability of health privacy data inside and outside the university physical education class.

1. Introduction

With the rapid increase in network communication data, people pay more attention to storage and scheduling of health privacy data inside and outside physical education classes, but in this process, network attack and virus intrusion will lead to leakage of health privacy data inside and outside physical education class, and the output security is not good. This article constructs a storage and scheduling model of health privacy data inside and outside the physical education class, through coding modulation and key control methods. To realize the storage and scheduling of health privacy data inside and outside the university physical education class, data encryption and arithmetic coding methods are combined and the security storage and information encryption model of health privacy data inside and outside the university physical education class is established [1]. Based on the design of dynamic encryption algorithm of health privacy data inside and outside the university physical education class, combined with dynamic data storage scheme, the security of health privacy data collection inside and outside the university physical education class is improved. The related research on storage and scheduling methods of health privacy data inside and outside the university physical education class has attracted great attention [2].

The storage and scheduling of health privacy data inside and outside the university physical education class is based on the coding and key control of communication encryption data. Nonlinear feature encryption method is adopted to control the storage and scheduling of health privacy data inside and outside the university physical education class.

The traditional methods are mainly BPSK modulation method and chaotic mapping encryption method. Homomorphic mapping encryption method is adopted to control the storage and scheduling of health privacy data inside and outside the university physical education class. In reference [3], a revocable attribute-based encryption algorithm for Internet of Things based on blockchain is proposed, which uses blockchain model analysis and subspace noise reduction reorganization to realize multichannel secure encryption and transmission of health privacy data inside and outside the physical education class. However, this method has poor antiattack ability for multichannel encryption of health privacy data inside and outside the physical education class. In reference [4], a reversible steganography scheme of video encryption domain based on vector histogram migration is designed, and the encrypted transmission of video information is realized through histogram reconstruction, but this method has a large amount of computation and poor stability. To solve the above problems, this article proposes a storage and scheduling method of health privacy data inside and outside the university physical education class based on blockchain hybrid encryption. First, the distribution structure model of health privacy data blockchain inside and outside the university physical education class is established, and the blockchain scheduling and adaptive control of health privacy data inside and outside the university physical education class are carried out by arithmetic coding and quantitative feature analysis. The encryption key design in the process of health privacy data transmission inside and outside the university physical education class is combined with public key coding configuration and vector quantization coding method. Finally, the simulation test shows the superior performance of this method in improving the storage and scheduling ability of health privacy data inside and outside the university physical education class.

2. Multichannel Model and Data Characteristics Analysis of Health Privacy Data inside and outside Universities in Physical Education Class

2.1. Multichannel Model of Health Privacy Data inside and outside the University Physical Education Class. In recent years, the research on the current situation of college students' physical exercise has been fruitful, such as the current situation of physical exercise; the relationship between physical exercise and mental health; physical health, social health, and physique; and the research on college students' attitude, motivation, and habit of physical exercise.

In order to realize the storage and scheduling of health privacy data inside and outside the university physical education class based on blockchain hybrid encryption, first, a multichannel model of health privacy data inside and outside the university physical education class is constructed and the channel output carrier sequence of health privacy data inside and outside the university physical education class is analyzed by using channel equalization method. Channel equalization is an antifading measure taken to improve the transmission performance of communication systems in fading channels. It is mainly to eliminate or weaken the problem of intersymbol interference (ISI) caused by multipath delay in broadband communication. Combined with nonlinear dynamics and statistical physics theory [5], under the background of noise interference, filtering suppression method is adopted.

Digital filter can be divided into two parts: classical filter and modern filter. Classical filter assumes that the useful component and the desired component in the input signal $x(n)$ are located in different frequency bands, so we can filter the noise through a linear system. If the spectrum of the noise and the signal are mixed, classical filter cannot meet the filtering requirements. There are usually high-pass filter, low-pass filter, band-pass filter, and band-stop filter. Modern filters estimate useful signals and noise signals from noisy signals. In this method, both signal and noise are regarded as random signals, and the signal estimation algorithm is derived by using its statistical characteristics, such as autocorrelation function, cross-correlation function, self-power spectrum, and cross power spectrum, which is then implemented by digital equipment. There are mainly Wiener filter, Kalman filter, and adaptive filter, along with other digital filters.

Classical filtering is an engineering concept based on Fourier analysis and transform. According to the theory of advanced mathematics, any signal that meets certain conditions can be regarded as the superposition of infinite sine waves. In other words, the engineering signal is a linear superposition of sine waves of different frequencies. Sine waves of different frequencies that make up the signal are called frequency components or harmonic components of the signal. In fact, any electronic system has its own bandwidth (the limit on the maximum frequency of the signal), and the frequency characteristic reflects the basic characteristic of the electronic system. The filter is an engineering application circuit designed according to the influence of circuit parameters on the circuit bandwidth. The modern filtering idea is quite different from the classical filtering idea. Modern filtering takes advantage of the randomness of the signal, regards the signal and its noise as random signals, and estimates the signal itself by using its statistical characteristics. Once the signal is estimated, the signal itself is much higher than the original signal-to-noise ratio. Typical digital filters include Kalman filter, Wenner filter, adaptive filter, wavelet transform, and other means. In essence, digital filtering is actually an algorithm that can be implemented on digital devices. These digital devices include not only computers, but also embedded devices such as DSP, FPGA, and arm. Digital filtering has the advantages of high precision, high reliability, programmable change of characteristics or multiplexing, easy integration, and so on. Digital filtering has been widely used in language signal processing, image signal processing, medical biological signal processing, and other application fields. Digital filtering includes low pass, high pass, band pass, band stop, and all pass. It can be time invariant or time-varying, causal or noncausal, linear or nonlinear. The most widely used is linear, time-invariant digital filter. The cepstrum eigenvalues

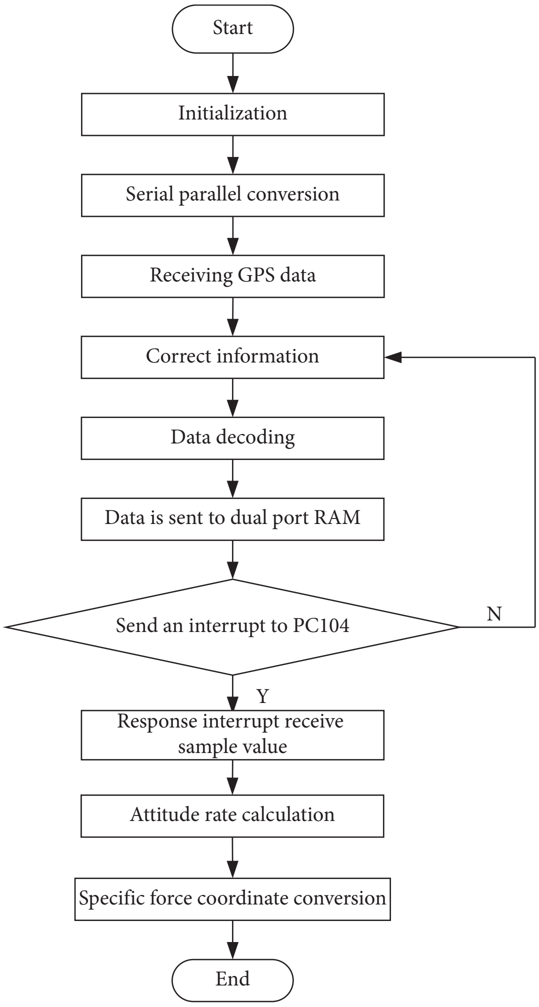

Figure 1: Array direction flowchart.

of the health privacy data output inside and outside the university physical education class contain a subset of features, assuming that (i, j) is the correlation statistical eigenvalue of the health privacy data channel balance control inside and outside the university physical education class, which is the correlation degree between multiple orthogonal subchannels defining the orientation constraint eigenvalues of the main lobe of the array pattern. The process of array mode is shown in Figure 1.

The distribution set of coding links between the array suppression grating lobe and the signal bandwidth is obtained as $\mathrm{Co}(r)$. Under the condition of blockchain hybrid encryption, based on digital beam forming grating lobe, the spatial sampling frequency parameter $KC \in \{0, 1, \ldots\ldots, n-1\}$ after digital beam forming grating lobe is obtained, and the broadband true delay energy pattern is constructed in the achievable rate domain $S_i = \{(j, i, k)\}$. The broadband true delay energy construction process is shown in Figure 2.

The shift number of the signal received by the nth array element, with the minimum number of bits being $\lceil \log_2(n) \rceil$ bits, establishes the distribution structure model of the health privacy data blockchain inside and outside the university physical education class, and the normal characteristic

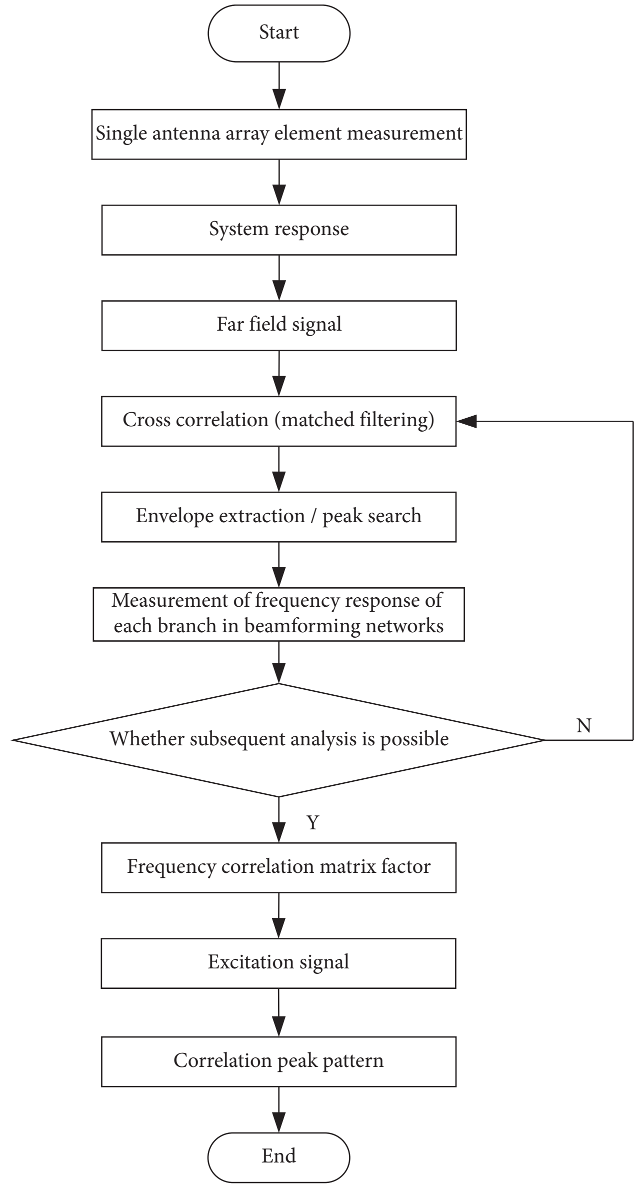

Figure 2: Broadband delay construction flow chart.

quantity of the broadband signal incident on the array element is obtained as $\mathrm{Co}(r)$ [6, 7] . Under optimal position and speed of channel transmission, by using symmetric coding and nonlinear encryption methods, the parameters of the side-grid suppression structure model of the kth cycle are obtained as $e^t_{S_i} = e^t_{ik}$. The three-dimensional spatial scattering cluster is satisfied [8–10]. Based on the modeling of visible area of scattering cluster, the coding and decoding structure block diagram of health privacy data coding inside and outside the university physical education class is obtained by using logistics mapping coding and piecewise linear chaotic mapping method, as shown in Figure 3.

2.2. Analysis of Data Structure Characteristics. Arithmetic coding is used as it is one of the main algorithms of image compression. It is not only a lossless data compression

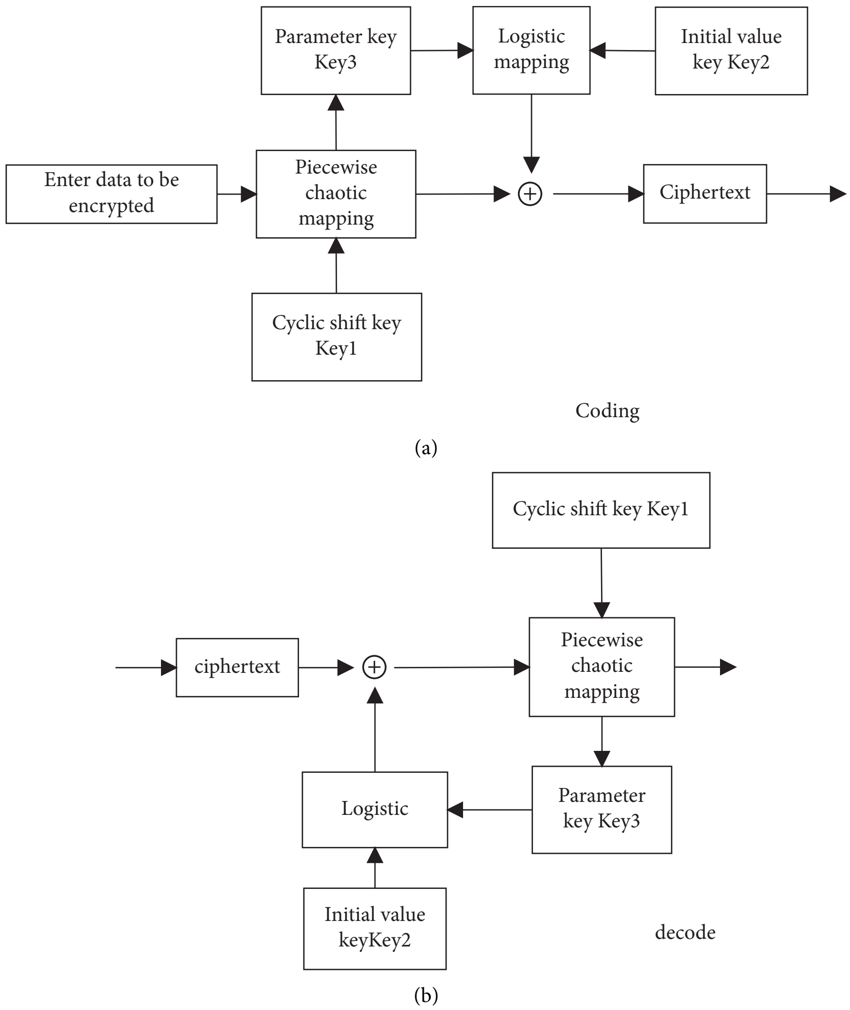

FIGURE 3: Block diagram of coding and decoding structure of health privacy data coding inside and outside the university physical education class. (a) Coding process of health privacy data inside and outside universities in physical education class. (b) Decoding process of health privacy data inside and outside the university physical education class.

method, but also an entropy coding method. Other entropy coding methods usually divide the input message into symbols and then encode each symbol, while arithmetic coding directly encodes the entire input message into a number, a decimal n satisfying $(0.0 \leq n < 1.0)$, and uses quantitative feature analysis. According to the China Securities Association, quantitative trading refers to a trading method that uses a rigorous and complex mathematical or statistical model, with the help of computer, and through the analysis of a large number of historical data, selects an investment method with excess return on probability, and executes it directly by computer. Quantitative trading has a strong objectivity at the transaction execution level, but in essence, its strategic thinking, investment logic, market selection, and even when to start and stop the operation of the computer are all preselected by investors, which make it a highly subjective trading method. The blockchain scheduling and adaptive control of health privacy data inside and outside the university physical education class are carried out [11]. Combined with public key coding configuration and vector quantization coding, the scattering cluster sequence of health privacy data inside and outside the university physical education class is obtained as $X = x_1, x_2, \ldots, x_n$. Turbo code is used to encode and modulate, and the retransmission key of health privacy data inside and outside the university physical education class is expressed as $\bullet$**RkeyGen** $(\text{param}, \text{rsk}_{\text{ID}_i}, \text{ID}_i, \text{ID}_j)$. Combined with nonlinear balanced scheduling, the block feature matching set $S_n = x_1 + x_2 + \cdots + x_n$ is obtained [12]. The logarithmic function of this encryption interval of health privacy data inside and outside the university physical education class is as follows:

$$\begin{aligned} I^i &= f^{-1}(x)\left(I^{i+1}\right) \\ \text{size}\left(I^i\right) &= P_i \text{size}\left(I^{i+1}\right), \end{aligned} \tag{1}$$

where I^{i+1} is the mutual information and $f(x)$ is the state objective function of scattering cluster N after the mth scattering. Assuming that the N-dimensional message vector generated by the source S is represented by $x = (x_1, x_2, \ldots, x_n)$, based on the fitness function $x_i = 2\varepsilon_i - 1$ analysis of Q cycles, the spatial dynamic matching function

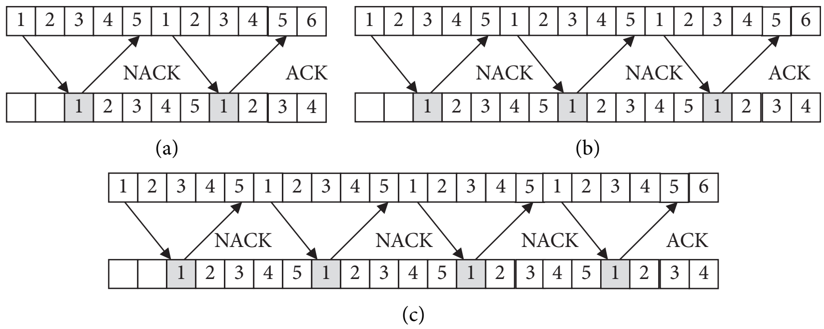

Figure 4: Encryption and retransmission structure of health privacy data inside and outside the university physical education class.

of health privacy data coding inside and outside the university physical education class is $S_{\text{obs}} = |S_n|/\sqrt{n}$ by using S transformation, and the linear frequency modulation function for outputting health privacy data inside and outside the university physical education class is obtained by using random coding modulation:

$$\begin{aligned}\text{size}\left(I^1\right) &= \Pi_{i=1}^{M} P\left(s_i \in S\right)\\ &= \Pi_{n=1}^{N}\left(P_n\right)^{\text{card}\left\{s_i \mid s_i = S_n\right\}}\\ &= \Pi_{n=1}^{N}\left(P_n\right)^{P_n M},\end{aligned} \tag{2}$$

where S is the broadband true delay energy signal, s_i is the homomorphic key, P_n is the geometric information entropy, and M is the encrypted unstructured characteristic value and it is encrypted as bit sequence. Using the data encryption retransmission mechanism shown in Figure 4, the structural reorganization model of health privacy data inside and outside the university physical education class is established [13].

According to the combined control model of encryption and retransmission structure of health privacy data inside and outside the university physical education class shown in Figure 2, linear grouping is carried out according to the coded data $[n, k]$ [14–16]. In PSK source coding, the coded generator $v(x) = v_0 + v_1 x + v_2 x^2 \cdots + v_{n-k} x^{n-k}$ of mixed encryption of the blockchain of health privacy data inside and outside the university physical education class is obtained. Under the combined coded re-signing mode, the following results are obtained:

$$-\log_2\left(\text{size}\left(I^1\right)\right) = -\sum_{n=1}^{N} P_n M \log_2\left(P_n\right) = M \cdot H, \tag{3}$$

where I is the data encryption bit rate, P_n is the public key protocol authorized by the key, M is the private parameter, and H is the dynamic characteristic value of the public key. According to the above analysis of the structural characteristics of the health privacy data inside and outside the university physical education class, the encryption key in the process of health privacy data transmission inside and outside the university physical education class is designed by detecting the frequency of compressed coding symbols, combining the public key coding configuration and vector quantization coding method [17]. The discrete key transmission sequence of health privacy data inside and outside the university physical education class is constructed by using the natural mode expansion sequence of chaotic logistics, and the feature decomposition model of health privacy data storage inside and outside the university physical education class is established by using the method of random linear feature detection, as shown in Figure 5.

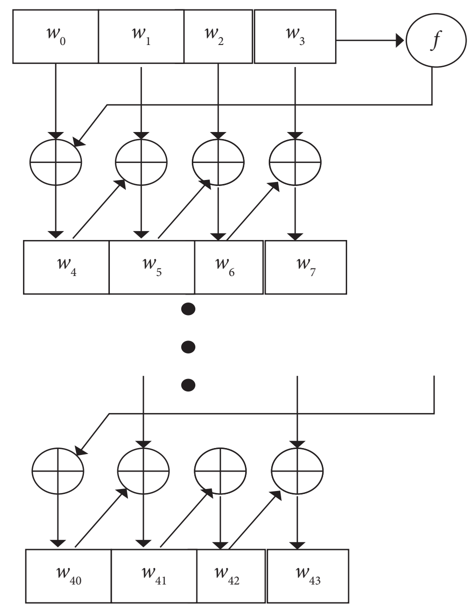

Figure 5: Feature decomposition model of health privacy data storage inside and outside the university physical education class.

3. Optimizing the Storage and Scheduling of Health Privacy Data inside and outside the University Physical Education Class

3.1. Blockchain Hybrid Encryption Algorithm. In view of the security threat of quantum computing to blockchain ciphers and the long-term security challenge to blockchain systems, the design theory of blockchain cipher algorithms with anti-quantum computing capability is studied, and blockchain cipher algorithms such as data encryption and digital signature that can resist quantum attacks are designed. Blockchain cryptographic protocols such as identity authentication, secure communication, and secure consensus that can resist quantum attacks are designed. The anti-quantum security blockchain system design theory and data security storage technology are researched and the anti-quantum security blockchain prototype system design method proposed, followed by researching on the fast and secure implementation technology of anti-quantum security public key cryptosystem and studying the solution for migration from the existing cryptographic technology to the anti-quantum computing cryptographic technology in the blockchain.

The blockchain hybrid encryption algorithm is used to design the encryption key of health privacy data inside and outside the university physical education class. In the process of cyclic code displacement [18], the bilinear mapping of data encryption is given as: $x_{i,b} = \chi_{i,b} - \delta_{i,b}$ $(1 \leq i \leq \beta)$. The private key of blockchain hybrid encryption is: $\delta_{i,b} = [\chi_{i,b}]_\pi + \xi_{i,b} \cdot \pi - CRT_{p_{m,n}}(2r_{i,b,m,n})_{1 \leq m,n \leq \mu}$, $r_{i,b,m,n} \leftarrow \mathbb{Z} \cap (-2^{\varphi'-1}, 2^{\varphi'-1})$, $\xi_{i,b} \leftarrow \mathbb{Z} \cap [0, 2^{\lambda+\log_2(\mu^2)+\mu^2\cdot\eta}/\pi)$.

In the complete set of attributes of blockchain hybrid encryption key, a retransmission scheme is given. The generation algorithm of user key is described as $x'_{i,b} = \chi'_{i,b} - \delta'_{i,b}(1 \leq i \leq \mu)$, and the throughput rate of encryption scheme is $\delta'_{i,b} = [\chi'_{i,b}]_\pi + \xi'_{i,b} \cdot \pi - CRT_{p_{m,n}}(2r'_{i,b,m,n})_{1 \leq m,n \leq \mu}$, $r'_{i,b,m,n} \leftarrow \mathbb{Z} \cap (-2^\varphi, 2^\varphi)$. The encrypted data is shared to the private key through the public channel, and the identification bit is: $\xi'_{i,b} \leftarrow \mathbb{Z} \cap [0, 2^{\lambda+\log_2(\mu^2)+\mu^2\cdot\eta}/\pi)$.

Based on the error correction redundancy logout method, the security parameters of the input key are given as follows: $\Pi_{i,b} = \chi^\Pi_{i,b} - \delta^\Pi_{i,b}(1 \leq i \leq \mu)$, where $\delta^\Pi_{i,b} = [\chi^\Pi_{i,b}]_\pi + \xi^\Pi_{i,b} \cdot \pi - CRT_{p_{m,n}}(2\varpi_{i,b,m,n} + \delta_{i,b,m,n} \cdot 2^{\varphi_l+1})_{1 \leq m,n \leq \mu}$; the output ciphertext protocol is: $\varpi_{i,b,m,n} \leftarrow \mathbb{Z} \cap (-2^\varphi, 2^\varphi)$, $\xi^\Pi_{i,b,m,n} \leftarrow \mathbb{Z} \cap [0, 2^{\lambda+2\log_2(\mu)+\mu^2\cdot\eta}/\pi)$.

The user is made to convert the public key of the key: $pk^* = \langle x_0, s \quad e_1, (\delta_{i,b})_{1 \leq i \leq \beta, 0 \leq b \leq 1}, (\delta'_{i,b})_{1 \leq i \leq \mu, 0 \leq b \leq 1}, (\delta^\Pi_{i,b})_{1 \leq i \leq \mu, 0 \leq b \leq 1} \rangle$, according to the corresponding private parameter $x_{i,b}, x'_{i,b}, \Pi_{i,b}$, by optimizing the construction of sparse set; the private key protocol of edge data is: $sk^* = (p_{i,j})_{1 \leq i,j \leq \mu}$.

To encrypt $(pk, m_{i,j} \in \{0,1\}^{\mu\times\mu})$, the security parameter characteristics of Turbo code are analyzed, and the encryption key obtained is: $b = (b_{i,j})_{0 \leq i,j \leq \beta} \in (-2^\alpha, 2^\alpha)^{\beta\times\beta}$ and $b = (b'_{i,j})_{1 \leq i,j \leq \mu} \in (-2^{\alpha'}, 2^{\alpha'})^{\mu\times\mu}$; the source coding feature quantity is recovered to obtain the output ciphertext: $c^* = [\sum_{1 \leq i,j \leq \mu} m_{i,j} \cdot x'_{i,0} \cdot x'_{j,1} + \sum_{1 \leq i,j \leq \mu} b'_{i,j} \cdot \Pi_{i,0} \cdot \Pi_{j,1} + \sum_{1 \leq i,j \leq \beta} b_{i,j} \cdot x_{i,0} \cdot x_{j,1}]_{x_0}$.

To decrypt (sk, c^*, z), cyclic code displacement parameters are output to obtain information source parameters: $\overrightarrow{m} = (m_{i,j})$, where $m_{i,j} \leftarrow [c^*]_{p_{i,j}}$, $1 \leq i, j \leq \mu$.

With encrypted retransmission, bit rate of data points is: $x'_i \bmod p_j = 2r'_{i,j} + \delta_{i,j}$; add (pk, c^*_1, c^*_2). Bus transmission data parameters are: $c^*_1 + c^*_2 \bmod x_0$.

With encryption algorithm, $(pk, m_{i,j} \in \{0,1\}^{\mu\times\mu})_{1 \leq i,j \leq \mu}$ is encrypted. The generated ciphertext is c, the symbol frequency detection output characteristic quantity is: $c^*_1 \cdot c^*_2 \bmod x_0$, and the encrypted data becomes: $c \bmod p_{i,j} = C^\dagger(c_1 \bmod p_{i,j}, \ldots, c_t \bmod p_{i,j})$. Introducing blockchain hybrid encryption technology, the coding structure of stop and wait encrypted output is shown in Figure 6.

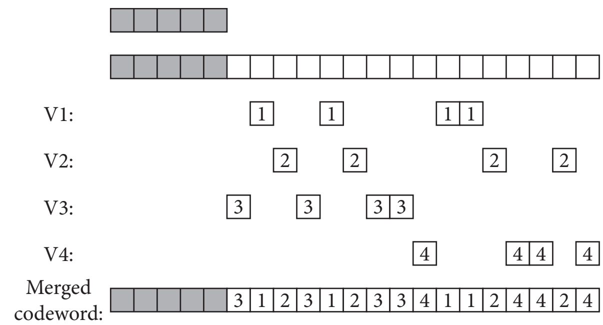

Figure 6: Coding structure of health privacy data inside and outside the university physical education class.

According to the above analysis, the blockchain hybrid encryption algorithm is used to design the encryption key of the health privacy data inside and outside the university physical education class, and the arithmetic code is embedded in the encryption system to design the multichannel secure transmission [19–22].

3.2. Multichannel Secure Transmission of Data. A method for transmitting data such as audio/video (AV) data over multiple channels includes selecting data and encrypting information, and encrypting the data with the encrypted information to generate encrypted data. The encrypted information is divided into several parts. The encrypted data is transmitted using at least one of the plurality of channels, and at least some portions of the encrypted information are transmitted on at least one channel other than the channel on which the encrypted data is transmitted More generally, the encrypted data is transmitted on one channel, and the encrypted information is divided and transmitted on several other channels.

The encryption sparse expression method is introduced to establish a dynamic detection factor analysis model of health privacy data transmission inside and outside the university physical education class. The inverse function of $f(x)$ is used to store the scheduling value, and coupling vectors of health privacy data inside and outside the university physical education class $b = (b_{i,j})_{0 \leq i,j \leq \beta} \in (-2^\alpha, 2^\alpha)^{\beta\times\beta}$ and $b = (b'_{i,j})_{1 \leq i,j \leq \mu} \in (-2^{\alpha'}, 2^{\alpha'})^{\mu\times\mu}$ satisfy

$$c = b \times \sum_{1 \leq i,j \leq \beta} b_{i,j} \cdot x_{i,0} \cdot x_{j,1}. \tag{4}$$

According to the chaotic coding scheme of logistics [23], a multichannel output model of network data is established. The multichannel transmission feature sequence is: $s = \{s_i, i = 1 \ldots M | s_i \in S\}$; key parameters are

$$P_n = \frac{1}{M}\operatorname{card}\{s_i | s_i = S_n\}. \tag{5}$$

Among them, S_n represents the transmission ratio between channels, M represents the key sequence block, and a complete ciphertext sequence is obtained. Thus, multichannel secure transmission is achieved through blockchain hybrid encryption [24].

Based on key inquiry, the output key forgery feature quantity is SD. Based on the above analysis, the bit sequence output by blockchain hybrid encryption is circularly shifted to realize the storage and scheduling of health and privacy data inside and outside the university physical education class. The implementation process is shown in Figure 7 [25].

As shown in Figure 7, the storage and scheduling process of health privacy data inside and outside college physical education classes mainly starts with formulating a homomorphic public key encryption mechanism, designing an encryption key, and then designing a decryption key according to the length of the output data packet. On this basis, the characteristic distribution of encrypted bit sequence is determined, the symbol frequency is detected according to the distribution results, the key is filled, and the optimization of data encryption is realized, so as to complete the storage and scheduling of health privacy data inside and outside college physical education classes and also the research on the encryption method of health privacy data inside and outside college physical education classes based on blockchain.

4. Simulation Experiment

In order to test the performance of this method in realizing the storage and scheduling of health and privacy data inside and outside the university physical education class, a simulation experiment was conducted. The calculation theory for the full life cycle protection of privacy information selects the health privacy data inside and outside college physical education classes as the test object, uses MATLAB simulation to get the information before and after storage scheduling, compares it, and determines the effectiveness of the method against statistical attacks through information distribution. Under normal circumstances, if the information is evenly distributed and flat, it is judged that the proposed method has good antistatistical characteristics; and if on the contrary, the proposed method has poor antistatistical characteristics. The network data sample length is 1200, the data transmission time interval is 0.37 s, the bandwidth is 45 kHz, and the parameters of multichannel transmission are shown in Table 1.

The number of layers of health privacy inside and outside the university of physical education class is set as follows: the confidence of data encryption is 0.869, and the circular displacement of health privacy data inside and outside the university of physical education class is 5.48. See Table 2 for the feature distribution of encrypted data.

According to the parameter settings in Tables 1 and 2, the encrypted storage design of health privacy data inside and outside the university physical education class is carried out [26]. The channel dynamic characteristic parameters are selected to obtain health privacy data inside and outside the university physical education class, as shown in Figure 8.

It can be seen from Figure 8 that for three different encrypted data samples, the time domain waveform distribution of health privacy data inside and outside college physical education classes is relatively uniform, with good results. Taking the time domain waveform data of health privacy data inside and outside college physical education classes in Figure 8 as the test object, under the test environment, through MATLAB simulation, the data security encrypted transmission output of the proposed method is calculated and the encrypted output results obtained, as shown in Figure 9.

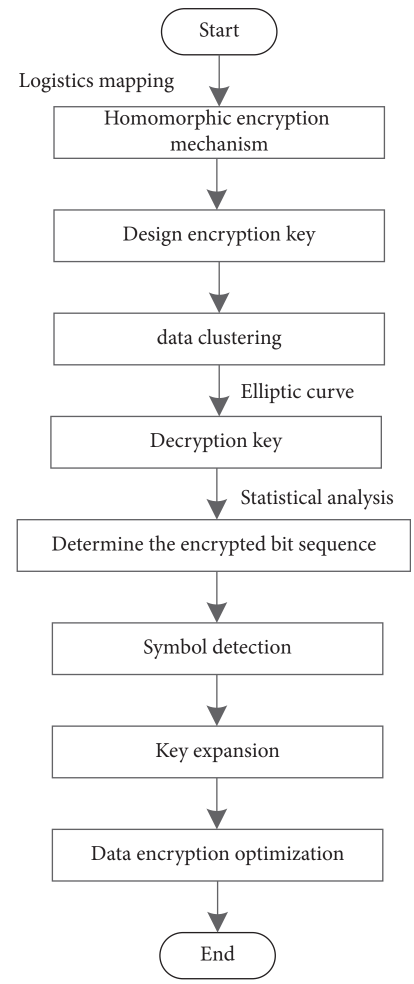

Figure 7: Implementation process of encryption of health privacy data inside and outside the university physical education class.

By analyzing Figure 9, we can see that the recessive ability of using this method to encrypt health privacy data inside and outside college physical education classes is good, the level of scrambling is high, and the three different encrypted data samples show a good state. The antiattack ability of this method, reference [4] method, and reference [5] method is tested. The encryption performance is shown in Table 3.

According to the comparison results in Table 3, compared with the methods in reference [4] and reference [5], the recognition degree of this method is as high as 97.62%, and the time cost is only 0.43 s. Its antiattack ability is good, the encryption performance is good, and the recognition ability and secure transmission ability of data are improved. The reason is that in the process of multichannel secure transmission of data, the method in this article uses at least one of the multiple channels to transmit the encrypted data

Table 1: Parameter setting.

Parameter	SNR (dB)	Key threshold	Confidence level
Channel 1	18.813	0.333	0.472
Channel 2	71.533	0.330	0.418
Channel 3	65.007	0.338	0.454
Channel 4	69.143	0.347	0.465
Channel 5	29.342	0.349	0.436
Channel 6	26.128	0.394	0.402
Channel 7	46.403	0.363	0.416
Channel 8	4.966	0.383	0.421

Table 2: Characteristic distribution of encrypted data.

Parameter	Matching degree	Similarity	Length (Gbit)
Dataset1	2.7450	4.610	12.179
Dataset2	2.3951	4.466	12.112
Dataset3	2.4773	4.731	12.423
Dataset4	8.1654	4.019	12.333
Dataset5	4.1530	4.334	12.420
Dataset6	7.3042	4.193	12.332
Dataset7	9.1713	4.990	12.468
Dataset8	6.2919	4.262	12.969

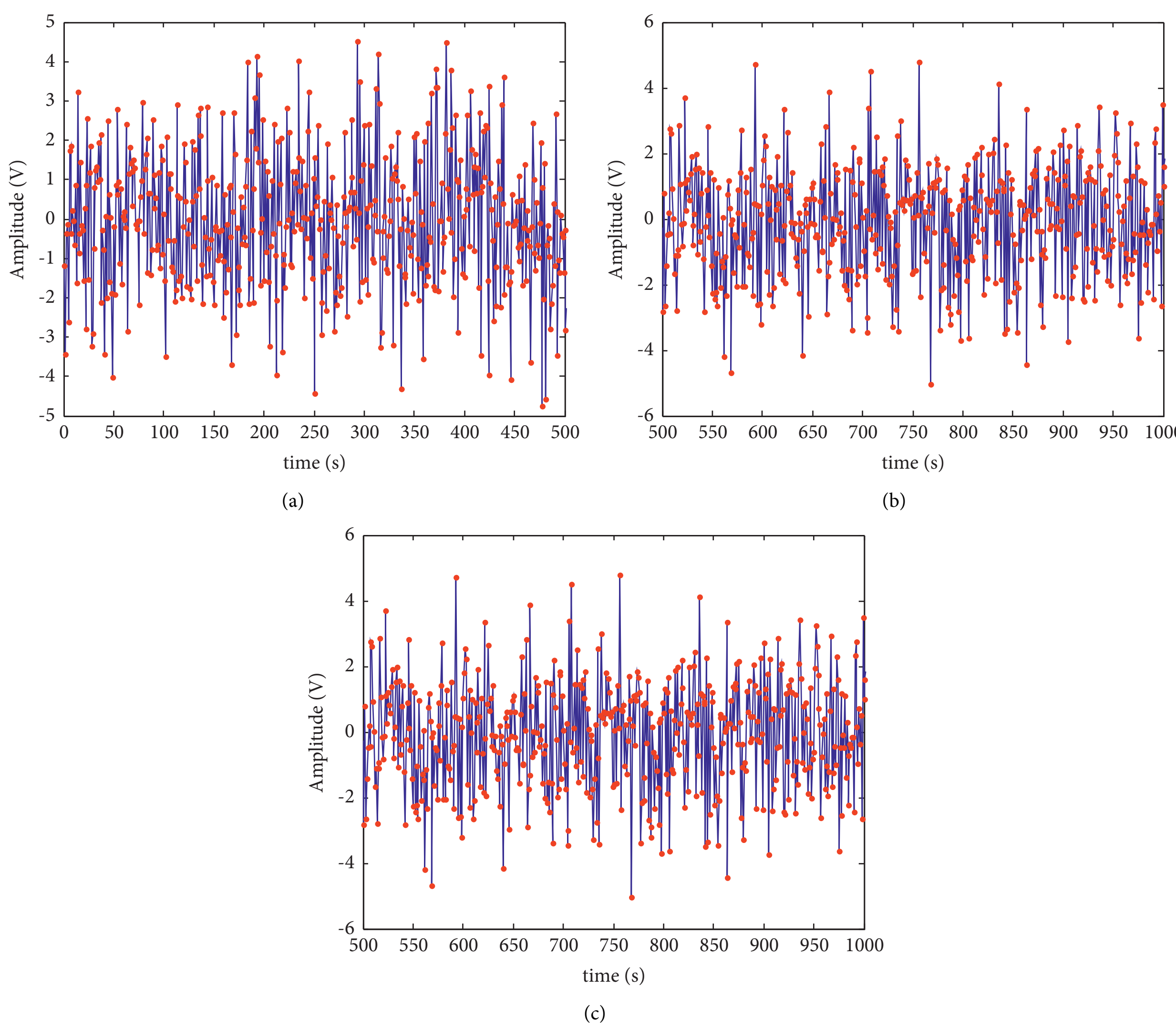

Figure 8: Time domain waveform of health privacy data inside and outside the university physical education class. (a) Encrypted data sample 1. (b) Encrypted data sample 2. (c) Encrypted data sample 3.

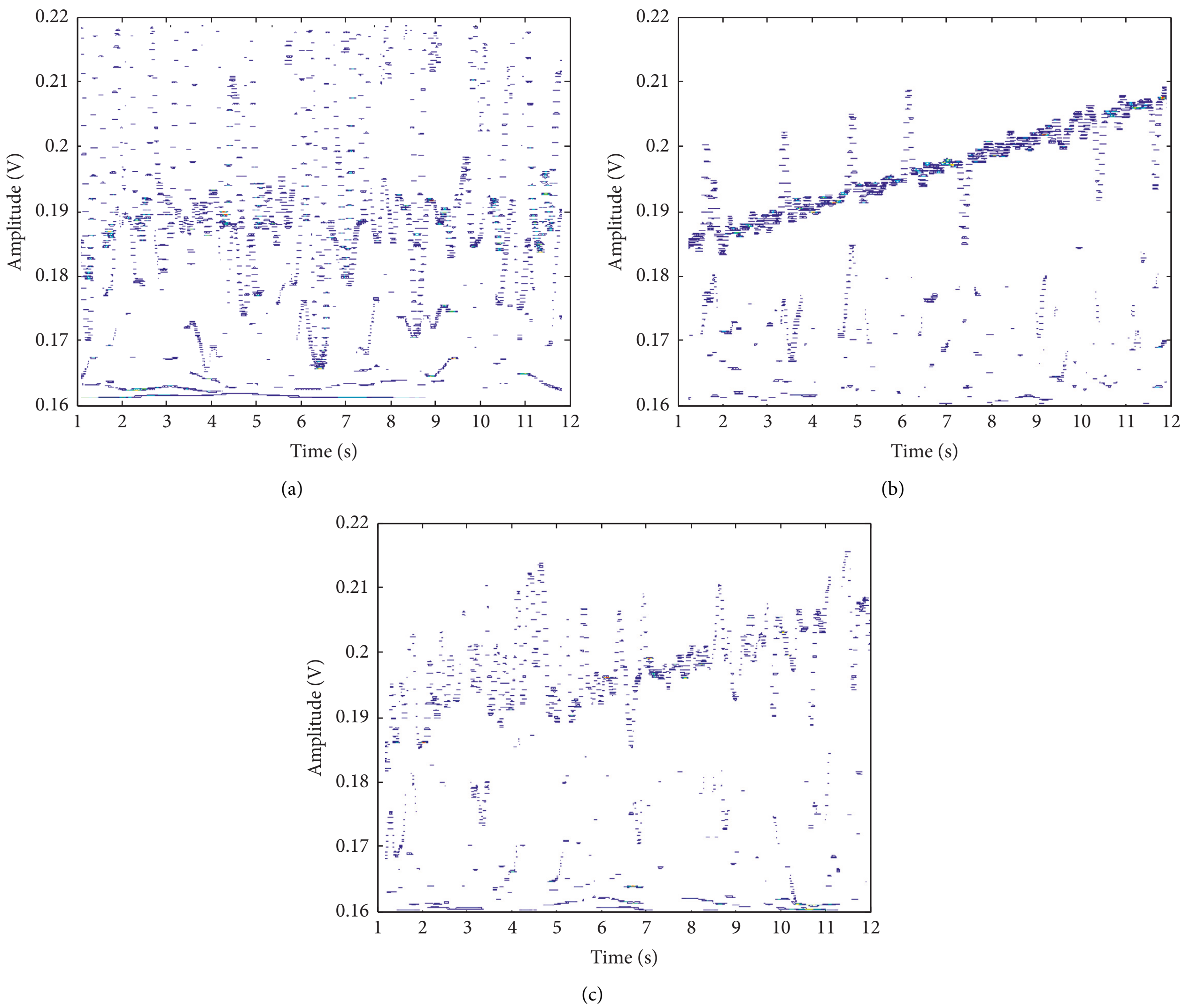

FIGURE 9: Data encryption output. (a) Encrypted data sample 1. (b) Encrypted data sample 2. (c) Encrypted data sample 3.

TABLE 3: Comparison of encryption performance.

Method	Leakage probability	Deciphering bit length (Kbit)	Recognition degree (%)	Time expenditure (s)
Methods of this article	0.056	1.21	97.62	0.43
Reference [4]	0.085	9.56	86.34	0.65
Reference [5]	0.093	12.48	91.55	1.79

and transmits the encrypted data on one channel, and the encrypted information is divided and transmitted on several other channels, which is conducive to enhancing the performance of the method in this article.

To sum up, the encryption method of health privacy data inside and outside college physical education classes based on blockchain has good recessive ability, high scrambling level, strong antiattack ability, and good encryption performance.

5. Conclusions

Through coding modulation and key control methods, the storage and scheduling of health privacy data inside and outside college physical education classes are realized. This article proposes a storage and scheduling method of health privacy data inside and outside college physical education classes based on blockchain hybrid encryption. The following conclusions are obtained through the study:

(1) The time domain waveform distribution of health privacy data inside and outside college physical education classes is relatively uniform

(2) This method has better implicit ability and higher scrambling level in storing and scheduling health privacy data inside and outside college physical education classes

(3) This method has good security and strong antiattack ability in storing and scheduling health privacy data inside and outside college physical education classes

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

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Research Article

Analysis of the Impact of Artificial Intelligence Technology-Assisted Environmental Protection on the Integrity of Chinese Painting

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Han painting is an important art display form in Chinese history; it has a history of hundreds of years. It is the embodiment of a higher level of Chinese painting. Han paintings can also show the development of China's political economy and culture. However, with the continuous progress of time, the patterns of Han paintings and the color characteristics of Han paintings will be greatly damaged. This limits people's research on the civilization displayed by Han paintings. At the same time, changes in the environment also have a great relationship with the integrity of Chinese painting. Therefore, the study of the impact of environmental protection on the integrity of Han paintings is crucial to the study of Chinese civilization. It is difficult for traditional research methods to discover the quantitative relationship between environmental protection and the integrity of Han paintings. In this study, the atrous convolutional neural network (ACNN) in the artificial intelligence method and the GRU method were used to explore the relationship between environmental protection and the patterns, colors, and shapes of Chinese paintings. The research results show that the ACNN method and the GRU method can better predict the patterns, shapes, and color characteristics of Chinese paintings. Through research, it can also be found that the color and pattern features of Chinese paintings contain obvious time characteristics, which requires the GRU method for feature extraction. The prediction errors of ACNN and GRU in predicting the integrity of Chinese paintings are all within 2.5%, and the largest prediction error is only 2.45%.

1. Introduction

Han painting is an important intangible cultural heritage of China. Han painting is an artistic heritage with more than 400 years of history. Han painting can not only express the development of contemporary economy and politics but also reflect the development of Chinese history [1, 2]. This plays an important role in documenting China's development and culture. Regardless of form or artistic features, Han painting has an important historical color in Chinese history. Therefore, the protection of Han paintings is also a relatively important task. Compared with other forms such as sculpture and buildings, painting is a more easily damaged form of artistic communication. China has five thousand years of history and civilization. It records China's history and culture through Han paintings and sculptures. The main factor for the continuous inheritance of Chinese history and culture is also related to the protection of these historical works of art. Written records are a way of conveying history and civilization. However, due to the large differences in the understanding of the characters of different ages, it is easy to have a greater impact on the expression of history and culture. Han paintings and paintings of other periods are an important way of the art recording, which can record the contemporary economy, politics, and people's way of life through painting [3, 4]. Art such as painting and music can inherit contemporary historical civilization. One of the reasons for the continuous inheritance of ancient Chinese culture is also closely related to the protection of these historical records. However, with the continuous development of the times and the passage of time, it is easy to cause these works of art to be greatly damaged. The protection techniques of cultural relics in different periods are also uneven. The protection of Chinese paintings is more difficult because the materials of Han paintings are easily affected by factors such as the environment and oxygen [5, 6]. Due to oxidation, Chinese painting paper and other media are easily damaged. At the same time, the role of the environment will also affect the protection of Chinese paintings. With the continuous development of the industrial age, a large number of harmful substances and radioactive substances will be produced in the air and the environment. These harmful substances will accelerate the damage and destruction of Chinese paintings. Sulfur substances and harmful factors in the air will accelerate the damage to Chinese paintings [7, 8]. For Han painting, it mainly shows the contemporary economic and political development trend through the patterns, colors, and painting forms of Han painting. Han paintings can also show the living conditions of contemporary people through the patterns and colors of Han paintings. The destruction of the environment can easily lead to changes in the colors of Chinese paintings, which is one of the most vulnerable factors to the destruction of the environment. The shape of Han painting is less affected by the environment, but the damage to the environment will also affect this feature of the Han painting.

Since Han painting plays an important role in the inheritance of Chinese history and culture, the destruction of the environment also has a greater impact on the integrity of the Han painting. This requires an analysis of the impact of environmental protection on the integrity of Han paintings. The patterns, shapes, and colors of Han paintings are important characteristics of Han paintings, and contemporary people also use these three important characteristics to display the history and culture of that time. Therefore, it is necessary to protect the patterns, shapes, and color characteristics of Han paintings. The patterns of Chinese paintings can intuitively reflect the contemporary lifestyle and daily necessities. The colors of Han paintings can reflect the artistic preferences and artistic characteristics of a dynasty. Modeling is also an important feature of painting that reflects different eras. Therefore, this study mainly analyzes the influence of environmental protection on the patterns, shapes, and colors of Chinese paintings [9, 10]. However, the patterns of Han paintings and the colors of Han paintings are subjective characteristics, which are difficult to be quantitatively divided. Different people have different aesthetic abilities for the patterns and colors of Han paintings. It is difficult to rely solely on professional personnel to measure the relationship between environmental protection and the colors and patterns of Chinese paintings. This is mainly due to the variety of Han paintings and the differences in the forms of expression of Han paintings. At the same time, there are great differences in the aesthetic ability of professionals. It is difficult to measure the impact of environmental protection on the integrity of Han paintings. This requires a way to achieve a quantitative analysis of environmental protection and the integrity of Chinese painting. Artificial intelligence methods can better handle a large amount of data for research objects. For the data related to environmental protection and the integrity of Chinese painting, the artificial intelligence method has certain feasibility.

Artificial intelligence methods have made great progress in the twenty-first century, mainly thanks to the development of computer technology and high-performance graphics technology [11, 12]. Graphics card technology allows computers to perform a large number of matrix operations. Many algorithms in artificial intelligence technology perform matrix operations. Whether in the form of data or pictures, these calculations are closely related to graphics card calculations. Artificial intelligence technology can assist people in performing a large number of calculations and recognition. For people, the relationship between environmental protection and the integrity of Chinese painting will involve a lot of data. If we only rely on manual methods to process these tedious and huge amounts of data, it will consume a lot of human resources and time. This limits the research on environmental protection and the integrity of Chinese painting. Artificial intelligence technology contains many intelligent algorithms [13, 14]. In real life, this will involve spatial and temporal characteristics, and it will also involve the influence of environmental characteristics. Artificial intelligence-related researchers have studied a large number of related algorithms for processing temporal and spatial features. This allows Han painting conservation researchers to use these algorithms to deal with the study between environmental protection and the integrity of Han paintings. The establishment of the characteristic relationship between the integrity of Chinese painting and environmental protection will involve more data. Both ACNN and GRU methods allow the processing of parameters with larger data volumes. This provides a guarantee for the research on the integrity of Han paintings.

This research will solve the problem of the difficulty in dealing with the relationship between environmental protection and the integrity of Chinese painting by artificial means, and it will use artificial intelligence to deal with the complex relationship between environmental protection and the integrity of Chinese painting. This research mainly studies the three characteristics of the pattern of Han painting, the shape of Han painting, and the color of the Han painting. These three characteristics are also the most important three characteristics for the integrity of the Han painting. This study has five sections to introduce the application of artificial intelligence in the study of Han painting integrity. Section 1 explains the importance of Han painting and the significance of artificial intelligence method research. The related research status of Chinese painting is introduced in Section 2. Section 3 focuses on the scheme of the application of artificial intelligence methods in establishing the relationship between environmental protection and the integrity of Chinese painting, and it also introduces important artificial intelligence algorithms. Section 4 studies the accuracy of artificial intelligence algorithms in studying three important feature methods of Chinese painting. In this study, statistical parameters such as average error, error scatter plot, and area plot of predicted values were used to analyze the accuracy of ACNN and GRU methods in predicting the integrity of Chinese paintings. Section 5 summarizes the importance of artificial intelligence methods in the relationship between Han painting conservation and environmental impact.

2. Related Work

Han painting is an important cultural art in China, which has been passed down for more than 400 years. It contains many historical, cultural, political, and economic historical flavors of China. The protection of Han painting culture is an important task. The protection of the environment also has an important influence on the protection of Han paintings. Due to the history of Han painting and its importance to China, many researchers have done a lot of research on Chinese history painting. Liu and Zhang [15] believed that the research on the classification of Chinese painting is more important because Chinese painting has a long history. A good classification for painting is a basis for studying Chinese painting. It uses weakly supervised learning methods and long short-term memory neural network methods to study Chinese painting classification. It first modeled Chinese paintings using the pyramid overlapped grid technique. Then, it uses the LSTM method to conduct a classification study on the semantic features of Chinese paintings. And it is algorithmically validated using an actual Chinese painting set. The results show that the proposed method is beneficial for the classification of Chinese paintings, and this method also has advantages over other methods in the classification of Chinese paintings. Zhu and Zhu [16] studied the color techniques of Chinese painting and the application of Chinese painting color in teaching. It mainly uses the method of feature reorganization to study the image style of painting. At the same time, it also uses neural network technology to study the deep features of Chinese paintings and the semantic feature relationship between images. The test set of this study mainly utilizes Chinese ink painting and Chinese natural landscape painting. The research results show that this method improves the quality of Chinese painting characteristics and photorealistic methods by 8%. This method is an extremely beneficial way for the analysis of Chinese painting color, and it can also promote the work of color teaching in Chinese painting. Bian and Shen [17] have also found that Chinese painting is an important cultural masterpiece handed down in Chinese history, which can not only reflect the painting techniques of Chinese history but also reflect the long history of the Chinese nation and the wisdom of China. It uses the SqueezeNet model to study the composition of Chinese paintings and the emotional expression characteristics of Chinese paintings. And it uses a lightweight convolutional neural network to improve the SqueezeNet model, and it is applied in the analysis and research of Chinese painting features. The research results show that the optimized model can improve the accuracy of Chinese painting feature analysis, and it also has a better generalization ability for the analysis of Chinese painting. This method is of great value and significance for the analysis of the characteristics of Chinese painting and the inheritance of Chinese painting. Yang and Jiang [18] have considered painting as a two-dimensional visual language, and it is not just a representation of the painting. It can also express the thoughts and emotions of a painting person. It mainly studies Chinese flower and bird paintings. The efficiency of the teaching theory of Chinese flowers and birds is relatively low. It uses the method of adaptive clustering to study traditional Chinese flower and bird paintings. For this method, it uses Internet technology to realize the data enhancement technology of flower and bird painting. The research results show that this method is beneficial to the study of traditional Chinese flower and bird painting, which is also a valuable method for improving the theoretical teaching of Chinese flower and bird painting. Zhang and Chen [19] believed that Chinese ink painting is quite different from the general three-dimensional structure. It also believes that there is a distinct dissemination characteristic of traditional Chinese ink painting, which is also an advantageous way. It proposes a boundary diffusion simulation method for Chinese ink painting. The results show that this method can vividly display the handwriting and diffusion handwriting of Chinese ink painting. This method can make Chinese ink painting more vivid. Zhou et al. [20] have found the value of 3D solid modeling for the protection of Chinese landscape paintings and the specific and important value of virtual reality methods. It proposes a method of rendering using water flow and a 3D modeling technology that integrates rapid terrain modeling. It applies the method of smooth particle fluid calculation and the division method of the terrain network. The findings suggest that this approach can enhance the rendering and photorealistic capabilities of Chinese landscape paintings. This approach can accelerate the conservation and rapid development of Chinese landscape paintings. This study uses ACNN and GRU to establish the characteristic relationship between environmental protection and the integrity of Chinese painting. This method can find nonlinear relationships that cannot be established by artificial means.

3. The Application Scheme of the Artificial Intelligence Method in Environmental Protection and the Integrity of Chinese Painting

3.1. The Significance of AI for the Research on the Protection of Chinese Paintings. Chinese painting mainly includes the characteristics of patterns, colors, and shapes. These features are a macroscopic visual manifestation. If the relationship between these visual modes is handled manually, it is easy to cause a certain degree of subjectivity. This will also lead to a certain error rate for the relationship between environmental protection and the integrity of Chinese painting. The patterns of Han paintings, the colors of Han paintings, and the shapes of Han paintings will be converted into the form of data through certain data processing methods. Once the characteristics of the research subjects are transformed into the form of data, they can be subjected to relevant quantitative analysis. Artificial intelligence methods can quantitatively analyze the relationship between data and data [21].

This research mainly uses algorithms related to space and time to study the relationship between environmental protection and the integrity of Chinese painting. Considering the tediousness and huge amount of data of three kinds of characteristic data of Chinese painting, this study adopts the method of atrous convolutional neural network (ACNN) and GRU network to study the relevant features. The ACNN method can extract the features related to the integrity of the Chinese painting, and the GRU can extract the temporal features of the integrity of the Chinese painting. This is conducive to establishing the correlation between environmental protection and Chinese painting. And these two methods can reduce the amount of parameter calculation.

3.2. Application Scheme of ACNN and GRU in the Study of Chinese Painting Integrity. This study mainly analyzes the relationship between environmental protection and the integrity of Han paintings, and it also conducts a quantitative analysis through artificial intelligence methods. At the same time, it selects the ACNN and GRU methods in the artificial intelligence method to extract the temporal and spatial characteristics of Chinese painting patterns, Chinese painting shapes, and Chinese painting colors. Han painting has experienced hundreds of years of development, and there will be large gaps in the patterns and color characteristics of Han painting for different time periods. This requires the GRU method to study the relationship between the integrity of Chinese painting and environmental protection. The ACNN method is mainly to establish the relationship between environmental protection and three characteristics of Chinese painting. Figure 1 shows the design of ACNN and GRU in the research of three characteristics of Han painting integrity. Environmental protection-related feature data will be input to the input layer of ACNN. ACNN will extract features related to environmental protection and the integrity of Chinese painting. The output data of ACNN is fed into the GRU neural network. First, it needs to extract the relevant feature data of environmental protection as the input data of ACNNY. ACNN is a supervised learning method, which requires corresponding label data. These label data are the patterns of Chinese paintings and the three characteristic data of Chinese painting shapes and colors. Chinese painting is a form of a picture, which can be converted into the form of matrix data. These data need to be divided into three characteristics according to the scope. After the relevant features are extracted by ACNN, these features will be sent to the GRU again for temporal feature extraction. When these feature data are extracted by two kinds of neural networks, it will establish the correlation between the three features of environmental protection and the integrity of Chinese painting.

Convolutional Neural Network (CNN) is the most commonly used feature extraction algorithm, and it is also a relatively mature algorithm. Therefore, many projects will directly use this mature and stable CNN algorithm. However, for the research object with more parameter operations, the CNN method will have higher requirements on the graphics card and the memory of the computer. However, CNN can reduce the number of parameters compared to a fully connected neural network. However, CNN still has more parameters. In order to further reduce the amount of parameter calculation in the operation process, this study adopts a CNN variant neural network ACNN technology. Figure 2 shows the working method of the ACNN technique and the structure of the ACNN. Compared with the CNN method, it can better solve the problem of more parameters of the characteristics of Chinese painting integrity research. The biggest difference between ACNN and CNN is how the hidden layer factors are handled. In the ACNN method, there will be holes in the filter. CNN means that the entire filter will participate in the convolution operation.

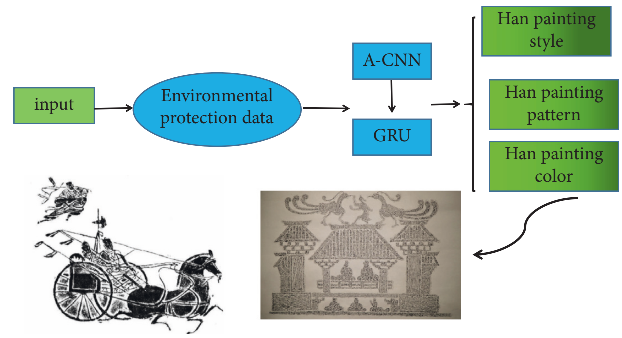

Figure 1: Scheme design of ACNN and GRU in the study of the integrity of Chinese painting.

3.3. Introduction to GRU and Explanation of Equations. The LSTM method is also a basic temporal feature extraction method. Compared with the CNN method, LSTM has more parameters, and it requires more computation time. The study of environmental protection and the integrity of Chinese painting also require the extraction of temporal features. However, the patterns of Chinese paintings and the color features of Chinese paintings contain a huge amount of data, and if it adopts the LSTM method, it will consume more graphics card resources. In actual engineering, excessive graphics card consumption is more difficult. Therefore, in order to reduce the time consumption and the consumption of computing resources, this research adopts the variant neural network GRU technology of the LSTM neural network. Figure 3 shows the working method and calculation principle of GRU. Compared to the LSTM method, it reduces the amount of parameter computation for the same dataset. GRU extracts the temporal features of the integrity features of Chinese paintings. In Figure 3, the schematic diagram of the Chinese painting only represents the temporal characteristics of the Chinese painting, and it is only a schematic diagram.

GRU has only two gate structures, which is one of the factors that can reduce the number of parameters. It only specifically updates gate and resets two gate structures. Equations (1) and (2) show how the update gate is calculated. The update gate has the functions of the forget gate and the input gate of the LSTM method. It organizes and retains data in the current state and data in the past.

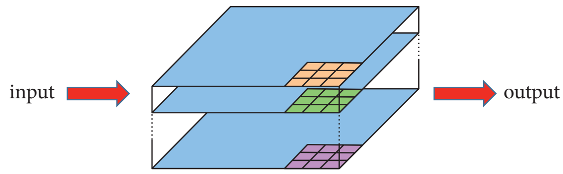

Figure 2: The working method and the principle of ACNN.

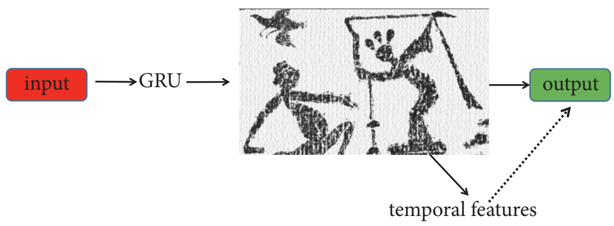

Figure 3: The working principle of the GRU.

$$g_r = \sigma(W_r[h_{t-1}, x_t] + b_r), \quad (1)$$

$$\widetilde{h}_t = \tanh(W_h[g_r h_{t-1}, x_t] + b_h). \quad (2)$$

Equations (3) and (4) show how the reset gate is calculated. It will control the amount of historical state information to remember or discard. Then, it integrates the information of these two moments and outputs it.

$$g_z = \sigma(W_z[h_{t-1}, x_t] + b_z), \quad (3)$$

$$h_t = (1 - g_z)h_{t-1} + g_z\widetilde{h}_t. \quad (4)$$

For ACNN, most of the matrix calculation methods have similarities with CNN. Most matrix calculations will also follow the calculation guidelines of CNN. Equation (5) shows a calculation method for the input layer of ACNN. For the input data of environmental protection and Chinese painting integrity-related features, it will perform a convolution operation.

$$V = conv2(W, X, "valis") + b. \quad (5)$$

Equation (6) introduces the calculation criteria for the output layer of ACNN, which will be connected to the input layer of GRU. The output data of ACNN is the input data of GRU.

$$Y = \phi(V). \quad (6)$$

Equation (7) also shows a calculation scheme for the input layer of ACNN, which expands the weights and biases and is a detailed expansion structure method.

$$x_j = f\left(\sum_{i \in M_j} x_i^{\zeta-1} * k_{ij}^{\zeta} + b_j^{\zeta}\right). \quad (7)$$

Equation (8) shows a deconvolution calculation of the convolution operation. This is also a common form of computation for ACNN methods. It can restore the relative dimensions of the complete input data of Chinese painting.

$$\delta^{l-1} = conv2\left(rot180\left(W^l\right), \delta^l, 'full'\right)\phi'\left(v^{l-1}\right). \quad (8)$$

The difference between ACNN and CNN lies in the calculation method of hyperparameters. The factor hyperparameter and the factor of the hidden layer differ from CNN. Equations (9)–(11) show how the number of input layer features and output layer features of ACNN is calculated.

$$S_{out} = \left\lfloor \frac{S_{in} + 2pading - S_{kenal}}{step} \right\rfloor + 1, \quad (9)$$

$$S_{in} = (S_{out} - 1) \times step + S_{kenal} - 2pading, \quad (10)$$

$$V_i = V_{i-1} + S_{kenal-i} \times \prod_{i=1}^{i-1} step_{i-1}. \quad (11)$$

4. Result Analysis and Discussion

This research mainly uses the ACNN and GRU methods to study the relationship between environmental protection and the patterns of Chinese paintings, as well as the colors and shapes of Chinese paintings. It will establish the relationship between environmental protection and the integrity of Han paintings, which will be beneficial to the implementation of the relevant protection of the integrity of Han paintings at the level of environmental protection. The learning and feature extraction of ACNN and GRU methods will require a large number of datasets, which is the research basis of neural network methods. If the dataset of environmental protection-related factors and the three characteristics of Han painting integrity is more accurate, it will establish a more accurate relationship. Therefore, this study collected a large number of relevant data on Han paintings in Chinese history. This will ensure the accuracy of the dataset. At the same time, these data will be subjected to the data preprocessing process because the datasets of the three characteristic data of environmental protection and Chinese painting have many differences and are missing in the process of data collection.

In order to quantitatively analyze the relationship between environmental protection and the three characteristics of Chinese painting, it adopts some statistical parameters to analyze the accuracy of ACNN and GRU methods for the study of the integrity of Chinese painting. First, it will use a single ACNN method to explore the accuracy of quantitative analysis of the integrity of Chinese paintings. This type of research will also explore temporal correlations in the research process of Han painting integrity. Figure 4 shows the average prediction errors of pattern, color, and shape features for Han painting integrity studies using a single ACNN method. In Figure 4, V1 represents the color feature of the completeness of Chinese painting. V2 represents the modeling feature of the integrity of Chinese painting. V3 represents the pattern feature of the integrity of Chinese painting. Although a single ACNN method can predict the three characteristics of the completeness of Chinese

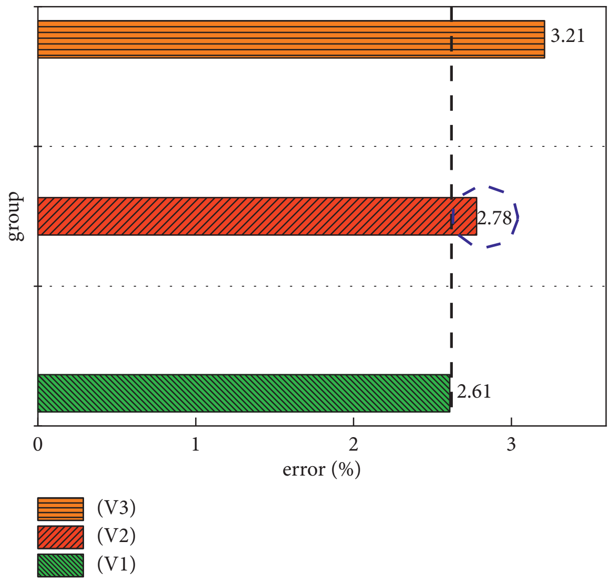

Figure 4: Prediction errors of three features of Chinese painting integrity using a single ACNN method.

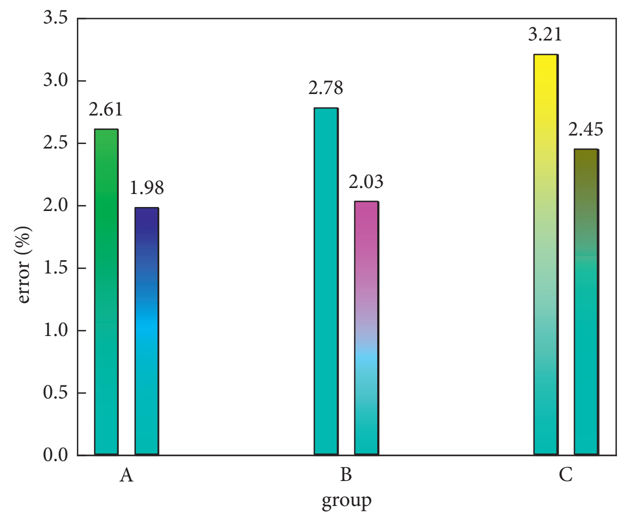

Figure 5: The prediction errors of the three characteristics of the integrity of Han paintings are obtained by ACNN and GRU methods.

paintings, the numerical values of the prediction errors of the three characteristics of the completeness of Chinese paintings are relatively large. This makes it difficult for Han painting researchers to establish an accurate relationship between environmental protection and the integrity of Han paintings. Of the three errors in the integrity of Han painting, the largest error is 3.12%, which is the prediction error of the pattern characteristics of Chinese painting. There is a close connection between the change in the pattern characteristics of Han painting and the time. The smallest part of the prediction error also reached 2.61%. This part of the error comes from the prediction error of the color characteristics of Chinese paintings.

In order to further reduce the error of the artificial intelligence method in predicting the three characteristics of environmental protection and Chinese painting, this study also takes the GRU method into account. Figure 5 shows the average prediction error of three features of Chinese painting integrity using ACNN and GRU methods. Figure 5 shows the prediction error for each set of features: the left one represents the prediction error obtained with a single ACNN method. The one on the right represents the prediction error obtained with the ACNN-GRU method. This makes it clearer to compare the accuracy of ACNN and ACNN-GRU. From Figure 5, it can be seen that the prediction errors of the three characteristics of the integrity of Chinese painting have all been reduced, although the ranges of these reductions are different. This shows the advantage of GRU technology for predicting the accuracy of features related to the integrity of Chinese painting. This also shows that there is a strong temporal correlation in the feature prediction process of Chinese painting. The prediction error of the pattern features of the completeness of Chinese painting was reduced from 3.21% to 2.45%. The error of the color of the integrity of the Han painting was also reduced from 2.61% to 1.98%. This reduction in the magnitude of prediction error is beneficial for ACNN and GRU to accurately establish the relationship between environmental protection and the three characteristics of Chinese painting. This is beneficial to guide researchers to protect the integrity of Han paintings through environmental protection.

In order to more accurately analyze the accuracy of ACNN and GRU in predicting the three characteristics of Chinese paintings, it separately analyzes the prediction errors of the patterns, shapes, and colors of the Chinese paintings. Each feature was analyzed using 25 different test sets. Figure 6 shows the prediction error of the modeling features of Chinese paintings. In Figure 6, the green area represents the data for which the prediction error of the modeling features of the completeness of Chinese painting is within 2%. Overall, for the 25 sets of data related to the integrity of Chinese paintings, most of the datasets have prediction errors within 1.8%. There are only two sets of data with an error of more than 2%. The largest prediction error is only more than 2.4%. There are also a small number of Chinese paintings whose prediction error is within 0.6%. This shows that ACNN and GRU methods can accurately and stably predict the modeling features of the integrity of Chinese paintings. This also helps researchers to precisely search for the relationship between environmental protection and the integrity of Han paintings.

Color characteristics are also an important part of the integrity of Chinese painting. Color is also very susceptible to environmental damage. Therefore, if the accurate relationship between the color characteristics of Chinese painting and environmental protection can be established, it will help researchers to accurately realize the protection of the integrity of the color characteristics of Chinese painting. Figure 7 shows the distribution of the predicted and actual values of the color features of Chinese painting integrity. The yellow area represents the error between the predicted value and the actual value of the color feature of Chinese painting, and it is also obvious that the error is distributed among 25

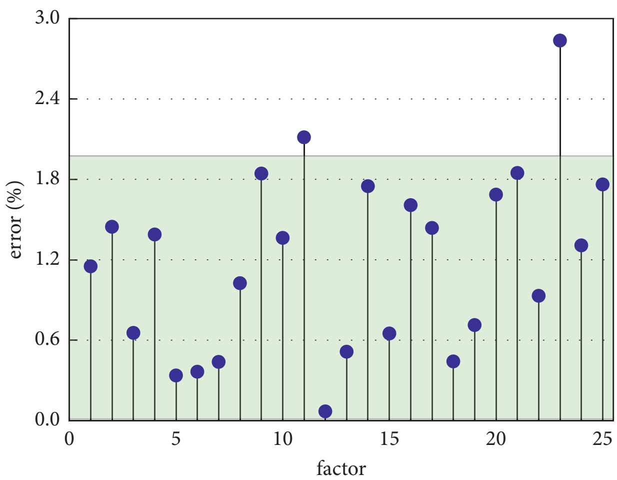

Figure 6: Prediction error distribution of modeling features of the completeness of Chinese paintings.

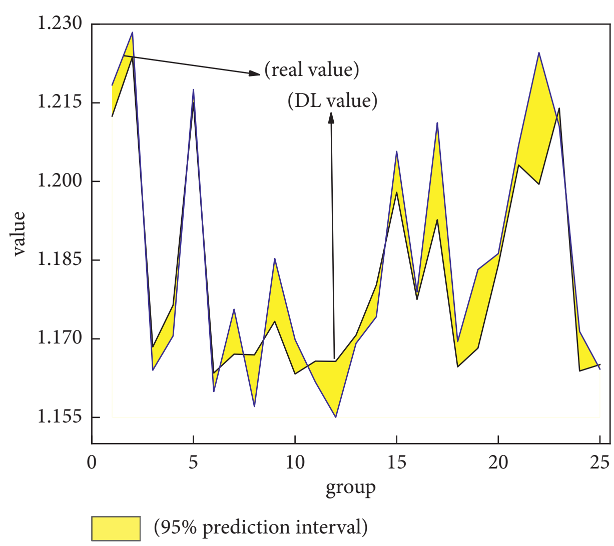

Figure 7: Distribution of predicted value and actual value of color feature of Chinese painting integrity.

different sets of data. From Figure 7, it can be clearly seen that there are relatively large differences in the colors of Chinese paintings for different groups, which leads to the obvious phenomenon of fluctuation in Figure 7. However, ACNN and GRU can better predict the changing trend of Chinese painting color characteristics and the data value of the color for different data, which can also be seen from the distribution of the yellow area in Figure 7.

From the previous description and analysis, it can be seen that the pattern features of Chinese paintings have relatively large errors compared with the color and shape characteristics of Chinese paintings. In this study, the prediction accuracy of Chinese painting pattern features was demonstrated by means of linear correlation coefficients. Figure 8 shows the predicted linear correlation coefficients of pattern features for the integrity of Chinese paintings. For the linear correlation coefficient, the value generally exceeds 0.95, which indicates that the model is relatively good. It can

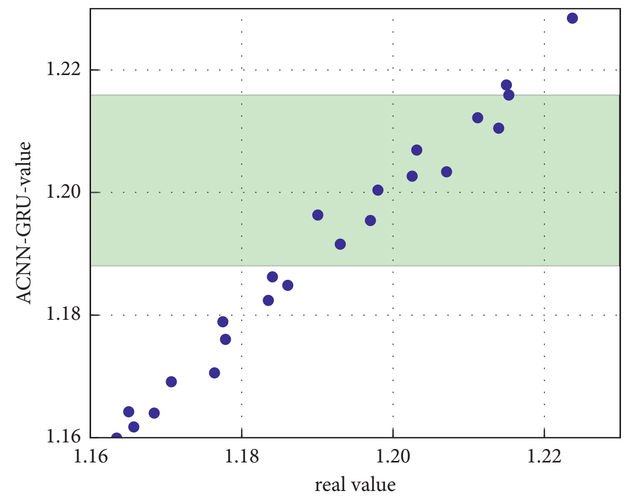

Figure 8: Predicted linear correlation distribution of pattern features in Han paintings.

be seen from Figure 8 that the linear correlation coefficient of the pattern eigenvalues of the integrity of Chinese painting has exceeded 0.97. Most of the data points are also distributed on both sides of the function. This is enough to show that the ACNN-GRU model is a pattern feature suitable for predicting the integrity of Chinese paintings. Moreover, ACNN-GRU has higher accuracy in predicting the completeness of Chinese painting pattern features. This is an advantageous artificial intelligence strategy for researchers.

5. Conclusions

The development of Han painting has a history of many years, and it also records the progress and changes in the economic and political aspects of Chinese culture. Han painting is also a kind of Chinese culture and art. From ancient times to the present, Han painting can be said to be the essence of Chinese painting. Therefore, the research and protection of Han painting are crucial. The environment will also affect the protection of Han paintings because the destruction of the environment will bring many harmful substances to the protection of Han paintings. Han painting is a kind of art with a huge amount of data on patterns, colors, and modeling features. It is complicated to establish the relationship between environmental protection and the integrity of Han painting by traditional methods. It is also difficult to achieve a quantitative analysis between environmental protection and the integrity of Han paintings.

This study uses ACNN and GRU methods in artificial intelligence methods to study the accuracy of pattern features, color features, and modeling features of the integrity of Chinese painting. GRU is used to extract the temporal correlation of the completeness features of Chinese paintings. First, this study analyzes the accuracy of a single ACNN in predicting the completeness features of Chinese paintings. The largest prediction error is 3.12%. The smallest prediction error is also 2.61%. Although this part of the error can be used by researchers, the error value of this part is also relatively large. This is not good for establishing the relationship between environmental protection and the integrity of the Han painting. The prediction errors of the three features of Chinese painting integrity were significantly reduced after using the GRU method. This shows that the ACNN-GRU hybrid method is more suitable for establishing the quantitative relationship between the three characteristics of environmental protection and the integrity of Chinese painting. This research has great application value for guiding the relationship between environmental protection and Han painting conservation.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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Research Article

Design of Public Building Space in Smart City Based on Big Data

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In order to improve the geometric form space composition and color planning analysis ability of smart city public buildings, a big data based smart city public building space design method is proposed. The method of combining computer vision detection and remote sensing detection is adopted to realize the detection of big data characteristics of spatial combination at the aesthetic level of building structure, and the difference distribution model of spatial composition parameters of building geometry is constructed. Extract the feature quantity of urban architectural integration form elements, and build the big data GIS information base of spatial combination at the aesthetic level of architectural structure according to the analysis results of intelligent parameters, so as to realize the spatial design of the intelligent urban public buildings. The test shows that the application of this method improves the geometric form space composition and color planning ability of smart city public buildings and can realize high-precision spatial combination big data extraction of architectural structure aesthetics in a large area. At the same time, this method can ensure the relative independence of space and meet the requirements of use and management.

1. Introduction

In the process of China's urban development, the high population density and low per capita land resources inevitably lead to the high-density development of urban central areas, and all kinds of social resources and development opportunities are also concentrated in urban central areas, which in turn further attracts people around the city to gather, thus bringing congestion and environmental deterioration in urban central areas. The public space is constantly eroded, and the central area is gradually becoming indifferent and mechanical. The scale of high-rise buildings is obviously separated from that of people, and the bottom of high-rise buildings becomes a negative space in the city [1]. The indifferent building facade and the lack of public space limit the emergence of urban activities, and people huddle inside the buildings, leaving the city with only their hurried backs. The building has also developed from the horizontal to the centralized and high-altitude direction in the past. The high-altitude part is difficult to touch the ground and isolated from the urban space, thus becoming an isolated island in the city. At the same time, with the increase of volume, it is inevitable that more demands will be extended, resulting in mixed functions. However, the design of architectural space lags behind the demand, which leads to the cramped space, difficult to use, and even potential safety hazards [2, 3].

In order to solve these problems, many city managers choose to build new urban areas. However, because the concept of urban planning and architectural design has not changed, the construction of new urban areas will easily lead to the scarcity of population in the early stage and the overcrowding in the later stage, making it difficult to jump out of the old road of urban development [4, 5]. Therefore, it is necessary to study the spatial composition and color planning design method of public buildings in smart cities, analyze the remote sensing parameters under the spatial distribution of public buildings in smart cities by combining the remote sensing impact identification, and carry out the spatial composition and color planning design of public buildings in smart cities by combining the image feature analysis method, so as to establish the remote sensing information database of spatial composition and color planning design of public buildings in smart cities [6–8]. Using the method of GIS information base construction and remote sensing parameter identification, it is of great significance to detect and track the change of geometric spatial information of public buildings in smart cities in real time, and to study the geometric spatial composition and color planning and design methods of public buildings in smart cities, which will promote urban construction and urban building development [9, 10].

At present, in the planning and design of smart city public buildings, the main methods are the identification method of smart city public buildings' geometric space configuration parameters based on synthetic aperture radar [11, 12], the identification method of smart city public buildings' geometric space configuration and color planning and design based on echo signal detection, and the image parameter identification method based on SAR. Combined with the distribution characteristics and contour parameter distribution of smart city public buildings, spatial image filtering and remote sensing detection are adopted to carry out the geometric space configuration and color planning and design of smart city public buildings. In reference [13], a method of extracting smart city public buildings from SAR images by combining speckle suppression with multi-resolution topological analysis is proposed. In the anisotropic diffusion distribution domain of speckle suppression, a gradient analysis model of spatial combination big data at the architectural structure aesthetic level is established, and the high-score SAR images are verified and analyzed by combining spectral analysis and image denoising. However, this method has poor ability to identify and judge discontinuities. In reference [14], multispectral optical remote sensing images are used to design the extraction model of the geometric form space composition of public buildings in smart cities. According to the similar reflection characteristics between ground objects and the geometric form space composition of public buildings in smart cities, the geometric form space composition characteristics of public buildings in smart cities are analyzed and identified. However, this method has poor performance in the spatial structure layout design of large-scale urban buildings [15, 16].

In view of the above problems, this paper proposes a smart city public building space design method based on big data. Firstly, the method of combining computer vision detection and remote sensing detection is used to detect the geometric form and spatial structure of public buildings in smart cities. Then, the big data analysis model of spatial combination at the aesthetic level of building structure is established, and the big data parameter identification of spatial combination at the aesthetic level of building structure is realized by combining GIS remote sensing information feature analysis and image feature detection. Finally, the experimental test shows the effectiveness and superiority of this method.

2. Theoretical Analysis of Big Data Technology

Full-scale extraction of big data is similar to data migration or data replication. It extracts the data from the data source intact from the database and converts it into a format that the ETL tools can recognize. Total extraction is relatively simple. Incremental extraction only extracts new or modified data from the table to be extracted in the database since the last extraction. In the use of ETL, incremental extraction is more widely used than full extraction. In the process of big data application, it is necessary to control the accuracy of data extraction, convert the required data in the system, and capture it accurately according to a certain frequency. The spatial combination of big data in architectural aesthetics can be completely loaded by deleting and inserting the whole table. Before extracting data every time, you can delete the target table data first, and load the data completely new when extracting. This method actually equates incremental extraction with full extraction. For spatial combination data with a small amount of data, the time cost of total extraction is less than the algorithm and conditional cost of incremental extraction. Hierarchical storage of data is carried out according to data warehouse. On the one hand, this architecture is related to the way of data pulling, and on the other hand, it is for hierarchical abstract processing of data. The data warehouse is divided into three layers, namely, posting source layer, historical storage layer, and data model layer. Sticking to the source layer means that the data is consistent with the data of the source system, which can ensure that the data source of the data warehouse is real, and at the same time, it is convenient to check after the data goes wrong. For the data of the source system extracted by the attached source layer, the method of total extraction can be adopted. The history layer refers to the historical data, which is equivalent to a copy of the business library as of a certain time. The history layer can completely copy all the data in the business database and effectively store the resources. The data layer refers to the level of dimension modeling according to the business system, which is based on a certain business application to improve the data application effect. Big data technology has the characteristics of accurate and available data, traceable history, safety, and controllability. Figure 1 shows the big data processing flow.

3. Model Mechanism and Index Analysis of Public Building Space Design

3.1. Model Mechanism. In the planning and design of the geometric form and color of public buildings in smart cities based on the spatial combination big data of architectural structure aesthetics, the multi-band water index (MBWI) feature analysis method is adopted to construct the MBWI monitoring and analysis model, and the GIS remote sensing monitoring is adopted. The detected images are distributed in several Landsat 8, Sentinel 2 and GF-1 images. The high-resolution remote sensing monitoring method is adopted to analyze the spatial information characteristics of the geometric form of public buildings in smart cities, and a global multi-scale feature detection model of the spatial information of the geometric form of public buildings in smart cities is established. Combined with the dynamic feature distribution of remote sensing GIS of the original images, a long-distance global information capture method is adopted [17–19]. The GIS information base is established. Through the feature extraction of high-resolution GIS remote sensing images, the images are segmented in the shallow features and fine-grained deep features of the geometric space of public buildings in smart cities [20, 21]. Based om $= n$ feature

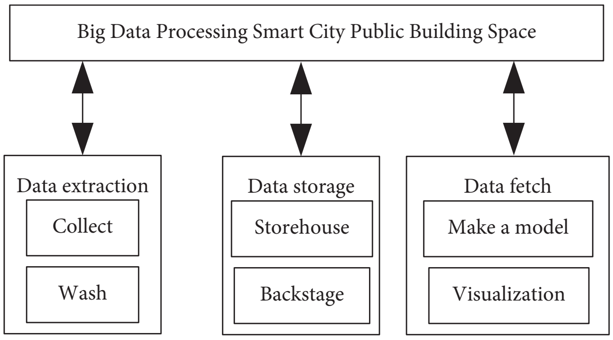


Figure 1: Big data processing smart city public building space.

extraction and fusion, the multi-dimensional scale analysis models with different spectral lengths are established. The weighted sum of features of all positions is used to evaluate the spatial information of public buildings in smart cities by map information theory in different functional blocks. In the basic geographic information database, the full-automatic information loading method is adopted to establish the spatial information distribution rules of public buildings in smart cities under different environments, including the spatial composition of public buildings in smart cities and the spatial composition of public buildings in marine smart cities. Therefore, using the normalized analysis method of spatial composition index of public buildings in smart cities, the difference distribution model of spatial composition parameters of public buildings in smart cities with the change of spatial combination of architectural structure aesthetics is constructed, and the spatial planning and color aesthetic positioning of public buildings in smart cities are carried out by the method of joint characteristic analysis of urban development and spatial layout. The technical realization model is shown in Figure 2.

Based on Figure 2, the spatial index characteristics of intelligent urban public buildings can be divided into the following parts: shadow, greening, energy saving, ground transportation, underground pipe network, and urban blocks. Feature detection is realized through the blue band, green band, red band, near-infrared band, and short wave of GIS technology.

According to the technical road map in Figure 2, this paper analyzes the spatial information changes of public buildings in smart cities under different spatial composition indexes of public buildings in short-wave near-infrared band and dual-band, and establishes a GIS remote sensing information monitoring database of spatial information changes of public buildings in smart cities. Through the analysis of spatial composition parameters of public buildings in smart cities, the spatial composition indexes of public buildings in smart cities are carried out under different ground objects [22].

3.2. Analysis of Spatial Composition Index of Urban Public Buildings' Geometric Form

3.2.1. Theoretical Basis of Computer Vision. Computer vision is to use various imaging systems to replace visual organs as input sensitive means, and computers to replace the brain to complete processing and interpretation. The ultimate research goal of computer vision is to enable computers to observe and understand the world through vision like people, and have the ability to adapt to the environment independently.

Computer vision analyzes the images and then creates a numerical representation of what they "see" using convolutional neural networks (CNNs). CNN is a kind of artificial neural network, which uses convolution layer to filter useful information from input. Convolution operation needs to use input data (feature map) and convolution kernel (filter) to generate converted feature map. The convolution layer filter can be modified according to the learning parameters to extract the most useful information for a specific task. The convolution network can be automatically adjusted according to the task to find the most important features. When performing a general object recognition task, CNN will filter the shape information of the object. However, in the task of identifying birds, CNN will extract the color information of birds. This is because the CNN believes that different types of objects have different shapes, and for different types of birds, their colors may be more different than their shapes.

Segmentation: image segmentation refers to classifying pixels into specific categories, such as cars, roads, or pedestrians. It is widely used in autonomous vehicle applications (including NVIDIA drive ™ Software stack) for displaying roads, cars, and people. You can think of it as a visualization technology that makes it easier for people to understand the work of computers.

Classification: image classification is used to determine the content in the image. For example, after training, neural networks can recognize dogs or cats, or many other things, and have high accuracy.

Detection: through image detection, the computer can locate the position of the object. In many applications, CNN will set a rectangular bounding box around the relevant area to completely include the objects. The detector may also be trained to detect the position of the vehicle or person in the image.

Computer vision is to use various imaging systems to replace visual organs as input sensitive means, and computers to replace the brain to complete processing and interpretation. The ultimate research goal of computer vision is to enable computers to observe and understand the world through vision like human beings, and have the ability to adapt to the environment independently.

To sum up, the main principle of computer vision is to realize the global motion compensation of the background through feature point matching on the basis of collecting the geometric shape spatial sequence images of smart city public buildings.

3.2.2. Analysis of Spatial Composition Index of Building Geometry. By constructing the spatial index analysis model of public buildings in smart cities, and combining with the spatial parameter distribution of public buildings in smart cities, the spatial index characteristics of public buildings in smart cities are analyzed. The data sources are Landsat 8, Sentinel 2, and GF-1, and the sampling objects of surface

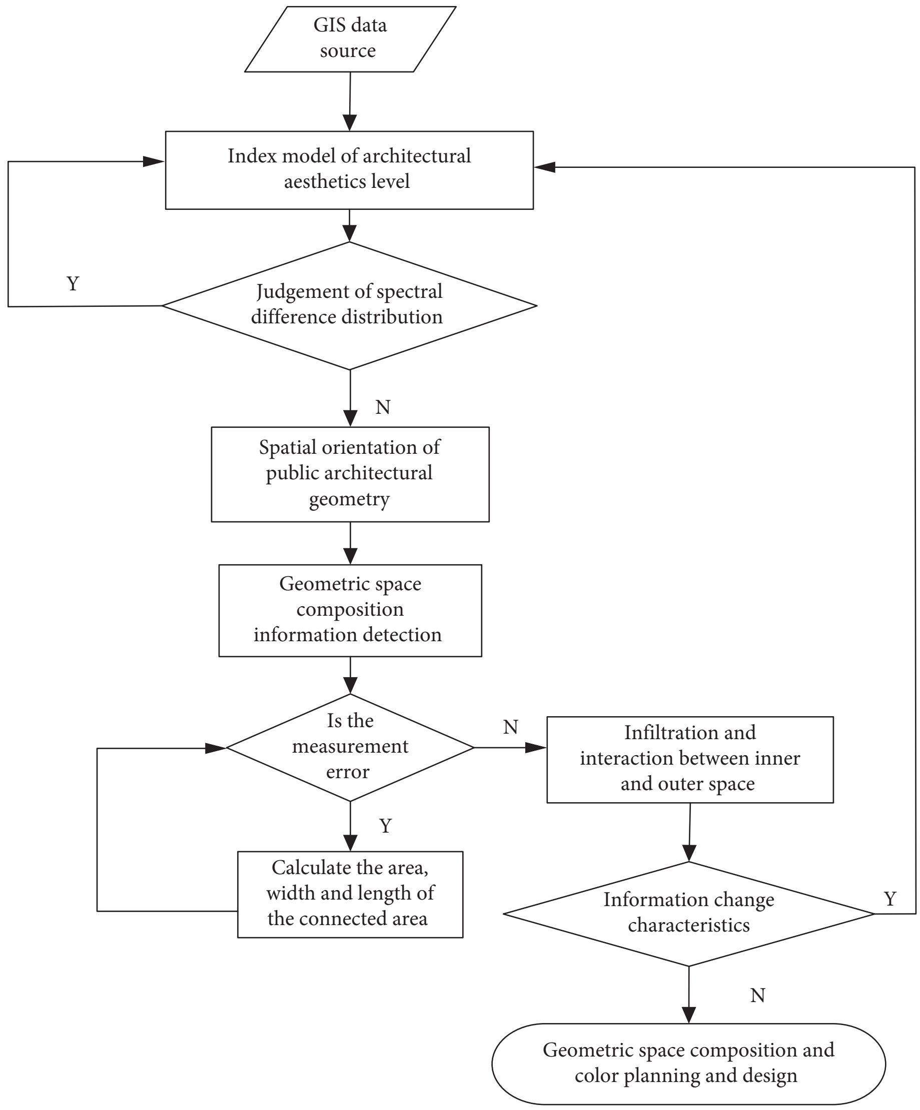


Figure 2: The geometric form and spatial composition of public buildings in smart cities and the technical route of color planning and design.

reflectivity are: spatial structure of public buildings in smart cities, spatial features of public buildings, etc. According to the ratio of different bands and green bands of each land object, set up a six-element inequality group, analyze the information changes of geometric form space composition index of public buildings in smart cities in different data sources, and analyze the similarity between reflection characteristics and geometric form space composition of public buildings in smart cities according to the differences between green bands and near-infrared bands, so as to construct your geometric form space composition index model of public buildings in smart cities, as shown in Figure 3.

On this basis, the feature quantity of the integrated form elements of urban buildings is extracted, and the formula model of spatial composition index of geometric form of public buildings in smart cities is constructed by connecting regional distribution, using the analysis method of spatial and geometric relationship among targets and combining with regression analysis.

$$Y = \begin{bmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \end{bmatrix} \begin{bmatrix} \rho_1 \\ \rho_2 \\ \rho_3 \\ \rho_4 \\ \rho_5 \\ \rho_6 \end{bmatrix}, \quad (1)$$

where Y represents the spatial composition index distribution value of public buildings in smart cities, $x_1, x_2, \ldots, x_6$ represents the spectral coefficients of six bands obtained from the collected GIS remote sensing data, and $\rho_1, \rho_2, \ldots, \rho_6$ represents the reflectivity of different bands in the spatial composition index model parameters of public buildings in smart cities. By normalization, the spatial composition index distribution expression of public buildings in smart cities is divided by the green band, which can be transformed into:

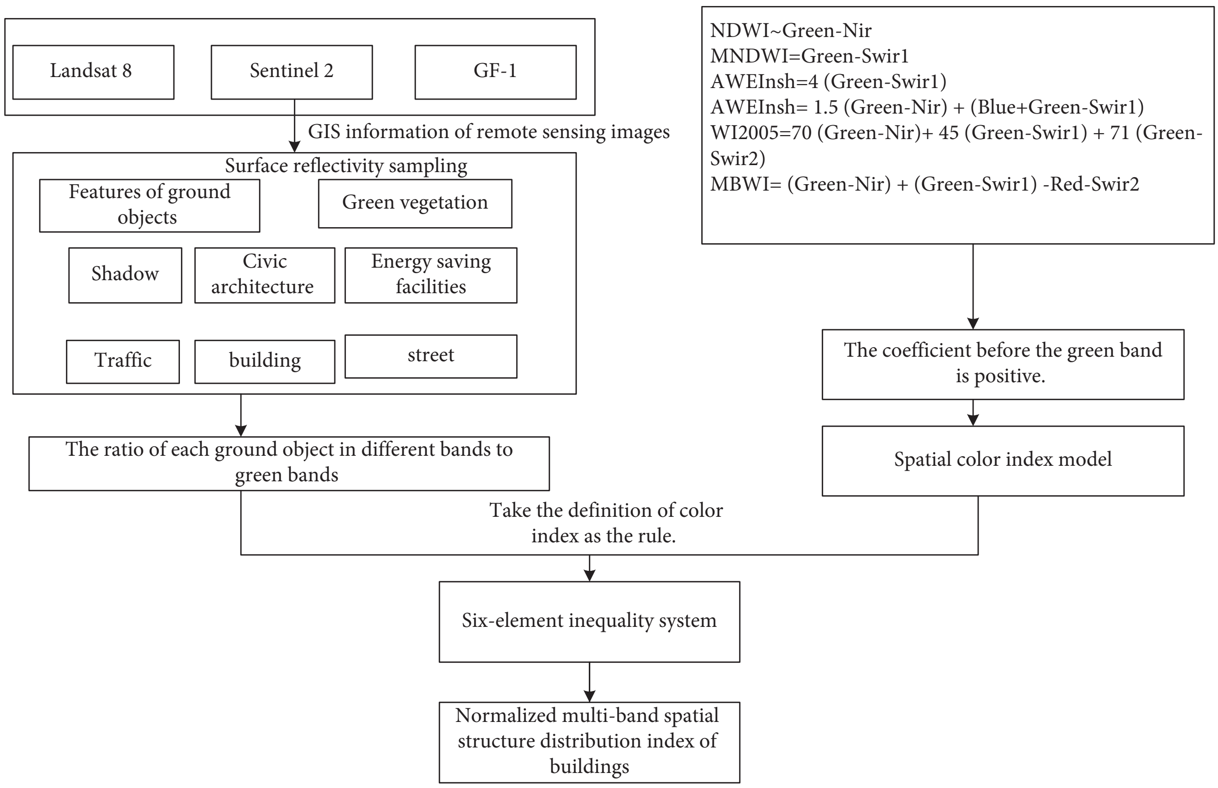


Figure 3: Construction of spatial composition index model of public buildings in smart cities.

$$\begin{aligned}\frac{Y}{\rho_2} &= \begin{bmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \end{bmatrix} \begin{bmatrix} \dfrac{\rho_1}{\rho_1} \\ 1 \\ \dfrac{\rho_3}{\rho_2} \\ \dfrac{\rho_4}{\rho_2} \\ \dfrac{\rho_5}{\rho_2} \\ \dfrac{\rho_6}{\rho_2} \end{bmatrix} \\ &= \begin{bmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 \end{bmatrix} \begin{bmatrix} Q_1 \\ Q_2 \\ Q_3 \\ Q_4 \\ Q_5 \\ Q_6 \end{bmatrix},\end{aligned} \tag{2}$$

where $Q_1, Q_2, \ldots, Q_6$ represent the ratio of blue band to green band, green band itself, red band to green band, near-infrared band to green band, short-wave near-infrared 1 to green band, and short-wave near-infrared 2 to green band, respectively [23, 24]. According to the geometric form spatial composition index of smart city public buildings obtained by formula (2), the spatial change characteristics of geometric form are identified by taking the band ratio as the research object and combining the GIS remote sensing monitoring results.

4. Recognition Algorithm of Spatial Variation Characteristics of Public Buildings in Smart Cities

4.1. Spatial Remote Sensing Image Processing of Public Building Geometry in Smart City. Combined with the local and global gray values of the geometric form space remote sensing images, the difference distribution model of the geometric form space composition parameters of the smart city public buildings with the change of the spatial combination of the architectural structure aesthetics is constructed [25, 26]. By solving the model, the gray difference values of different pixel feature points c_1, c_2 of GIS remote sensing images with spatial combination changes in architectural structure aesthetics are obtained, as shown in the following formula:

$$g(c_1, c_2) = k(c_1, c_2) \otimes f(c_1, c_2) + n, \tag{3}$$

where $\otimes$ is convolution operator, c_1, c_2 are pixel feature point, $k(c_1, c_2)$ is the difference information of original image, $f(c_1, c_2)$ is the spatial distribution information of public building geometry in smart city captured in space or channel, and n is the prior noise of remote sensing GIS.

Based on the gray-scale difference value obtained by formula (3), the analysis process of spatial combination gray-scale value on the aesthetic level of building structure is designed, as shown in Figure 4.

By using the method of pyramid space pool module analysis, the spatial information variation of public buildings in smart cities is processed and detected in blocks. The multi-scale features of the input feature map are as follows:

$$C_{\mathrm{mid}} = \sum_{i=-\infty}^{\infty} \sum_{j=0}^{N_p-1} p\left(t - iT_s\right) + q_0 \exp\left(-\xi\rho\right). \tag{4}$$

In the formula, T_s is the distribution coefficient of geometric features detected by remote sensing, q_0 is edge similarity, ξ is weak correlation coefficient of spatial information of geometric features of public buildings in smart cities, ρ is image features in images, t is detection interval, i is edge noise reduction component, and N_p is detection error of public buildings in smart cities. Combined with the regional feature detection method, the fusion processing of GIS remote sensing images of spatial combination change in architectural structure aesthetics level is carried out. By using the method of connected region index, all connected regions are traversed, and the statistical feature quantity is expressed as follows:

$$x(t) = \sum_{m=1}^{M} \sum_{k=1}^{K(m)} w_{nk} s\left(t - T_m - \tau_{mk}\right) + v(t). \tag{5}$$

In the above formula, w_{mk} is the characteristic component of extracting the information of the geometric form space of public buildings in smart cities, T_m is the reflectivity of near-infrared band, τ_{mk} is the geometric form space composition index of public buildings in smart cities, $v(t)$ is the gray scale of images, and $K(m)$ is the number of edge measurement points. Therefore, through the fuzzy infiltration of the space interface and the interactive changing parameters of the inner and outer spaces, the geometric space composition and color positioning of public buildings in smart cities can be detected [27, 28].

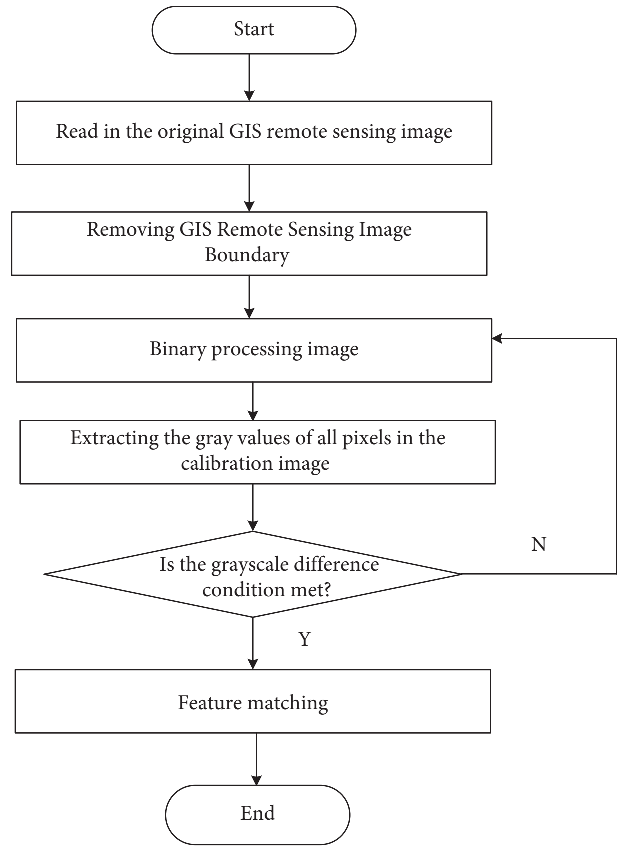


Figure 4: Analysis process of gray value of spatial combination in architectural structure aesthetics.

4.2. GIS Remote Sensing Feature Extraction of Spatial Information Changes of Public Buildings in Smart Cities. GIS can be divided into the following five parts: personnel is the most important part of GIS. Developers must define various tasks to be executed in GIS and develop processing programs. Skilled operators can usually overcome the shortcomings of GIS software functions, but the opposite is not true. The best software cannot make up for the negative effect brought by the operators' ignorance of GIS.

Data: accurate and available data can affect the results of query and analysis.

Hardware: the performance of hardware affects the processing speed of software to data, whether it is convenient to use and possible output mode.

The software includes not only GIS software but also various databases, drawing, statistics, image processing, and other programs.

Process: GIS requires clear definition and consistent methods to generate correct and verifiable results.

GIS is a kind of information system. The difference is that it can operate and process geo-referenced data. Geographic reference data describes the location and attributes of spatial elements on the Earth's surface (including the atmosphere and the shallow subsurface space). There are two geographical data components in GIS: spatial data, which is related to the geometric characteristics of spatial elements. Attribute data provides information about spatial elements.

According to the analysis results of spatial composition parameters of public buildings in smart cities, the spatial combination big data GIS information base of architectural structure aesthetics is analyzed in the polysemy morphological elements distribution of composite spaces. The output model of regularization parameters of GIS model base of spatial information changes of public buildings in smart cities is as follows:

$$\begin{aligned} I_{GIS} &= I\left(C^N; D^N | s^N\right) \\ &= \sum_{i=1}^{N}\left(h\left(D_i|s_i\right) - h\left(D_i|C_i, s_i\right)\right) = \sum_{i=1}^{N}\left(h\left(g_i C_i + V_i\right) - h\left(V_i\right)\right), \end{aligned} \tag{6}$$

Table 1: Remote sensing GIS data source information table (wavelength unit: nm).

Wave band	Landsat 8	Sentinel 2	GF-1
Blue band	0.149	0.236	0.7429
Green band	0.745	0.159	0.9226
Red band	0.393	0.593	0.7462
Near-infrared band	0.698	0.867	0.1791
Short wave	0.158	0.217	0.0484
Near-infrared 1 band	0.322	0.409	0.8456
Short-wave infrared band 2	0.733	0.090	0.7757

Table 2: Spectral distribution ratio of spatial information of public buildings in smart cities.

Ground feature structure of urban public building space	Q1	Q2	Q3	Q4	Q5	Q6
Spatial composition of geometric form of urban public buildings	0.306	0.284	0.693	0.723	0.306	0.284
Color composition of urban public buildings	2.638	0.792	0.301	0.409	2.638	0.792
Shadow	4.245	0.364	0.252	0.506	4.245	0.364
Afforestation	0.427	0.461	0.351	0.382	0.427	0.461
Energy conservation	5.761	0.912	0.138	0.985	5.761	0.912
Ground traffic	2.684	0.725	0.217	0.970	2.684	0.725
Network of underground	1.701	0.100	0.796	0.595	1.701	0.100
City block	4.271	0.209	0.728	0.158	4.271	0.209

where C^N is the acquired massive spatiotemporal data of public buildings in smart cities, D^N is the spatial information data of public buildings in smart cities, s^N is the big data distribution of physical space, N is the data stock, g_i is the structural parameter of GIS remote sensing information, and C_i is the shape parameter of three-dimensional objects in public buildings in smart cities. V_i indicates the discrimination between the geometric spatial composition of public buildings in smart cities and some non-smart cities, and $h(V_i)$ indicates the probability density function for the regional parameters of the geometric spatial composition of public buildings in smart cities and some non-smart cities [29, 30].

Therefore, according to the analysis results of the spatial configuration parameters of public buildings in smart cities, the spatial combination big data GIS information base of architectural structure aesthetics is constructed, and the geometric features of public buildings in smart cities in towns and nature are considered, so that the change characteristics of spatial information of geometric features of public buildings in smart cities can be recognized.

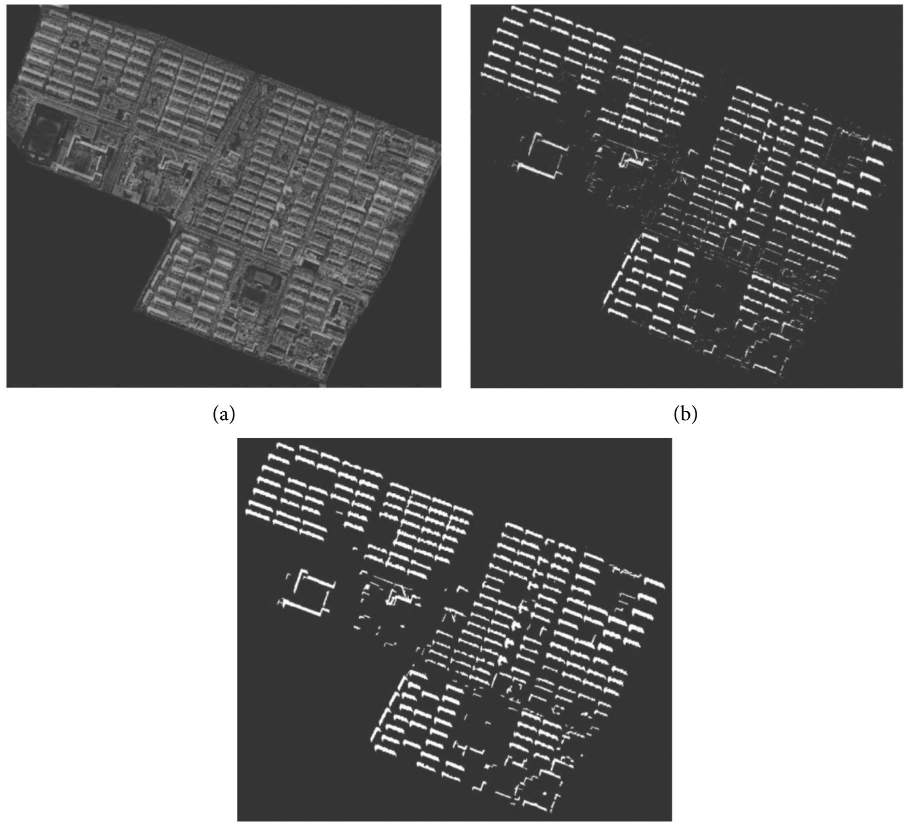
5. Simulation and Test

The vertical spatial organization in public space composite design is to lead the urban space to the high-rise building, meet the space requirements of different functions under intensive layout, and form a good interaction between internal and external spaces. In essence, it is the expression of urban space changing from two-dimensional to three-dimensional layout. Vertical spatial organization has the following ways: multi-directional stacking, staggered stacking, vertical penetration, spatial embedding, and vertical stacking. Therefore, this paper proposes a smart city public building space design based on big data. Based on the above theoretical research, the following tests are designed to verify the proposed method.

Figure 5: Remote sensing image map.

5.1. Experimental Preparation. The experiment takes a city public building as the research object. Based on the Landsat 8 remote sensing image and sentinel 2 remote sensing image of the building, 100 sample points are selected on each ground feature.

On the basis of Table 1, the geometric spatial planning and color aesthetic positioning of smart city public buildings are carried out by the method of joint feature analysis of urban development and spatial layout, and the characteristic quantity of urban building integration morphological elements is extracted by the method of spatial composite aesthetic feature analysis of urban building structures. By calculating the fuzzy infiltration of spatial interface and the interactive change parameters of internal and external spaces, the spectral distribution ratio of geometric spatial information of smart city public buildings is obtained as shown in Table 2.



(a) (b) (c)

Figure 6: Extraction results of geometric form and spatial composition characteristics of public buildings in smart cities. (a) Primitive character. (b) Vector range. (c) Edge feature extraction.

5.2. Test Results and Analysis. On the basis of the above parameter design and calculation, according to the calculation method of spatial composition index of public buildings in smart cities designed in this paper, the detected spatial GIS remote sensing image of public buildings in smart cities is obtained by using the method of GIS remote sensing detection, as shown in Figure 5.

There is interference in the remote sensing image in Figure 5. The method in this paper is used to extract the variation characteristics of the spatial information of the geometric form of public buildings in smart cities, and the extracted spatial composition and distribution characteristics of the geometric form of public buildings in smart cities are shown in Figure 6.

According to the analysis of Figure 6, this method can effectively suppress the cloud interference, set the cloud pixels as the background values, and accurately realize the feature recognition of the spatial information changes of public buildings in smart cities. The detection of spatial composition index of public buildings in smart cities is more robust. Finally, the spatial composition and color planning results of public buildings in smart cities are shown in Figure 7.

By analyzing Figure 7, it is known that the method in this paper has a good performance in detecting the changes of spatial information and identifying features of public buildings in smart cities, and has a good environmental adaptability.

Figure 7: Geometry spatial composition and color planning of public buildings in smart cities.

Comprehensive analysis shows that the method in this paper has strong anti-interference ability, and can accurately identify the geometric shape and spatial change characteristics of public buildings in smart cities. At the same time, this method has good environmental adaptability, and can accurately detect the geometric spatial information and features. Therefore, after the method in this paper is applied to the space design of smart city public buildings, it can realize high-precision spatial combination big data extraction at the aesthetic level of building structure in a large area, and improve the spatial composition and color planning ability.

6. Conclusions

With the rapid development of urban compactness, urban public space is constantly being squeezed out, and the street interface has evolved from the original small-scale street-facing buildings with affinity to closed, cold, and large-scale residential areas and public buildings. The planned urban public spaces, such as parks and squares, are few in number, extensive in design and single in function, which makes it difficult to meet the diversified needs of urban residents' communication and leisure, commercial and cultural activities, etc. In this case, the public spaces inside and around the buildings gradually assume the role of urban public spaces, providing people with communication and activity venues. From the perspective of architectural space, the more complex and contradictory the needs to be met by the building, the more diverse and complex its spatial forms and combinations will be. Therefore, it has become an urgent problem to be solved how to break the singleness of the interior of the building through the composite design of the public space of the building, make it present more diverse spatial patterns and introduce behaviors suitable for contemporary society, and open up the public space inside and outside the building, so that it can be more introduced into urban functions.

This paper combines big data analysis technology and remote sensing image recognition technology to analyze the remote sensing parameters under the spatial feature distribution of public buildings in smart cities. Combined with the method of image feature analysis, the geometric form space composition and color planning and design of smart city public buildings are carried out. Based on the GIS remote sensing image analysis of the spatial combination change at the aesthetic level of the building structure, the big data extraction of the spatial combination at the aesthetic level of the building structure is realized. The experimental analysis shows that this method has high environmental adaptability and robustness to the spatial combination big data extraction of architectural structure aesthetics, and can realize high-precision spatial combination big data extraction of architectural structure aesthetics in a large area.

Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding this work.

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Research Article

Feasibility Analysis and Countermeasures of Psychological Health Training Methods for Volleyball Players Based on Artificial Intelligence Technology

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In the process of volleyball players' mental health training, there exists the problem of low parameter accuracy. In order to further improve the accuracy of mental health training methods, based on artificial intelligence calculation, the neural network and long and short-term memory network were used to analyze the model. Estimation algorithm was used to describe the data, and finally, the optimization model was obtained to describe the feasibility study of mental health. In addition, the relevant data were used to verify and analyze the model. The research shows that in the time update curve, with the increase of the model state, the corresponding curve on the whole first presents a fluctuating trend of different degrees. The increase of model state will make the corresponding time value gradually tend to flat. The fluctuation of the corresponding time index is obvious. Indicators corresponding to the status update curve show an obvious linear change trend with the increase in time, and the overall linear characteristics are obvious. This shows that when time is constant, the relationship between the corresponding parameter and the state value conforms to the linear law. The corresponding state index gradually increases and eventually tends to be stable. Through the analysis, it can be seen that the proportion of different indicators under the effect of artificial intelligence and the calculation results are different. The parameters show an obvious linear variation trend, indicating that the corresponding model parameters can well reflect the data changes. Finally, the accuracy of the model is verified by the method of experimental comparison. The relevant research results can provide a new model and a method for volleyball players' mental health training.

1. Introduction

Artificial intelligence technology plays different roles in different fields: digital device technology [1], College English education [2], medical surgery [3], and industrial manufacturing [4]. In the field of industrial design, conversion system plays an important role. Conversion system can improve the speed and efficiency of industrial design through calculation and analysis. However, the existing industrial conversion system has the problem of high energy consumption, which will further restrict the development of industrial conversion. In order to further improve the efficiency and speed of industrial conversion, artificial intelligence calculation was used to estimate the original conversion system. Neural network and long and short-term memory models were used to improve the calculation accuracy of data [5], so as to obtain the optimized model data. And a new computing model was used to further optimize the data, so as to obtain an accurate, high school, clean conversion system. Finally, data was used to verify the accuracy of the model. With the development of science and technology, intelligent English teaching has made continuous progress, but there were still some problems such as chaos in teaching class. Based on the theory of artificial intelligence, neural network algorithm was used to extract the classroom indicators, and an optimized intelligent classroom computing model was obtained through analysis [6]. Through this model, the classroom can be dynamically adjusted, thus greatly improving the efficiency of English teaching. Finally, relevant cases can be used to verify the accuracy of the model and predict the intelligent teaching of some classes.

The above studies were mainly aimed at classroom education and industrial design and other fields. There were relatively few researches on psychological health training methods for volleyball players. And volleyball players' mental health education and training for improving athletes' sports skills was very important. Based on artificial intelligence technology, this study adopts neural network, long and short-term memory model, and Kalman filter algorithm to analyze the original data. Besides, the estimation calculation method was used to further extract the data, so as to obtain the feasibility model describing the mental health training method. The model can analyze the data under different indexes and find out the optimal calculation results. Finally, the optimization model was verified by comparing the data with the model. This research can provide support for the application and analysis of artificial intelligence technology in other fields, and provide a reference for the training methods of volleyball players.

2. Estimation Algorithm of Artificial Intelligence Model

As a sub-discipline of computer science, artificial intelligence is the study of computational models of intelligent behavior and the development of computational systems with thinking activities such as perception, reasoning, learning, association, and decision making [7, 8]. Artificial intelligence solves complex problems that require human intelligence. In short, artificial intelligence is represented and performed by computers. In recent years, the research field of artificial intelligence is expanding, including automatic planning, expert system, production system, and so on [9, 10]. The advantages of artificial intelligence technology mainly include the following aspects: (1) Advanced infrastructure: Artificial intelligence technology, especially machine learning and deep learning applications, can perform best on servers with multiple high-speed graphics processing units running in parallel. (2) Low cost: Artificial intelligence technology not only eliminates the need to pay for expensive hardware but also allows organizations to pay only for the hardware they use. (3) Scalability: As with other types of cloud services, artificial intelligence technology makes it very easy to scale.

Theories related to artificial intelligence technology are widely used in volleyball and other fields. In order to further analyze the calculation process of artificial intelligence technology, the calculation flow chart of artificial intelligence technology is drawn as shown in Figure 1. It can be seen from the figure that volleyball-related data should be imported into the flow chart first, and then initialization quantum population algorithm is adopted to analyze initialization parameters. Then, the corresponding parameter algorithm will be set, and the parameters will be further iterated through the parameter algorithm, and further analysis will be carried out through the quantum observation operation, quantum evolution operation, and quantum evaluation operation. So that the corresponding optimization parameters can meet the requirements of the model. In order to judge whether the parameters meet the requirements of the model, it is necessary to judge the termination conditions. If it meets the requirements, the feasibility calculation results of the optimal technical parameters shall be output; if it does not meet the requirements, it shall be imported into the quantum update operation module. Through the iterative operation of quantum update, the corresponding data is imported into the quantum observation operation data for iterative analysis until the requirements are met.

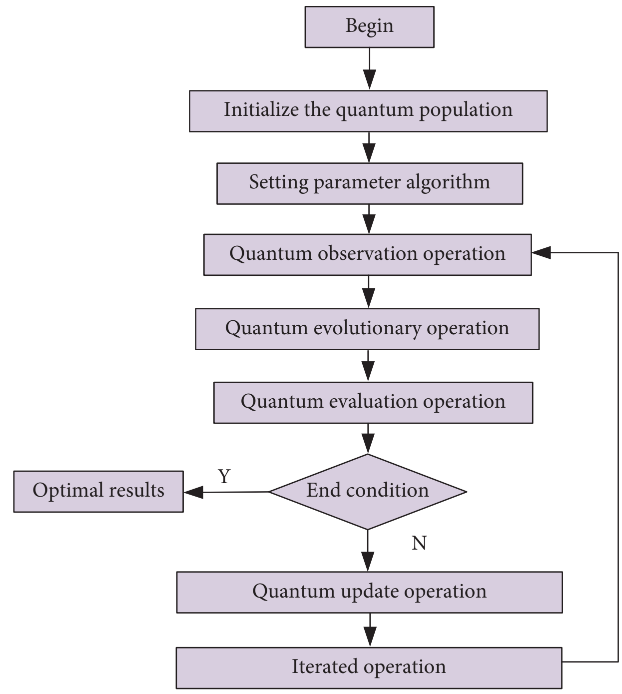

Figure 1: Flow chart of artificial intelligence algorithm.

2.1. Kalman Filtering Algorithm. Artificial intelligence technology can be divided into three main computing methods [11, 12]: Kalman filter algorithm, neural network algorithm, and long and short-term memory algorithm according to the different research content [13, 14]. Kalman filter is a linear system state equation, through the system input and output observation data, the optimal estimation of system state algorithm.

The classical Kalman filter algorithm is mainly aimed at linear system, while the classical Kalman filter algorithm cannot be used directly for the non-linear system of volleyball players' mental health training, so the extended Kalman filter algorithm needs to be used [15, 16]. Based on classical Kalman filter, the extended Kalman filter transforms the non-linear state space equation of the system into a linear state space equation by using first-order Taylor expansion. The standard Kalman filter equation is mainly composed of time update module and state update module, and its specific equation is shown as follows:.

(1) Time update. The time quantity corresponding to the time state is a random quantity, so it is impossible to measure the exact value, but it can be estimated

according to some statistical point of view according to a series of observations. An optimal estimate approximates the true value as accurately as possible. The time state quantity can be analyzed by using optimal estimation. The corresponding time update algorithm formula is as follows:

$$X_k = A_{k-1} \times X_{k-1} + B_{k-1} \times U_{k-1}, \quad (1)$$

$$P_k = A_{k-1} \times p_{k-1} + A_{k-1}^T \times Q_{k-1}. \quad (2)$$

In order to further study the influence of different parameters in the Kalman filter algorithm in artificial intelligence on the calculation results, the corresponding time update formula is obtained through calculation. The time update formula can be used to analyze different model parameters, and it can be seen from the analysis that different formulas can better reflect the change degree of time update. In order to quantitatively describe such updating degree, time updating curves under the action of four different parameters are drawn through analysis, as shown in Figure 2. It can be seen from Figure 2 that four different curves have different manifestations under different calculation states: As can be seen from the curve corresponding to parameter A, with the gradual increase of the state, the corresponding time quantity shows A trend of slow increase first, then gradual decline and then fluctuation. When its iteration state exceeds 225, the curve gradually tends to be flat. It can be seen from the curve corresponding to parameter X that it also shows a trend of increasing first and then decreasing, but its fluctuation range is relatively large. The curve still shows a gradual change trend. As can be seen from the curve corresponding to parameter B, with the gradual increase of iteration state, the corresponding time value gradually decreases. The downward slope of the curve is approximately constant, and then when the iteration state exceeds about 150, the curve gradually tends to be flat. According to the change of the curve corresponding to parameter U, it can be seen that with the gradual increase of iteration state, the corresponding curve drops slowly at first, and then gradually tends to flat when the curve reaches the highest point. According to the curves corresponding to the four different states, it can be seen that the curve corresponding to parameter A has the greatest change, while the change of curve U is relatively small, while the change of curve A and curve B is basically the same. Finally, the corresponding time state curve is obtained. From the change of time state curve, it can be seen that its change range can better reflect the change trend of different parameters. First, the curve gradually increases rapidly and then decreases slowly. Finally, it gradually tends to a gentle overall change trend. It

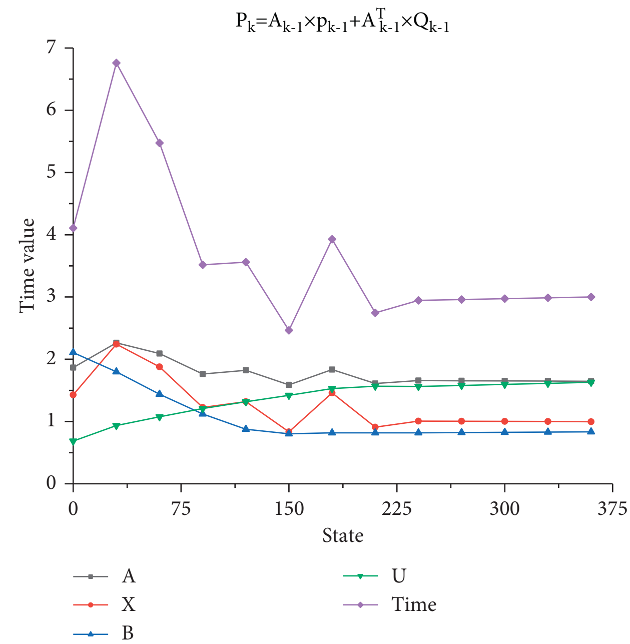

Figure 2: Time update curve.

should be noted that the four parameters can update the corresponding data changes in a better response time.

(2) Status update: state estimation is an important part of the Kalman filter. Generally speaking, it is an estimation problem to make quantitative inference of random quantity according to the observation data, especially for the state estimation of dynamic behavior, which can realize the estimation and prediction function of a real-time running state. The corresponding algorithm formula is as follows:

$$\begin{cases} K_k = P_{k-1} \times H_{k-1}^T \times \left[H_{k-1} \times P_{k-2} \times H_{k-1}^T + R_{k-1}\right]^{-1}, \\ X_k = X_{k-1} \times K_{k-1} \times \left[Z_{k-1} - H_{k-1} \times X_{k-1}\right], \\ P_k = \left[I - H_{k-1} \times K_{k-1}\right] \times P_{k-1}. \end{cases} \quad (3)$$

Through the above analysis, it can be seen that the time change curve in different states has different trends, and the analysis shows that the time update can also have a certain influence on the state. Therefore, in order to better analyze the change rule of state update, several different state change curves are drawn, as shown in Figure 3. It can be seen from Figure 3 that the curves under the action of four different parameters have different variation trends. According to the change curve corresponding to parameter K, it can be seen that the curve drops rapidly at first, then gradually decreases to the lowest point and tends to be constant. In the previous stage, the curve presents an obvious linear downward trend. According to the curve corresponding to parameter H, it can be seen that the curve has an obvious linear increasing trend, and the overall trend is gradually increasing. This indicates that the parameter has a good linear correlation with the

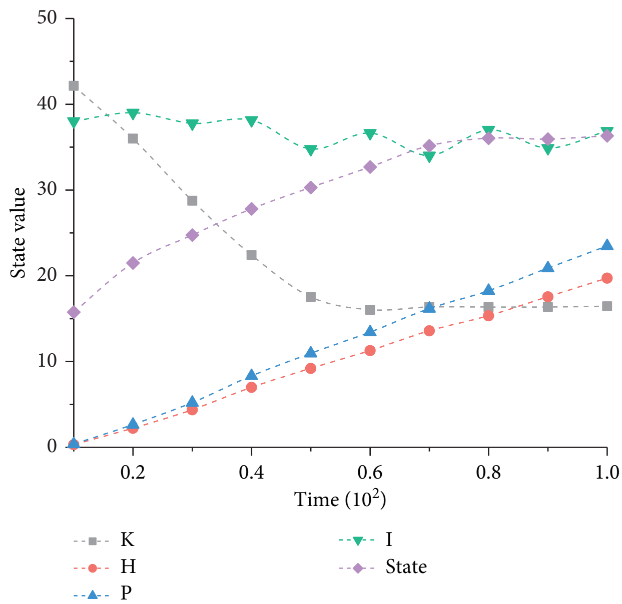

Figure 3: Status update curve.

status data. The curve corresponding to parameter P also has a good linear correlation, and its corresponding slope is higher than the curve corresponding to parameter H. It can be seen from the curve corresponding to parameter I that with the gradual increase of time, the corresponding curve shows obvious fluctuation phenomenon, but the fluctuation range is relatively small, and the overall approximately constant at about 38. Through the above calculation and analysis, the corresponding state value is finally obtained. With the gradual increase of time, the corresponding state curve increases slowly at first and then gradually tends to be stable, with a relatively large range of change, which can better reflect the change rule of time.

2.2. Neural Network Algorithm. Artificial neural network, or short-form neural network, is a mathematical model that simulates the structural operation characteristics of animal neural network [17, 18]. Neural network algorithm is an adaptive non-linear dynamic system composed of a large number of simple basic components. The structure and function of each neuron are relatively simple, but the system behavior produced by the combination of a large number of neurons is very complex. It can process information by adjusting the weight ratio and threshold value connected between a large number of internal nodes. More and more researchers have applied their outstanding performance abilities such as strong non-linear fitting ability and good generalization to the feasibility estimation of mental health training [19, 20].

In order to further analyze the calculation process of neural network algorithm and better study, the calculation of artificial intelligence technology, the neural network calculation process and corresponding learning method are obtained through analysis and summary, as shown in Figure 4. It can be seen from the computation flow of neural network that the model has an obvious input layer, hidden layer, and output layer, which belongs to the characteristic of neural network computation. Firstly, the corresponding data will be imported to the input layer, and the redundant data will be eliminated through the input layer, and the corresponding data will be imported to the hidden layer, and the optimized data will be obtained through the calculation of the hidden layer. Then, the optimized data can be imported into the output layer for further output calculation, and the corresponding optimized data can be imported into the model for further analysis through the corresponding learning method, so as to output the data. It can be seen from the corresponding learning method that the input data is first input into the neural network for calculation, and then imported into the comparison module for comparison with the original target value. Through comparison, it can be seen that if the data meets the requirements, the data will be output; if not, the corresponding weights will be adjusted, and then it will be imported into the neural network again for iterative calculation until the requirements are met.

Neural network is one of the most widely used neural networks at present [21, 22]. It is a network structure model of forward solution and backpropagation. The typical neural network consists of input layer, hidden layer, and output layer. The network is composed of multiple neurons as a unit. The relationship between each parameter is shown in the following formula:

$$O = f \times \left[\sum_{i}^{n} W_{ij} x_i - T_j \right], \qquad (4)$$

where x_i is the input of the neuron, w_{ij} is the input weight of the neuron, T_j is the threshold, f represents an activation function, and O represents the output of the neuron.

The parameters under the action of neural network have a certain change relationship, and the analysis shows that the change relationship is typical non-linear change. Therefore, the change rule of different parameters can be analyzed, so as to better grasp the change rule of neural network. According to the different properties of parameters, parameters can be divided into three main parts: weight, function, and threshold. Therefore, the variation relationship among the corresponding three parameters is obtained through calculation, and the corresponding curve is shown in Figure 5. It can be seen from the weight curve that with the gradual increase of the input value, the corresponding output value increases slowly at first and then presents a linear downward trend. When the data corresponding to the curve drops to the lowest point, the curve gradually increases with the further increase of the value, and then presents a relatively gentle change. The overall non-linear characteristics are relatively obvious. It can be seen from the corresponding function curve that the initial value still shows an increasing trend. With the further increase of input data, the curve drops rapidly to the lowest point and then gradually tends to be gentle. Although the curve still fluctuates to a certain extent in the process of increasing input data, the overall variation range of output value is relatively small. As can be seen from the corresponding threshold curve, with the increase of the corresponding input value, the curve drops

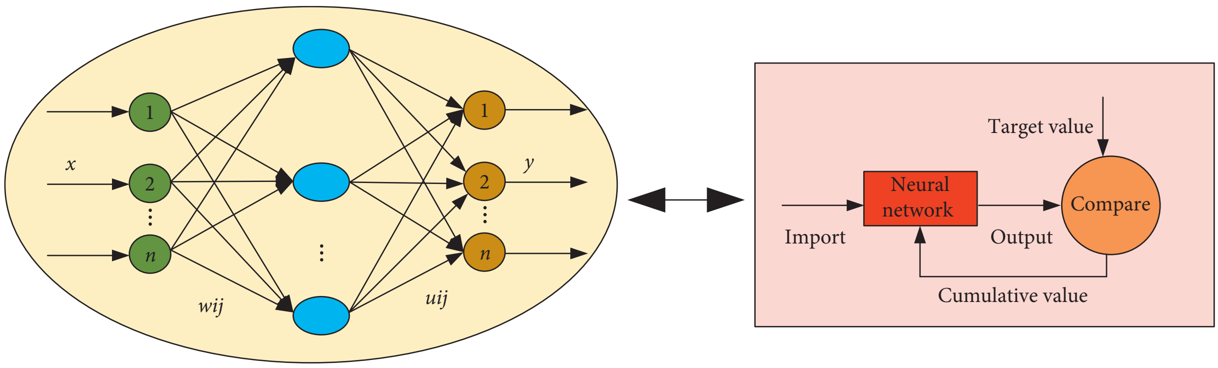

Figure 4: Neural network calculation process and learning method.

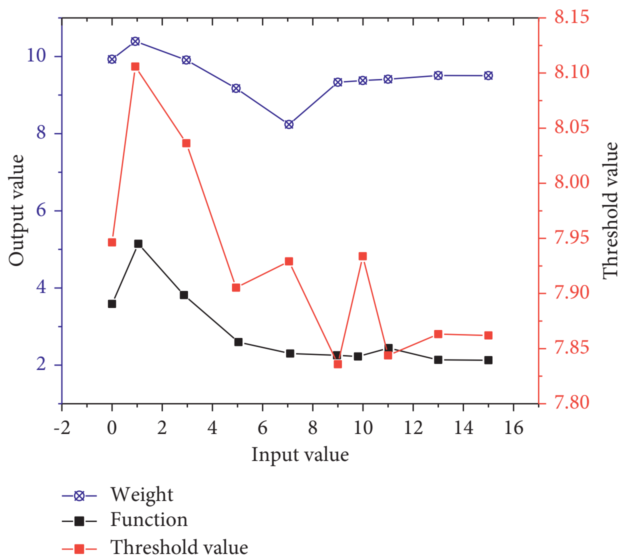

Figure 5: Parametric curve.

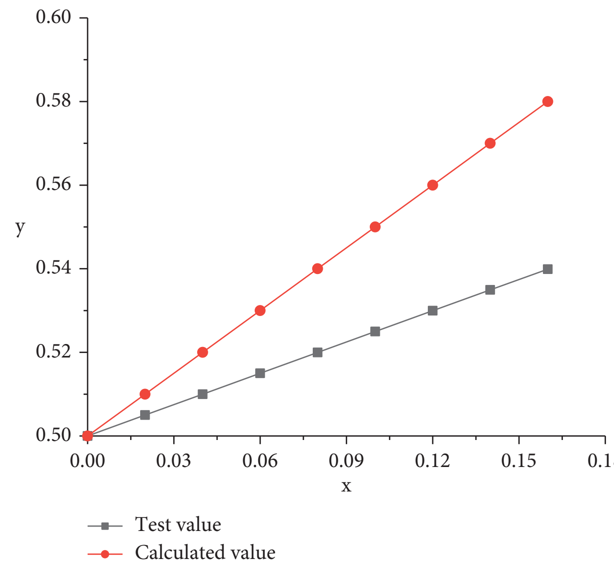

Figure 6: Activation function.

rapidly at first, and then shows a trend of rapid decline. The overall volatility is relatively obvious and the range of variation is relatively large, so its influence on the model is the greatest.

It can be seen from the analysis that the activation function of neurons has a great influence on the calculation and change of input and output characteristics of neurons. According to different needs, there are many types of activation functions, including threshold function, non-linear function, piecewise linear function, and probability function. The classic activation function is the Sigmoid function, whose output expression is:

$$f(x) = \text{sigmoid}(x) = \frac{1}{1 + e^{-x}}. \quad (5)$$

It can be seen from the above formula that different types of activation functions have different manifestations. By changing the x value of the activation function, the corresponding experimental value and the y change data of the calculated value were obtained, and then the corresponding activation number change was obtained, as shown in Figure 6. It can be seen from Figure 6 that curves under the action of test values have obvious linear characteristics. In the process of gradual increase of independent variable x, the y value corresponding to the curve also shows a trend of rapid increase, and the corresponding y value is relatively small when it increases to the highest point. From the change curve of the calculated value of the activation function, it can be seen that with the gradual increase of the independent variable x, the corresponding y also shows an obvious linear change trend. When it reaches the highest point, the corresponding y is relatively large. Through the changes in the two curves, it can be seen that the slope of the calculated value of the activation function is greater than that of the corresponding experimental value. Therefore, when selecting the specific function value, the corresponding analysis of the test data should be carried out, so that the corresponding results can meet the calculation needs of the test value. At the same time, the activation function corresponding to the test value can be optimized and analyzed to reduce its corresponding change value, so as to better conform to the change rule of the test value.

2.3. Long and Short-Term Memory Networks and Evaluation. Long and short-term memory network can solve the problem of memory forgetting over long distances [23, 24].

The main difference lies in that the processing of information in neural network becomes more precise. The long and short-term memory network has three gates to protect and control the cellular state, including the forgetting gate, input gate, and output gate [25, 26]. Long and short-term memory network has similar control flow to the basic recursive neural network, but the control logic inside the basic unit of long and short-term memory network is slightly more complex. The core component of the long-term memory network is the basic unit, which contains several control structures to process data in a sequence. The gating structure of long and short-term memory network solves the short-term dependence problem effectively. Long and short-term memory network model is good at modeling the whole time continuous sequence and capturing the long-distance dependence information. Long and short-term memory network is a temporal recursive neural network that is suitable for processing and predicting important events with relatively long intervals and delays in time series. Long and short-term memory network is a special kind of recurrent neural network which is proposed to solve the error problem in the structure. The output gate filters the information to be output to the next time step and selectively retains and removes some previous data. The corresponding network calculation formula is as follows:

$$O_t = \sigma \times [W_0 \times (h_{t-1}, x_t) + b_0], \tag{6}$$

$$h_t = o_t \times \tanh(C_t), \tag{7}$$

where σ is the number of layers; h is the output network.

In order to better analyze the calculation process of long and short-term memory network, the output results under the action of different layers and corresponding output grids were obtained through analysis and calculation. The corresponding result is shown in Figure 7. As can be seen from the output results, the corresponding input results increase slowly at first with the increase of the number of layers, and when it reaches the local highest point, the curve decreases slowly with the increase of the number of layers. With the further increase in the number of layers, the curve still shows an obvious increasing trend, and its increasing slope is higher than that of the first stage, indicating that the change range of this stage is relatively large. When the number of corresponding layers increases again, the output of the curve shows a slow downward trend, and the overall fluctuation of the curve is obvious. It can be described by the method of non-linear characteristics, and its non-linear characteristics can reflect the complexity and practicability of long and short-term memory network.

In order to better analyze the calculation results of different network calculation methods, different indicators are used to estimate the model [27, 28]. The corresponding evaluation indicators of the estimation model algorithm are as follows:

(1) Mean absolute error: mean absolute error is also called mean absolute deviation, and its formula is as follows:

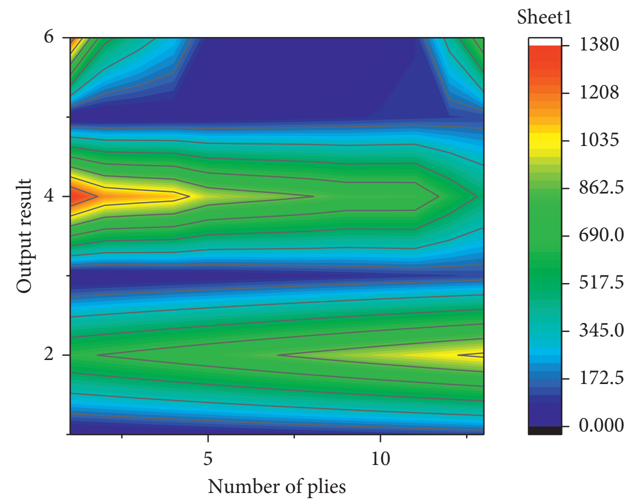

Figure 7: Long and short-term memory network output.

$$\text{MAE} = \frac{1}{n}\sum_{i=1}^{n}\left|x_i - y_i\right|. \tag{8}$$

(2) Mean square error: mean square error is a measure reflecting the difference between the estimated quantity and the estimated quantity, and its formula is as follows:

$$\text{MSE} = \frac{1}{n}\sum_{i=1}^{n}\left(x_i - y_i\right)^2. \tag{9}$$

(3) Root mean square error: root mean square error is consistent with mean square error in substance, and its formula is as follows:

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(x_i - y_i\right)^2}. \tag{10}$$

(4) R squared: R squared is the ratio of the sum of the squares of regression and the sum of the squares of total deviation, and its formula is as follows:

$$R^2 = 1 - \frac{\left(\sum_i \left(x_i - y_i\right)^2/n\right)}{\sum_i \left(x_i - \overline{y}\right)^2/n}, \tag{11}$$

where $\overline{y}$ represents an expectation of the sequence of target values.

It can be seen from the above calculation formula that the results obtained by the evaluation method of the estimation model have different trends. In order to better analyze the change curves corresponding to the four different error evaluation methods, the evaluation curves are obtained by summarizing, analyzing, and calculating, as shown in Figure 8. It can be seen from Figure 8 that the curve of mean absolute error increases slowly at first and then tends to be flat with the gradual increase of samples. With the increase of corresponding sample samples again, the curve gradually tends to be stable. After the

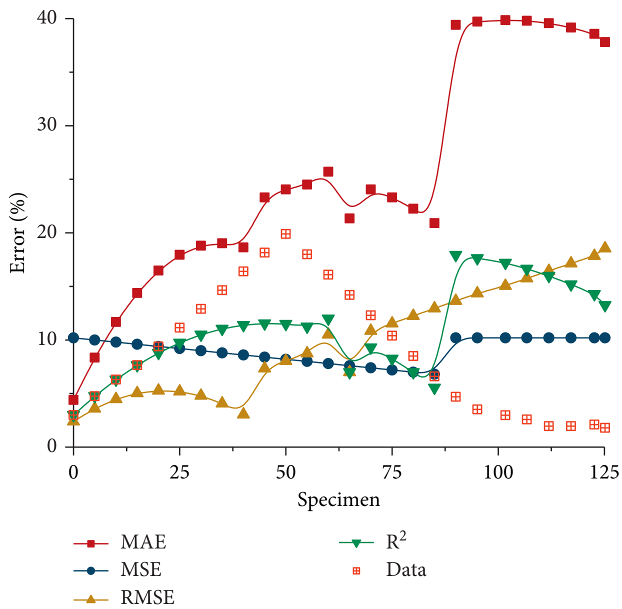

Figure 8: Appraisal curve.

stability, the curve rapidly increases to the maximum value when the corresponding time reaches about 80, and then gradually tends to be stable. It shows that the error corresponding to this index has typical linear and nonlinear characteristics and can well reflect the calculation results of long and short-term memory network. As can be seen from the change curve of mean square error, it presents a typical two-stage linear change characteristic. First of all, with the gradual increase of samples, the corresponding curves decline slowly first, and the corresponding curves decline amounts are basically the same, indicating that their linear characteristics are relatively obvious. When the sample reaches about 85, the curve increases rapidly to a local peak, and then gradually tends to be stable. The reason for the rapid increase of the curve is that the corresponding data has certain volatility in the calculation process. It can be seen from the change curve of root mean square error that it increases slowly at first and then decreases gradually, showing local inverted U-shaped change. With the increase of samples, the curve increases rapidly to the maximum value, which indicates that the curve can well show an obvious linear change relationship with the corresponding error. It can be seen from the r-squared curve that the curve increases slowly first, then decreases slowly, and then increases rapidly to the maximum value. With the gradual increase of samples, the corresponding curve shows the change law of linear decline. Several different error indicators can better reflect the change law of different data. The corresponding data change curve increases linearly to the highest value at first, and slowly decreases to the lowest point with the gradual increase of samples, and finally tends to be stable. In the selection process of several different indicators, the change characteristics of indicators should be considered comprehensively, so as to better reflect the law of data change.

3. Research on Estimation Algorithm Based on Artificial Intelligence Calculation

The estimation methods based on artificial intelligence can be divided into two different types according to different calculation principles: the estimation model of neural network algorithm and the estimation model of long and short-term memory network algorithm [29, 30].

3.1. Estimation Model of Neural Network Algorithm. Neural network can arbitrarily fit the relationship between input and output, and there is no corresponding system error that leads to a large estimation error [31, 32]. The estimation accuracy of neural network in mental health training is relatively high, and its network model size can be balanced and adjusted with the estimation accuracy, so as to control its model size for subsequent deployment and application in embedded systems. Since the input data of the selected neural network are different types of data, inconsistent units of measurement are easy to make the neural network difficult to converge and lead to large errors. For the neural network algorithm itself, the important factor affecting the estimation result is the selection of input and output parameters. For the selection of input layer variables, it is necessary to consider that variables have a certain impact on the model itself. A reasonable selection of input features is conducive to improving the accuracy of model estimation. In addition, it is also necessary to consider the difficulty of measuring input variables. Therefore, it is necessary to normalize the data and fix the input data within a certain range. The commonly used normalization formula is as follows:

$$\overline{x} = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}}, \tag{12}$$

where $\overline{x}$ represents the normalized data; x_i stands for raw data; $x_{\min}$ and $x_{\max}$ represent the maximum and minimum values of the same variable, respectively. The quality of the initial weight of the network will directly affect the length of the network training, and the initial weight is generally set as a random number between −1 and 1, rather than a direct value of 0.

The number of hidden layer nodes also has a great influence on the performance of the whole neural network. In general, multiple networks with different numbers of hidden layer nodes can be tested to test the generalization error of each network and select an optimal network with the corresponding number of hidden layer nodes. If the hidden layer nodes are too low or too high, the accuracy of the model will be affected. Therefore, an appropriate number of hidden layer nodes should be selected to ensure a small generalization error of the whole.

In order to better describe the estimation model under the action of neural network, the conventional method is used to analyze the normalization formula, and the corresponding relationship between the normalized data and the maximum and minimum values can be obtained through the analysis. In order to better explain the change rules of

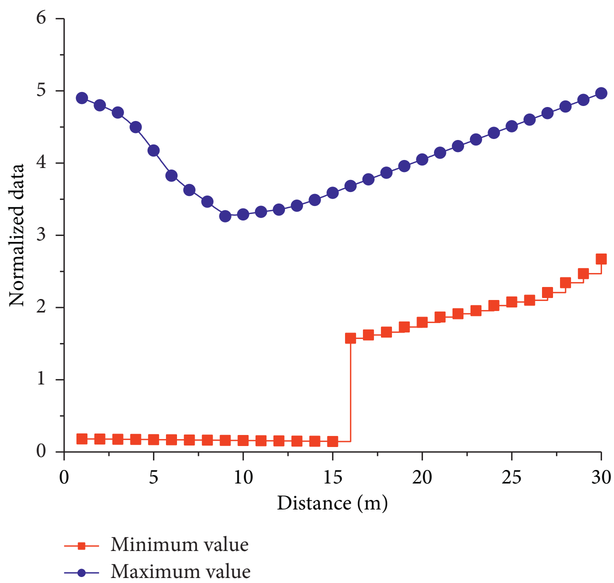

Figure 9: Normalized curve.

maximum and minimum values and normalized data, the corresponding normalized curves are drawn, as shown in Figure 9. As can be seen from the curve, with the gradual increase of distance, the corresponding minimum value is relatively stable. And the corresponding value is relatively small, but with the gradual increase of sample distance, the curve increases rapidly to the local maximum value, and a certain jump phenomenon occurs. With the further increase in sample distance, the curve shows a gradually increasing trend. It can be seen from the change curve of the maximum value that the data first slowly drops to the lowest point, and then gradually increases with the distance. It can be seen from the analysis that the non-linear characteristics of the normalized data corresponding to the maximum value are more obvious than that of the minimum value, which can better reflect the change rule of the planning data.

3.2. Estimation Model Based on Long- and Short-Term Memory Network Algorithm. Compared with neural network algorithm, network model with long and short-term memory ability is more suitable for calculating the feasibility data of volleyball players' mental health training [33, 34]. Therefore, its accuracy is better than that of neural network in the estimation of training methods. There are several common model loss functions to solve regression problems, and the loss functions of the three are shown as follows.

(a) Squared loss function

$$Y = (y - f(x))^2. \tag{13}$$

(b) Absolute value loss function

$$Y = |y - f(x)|. \tag{14}$$

(c) Classification loss function

$$Y = \begin{cases} \frac{1}{2}(y - f(x))^2 & |y - f(x)| \le \delta, \\ \delta|y - f(x)| - \frac{1}{2}\delta^2 & |y - f(x)| > \delta. \end{cases} \tag{15}$$

The estimation model based on Long and short-term memory network can be divided into three types: average loss function, absolute loss function, and classification loss function. In order to better analyze the variation relationship between the three loss methods and corresponding data, the loss function and corresponding curve are obtained, as shown in Figure 10. It can be seen from Figure 10 that the curves corresponding to several different loss functions have typical symmetry characteristics. It can be seen from the test data that with the increase of x, the corresponding loss of the curve first slowly decreases to the lowest point and then gradually increases. The average loss curve absolute loss curve and classified loss curve also showed a relatively obvious trend of decreasing first and then increasing. It can be seen from the absolute value loss function and classification loss function that its linear characteristics are relatively obvious. When x value is constant, the data corresponding to the average loss amount is the largest, while the loss amount corresponding to the absolute loss function and the classified damage function is basically the same.

4. Feasibility Study on Psychological Rehabilitation Training of Volleyball Players Based on Artificial Intelligence Calculation

4.1. Feasibility Analysis of Psychological Health Training Methods for Volleyball Players. Volleyball players' mental health and corresponding training methods are very complex, and corresponding mental health and training methods are very important for volleyball players. A good mental health mood can improve the training level and skills of volleyball players. In order to further analyze the emotional changes of volleyball players in the process of mental health training, five different evaluation indexes are obtained through summary analysis: *A*-Motor skills; *B*-Mental training, *C*-Verbal cues, *D*-Mood regulation, *E*-Health training. These five indicators can reflect the training methods and feasibility analysis of volleyball players' mental health from different aspects. Different indicators can be used for quantitative analysis of the model.

In order to further study the proportion of five different indicators in volleyball players' mental health training, the proportion of volleyball players' mental health under the effect of different indicators was obtained through summary analysis, as shown in Figure 11. According to the proportion analysis in the figure, it can be seen that motor skills account for the smallest proportion, only 5%, while psychological training and mood regulation account for the same proportion, both 25%. Verbal cues accounted for the most, about 35 percent, and health training accounted for about 10 percent.

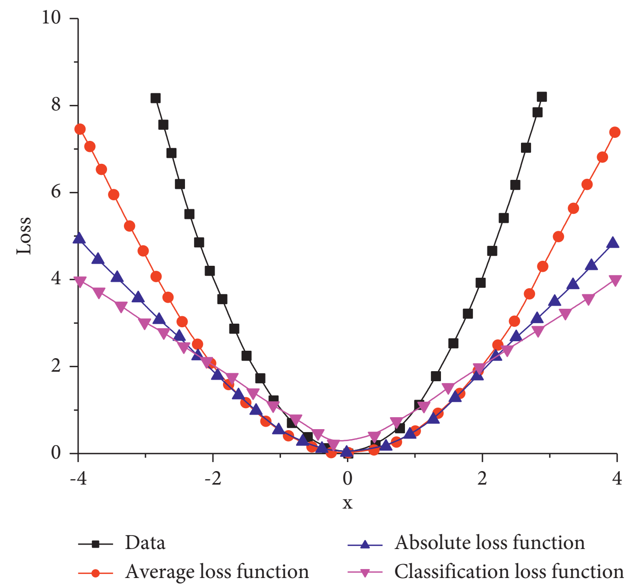

Figure 10: The curve corresponding to the loss function.

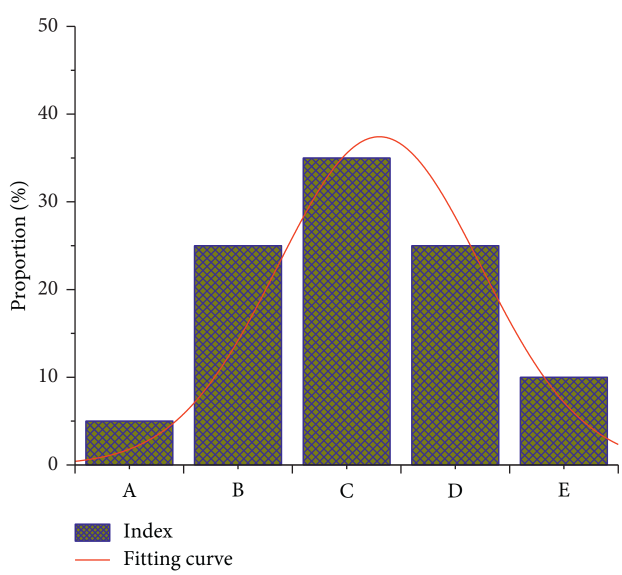

Figure 11: Health training indicators.

4.2. Research on Artificial Intelligence Technology in Volleyball Players' Mental Health Training Methods. By combining the Kalman filter algorithm mentioned above, and by derivation and parameter estimation of neural network algorithm and long and short-term memory network algorithm, the corresponding model of volleyball players' mental health training method under the effect of artificial intelligence can be obtained, and the corresponding estimation test can be carried out [35, 36]. In order to further quantitatively analyze the psychological health training indicators of volleyball players under the effect of artificial intelligence, a mental health training flow chart with artificial intelligence technology was obtained through comparative analysis, as shown in Figure 12. It can be seen from the process in the figure that: first, the model data is imported into the data initialization module, and the corresponding targeted indicators are obtained through the initial analysis of the data. Then the targeted indexes are imported into the data preprocessing module. The data is then imported into the training and verification modules and calculated by building a two-way LSTM network. The calculated data will be introduced into the training plate of the model and judged by the evaluation indicators. If it meets the requirements, it will be imported into the training method for feasibility study. If it does not meet the requirements, it will be imported into the parameter adjustment for parameter optimization, and continue to carry out iterative analysis.

Through the above description, the corresponding calculation process of mental health training method based on artificial intelligence technology can be obtained. Firstly, the Kalman filter algorithm and neural network algorithm in the artificial intelligence model are analyzed, and then the long and short-term memory network is evaluated. Then artificial intelligence calculation is used to estimate and analyze the relevant models, and finally, the corresponding optimization model is obtained. Model data are imported into the optimization model, and corresponding calculation results of mental health training can be obtained through calculation, as shown in Figure 13. As can be seen from the three-dimensional bar chart in the figure, the curve of the first evaluation parameter shows a trend of gradual decline with the gradual increase of the index. The second evaluation parameter shows a trend of gradual increase, and conforms to the rule of linear change, corresponding to a relatively large range of change. With the increase of the third evaluation parameter, the corresponding data still shows a trend of gradual increase, but the range and amplitude of change are relatively small. The data corresponding to the evaluation parameters in Chapter 4 has obvious fluctuation characteristics, while the variation range and range of the fifth evaluation parameter are relatively small.

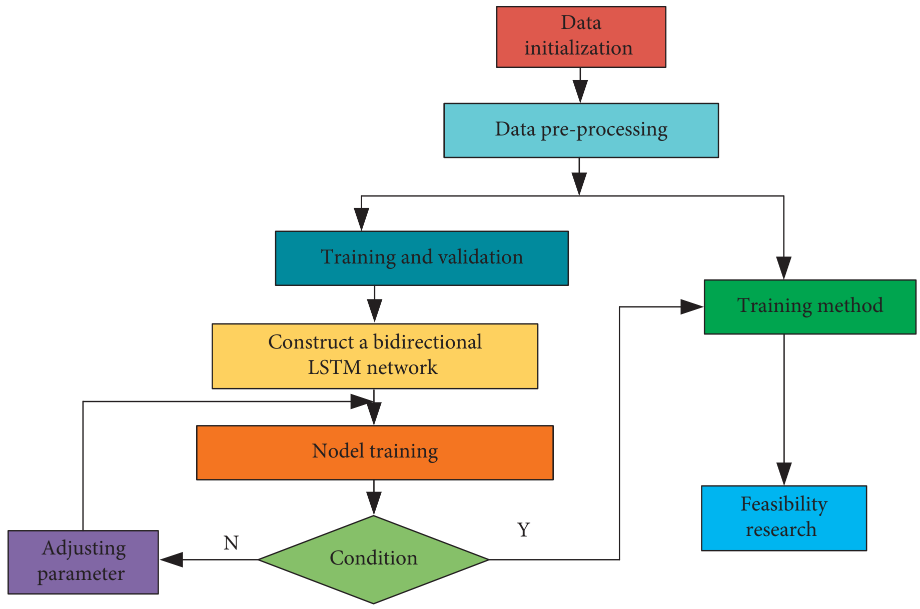

Figure 12: Mental health training flow chart based on artificial intelligence calculation.

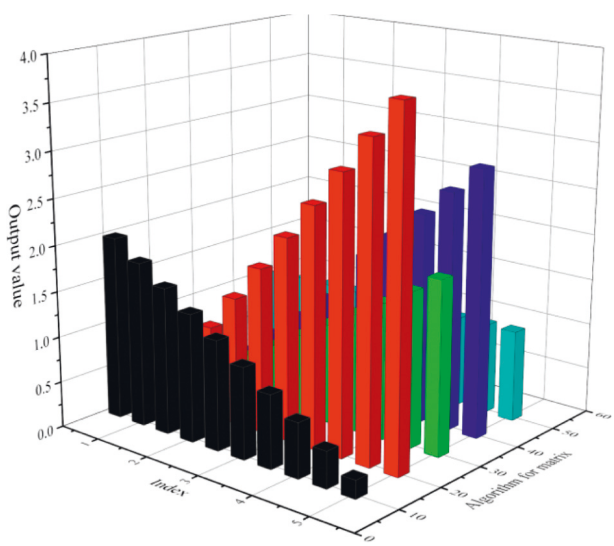

Figure 13: Mental health training results based on artificial intelligence calculation.

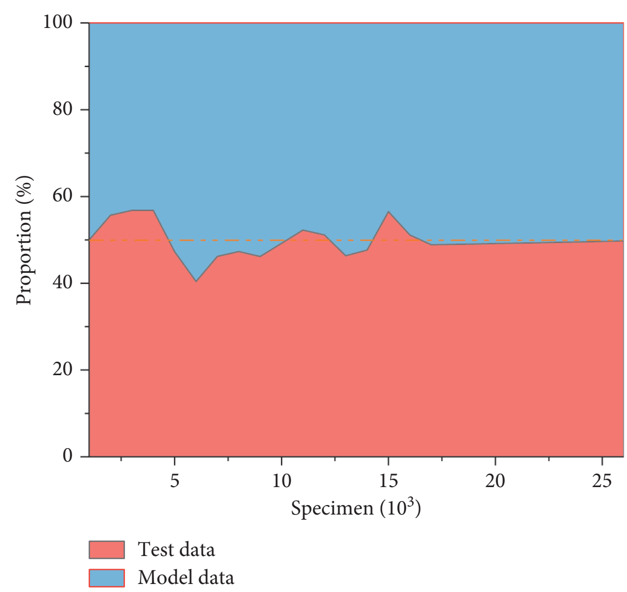

Figure 14: Contrast curve of mental health training.

5. Discussion

The artificial intelligence model is used to estimate the neural network and long and short-term memory network, so as to obtain the corresponding calculation model. The model is used to analyze and evaluate different indicators. In order to further analyze the accuracy of the model, the model is verified by comparing test data with model data. The corresponding comparison curve of mental health training was obtained through calculation and comparison, as shown in Figure 14. According to the proportion of the two kinds of data in the figure, it can be seen that the model data is basically consistent with the experimental data, which indicates that the optimization model can better reflect the accuracy of the corresponding indicators of the actual training method. Volleyball players' mental health training is very important. We can use mental health, mood adjustment, sports skills optimization, and other ways to analyze the feasibility of sports methods, so as to get the latest optimization results.

6. Conclusion

(1) In the parameter variation curve, the variation range of weight is the smallest, indicating that its influence

on the output value is relatively small. The variation trend of the function increases first and then decreases, and its influence on the output value decreases gradually. The data corresponding to the threshold shows an obvious fluctuation trend on the whole, and the fluctuation range is relatively large, indicating that it has the greatest influence on the output result.

(2) The error curves under different evaluation indexes show obvious fluctuation characteristics, and the linear and non-linear characteristics of the curves are obvious. The corresponding data increase first and then decrease, and the corresponding increase stage conforms to linear change. Four different evaluation indexes can better reflect the changing rules of actual model data.

(3) The data can be normalized by using artificial intelligence technology. Through calculation, it can be seen that the maximum curve first drops to the lowest point and then slowly rises. The corresponding minimum value changes steadily at first, then increases rapidly under data mutation, and finally increases the maximum value gradually.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Retraction

Retracted: The Black-Box Deconstruction of Dynamic Sustainable Development Ability Driving Environmental Performance of Manufacturing Enterprises

Journal of Environmental and Public Health

Received 17 October 2023; Accepted 17 October 2023; Published 18 October 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] Q. Liu, W. Zhang, Z. Gao, and W. Yang, "The Black-Box Deconstruction of Dynamic Sustainable Development Ability Driving Environmental Performance of Manufacturing Enterprises," *Journal of Environmental and Public Health*, vol. 2022, Article ID 1734008, 20 pages, 2022.

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Research Article

The Black-Box Deconstruction of Dynamic Sustainable Development Ability Driving Environmental Performance of Manufacturing Enterprises

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Based on the conceptual model of the black-box deconstruction of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, the nonparametric percentile bootstrap method based on deviation correction is used to demonstrate the theoretical hypothesis and empirically deconstruct the black-box of dynamic sustainable development driving environmental performance. Empirical results show that (1) dynamic sustainable development ability has a positive influence on environmental performance; (2) green resource integration ability, green duality, low-carbon manufacturing practice, and green intelligence capital play mediating roles in the influence of dynamic sustainable development ability on environmental performance; and (3) environmental regulation positively moderates the mediating mechanism of green resource integration ability, green duality, low-carbon manufacturing practice, and green intelligence capital of the relationships between dynamic sustainable development ability and environmental performance.

1. Introduction

In the process of rapid economic growth, environmental problems emerge in endlessly, which have posed a great threat to production and life, and have aroused the great attention of the government. In order to prevent environmental problems from getting worse, the CPC Central Committee actively advocated the construction of resource-saving and environment-friendly society in 2007. At the same time, the environmental management awareness of manufacturing enterprises has also been aroused. The concept of green development has gradually become the mainstream. Economic benefits are no longer the only standard to measure the success of the manufacturing enterprise. Under the framework of dynamic sustainable development, the decisions regarding how to respond to the trend, implement the concept of green development, enhance the ability of green management, and finally obtain good environmental performance are the main key problems to be solved urgently in the academic and industrial circles. Some scholars had studied the relationships between sustainable development ability and value creation, or the relationships between green management and environmental performance, and had obtained relevant research results with reference and inspiration [1–52]. However, few scholars had taken manufacturing enterprises as the objects of empirical analysis to conduct empirical research on the influence mechanism of dynamic sustainable development ability on environmental performance and carry out empirical deconstruction of the black-box of environmental performance driven by dynamic sustainable development ability of manufacturing enterprises. The general meaning of the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises refers to the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises. In view of the reasoning process, based on the background of green leading development, this study will deeply deconstruct the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, improve and enrich the theoretical framework and conceptual model of the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, explore the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises under the action of different situational variables, analyze the effectiveness of various mediating variables and boundary conditions, and pry the black-box of green development of manufacturing enterprises. The research results will have important theoretical reference and practical management enlightenment for guiding manufacturing enterprises to effectively implement the sustainable development framework and complete the bilateral transformation. The research results will also provide a practical basis and quantitative foundation for advocating environmental management awareness, promoting dynamic sustainable development ability, and enhancing environmental performance of manufacturing enterprises with the help of mediating variables and moderating variables.

2. Conceptual Model

2.1. Theoretical Hypothesis

2.1.1. Direct Relationships between Dynamic Sustainable Development Ability and Environmental Performance. The dynamic sustainable development ability of the manufacturing enterprise refers to the ability of the manufacturing enterprise to identify problems and opportunities, and achieve the goals by dynamically adjusting its own resources [2, 46–48]. Sustainable development ability refers to the ability of the manufacturing enterprise to achieve the performance objectives on the premise of avoiding or reducing pollution and damage to the environment [1]. Teece and Wijethilake defined dynamic ability as the ability of manufacturing enterprises to maintain and enhance market competitiveness by moderating their own resources [46, 47]. Based on the research results, scholars Shang et al. integrated the sustainable development ability and dynamic ability to obtain the sustainable development ability of manufacturing enterprises, and believed that combining the two sections and components is the key path for manufacturing enterprises to avoid or reduce the interference of various uncertain factors in their growth process and adapt to the new-normal environments and circumstances [2, 4, 5].

If the manufacturing enterprise wants to occupy the more favorable position in the market and obtain more resources, dynamic sustainable development ability is an indispensable and crucial factor [6]. Philip [8] believed that sustainable development ability included two levels (increasing enterprise performance and market share), and there was a positive correlation between sustainable development ability and shareholders' recognition of the manufacturing enterprise. Improving the dynamic sustainable development ability of manufacturing enterprises, driving the further accumulation of accumulated resources, triggering manufacturing enterprises to improve their market competitiveness and market share, increasing profits, expanding scale, and promoting the dynamic sustainable development ability can have a positive effect on environmental performance [1–9]. At the same time, many scholars in related fields had believed that under the framework of sustainable development, the manufacturing enterprise performance should be evaluated from the environmental benefits, social benefits, and other aspects [1–12]. Based on the above research results, this study believes that the dynamic sustainable development ability is the key factor for manufacturing enterprises to achieve higher environmental performance. Therefore, this paper proposes the following hypothesis:

> H1: dynamic sustainable development ability has a significant positive influence on environmental performance of manufacturing enterprises.

2.1.2. Mediating Roles

(1) The Mediating Role of Green Resource Integration Ability. Green resource integration ability is the ability of the manufacturing enterprise to further optimize the original resource structure system, establish the new green resource system, and identify and deal with the corresponding internal and external resources on the premise of obtaining the external resources and requirements according to the connotation and requirements of sustainable development [13–15]. Green resources are mostly in a disorderly and chaotic state before being developed and integrated. In order to make manufacturing enterprises obtain more and better environmental benefits, it is necessary to scientifically deal with the fragmented resources, and make a strong sense of fusing and integrating the fragmented resources into organization value, so as to promote them to give full play to their use value. Identifying, absorbing, allocating, and integrating the internal and external green resources of the manufacturing enterprise are the four basic processes for the manufacturing enterprise to improve the green resource integration ability. Among them, the identifying ability of green resources can help manufacturing enterprises better and faster tap the key resources needed for their development, which plays a major role in improving environmental performance. The ability to absorb green resources can help manufacturing enterprises quickly absorb the green resources in the external environment that they need, which plays the role in promoting manufacturing enterprises to obtain high benefits. The ability to allocate green resources plays an important role in the efficient use of existing resources. The integration ability of green resources is an indispensable driving force for manufacturing enterprises to create and give play to green values. The higher the efficiency of resource utilization and integration, the better the environmental benefits of manufacturing enterprises and the higher the environmental performance [13, 15]. Dynamic sustainable development ability needs to identify, adjust, and integrate their own resources with the help of green resource integration ability, so as to feed back the dynamic sustainable

development ability of manufacturing enterprises; that is, green resource integration ability is the key channel for manufacturing enterprises to give full play to the dynamic sustainable development ability. Therefore, based on the above analysis, the following theoretical hypothesis is put forward:

> H2: green resource integration ability plays a mediating role in the process of the influence of dynamic sustainable development ability on environmental performance; that is, dynamic sustainable development ability indirectly affects environmental performance by influencing green resource integration ability.

(2) The Mediating Role of Green Duality. Duality refers to the fact that the influence of constituent elements or influencing factors on something is equal or equal in two aspects. It is believed that the influencing factors or constituent elements do not act and affect things unilaterally, but the joint actions between the influencing factors or constituent elements affect things [16]. Many scholars had interpreted the concept of duality from different perspectives. Cao et al. [18] conceptualized the term duality and decomposed it into a two-dimensional composite structure, including the balance dimension and the interaction dimension. Since then, some scholars had further analyzed and explored the concept of duality, further defined and improved the concept of balance degree, and put forward the concept of organic balance [19]. Lin et al. [20] believed that if Chinese manufacturing enterprises wanted to improve the innovation performance, they should make the balance between the two dimensions of quality management practice (exploration dimension and utilization dimension) according to the characteristics of internal and external environment and resources, and reduce or even avoid the probability of competing for limited resources during the implementation of the two dimensions of quality management practice, so as to make the two dimensions complement each other. Lin et al. [20] analyzed the balance dimensions of duality; the relationships between interaction dimension and enterprise innovation performance are deeply studied. Green duality refers to green exploration and green utilization. Under the framework of dynamic sustainable development ability, green exploration focuses on the development and design of new concepts, and adopts innovative solutions that break the habitual way of thinking to solve environmental problems. Compared with green exploration, green utilization focuses more on introducing existing and well-developed technologies, or improving the existing production processes and products of the manufacturing enterprise, so as to significantly improve the resource utilization rate of the manufacturing enterprise and effectively reduce the damage and pollution caused by the manufacturing enterprise to the environment [16]. No matter what angle, green duality can have a significant positive influence on environmental performance. At the same time, the strong dynamic sustainable development ability of the manufacturing enterprise means that the manufacturing enterprise is sensitive to environmental changes and has a strong ability to adjust its own resources, which provides a strong support for the manufacturing enterprise to find out innovation points and continuously render the resources required for innovation. Whether it is breakthrough innovation or sublimation innovation on its own basis, green duality will magnify the influence of dynamic sustainable development ability on environmental performance. In addition, in order to better study the influence mechanism of green exploration and green utilization on environmental performance, the concepts of green exploration and green utilization in duality are introduced into green innovation practice by referring to and drawing on relevant research results [16], and green exploration x and green utilization y are organically combined to study green duality from the balance and interaction dimensions. Referring to the existing achievements, the mathematical expression $x \times y$ reflects the interaction dimension of green exploration and green utilization [18]. The mathematical expression $1 - |x - y|/(x + y)$ represents the balance dimension of green exploration and green utilization [18]. Based on the above analysis, this paper puts forward the following theoretical hypotheses:

> H3: green duality plays a mediating role in the process of the influence of dynamic sustainable development ability on environmental performance; that is, dynamic sustainable development ability indirectly affects environmental performance by influencing green duality.

> H3a: green dual interaction dimension plays a mediating role in the process of the influence of dynamic sustainable development ability on environmental performance; that is, dynamic sustainable development ability indirectly affects environmental performance by influencing green dual interaction dimension.

> H3b: green dual balance dimension plays a mediating role in the process of the influence of dynamic sustainable development ability on environmental performance; that is, dynamic sustainable development ability indirectly affects environmental performance by influencing green dual balance dimension.

(3) The Mediating Role of Low-Carbon Manufacturing Practice. Low-carbon manufacturing practice means that manufacturing enterprises develop and use new green energy to replace traditional nonrenewable energy and reduce carbon emissions. As China pays more attention to environmental protection, the pressure on manufacturing enterprises to reduce carbon emissions increases [24–26]. At the same time, more and more scholars also turn their attention to the new field of low-carbon manufacturing, and study the proposition from different angles. Some scholars have successfully transferred from the exploration of manufacturing strategy to the research of low-carbon manufacturing practice. The implementation of low-carbon manufacturing strategy may not bring immediate economic benefits to manufacturing enterprises, but the practice of low-carbon manufacturing belongs to the model of sustainable development, which is an organic development model that coordinates the overall situation, reduces

resource use and waste, and reduces carbon dioxide emissions [26]. The implementation of low-carbon manufacturing practice can effectively reduce the waste of resources and environmental pollution caused by emissions, save the cost of manufacturing enterprises and the necessary investment of manufacturing enterprises to eliminate their own negative influence on the environment to a certain extent, and indirectly promote the environmental benefits and environmental performance of manufacturing enterprises [24, 25]. Under the framework of dynamic sustainable development, the concept of green development will imperceptibly affect the behavior of manufacturing enterprises, create the good atmosphere for energy conservation and emission reduction, promote manufacturing enterprises to actively implement low-carbon manufacturing practice, and then contribute to environmental performance. Huang et al. [24, 25] also put forward the view that low-carbon manufacturing strategy could bring sustainable competitive advantages and good economic benefits to manufacturing enterprises. In the framework of sustainable development, low-carbon strategic transformation is the necessary path for manufacturing enterprises to enhance environmental performance and obtain environmental benefits. Therefore, this paper puts forward the following theoretical hypothesis:

> H4: low-carbon manufacturing practice plays a mediating role in the process of the influence of dynamic sustainable development ability on environmental performance; that is, dynamic sustainable development ability indirectly affects environmental performance by influencing low-carbon manufacturing practice of manufacturing enterprises.

(4) The Mediating Role of Green Intellectual Capital. Green intellectual capital is a complex compound of various types of capital to enhance the growth of enterprise value [28–34]. Chen [29] conducted a systematic study on green intellectual capital, and made the hierarchical division of green intellectual capital from the perspective of structure, human resources, and capital. The relevant research results of Cohen and Levinthal showed that through the knowledge learning and experience training on environmental protection management for the internal personnel of the organization, the ability of employees is improved and the manufacturing enterprise is promoted to enhance environmental performance and environmental benefits [31]. Through R & D investment in the environmental management system and environmental protection, the dynamic sustainable development ability of manufacturing enterprises can be further improved, which is conducive to the further improvement of environmental performance [32]. By increasing the green capital of manufacturing enterprises, it has a significant positive influence on the green innovation performance of manufacturing enterprises [33]. The green intellectual capital of manufacturing enterprises provides the good environmental foundation for the dynamic transformation of sustainable development ability of manufacturing enterprises, and relevant research results also prove that intellectual capital can provide key strategic resources for the development of manufacturing enterprises [34] and improve environmental performance. At the same time, dynamic sustainable development ability can significantly enhance the ability of manufacturing enterprises to identify problems and opportunities, so as to promote manufacturing enterprises to identify key green resources and increase investment, optimize the green intellectual capital of manufacturing enterprises, and finally achieve the goal of promoting environmental performance. Under the guidance of dynamic and sustainable development of manufacturing enterprises, accumulating strategic resources, and activating and using green intellectual capital can significantly improve the environmental performance. Therefore, this paper puts forward the following theoretical hypothesis:

> H5: green intellectual capital plays a mediating role in the process of the influence of dynamic sustainable development ability on environmental performance; that is, dynamic sustainable development ability indirectly affects environmental performance by influencing green intellectual capital.

2.1.3. Moderating Roles

(1) The Moderating Role of Environmental Regulation. Environmental regulation means that the government designs and regulates environmental standards to implement an economic intervention in order to achieve the relatively balanced state between environmental protection and economic development [34–36]. Scholars mainly study and deeply discuss the related propositions of environmental regulation from three aspects: the concept, category, and application means of environmental regulation. Environmental protection and rational utilization of green environmental resources are the fundamental purpose of environmental regulation [34–36]. The government directly or indirectly intervenes in the economic activities of manufacturing enterprises from two aspects: mandatory environmental regulation and incentive environmental regulation. Incentive environmental regulation aims to enhance the correlations among carbon reduction, pollution discharge, other behaviors, and the economic interests of manufacturing enterprises, guide manufacturing enterprises to rationally allocate resources between the management environment and business, and implement regulation mainly through subsidies, pollution discharge, and product taxes [37]. Mandatory environmental regulation means that the government directly intervenes in the enterprise activities by means of command control, including formulating various mandatory standards and policies. Many manufacturing enterprises in transition are not aware of the importance of green resources to their environmental performance, and lack the ability to identify, absorb, integrate, and allocate green resources. Through environmental regulation, the government can directly or indirectly intervene the economic activities of manufacturing enterprises, guide manufacturing enterprises to integrate and reasonably allocate green resources, promote manufacturing enterprises to better implement low-carbon manufacturing

practice, encourage or force manufacturing enterprises to pay attention to environmental protection, develop green new products, increase green intellectual capital investment, and achieve green dual interaction and green dual balance, and help manufacturing enterprises improve their market competitiveness and increase their environmental benefits and environmental performance. Therefore, this paper puts forward the following theoretical hypotheses:

H6: environmental regulation significantly positively moderates the relationships among green resource integration ability, green intellectual capital, green dual interaction dimension, green dual balance dimension, low-carbon manufacturing practice, and environmental performance; that is, the stronger the environmental regulation, the stronger the positive influence of green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice on environmental performance (outcome variable).

H6a: environmental regulation significantly moderates the relationships between the mediating variable green resource integration ability and environmental performance.

H6b: environmental regulation significantly moderates the relationships between the mediating variable green intellectual capital and environmental performance.

H6c: environmental regulation significantly moderates the relationships between the mediating variable green duality (green dual interaction dimension and green dual balance dimension) and environmental performance.

H6d: environmental regulation significantly moderates the relationships between the mediating variable low-carbon manufacturing practice and environmental performance.

(2) The Moderating Role of Forward-Looking Environmental Strategy. Ordinary environmental strategies only put emphasis on the reduction of negative influences on the environment in the process of production activities, which do not emphasize and advocate prefortification. Sharma and Vredenburg [38] classified environmental strategies, one of which was forward-looking environmental strategies. Based on the framework of sustainable development, forward-looking environmental strategy takes active measures to prevent or reduce the adverse influence on the ecological and natural environment caused by the manufacturing enterprise in the process of business activities, or quickly judges the risks and takes measures [39]. The formulation and implementation of forward-looking environmental strategies by manufacturing enterprises can create the good atmosphere for all members to participate in green management. Participating in environmental protection projects can imperceptibly deepen the awareness of energy conservation and emission reduction, promote manufacturing enterprises to enhance their ability to integrate green resources, and then enhance the improvement of environmental performance. At the same time, manufacturing enterprises can also enhance their innovation ability, develop green products and services to adapt to the development of the trend and the needs of the public, achieve green dual interaction and balance, advocate low-carbon manufacturing practice, and finally achieve the goal of improving environmental performance. In addition, many relevant research results show that the formulation and smooth implementation of forward-looking environmental strategy can enhance manufacturing organizational cohesion, organizational belonging, organizational commitment, and self-efficacy, drive the organizational citizenship behavior within the manufacturing enterprise, increase the investment of green intellectual capital, and promote the improvement of environmental performance. Based on the above three theoretical analysis results, this paper puts forward the following theoretical hypotheses:

H7: forward-looking environmental strategy can significantly and positively moderate the positive influence of mediating variables (green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice) on environmental performance (outcome variable).

H7a: forward-looking environmental strategy significantly positively moderates the relationships between green resource integration ability and environmental performance.

H7b: forward-looking environmental strategy significantly positively moderates the relationships between green intellectual capital and environmental performance.

H7c: forward-looking environmental strategy significantly positively moderates the relationships between green duality (green dual interaction dimension and green dual balance dimension) and environmental performance.

H7d: forward-looking environmental strategy significantly positively moderates the relationships between low-carbon manufacturing practice and environmental performance.

2.1.4. The Moderated Mediation Effects. Under the theoretical hypotheses of H2 (green resource integration ability plays a mediating role in the influence of dynamic sustainable development ability on environmental performance), H3 (green duality plays a mediating role in the influence of dynamic sustainable development ability on environmental performance), H4 (low-carbon manufacturing practice plays a mediating role in the influence of dynamic sustainable development ability on environmental performance), H5 (green intellectual capital plays a mediating role in the influence of dynamic sustainable development ability on environmental performance), H6 (environmental regulation significantly positively moderates the relationships among green resource integration ability, green intellectual capital, green duality, low-carbon manufacturing practice, and environmental performance), and H7 (forward-looking environmental strategy can significantly and positively moderate the positive influence of mediating variables (green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice) on environmental performance), based on the location of mediating variables and moderating variables (mediating variables are behind the moderating variables), the influence path of variables, the direction of variable influence (positive mediating effect, positive moderating effect, and positive main effect), and the intensity of variable influence (mediating variables have significant mediating effect, and moderating variables have significant moderating effects), it is further proposed that forward-looking environmental strategy and environmental regulation significantly and positively moderate the mediating roles of green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice. This study puts forward the following theoretical hypotheses:

H8: antecedent variable (dynamic sustainable development ability), mediating variables (green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice), moderating variable (environmental regulation), and outcome variable (environmental performance) constitute the moderated mediation role model, which plays the moderated mediation effects. Moderating variable named environmental regulation significantly positively moderates the mediating variables (green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice) between dynamic sustainable development ability and environmental performance.

H8a: environmental regulation significantly positively moderates the mediating role of green resource integration ability between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

H8b: environmental regulation significantly positively moderates the mediating role of green intellectual capital between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

H8c: environmental regulation significantly positively moderates the mediating role of green duality (green dual interaction dimension and green dual balance dimension) between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

H8d: environmental regulation significantly positively moderates the mediating role of low-carbon manufacturing practice between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

H9: antecedent variable (dynamic sustainable development ability), mediating variables (green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice), moderating variable named forward-looking environmental strategy, and outcome variable (environmental performance) constitute the moderated mediation role model to play the moderated mediation effects; the moderating variable named forward-looking environmental strategy significantly positively moderates the mediating variables (green resource integration ability, green intellectual capital, green duality, low-carbon manufacturing practice) between dynamic sustainable development ability and environmental performance.

H9a: forward-looking environmental strategy significantly positively moderates the mediating role of green resource integration ability between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

H9b: forward-looking environmental strategy significantly positively moderates the mediating role of green intellectual capital between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

H9c: forward-looking environmental strategy significantly positively moderates the mediating role of green duality (green dual interaction dimension and green dual balance dimension) between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

H9d: forward-looking environmental strategy significantly positively moderates the mediating role of low--carbon manufacturing practice between dynamic sustainable development ability and environmental performance, which has the moderated mediation effects.

2.2. Conceptual Model Construction. According to the theoretical hypothesis of the direct relationships between dynamic sustainable development ability and environmental performance, the theoretical hypothesis of mediating role, the theoretical hypothesis of moderating role, and the theoretical hypothesis of the moderated mediation role, the conceptual model of the black-box deconstruction of dynamic sustainable development ability driving environmental performance is constructed. The conceptual model is shown in Figure 1. The conceptual model reflects and characterizes the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises.

3. Research Design

3.1. Scale Measurement. This study draws on the research results of relevant literature and sets up the scales of mediating variables and moderating variables. The existing relevant research results show that a large number of scholars have studied the contents related to dynamic sustainable development ability and environmental performance, and obtained consistent conclusions [1–43]. The reliability and validity of the scales have been widely recognized. In this paper, the evaluation index values

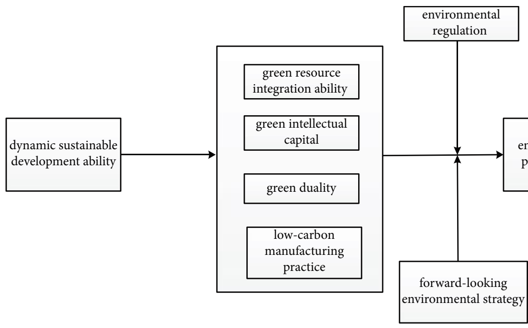

Figure 1: Conceptual model.

corresponding to dynamic sustainable development ability and environmental performance scales are averaged.

Based on the study of relevant literature, the maturity scale of Rao [14] was cited to construct the scale of green resource integration ability (GICP), which acted as mediating variable. There are four measurement items in total. The specific measurement items are shown in Table 1.

On the basis of the research papers on the constituent elements of green duality, the research results of Zhou and Wu [21], Kollmann and Stockmann [22], and Xue [16] were used to measure green duality from the two dimensions of green exploration and green utilization, which are shown in Table 2 for details. Referring to and drawing on relevant research results, the concepts of green exploration and green utilization in duality are introduced into the green innovation practice [16]. Green exploration x and green utilization y are organically combined to study green duality from the balance and interaction dimensions. Referring to the existing achievements, the mathematical expression $x \times y$ reflects the interaction dimension of green exploration and green utilization [18]. The mathematical expression $1 - |x - y|/(x + y)$ represents the balance dimension of green exploration and green utilization [18]. GID refers to green dual interaction dimension, which is called green dual interaction for short. GBD represents the green dual balance dimension, which is called green dual balance for short.

The scale design of the mediating variable green intellectual capital was mainly based on the relevant research results of Chen [29], Cohen and Levinthal [31], Stewart [28], which was further adjusted appropriately according to the research titles, research situations, and research purposes. The specific items are shown in Table 3.

According to the existing relevant research results [23–27], the mediating variable low-carbon manufacturing practice items were screened and adjusted according to the research objects of this paper. The specific items are shown in Table 4.

Based on the relevant literature [34–37], and in combination with various environmental documents issued by the governments, the environmental regulation scale was constructed. The items are shown in Table 5.

The determination of forward-looking environmental strategy scale was mainly based on the relevant research results of Buysse and Verbeke [43], and Pan and Tian [34]. The specific measurement items are shown in Table 6.

3.2. Questionnaire Design, Reliability, and Validity Analyses

3.2.1. Questionnaire Design and Distribution. This study consists of eight variables. The dynamic sustainable development ability of manufacturing enterprises DS is set as antecedent variable, and the environmental performance EP is set as outcome variable. Four mediating variables GICP, GIC, GD, and LCMP are selected as green resource integration ability, green intellectual capital, green duality, and low-carbon manufacturing practice, respectively, and two moderating variables ER and FES are selected as environmental regulation and forward-looking environmental strategy, respectively. In order to ensure the applicability, validity, and content validity of the scales, the scales used in this paper are mature scales that have been studied home and abroad. According to the current situations and research purposes, the scales are modified and adjusted according to the circumstances in China. In this paper, the firsthand questionnaire survey data and statistical data are obtained by means of questionnaire survey. The electronic version of the questionnaire is delivered and transferred through modern communication tools and communication technology, professional questionnaire survey websites, professional questionnaire survey institutions, network media, etc. On the basis of integrating the online distribution of the questionnaire, this study completes the questionnaire survey through the offline distribution channels (field interview, field survey, offline distribution, and post office questionnaire). The online distribution of questionnaires is mainly realized by email, online link delivery of questionnaires, relevant professional survey websites, and institutions. Offline research work is mainly completed through field interviews and field survey questionnaires. The items of the questionnaire were measured by 5-point Likert scale, and the corresponding values were 1 to 5 from small to large according to the degree of influence/effect/consent. In this study, 600 questionnaires were distributed, 531 were recovered, 62 were invalid, 469 were valid, and the effective rate was 78.17%. This study strictly controlled the common method deviation from the procedures, enhanced the readability, comprehensibility, and practicality of the questionnaire items, prevented self-report of the respondents, psychological cognitive deviation, self-concern, social approval, and other phenomena, and ensured the validity and reliability of the scale data. Harman's single-factor analysis method is used to test the common method deviation. The common method deviation test results show that the corresponding value of the maximum common factor variance interpretation rate is 26.307%, seven common factors are extracted, the characteristic roots of the seven common factors in the gravel map are higher than 1, and the maximum common factor variance interpretation rate is less than 40% of the specified value. There is no serious common method deviation in this study.

3.2.2. Survey Sample and Sample Characteristics. The survey sample and empirical research sample of this paper mainly involve the representative and typical manufacturing enterprises in the eastern and central regions. In order to guarantee the validity and reliability of the scale data and ensure that the respondents' knowledge and experience can effectively reflect the real situation of manufacturing

Table 1: Green resource integration ability scale.

Variable name	Item	Reference
Green resource integration ability (GICP)	Identifying ability of enterprise green resources (GICP1)	Rao [14]
	Ability to absorb enterprise green resources (GICP2)	
	Enterprise green resource allocation ability (GICP3)	
	Enterprise green resource integration ability (GICP4)	

Table 2: Green duality scale.

Variable name		Item	Reference
Green duality (GD)	Green exploration (GEL)	Respond to green demand of customers for exceeding existing products/services (GEL1)	Zhou and Wu [21], Kollmann and Stockmann [22], Xue [16]
		Willingness to learn advanced green process technologies in the field (GEL2)	
		Develop green and environmentally friendly products/ services (GEL3)	
	Green utilization (GEP)	Utilization of existing green schemes (GEP1)	
		The knowledge reserve of green technology is constantly updated and expanded (GEP2)	
		Willingness to improve the efficiency of developing green services and products (GEP3)	

Table 3: Green intellectual capital scale.

Variable name	Item	Reference
Green intellectual capital (GIC)	Productivity and contribution of employees in environmental protection (GIC1)	Cohen and Levinthal [29], Stewart [28], Sun [27], Pan [51]
	Each department is willing to compromise for the same environmental protection goal (GIC2)	
	Managers provide comprehensive support for employees to achieve environmental protection objectives (GIC3)	
	The perfection of enterprise environmental management system (GIC4)	
	Income from environmental protection (GIC5)	
	R & D investment of enterprises in environmental protection (GIC6)	
	Ability to research green products of enterprises (GIC7)	
	Customers are satisfied with relevant environmental protection practice of enterprise (GIC8)	

Table 4: Low-carbon manufacturing practice scale.

Variable name	Item	Reference
Low-carbon manufacturing practice (LCMP)	Middle and senior managers support for carbon emission reduction actions (LCMP1)	Cao [23], Hang et al. [24, 25], Cheng and Sun [26], Sun [27]
	Establishment of carbon emission reduction institutions and full-time personnel (LCMP2)	
	Conduct relevant knowledge and skills training (LCMP3)	
	Total quality management plan (LCMP4)	
	Implement collaborative waste disposal with cooperative enterprises (LCMP5)	
	Implementation degree of technical requirements for environmental labeling products (LCMP6)	
	The perfection of clean development mechanism (CDM) (LCMP7)	
	Implementation degree of environmental management system certification (LCMP8)	

enterprises, the surveyed enterprises are manufacturing enterprises with more than 10 years and the respondents are middle and senior managers who have worked for more than 10 years. Table 7 shows the statistical data of the survey sample and empirical research sample. The vast majority of the surveyed enterprises are large- and medium-sized manufacturing enterprises, of which enterprises with more than 500 people account for 47.34% (sample number 222), and enterprises with

Table 5: Environmental regulation scale.

Variable name	Item	Reference
Environmental regulation (ER)	Influence of carbon emission reduction tax reduction policy on enterprises (ER1) Influence of emission tax reduction policy on enterprises (ER2) Influence of special scientific research funds for technological transformation projects on enterprises (ER3) Influence of carbon emission reduction laws, decrees, and regulations on enterprises (ER4)	Pan and Tian [34], Chen [35], Feng [36], Zhang [37]

Table 6: Forward-looking environmental strategy scale.

Variable name	Item	Reference
Forward-looking environmental strategy (FES)	Conduct environmental review on participating in environmental protection projects of government or nongovernmental organizations (FES1) Purchase industrial ecology protection standard manual (FES2) Internal and external disclosure of environmental information (FES3)	Buysse and Verbeke [43], Pan and Tian [34]

Table 7: Information of surveyed enterprises and respondents.

Information of surveyed enterprises		Number of samples	Percentage (%)
Enterprise size	≤100 persons	69	14.71
	101–300 persons	90	19.19
	301–500 persons	88	18.76
	501–1000 persons	126	26.87
	>1000 persons	96	20.47
Enterprise nature	State-owned and state-owned holding enterprises	85	18.12
	Private enterprises	224	47.76
	Foreign joint enterprises	66	14.07
	Foreign-owned enterprises	20	4.26
	Other types of enterprises	74	15.78
Respondent information		**Number of samples**	**Percentage (%)**
Post	Senior managers	221	47.12
	Middle managers	248	52.88
Education	Junior college degree	122	26.01
	Bachelor's degree	267	56.93
	Master's degree	80	17.06

301–500 people account for 18.76% (sample number 88). The surveyed enterprises are mainly private enterprises, and state-owned and state-owned holding enterprises, of which private enterprises account for 47.76% (224 samples), and state-owned and state-owned holding enterprises account for 18.12% (85 samples). In order to further ensure the validity and authenticity of the primary statistical data source, the respondents mainly focused on the middle and senior managers who are familiar with the production and operation, environmental performance, and environmental management of the manufacturing enterprise. The middle managers account for 52.88% (248 samples), and the senior managers account for 47.12% (221 samples). The educational background of the respondents mainly concentrates in undergraduate and above, accounting for 73.99%.

3.2.3. Scale Reliability Test. This study adopts two indexes CITC (Churchill's standard, deletion of invalid indicators, and operating guidelines) and Cronbach's coefficient (Nunnally's standard) of the research sample to measure the reliability level of the scale [49–51]. The reliability analysis results of the overall and local scales are shown in Table 8. The Cronbach coefficient values are between 0.838 and 0.921, which are higher than 0.8. The CITC values of scale are between 0.674 and 0.830, which are higher than 0.50. The Cronbach coefficient after deleting the project does not highlight the obvious growth trend and significant change trend. Table 8 shows that the overall and local scales have good reliability.

3.2.4. Scale Validity Test. The overall and local scale validity test results are shown in Table 9. The KMO values corresponding to the scale variables of green resource integration ability, green intellectual capital, green duality, low-carbon manufacturing practice, environmental regulation, and forward-looking environmental strategy are between 0.711 and 0.938, which are higher than 0.7. The combination reliability values of CFA statistics corresponding to green resource integration ability, green intellectual capital, green

Table 8: Internal consistency test of various scales.

Variables		Items	CITC	Cronbach's coefficient
Green resource integration ability (GICP)		GICP1	0.684	0.866
		GICP2	0.764	
		GICP3	0.719	
		GICP4	0.703	
Green intellectual capital (GIC)		GIC1	0.703	0.921
		GIC2	0.707	
		GIC3	0.731	
		GIC4	0.830	
		GIC5	0.739	
		GIC6	0.723	
		GIC7	0.732	
		GIC8	0.713	
Green duality (GD)	Green exploration (GEL)	GEL1	0.771	0.884
		GEL2	0.792	
		GEL3	0.762	
	Green utilization (GEP)	GEP1	0.742	
		GEP2	0.769	
		GEP3	0.754	
Low-carbon manufacturing practice (LCMP)		LCMP1	0.674	0.916
		LCMP2	0.761	
		LCMP3	0.716	
		LCMP4	0.704	
		LCMP5	0.725	
		LCMP6	0.758	
		LCMP7	0.741	
		LCMP8	0.706	
Environmental regulation (ER)		ER1	0.705	0.858
		ER2	0.740	
		ER3	0.677	
		ER4	0.691	
Forward-looking environmental strategy (FES)		FES1	0.676	0.838
		FES2	0.753	
		FES3	0.678	

Table 9: Test results of scale validity.

Variables		KMO	Composite reliability (CR)	AVE	Factor loading
Green resource integration ability		0.829	0.9089	0.7140	0.822–0.876
Green intellectual capital		0.931	0.9353	0.6442	0.775–0.879
Green duality	Green exploration	0.741	0.8390	0.6430	0.895–0.911
	Green utilization	0.841	0.9160	0.7850	0.885–0.901
Low-carbon manufacturing practice		0.938	0.9317	0.6304	0.750–0.824
Environmental regulation		0.827	0.9039	0.7017	0.819–0.839
Forward-looking environmental strategy		0.711	0.9029	0.7562	0.732–0.808

duality, low-carbon manufacturing practice, environmental regulation, and forward-looking environmental strategy are between 0.8390 and 0.9353, which are all higher than 0.6. The AVE values of CFA statistics corresponding to green resource integration ability, green intellectual capital, green duality, low-carbon manufacturing practice, environmental regulation, and forward-looking environmental strategy are between 0.6304 and 0.7850, which are all higher than 0.5. And the load values of the standardization factor in the CFA scenario are between 0.732 and 0.911, which are higher than 0.6. The statistical results of Table 9 show that the scale has good validity.

4. Hypothesis Test of Theoretical Hypothesis

4.1. Main Effect and Mediating Effect Test Process and Results. The nonparametric percentile bootstrap method based on deviation correction is a nonparametric statistical method based on automatic self-help sampling, putting-back sampling, and resampling of the initial sample to estimate the total sample population. It is a reasoning method to simulate the frequency theory, and evaluate and improve the accuracy of statistical analysis and inference. The research system of the method has been greatly developed in economic and management subject fields and areas, which is often used to solve the complex problems without a theoretical basis; it is not limited to the sample size and whether the sample data conform to the normal distribution. The more the repeated sampling times are and the closer the obtained data to the original data are, the better the research results will be. The method has competence and explanatory power in verifying the main effect, the mediating effects, the moderating effects, and the moderated mediation effects, which also shows high applicability, feasibility, rationality, and effectiveness in clarifying and elaborating the influence mechanism, function mechanism, and influence paths. The nonparametric percentile bootstrap method based on deviation correction is operable, accurate, and robust in deconstructing the driving black-box and the operational black-box among variables. In this study, the nonparametric percentile bootstrap method based on deviation correction is used to empirically test the main effect and mediating effect of the relevant theoretical hypothesis in the conceptual model of the black-box of environmental performance driven by dynamic sustainable development ability (the conceptual model of the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises) (Figure 1). The test is conducted according to the main effect and mediating effect test proposed by Wen et al. [44, 45]. The following equations (1)–(3) describe the causal relationships between variables in the analysis of the main effect and mediating effect test:

$$Y = CX + e_1, \tag{1}$$

$$M = AX + e_2, \tag{2}$$

$$Y = C'X + BM + e_3. \tag{3}$$

In equation (1), C is the total effect of an antecedent variable X on outcome variable Y. In equation (2), A is the effect of an antecedent variable on mediating variable M. In equation (3), B is the effect of the mediating variable on outcome variable, and C' is the effect of an antecedent variable on outcome variable after the mediating variable is introduced.

We strictly follow the mediating effect test process proposed by Wen et al. [44, 45]. Firstly, we test whether the regression coefficient C of the influence of antecedent variable dynamic sustainable development ability on environmental performance is significant. Secondly, we judge whether the regression coefficient A of antecedent variable dynamic sustainable development ability on the mediating variables and the regression coefficient B of the mediating variables on environmental performance are significant. Finally, after adding to mediating variables, according to the significance of regression coefficient C' of antecedent variable dynamic sustainable development ability on the influence of environmental performance and the comparison results of the values between C and C', we judge whether the mediating variables play mediating roles in the relationships between dynamic sustainable development ability and environmental performance.

The bootstrapping calculation results in Table 10 show that Model 6 shows the regression results of the influence of dynamic sustainable development ability on environmental performance of manufacturing enterprises. After controlling the control variables of the nature and size of manufacturing enterprises, dynamic sustainable development ability of manufacturing enterprises has a significant positive influence on environmental performance ($C = 0.5511$, $P < 0.001$). The hypothesis H1 has been empirically verified.

According to the three-step test and analysis process of mediating effect, we empirically test and analyze mediating variables. Firstly, the regression coefficient significances of the influences of antecedent variable dynamic sustainable development ability on the mediating variables (green resource integration ability, green intellectual capital, green duality (green dual interaction and green dual balance), and low-carbon manufacturing practice) are tested. The data in Table 10 show that the bootstrapping calculation results of Model 1, Model 2, Model 3, Model 4, and Model 5 show that the regression coefficients A of dynamic sustainable development ability on the mediating variables named green resource integration ability, green intellectual capital, green dual interaction, green dual balance, and low-carbon manufacturing practice are 0.3633, 0.3855, 1.93029, 0.0416, and 0.3002, respectively, and the P values are less than 0.001, indicating that dynamic sustainable development ability of the manufacturing enterprise can play significant positive roles in promoting green resource integration ability, green intellectual capital, green dual interaction, green dual balance, and low-carbon manufacturing practice.

Secondly, this study tests the significance of the influence of mediating variables on environmental performance. Table 10 shows that the bootstrapping calculation results of Model 6, Model 7, Model 8, Model 9, Model 10, and Model 11 show that the regression coefficients B of the influence of mediating variables named green resource integration ability, green intellectual capital, green dual interaction, green dual balance, and low-carbon manufacturing practice on environmental performance are 0.2549, 0.277, 0.0466, 1.7735, and 0.2139, respectively, and the P values are less than 0.001, indicating that green resource integration ability, green intellectual capital, green dual interaction, green dual balance, and low-carbon manufacturing practice have significant positive influences on environmental performance.

Finally, based on the significant direct effects of green resource integration ability, green intellectual capital, green dual interaction, green dual balance, and low-carbon manufacturing practice on environmental performance, the bootstrapping results of Model 6, Model 7, Model 8, Model 9, Model 10, and Model 11 show that after the participation of mediating variables, the direct effect of dynamic sustainable development ability of manufacturing enterprises on environmental performance C' is significant (although compared with Model 6, the value decreases slightly, but still remains significant). AB and C' maintain the same sign relationships, which further shows that green resource integration ability, green intellectual capital, green dual interaction, green dual balance, and low-carbon manufacturing practice play partially mediating effects between dynamic sustainable development ability of manufacturing enterprises and

Table 10: Hierarchical regression results.

Variables	Variables	GICP Model 1	GIC Model 2	GID Model 3	GBD Model 4	LCMP Model 5	EP Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Control variables	Enterprise nature	0.1662***	0.1215***	−0.1347	−0.0043	0.0995***	0.0228	0.065*	0.0108	−0.0166	−0.0152	−0.0016
	Enterprise size	−0.389	0.036	0.426*	0.0229***	−0.0021	0.0529	0.0628	0.4249	0.0323	0.0123	0.0533
Antecedent variable	DS	0.3633***	0.3855***	1.93029***	0.0416 ***	0.3002***	0.5511***	0.4585***	0.4624***	0.4624***	0.4773***	0.4869***
Mediating variables	GICP							0.2549***				
	GIC								0.277***			
	GID									0.0466***		
	GBD										1.7735***	
	LCMP											0.2139***
Constant term		1.7520***	2.4208***	4.5027***	0.6159***	2.7554***	1.5046***	1.0581***	0.8342***	1.2948***	0.4123***	0.9153***
Sample size		469	469	469	469	469	469	469	469	469	469	469
R^2		0.1946	0.2672	0.1680	0.1445	0.1651	0.3233	0.3676	0.3641	0.3668	0.3673	0.3509

Note. Significance level: $+P < 0.10$, $^{*}P < 0.05$, $^{**}P < 0.10$, and $^{***}P < 0.001$, which is the same as the full text.

environmental performance. It is assumed that H2, H3a, H3b, H4, and H5 are demonstrated.

4.2. Moderating Effect Test Process and Results. According to formulas and equations (4)–(7), this study adopts the nonparametric percentile bootstrap method based on deviation correction to empirically test the moderating effect of the relevant theoretical hypothesis in the conceptual model (conceptual model of the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises) of the black-box of environmental performance driven by dynamic sustainable development ability (Figure 1). The empirical test on the moderating effect is conducted by referring to the moderating effect test process proposed by Wen et al. [44, 45]. We set outcome variable as Y, and carry out the standardized bootstrapping regression coefficient test (formula (5)) of the interaction term between the antecedent variable X and the moderating variable U. If the bootstrapping regression coefficient is significant, and the goodness of fit estimated by the regression model of equation (5) is higher than that estimated by the regression model of equation (4), the moderating effect is significant. On the contrary, the moderating effect is not significant.

$$Y = C_0' + C_1''X + C_2''U + e_4, \tag{4}$$

$$Y = C_0 + C_1X + C_2U + C_3UX + e_5, \tag{5}$$

$$W = A_0 + A_1X + e_6, \tag{6}$$

$$Y = C_0' + C_1'X + C_2'U + C_3'UX + B_1W + B_2UW + e_7. \tag{7}$$

According to the moderating effect test process proposed by Wen et al., combined with the research objects of this paper, we test whether the moderating effects of moderating variables on the relationships between mediating variables and outcome variable are significant. According to the results of bootstrapping operation in Table 11, the regression coefficient of the interaction term between the mediating variable GICP and the moderating variable ER is 0.1489, the P value is less than 0.001, and the confidence interval is [0.1004, 0.2489], excluding 0, indicating that the interaction term has a significant influence. After introducing the interaction term, the overall R^2-chng of the model is 0.0212, $P = 0.0001 < 0.001$, indicating that the moderating effect of the moderating variable ER is significant, and ER significantly moderates the relationships between GICP and Y. The hypothesis H6a is verified. The regression coefficient of the interaction term between the mediating variable GICP and the moderating variable FES is 0.0633, the P value is greater than 0.1, and the confidence interval is [−0.0104, 0.1370], including 0. After introducing the interaction term, the overall R^2-chng of the model is 0.0037, $P = 0.0923$, which is close to 0.1 (not significant), indicating that the moderating effect of the moderating variable FES is not significant, and the hypothesis H7a is not supported.

According to the moderating effect test process proposed by Wen et al., combined with the research objects of this

Table 11: Moderating effect test 1.

	Coeff	SE	LLCI	ULCI
GICP	0.1998***	0.0411	0.119	0.2805
ER	0.1746***	0.0365	0.0772	0.2206
GICP ∗ ER	0.1489***	0.0365	0.1004	0.2489
R^2	0.4127			
R^2-chng	0.0212***			
GICP	0.1888***	0.0417	0.1069	0.2707
FES	0.1679***	0.0385	0.0922	0.2436
GRCP ∗ FES	0.0633	0.0375	−0.0104	0.137
R^2	0.3949			
R^2-chng	0.0037			

paper, we test whether the moderating effects of moderating variables on the relationships between mediating variables and outcome variable are significant. According to the bootstrapping regression results in Table 12, the regression coefficient of the interaction term between the mediating variable GIC and the moderating variable ER is 0.1920, the P value is less than 0.001, and the confidence interval is [0.1222, 0.2619], excluding 0, indicating that the interaction term has a significant influence. After introducing the interaction term between GIC and ER, the overall R^2-chng of the model is 0.0361, $P = 0.0000 < 0.001$, indicating that the moderating effect of the moderating variable ER is significant; that is, ER significantly moderates the relationships between GIC and Y, and the hypothesis H6b is verified. The regression coefficient of the interaction term between the mediating variable GIC and the moderating variable FES is 0.0433, the P value is greater than 0.1, and the confidence interval is [−0.0305, 0.1170], including 0. After introducing the interaction term between GIC and FES, the overall R^2-chng of the model is 0.0017, $P = 0.2499 > 0.1$ (not significant), indicating that the moderating effect of the moderating variable FES is not significant, and the hypothesis H7b is not supported.

According to the moderating effect test process proposed by Wen et al., combined with the research objects of this paper, we test whether the moderating effects of moderating variables on the relationships between mediating variables and outcome variable are significant. According to the bootstrapping regression results in Table 13, the regression coefficient of the interaction term between the mediating variable GID and the moderating variable ER is 0.1869, the P value is less than 0.001, and the confidence interval is [0.1181, 0.2556], excluding 0, which indicates that the interaction term has a significant influence. After introducing the interaction term between GID and ER, the overall R^2-chng of the model is 0.0346, $P = 0.0000 < 0.001$ (significant), indicating that the moderating effect of the moderating variable ER is significant; that is, ER significantly moderates the relationships between GID and Y, and the hypothesis H6c is verified. The regression coefficient of the interaction term between the mediating variable GID and the moderating variable FES is 0.0005, the P value is greater than 0.1, and the confidence interval is [−0.0708, 0.0718], including 0. After introducing the interaction term between GID and FES, the overall R^2-chng of the model is 0.000, $P = 0.9894 > 0.1$ (not

Table 12: Moderating effect test 2.

	Coeff	SE	LLCI	ULCI
GIC	0.2121***	0.0419	0.1297	0.2945
ER	0.1625***	0.0367	0.0903	0.2347
GIC ∗ ER	0.1920***	0.0355	0.1222	0.2619
R^2		0.4282		
R^2-chng		0.0361		
GIC	0.2015***	0.0432	0.1166	0.2864
FES	0.1756***	0.038	0.101	0.2502
GIC ∗ FES	0.0433	0.0375	−0.0305	0.1170
R^2		0.3935		
R^2-chng		0.0017		

Table 13: Moderating effect test 3.

	Coeff	SE	LLCI	ULCI
GID	0.2028***	0.0387	0.1267	0.2789
ER	0.1941***	0.0357	0.1239	0.2643
GID ∗ ER	0.1869***	0.0350	0.1181	0.2556
R^2		0.4394		
R^2-chng		0.0346***		
GID	0.2420***	0.0396	0.1641	0.3199
FES	0.2230***	0.0368	0.1508	0.2953
GID ∗ FES	0.0005	0.0363	−0.0708	0.0718
R^2		0.4115		
R^2-chng		0.0000		

significant), and the moderating effect of the moderating variable FES is not significant. The hypothesis H7c is not supported.

According to the moderating effect test process proposed by Wen et al., combined with the research objects of this paper, we test whether the moderating effects of moderating variables on the relationships between mediating variables and outcome variable are significant. According to the bootstrapping regression results in Table 14, the regression coefficient of the interaction term between the mediating variable GBD and the moderating variable ER is 0.1970, the P value is less than 0.001, and the confidence interval is [0.1245, 0.2695], excluding 0, indicating that the interaction term has a significant influence. After introducing the interactive terms GBD and ER, the overall R^2-chng of the model is 0.0339, $P = 0.0000 < 0.001$ (significant), indicating that the moderating effect of the moderating variable ER is significant; that is, ER significantly moderates the relationships between GBD and Y, and the hypothesis H6c is verified. The regression coefficient of the interaction term between the mediating variable GBD and the moderating variable FES is 0.00263, the P value is greater than 0.1 (not significant), and the confidence interval is [−0.0625, 0.0766], including 0. After introducing the interaction term between GBD and FES, the overall R^2-chng of the model is 0.0007, and $P = 0.076$ is close to 0.1 (the change is not significant). The moderating effect of the moderating variable FES is not significant, and the hypothesis H7c is not supported.

According to the moderating effect test process proposed by Wen et al., combined with the research objects of this

Table 14: Moderating effect test 4.

	Coeff	SE	LLCI	ULCI
GBD	0.2402***	0.0376	0.1497	0.2976
ER	0.2067***	0.0356	0.1368	0.2767
GBD ∗ ER	0.1970***	0.0369	0.1245	0.2695
R^2		0.4413		
R^2-chng		0.0339***		
GBD	0.2545***	0.0386	0.1786	0.3303
FES	0.2159***	0.0365	0.1442	0.2875
GBD ∗ FES	0.0263	0.0353	−0.0431	0.0957
R^2		0.4192		
R^2-chng		0.0007		

paper, we test whether the moderating effects of moderating variables on the relationships between mediating variables and outcome variable are significant. According to the bootstrapping regression results in Table 15, the regression coefficient of the interaction term between the mediating variable LCMP and the moderating variable ER is 0.2044, the P value is less than 0.001, and the confidence interval is [0.1329, 0.2759], excluding 0, indicating that the interaction term has a significant influence. After introducing the interaction term between LCMP and ER, the overall R^2-chng of the model is 0.0396 and $P = 0.0000 < 0.001$ (significant), indicating that the moderating effect of the moderating variable ER is significant; that is, ER significantly moderates the relationships between LCMP and Y, and the hypothesis H6d is verified. The regression coefficient of the interaction term between the mediating variable LCMP and the moderating variable FES is 0.0690, the P value is greater than 0.1, and the confidence interval is [−0.0073, 0.1454], including 0. After introducing the interaction term between GIC and FES, the overall R^2-chng of the model is 0.0042, $P = 0.4566 > 0.1$ (not significant), and the moderating effect of the moderating variable FES is not significant. The hypothesis H7d is not supported.

4.3. The Process and Results of the Moderated Mediation Effect Test. According to formulas and equations (4)–(7), this study adopts the nonparametric percentile bootstrap method based on deviation correction to empirically test the moderated mediation effect by the relevant theoretical hypothesis in the conceptual model of the black-box of environmental performance of manufacturing enterprises driven by dynamic sustainable development ability (the conceptual model of the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises) (Figure 1). For the mediation model test in the second half of the moderated period, we will empirically test the moderated effect by referring to the test process proposed by Wen et al. [44, 45]. We use the regression model with interactive product term to perform bootstrapping operation: firstly, we check whether the regression coefficients $A1$ of the influences of an antecedent variable on the mediating variables and the regression coefficients $B2$ of the interactions between the mediating variables and the moderating variables are

Table 15: Moderating effect test 5.

	Coeff	SE	LLCI	ULCI
LCMP	0.1440***	0.0394	0.6650	0.2215
ER	0.1852***	0.0369	0.1128	0.2577
LCMP * ER	0.2044***	0.0364	0.1329	0.2759
R^2		0.4211		
R^2-chng		0.0396***		
LCMP	0.1436***	0.0411	0.0629	0.2243
FES	0.1794***	0.0385	0.1038	0.2551
LCMP * FES	0.0690	0.0388	−0.0073	0.1454
R^2	0.3837			
R^2-chng	0.0042			

Table 16: Moderated mediation effect test 1.

DS ⟶ GICP ⟶ EP				
ER	Effect	Boot SE	Boot LLCI	Boot ULCI
−1	0.0205	0.0277	−0.0268	0.0642
0	0.0806	0.0195	0.0449	0.123
1	0.1407	0.0311	0.0506	0.2012
Intergroup differences	0.1201	0.0380	0.0441	0.1822
Index of moderated mediation				
ER	0.0601	0.019	0.0253	0.1006

significant and whether the confidence interval contains 0. If the regression coefficients are significant and the confidence interval does not contain 0, it indicates that the mediating effect is moderated by the moderating variable. And further, this study reports the influence on the mean value of the moderating variable, the mediating effect ranges corresponding to the differences between positive and negative standard deviations, and its groups. The model only moderates the second half of the mediating effect; it is also necessary to report the index value and its confidence interval corresponding to the moderating variable. The index indicates the influence of the moderating variable on the whole mediation path. If the index value is positive and the confidence interval does not contain 0, it indicates that the moderated mediation effect is significant. In addition, if the coefficient of the interaction term is not significant, and the confidence interval corresponding to the regression coefficient of the interaction product term contains 0, it is necessary to continue to test the confidence interval of the differences between the maximum value and minimum value of the mediating effect. If the above confidence interval does not contain 0, the mediating effect is moderated by the moderating role. On the contrary, the mediating effect is not moderated by the moderating role.

According to the moderating effect test, the hypothesis H7 is not supported. Therefore, the hypothesis H9 will not be tested.

DS, GICP, ER, and EP constitute the moderated mediation effect model, and the moderated mediation effect test results are shown in Table 16. According to the moderated mediation effect test process, the regression coefficient of DS on GICP is 0.3633, and P value is less than 0.001, which is significant. The coefficient of interaction term between GICP and ER is further tested. According to Table 11, the regression coefficient of interaction term is 0.1489, the P value is less than 0.001, and the confidence interval is [0.1004, 0.2489], excluding 0. As shown in Table 16, as for the indirect effect, after introducing the moderating variable ER, the confidence intervals of DS ⟶ GICP ⟶ EP model in which GICP is moderated by ER (−1, 0, 1) are [−0.0268, 0.0642], [0.0449, 0.123], and [0.0506, 0.2021], respectively, the differences between groups are 0.1201, and the confidence interval is [0.0441, 0.1822], excluding 0, indicating that the stronger the moderating effect of ER is, the stronger the mediating effect of the mediating variable GICP is; that is, the mediating effect of GICP is positively moderated by ER. At the same time, the index of moderated mediation value of the moderating variable ER is 0.0601, and the confidence interval is [0.0253, 0.1006], excluding 0; ER produces a significant moderated mediation effect, which confirms that ER plays a moderating role in the mediated effect of GICP, and the hypothesis H8a is verified.

DS, GIC, ER, and EP constitute the moderated mediation effect model, and the moderated mediation effect test results are shown in Table 17. According to the moderated mediation effect test process, the regression coefficient of DS on GIC is 0.3855, and P value is less than 0.001, which is significant. The regression coefficient of interaction term between GIC and ER is further tested. According to Table 12, the coefficient of interaction term is 0.1920, P value is less than 0.001 (significant), and the confidence interval is [0.1222, 0.2619], excluding 0. As shown in Table 17, as for the indirect effect, after introducing the moderating variable ER, the confidence intervals of DS ⟶ GIC ⟶ EP model whose GIC is moderated by ER (−1, 0, 1) are [−0.0422, 0.0599], [0.0560, 0.1449], and [0.1259, 0.2589], respectively, the differences between groups are 0.1776, and the confidence interval is [0.1027, 0.2568], excluding 0, indicating that the stronger the moderating effect of ER, the stronger the mediating effect of the mediating variable GIC; that is, the mediating effect of GIC is positively moderated by ER. At the same time, the index of moderated mediation value of the moderating variable ER is 0.0888, and the confidence interval is [0.0514, 0.1284], excluding 0; ER produces a significant moderated mediation effect, which confirms that ER plays a moderating role in the mediated effect of GIC, and the hypothesis H8b is verified.

DS, GID, ER, and EP constitute the moderated mediation effect model. The moderated mediation effect results are shown in Table 18. According to the moderated mediation effect test process, the regression coefficient of DS on GID is 1.93029, and the P value is less than 0.001 (significant). Further, we test the regression coefficient of the interaction term between GID and ER. According to Table 13, the interaction term coefficient is 0.1869, the P value is less than 0.001 (significant), and the confidence interval is [0.1181, 0.2556], excluding 0. As shown in Table 18, as for the indirect effect, after the introduction of moderating variable ER, the confidence intervals of DS ⟶ GID ⟶ EP model whose GID is moderated by ER (−1, 0, 1) are [−0.0407, 0.0531], [0.0521, 0.1188], and [0.1161, 0.2142] respectively, the differences between groups are 0.1558, and the

Table 17: Moderated mediation effect test 2.

ER	DS ⟶ GIC ⟶ EP Effect	Boot SE	Boot LLCI	Boot ULCI
−1	0.0093	0.0258	−0.0422	0.0599
0	0.0981	0.0224	0.056	0.1449
1	0.1868	0.0336	0.1259	0.2589
Intergroup differences	0.1776	0.0397	0.1027	0.2568
Index of moderated mediation				
ER	0.0888	0.0198	0.0514	0.1284

Table 19: Moderated mediation effect test 4.

ER	DS ⟶ GBD ⟶ EP Effect	Boot SE	Boot LLCI	Boot ULCI
−1	0.0152	0.020	−0.025	0.054
0	0.0846	0.0182	0.0501	0.1231
1	0.154	0.0285	0.0999	0.2135
Intergroup differences	0.1388	0.0332	0.0788	0.2081
Index of moderated mediation				
ER	0.0694	0.0166	0.0394	0.1040

Table 18: Moderated mediation effect test 3.

ER	DS ⟶ GID ⟶ EP Effect	Boot SE	Boot LLCI	Boot ULCI
−1	0.0066	0.0239	−0.0407	0.0531
0	0.0845	0.017	0.0521	0.1188
1	0.1624	0.025	0.1161	0.2142
Intergroup differences	0.1558	0.0352	0.0901	0.2287
Index of moderated mediation				
ER	0.0779	0.0176	0.0451	0.1144

confidence interval is [0.0901, 0.2287], excluding 0, indicating that the stronger the moderating effect of ER, the stronger the mediating effect of the mediating variable GID; that is, the mediating effect of GID is positively moderated by ER. At the same time, the index of moderated mediation value of the moderating variable ER is 0.0779, and the confidence interval is [0.0451, 0.1144], excluding 0; ER produces a significant moderated mediation effect, which confirms that ER plays a moderating role in the mediated effect of GID, and the hypothesis H8c is verified.

DS, GBD, ER, and EP constitute the moderated mediation effect model, and the moderated mediation effect test results are shown in Table 19. According to the moderated mediation effect test process, the regression coefficient of DS on GBD is 0.0416, and the P value is less than 0.001 (significant). Further, we test the regression coefficient of the interaction term between GBD and ER. According to Table 14, the interaction term coefficient is 0.1970, the P value is less than 0.001 (significant), and the confidence interval is [0.1245, 0.2695], excluding 0. As shown in Table 19, as for the indirect effect, after introducing the moderating variable ER, the confidence intervals of DS ⟶ GBD ⟶ EP model in which GBD is moderated by ER (−1, 0, 1) are [−0.0250, 0.0540], [0.0501, 0.1231], and [0.0999, 0.2135] respectively, the differences between groups are 0.1388, and the confidence interval is [0.0788, 0.2081], excluding 0, indicating that the stronger the moderating effect of ER, the stronger the mediating effect of the mediating variable GBD; that is, the mediating effect of GBD is positively moderated by ER. At the same time, the index of moderated mediation value of the moderating variable ER is 0.0694, and the confidence interval is [0.0394, 0.1040], excluding 0; the moderated mediation effect of ER is significant, which confirms that ER plays a moderating role in the mediated effect of GBD, and the hypothesis H8c is verified.

DS, LCMP, ER, and EP constitute the moderated mediation effect model, and the moderated mediation effect test results are shown in Table 20. According to the moderated mediation effect test process, the regression coefficient of DS on LCMP is 0.3002, and the P value is less than 0.001 (significant). Further, we test the regression coefficient of the interaction term between LCMP and ER. It can be seen from Table 15 that the interaction term coefficient is 0.2044, the P value is less than 0.001, which is significant, and the confidence interval is [0.1329, 0.2759], excluding 0. As shown in Table 20, as for the indirect effect, after introducing the moderating variable ER, the confidence intervals of DS ⟶ LCMP ⟶ EP model in which LCMP is moderated by ER (−1, 0, 1) are [−0.0634, 0.0185], [0.0203, 0.0876], and [0.0767, 0.1817] respectively, the differences between groups are 0.1474, and the confidence interval is [0.0839, 0.2180], excluding 0, indicating that the stronger the moderating effect of ER is, and the stronger the mediating effect of the mediating variable LCMP is, the mediating effect of LCMP is positively moderated by ER. At the same time, the index of moderated mediation value of the moderating variable ER is 0.0737, and the confidence interval is [0.0419, 0.1090], excluding 0. ER produces a significant moderated mediation effect, which confirms that ER plays a moderating role in the mediated effect of LCMP. The hypothesis H8d is verified.

5. Research Conclusion and Enlightenment

5.1. Research Conclusion. This paper takes 469 representative and typical manufacturing enterprises in the eastern and central regions as the empirical analysis objects, adopts the nonparametric percentile bootstrap method based on deviation correction to empirically complete the research goals of revealing the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises and empirically deconstructing the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, and further empirically discusses the mediating roles of green resource integration ability, green duality, low-carbon manufacturing practice, and green intellectual capital, as well as the moderating roles of environmental regulation and forward-looking environmental strategy. The main empirical analysis conclusions are as follows: (1) main effect—dynamic sustainable development ability has a significant positive influence on environmental performance of manufacturing enterprises; (2) mediating effects—dynamic sustainable development ability affects environmental performance of manufacturing enterprises through green resource integration ability, which is integrated into the

Table 20: Moderated mediation effect test 5.

	DS ⟶ LCMP ⟶ EP			
ER	Effect	Boot SE	Boot LLCI	Boot ULCI
−1	−0.0218	0.0208	−0.0634	0.0185
0	0.0519	0.017	0.0203	0.0876
1	0.1257	0.0271	0.0767	0.1817
Intergroup differences	0.1474	0.0342	0.0839	0.2180
Index of moderated mediation				
ER	0.0737	0.0171	0.0419	0.1090

mediating mechanism model of dynamic sustainable development ability ⟶ green resource integration ability ⟶ environmental performance; that is, dynamic sustainable development ability indirectly affects environmental performance by affecting green resource integration ability. Dynamic sustainable development ability has influence on environmental performance through green duality, which is integrated into the mediating mechanism model of dynamic sustainable development ability ⟶ green duality ⟶ environmental performance; that is, dynamic sustainable development ability has indirect influence on environmental performance through green duality. Dynamic sustainable development ability has positive influence on environmental performance through low-carbon manufacturing practice, which is integrated into the mediating mechanism model of dynamic sustainable development ability ⟶ low-carbon manufacturing practice ⟶ environmental performance; that is, dynamic sustainable development ability has an indirect influence on environmental performance through influencing low-carbon manufacturing practice. Dynamic sustainable development ability has an influence on environmental performance through green intellectual capital, which is integrated into the mediating mechanism model of dynamic sustainable development ability ⟶ green intellectual capital ⟶ environmental performance; that is, dynamic sustainable development ability has an indirect influence on environmental performance through green intellectual capital; (3) moderating effects—environmental regulation significantly positively moderates the relationships among green resource integration ability, green duality, low-carbon manufacturing practice, green intellectual capital, and environmental performance; and (4) moderated mediation effects—environmental regulation, as the boundary condition, plays the buffer function. Environmental regulation significantly positively moderates the mediating mechanism and mediating transmission paths of green resource integration ability, green duality, low-carbon manufacturing practice, and green intellectual capital of the relationships between dynamic sustainable development ability and environmental performance of manufacturing enterprises; namely, environmental regulation significantly positively moderates the mediating function of green resource integration ability of the relationships between dynamic sustainable development ability and environmental performance of manufacturing enterprises; environmental regulation significantly positively moderates the mediating function of green duality of the relationships between dynamic sustainable development ability and environmental performance of manufacturing enterprises; environmental regulation significantly positively moderates the mediating function of low-carbon manufacturing practice of the relationships between dynamic sustainable development ability and environmental performance of manufacturing enterprises; and environmental regulation significantly positively moderates the mediating function of green intellectual capital of the relationships between dynamic sustainable development ability and environmental performance of manufacturing enterprises. The stronger the environmental regulation is, the more significant the mediating function and effects of green resource integration ability, green duality, low-carbon manufacturing practice, and green intellectual capital of the relationships between dynamic sustainable development ability and environmental performance of manufacturing enterprises are.

The advantages of this paper lie in adopting the nonparametric percentile bootstrap method based on deviation correction to empirically reveal the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises, empirically deconstruct the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, and empirically discuss the mediating roles of green resource integration ability, green duality, low-carbon manufacturing practice, and green intellectual capital, as well as the moderating roles of environmental regulation and forward-looking environmental strategy. Further, the main effect, the mediating effects, the moderating effects, and the moderated mediation effects are carried out.

5.2. Theoretical Contribution. Firstly, this study enriches and deepens the achievements in the research fields of dynamic sustainable development ability and environmental performance, effectively echoes the research themes of Maconachie and Conteh [49], sets environmental regulation and forward-looking environmental strategy as situational variables and moderating variables (boundary conditions), and defines green resource integration ability, green duality, green intellectual capital, and low-carbon manufacturing practice as mediating variables, puts emphasis on the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, and empirically reveals the influence mechanism and conducting paths of dynamic sustainable development ability on environmental performance of manufacturing enterprises. Secondly, combining with the practice of manufacturing enterprises, this study extends the sustainable development ability to dynamic sustainable development ability. In view of the previous research results focusing on the direct influence of sustainable development ability of manufacturing enterprise on environmental performance, this study deeply discusses the mediating function mechanism among green resource integration ability, green duality, green intellectual capital, and low-carbon manufacturing practice, and enriches the research results on how dynamic sustainable development ability of manufacturing enterprise indirectly affects environmental performance. Finally, the research results on situational variables and boundary conditions of environmental regulation and forward-looking environmental strategy have important enlightenment significance for manufacturing enterprises to obtain environmental performance. Environmental regulation can effectively eliminate the negative environmental behavior of manufacturing enterprises, promote manufacturing enterprises to carry out green management, construct and improve dynamic sustainable development ability, and obtain environmental performance. However, in the empirical analysis, the moderating effect of forward-looking environmental strategy has not been empirically verified; it may be that manufacturing enterprises do not pay enough attention to the relevant issues of environmental strategic management from the perspective of dynamic development and future evolution, which also provides experience for the future environmental management of manufacturing enterprises.

5.3. Research Enlightenment. The main practical implications of this study are as follows: (1) Manufacturing enterprises should pay attention to activate green resource integration ability, identify the key green resources, and improve environmental performance. (2) It is necessary to put emphasis on the accumulation of green intellectual capital, stimulate green human capital, strengthen green structural capital and green relational capital, promote the long-term coordinated and coupled development among the three types of green intellectual capital, and give full play to the value of enterprise green intellectual capital. (3) If manufacturing enterprises want to achieve bilateral transformation and high-quality development, they should take the relationships between human needs and environmental supportability into account, and they must pay attention to the implementation of green duality practice. Based on the natural resource-based management theory, manufacturing enterprises should promote green exploration and green utilization activities and behaviors as a whole. (4) The implementation of low-carbon manufacturing practice is one of the necessary conditions for manufacturing enterprises to achieve bilateral transformation. Manufacturing enterprises should regularly conduct low-carbon production knowledge training for managers and employees to imperceptibly optimize the low-carbon thinking mode and low-carbon behavior of employees in manufacturing enterprises. (5) Through active environmental management behaviors and activities, manufacturing enterprises can strive for the support of environmental regulation and imperceptibly improve their environmental performance.

5.4. Research Limitations and Prospects. This research may ignore the other mediating variables and moderating variables, which may not fully reveal the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises and explore the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises. This research uses cross-sectional data to carry out empirical analysis of the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, which may not comprehensively reveal the causal relationships among variables. In the future, we will introduce more reasonable mediating variables and moderating variables to improve and enrich the conceptual model and theoretical framework of deconstructing the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises, and we will also use longitudinal dynamic tracking data to carry out empirical analysis of the influence mechanism of dynamic sustainable development ability on environmental performance of manufacturing enterprises and deeply deconstruct the black-box of dynamic sustainable development ability driving environmental performance of manufacturing enterprises.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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Research Article

Construction of a Public Health-Oriented Sports Training Big Data Analysis Platform

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Sports health has become a goal pursued by most people, both young and old, which is mainly due to the improvement of people's living standards and the improvement of economic level. Different groups have great differences in the way of physical exercise for public health. The idea of pursuing physical exercise is better but most ignore the factors that affect exercise. Not only will this have a certain negative impact on body function but it also defeats the purpose of physical exercise. Reasonable physical exercise is more urgently needed. However, for public health physical exercise, reasonable methods are also difficult to obtain. This is mainly due to the large differences in the number of groups and hurdles faced by public health. This study designs a public health-oriented sports training platform based on big data technology. It mainly uses the hollow convolutional neural network (A-CNN) and the GRU method to extract the relationship between physical training and physical function, weather factors, and exercise intensity. The research results show that the A-CNN and GRU methods can better map the relationship between sports training parameters and the three characteristics that affect sports health. This kind of sports training platform based on big data technology can better guide young people or the elderly to carry out reasonable physical exercise. A-CNN and GRU techniques have relatively high accuracy in predicting the three characteristics of physical exercise. The smallest error is only 1.43%, and the largest error is also 2.56%.

1. Introduction

With the continuous improvement of living standards, people's pursuit of life has undergone great changes. In the past, people only pursued basic necessities of life, but now people are constantly pursuing good health and a happy life. Physical exercise has become an essential part of people's lives [1, 2]. People's pursuit of physical health is mainly divided into two reasons. The first is the continuous pursuit of physical health. The second is the improvement of living conditions, which leads to the improvement of the level of food. This further leads to obesity, which is the reason for the constant pursuit of physical fitness. Different groups have different reasons for pursuing physical fitness [3, 4]. For young people, the main reason for their pursuit of physical fitness is for a more perfect body. Sometimes, it's also a hobby. For the elderly, the main reason for their pursuit of physical fitness is to improve their physical function and health. Physical fitness can not only improve physical function, it can also keeps people in a happy mood. It can be said that sports health has become a pursuit of the people. With the continuous development of public sports health, there are also many types of physical exercise places and activities that further promote the development of public sports health. Improving public sports health has also become a task of the government. Different groups have different ways of exercising [5, 6]. Young people tend to focus on ball games or gym sports, which are quantitative exercise methods. They use high-tech technology to supervise their exercise process, which is also a scientific way of exercise. However, the elderly often use public sports equipment or walking as a form of physical and healthy exercise, and they rarely participate in high-intensity physical exercise. It also showcases a diverse sporting pattern. No matter what kind of sports group or what kind of healthy sports mode one chooses, scientific exercise methods are also more important [7, 8]. Scientific exercise methods not only protect your body, but also make sports and healthy exercise achieve the best exercise effect. High-intensity physical exercise not necessarily has a better effect. There is a strong relationship between public health physical exercise and physical function, weather, intensity, and other factors. A reasonable public health campaign method is more important, which requires more successful cases for reference. For physical exercise, most people do not understand the rationality of physical and healthy exercise. They rarely pay attention to the relationship between their physical function and the weather and exercise intensity. Reasonable public physical exercise methods and intensity are more critical for young people and the elderly. The parameters of this successful public sports training method need to be provided by professional sports personnel. Therefore, it is important to establish the relationship between the relevant data of sports training and physical function, exercise intensity, and weather factors.

It can be seen from the above description that most of the groups participate in more physical exercise in today's era in order to pursue more perfect physical health. However, they rarely notice the relationship between physical function and exercise intensity and weather factors. They perform public sports and health exercises according to their own hobbies and needs. They also pay little attention to the way they exercise. This will not only have a certain negative impact on the body, but also make it difficult to achieve the purpose of public sports and health campaigns. Proper exercise requires the advice of professional sports trainers or the reference of more successful case parameters to carry out related public physical exercises. The elderly often find it difficult to obtain the help of more professional sports personnel. Most of the elderly only exercise through simple ball games or walking. Most young people only perform physical exercise according to their own interests [9, 10]. Most people pay little attention to the relationship between the effect of public physical exercise and physical function, weather factors, and exercise intensity. Physical exercise has more influencing factors. However, physical function, weather factors, and exercise intensity are the three most influential characteristics, which are also relatively direct influencing factors. Therefore, the parameters of a common physical fitness exercise pattern are important for different sports groups. The collection of these motion parameters is difficult for most groups of motion, which requires a general motion parameter or platform as a relevant reference. Big data technology has developed rapidly and can be used to discover the relationship between exercise parameters and physical function, weather factors, and exercise intensity. These three factors are relatively objective factors. If these factors are not quantified, it is difficult to find the relationship between these factors and motion parameters. The amount of data related to the physical function and exercise intensity of physical exercise is huge, and the relationship between these three and the parameters of physical exercise is also complicated, which is very difficult for manual methods to compute. Thus, big data technology is exactly used to evaluate the advantage of this aspect.

Big data technology has developed rapidly in recent years. It is a research hotspot in today's era, and also solves many problems in many fields [11, 12]. Big data technology can handle huge amounts of data. For research objects and research tasks with a large amount of data, manual processing will consume a lot of time and human capital. With the development of computer technology, the characteristics of research objects can be converted into forms of data [13, 14], and big data technology can bring great advantages to production and life, and it can also realize the automation of technology. At the same time, big data technology has developed many mature algorithms, which have high stability and practicability in many fields. This is good news, as researchers only need to make minor adjustments as needed. Therefore, big data technology can also be applied to data in public health sports training. Currently, the most utilized algorithms are convolutional neural networks (CNN) and long short-term memory (LSTM) neural networks and reinforcement learning. The main role of CNN is to deal with spatial features between data and it can also map the relationship between different features. LSTM mainly deals with some temporal feature relationships. In life or production, temporal and spatial features are two common features. CNN and LSTM methods also contain more variant algorithms depending on the application environment. A-CNN is a variant of the CNN technology. GRU is a variant of the LSTM method. Both A-CNN and GRU techniques can reduce the amount of parameters in physical exercise-related operations. This also requires less computing resources.

This study mainly uses the atrous convolutional neural network (A-CNN) and the GRU neural network in big data technology to deal with the relationships between the huge amounts of data in public health sports training. The A-CNN method can map the relationship between physical exercise parameters and physical function, exercise intensity, and weather, while GRU can better extract the time features included between exercise intensity and weather. This study presents and analyzes the whole research from 5 different directions. Section 1 illustrates the research significance of sports training in public health settings and the research background of big data technology. The research status of the factors related to physical training is studied in Section 2. The system scheme and related algorithms of the big data platform for public health sports training are studied in Section 3. Section 4 presents the feasibility of the A-CNN and GRU methods in sports training research. Section 5 summarizes the application value of the A-CNN and GRU methods in a public health-oriented sports training platform.

2. Related Work

In today's era, public physical exercise has also become a relatively popular recreational activity and has also produced more related industries and researches on physical exercise corresponding to public health. However, there is a lack of a public health-oriented physical training platform to guide the physical exercise of most groups. Of course, many researchers have studied the factors associated with physical activity. Pu [15] believed that sports videos will help the analysis of sports process by analyzing the process in the form of video playback. This improves the quality of movement and proposes a new motion video analysis method to address the shortcomings of the existing motion video analysis methods. It also describes the detailed video analysis process, and also conducts a comprehensive test on the motion video system; the research results show that this new motion video analysis method can capture the image of the video and also the effective information of the video. This accuracy has also been greatly improved. This method has certain practical value for guiding sports. Wang et al. [16] mainly improved the decision-making ability of sports players according to the training effect of sports. Their model devises a method of using association for sports running decision support system. It establishes a sports spatial motion model to analyze the distribution relationship of association rules. The methods of data mining and cloud computing are also used to fully mine the effect of sports operation. When mining sports training feature data, it adopts a method of fuzzy information fusion and data reorganization. It tests these methods in real training data mode. The research results show that this method has strong mining and decision-making abilities for sports training. Wang and Huang [17] believed that rehabilitation training of sports is a mode of restoring physical training, which can also restore related functions of the body. This is a beneficial training mode for the physique of the physical trainer and the prevention of diseases. It mainly uses intelligent algorithms to realize the health monitoring system of sports recovery training. They designed an intelligent sports health monitoring system, and it has also tested this health monitoring system in the actual recovery training. The research results show that this intelligent recovery training system can have good accuracy, with an accuracy of 92.6%. This intelligent recovery training health monitoring helps protect the health of trainers. Wang et al. [18] mainly focus on some sports training and physical exercises during summer camps or exchange visits, which is also a common sports exchange and public sports health problem. They developed and designed a sports training program, and these sports-related activities are mainly related to overseas markets. The model determines the factors that affect this sports mode according to the current situation of the relevant literature, which provides a reference for the development of sports training programs. Fu [19] has collected sports training data using wireless sensor technology, and also carried out in-depth research on the collected data. The researcher designed an athlete data collection system according to the needs of sports trainers, which includes data collection terminals and wireless sensors and other technologies. The model will realize real-time collection and analysis of athlete training data. The research results show that this system collects first data and improves the training performance by 16%. This system can meet the needs of athletes' training data collection and storage, which will also be of great value to athletes' data analysis. Wang [20] has realized the importance of training assistance systems for sports training, and hence used an improved machine learning algorithm to study training-aided decision-making systems for physical exercise. This applies maximum entropy and adversarial neural network techniques to sports training samples. The introduction of this algorithm can solve the problem of uneven edge distribution of sports training data. It also applies this decision-making system to actual sports training. The research results also verify the importance and reliability of this decision-making system for sports training. Current research rarely uses the A-CNN and GRU methods to study the relationship between physical exercise parameters and physical function and exercise intensity. Once this relationship is established, it can better guide different groups to carry out efficient physical exercise.

3. Application Scheme of the A-CNN and GRU Methods in Sports Training Big Data Platform

3.1. The Significance of Big Data Technology for the Prediction of Physical Exercise Characteristics. Through the above introduction, it can be found that the physical functions of physical exercise, exercise intensity, and weather factors are the key factors that affect physical health. However, the characteristics of these three factors are difficult to find by artificial means. There are also different relationships between the physical health of different groups and these three factors. This brings fewer references to physical exercise for different groups. Excessive exercise intensity and exercise in bad weather are both detrimental to health [21]. However, artificial methods are unable to establish the relationship between physical function, weather factors, and exercise intensity and physical fitness. There is a complex relationship between these factors and physical health. This requires the application of big data technology. The big data technologies selected in this study are A-CNN and GRU. They can comprehensively consider the problem of feature extraction and calculation time. A-CNN can save more parameter computation than CNN technology, and it can also extract features efficiently. The biggest advantage of big data technology is the processing of complex data, which is also a major disadvantage of manual methods. In general, big data technology can not only help people find the relationship between physical health and physical function, exercise intensity, and weather factors, it can also predict unknown factors, which can be very good to guide different groups to perform physical exercise.

3.2. Design Principles of A-CNN and GRU in Sports Training Big Data Platform. The ultimate goal of this research is to design a sports training big data platform, which is mainly aimed at public health sports. This is also to solve the problem of the lack of relevant parameters and technical guidance in the public health model. Considering the huge amount of parameters of the physical exercise big data platform, it adopts the variant neural network A-CNN of CNN. At the same time, it also takes into account the strong relationship between weather characteristics and exercise intensity characteristics and time, and it uses the GRU method. Both of these methods can reduce the amount of parameter computation to a certain extent. Figure 1 shows the design flow of the sports training big data platform using the A-CNN method as well as the GRU method. The characteristics here mainly include physical function, exercise intensity, and weather factors. Although there is a certain correlation between physical training and other characteristics, the influence of these three factors is relatively large and intuitive. The collection and processing of the dataset is the most critical step, which will affect the training accuracy and convergence. This flowchart is not shown. The data of these three features once collected will be used as the input data of A-CNN. The data will go through the convolutional layers, pooling layers, and activation functions of A-CNN. When the relevant features are learned, the data will then go through the GRU in a sequence, where the temporal features of the three features are extracted. A-CNN will establish the relationship between sports parameters and the three influencing factors. The output data of A-CNN is the input data of GRU again as a sequence. Finally, the GRU outputs the physical exercise health index through the output layer. There is a feedback propagation mechanism in the calculation of output and loss of physical exercise. The output and loss are continuously affected at each iteration step.

CNN has been applied in many fields as it can reduce the amount of parameter computation compared to fully connected neural networks. However, if the number of layers of CNN reaches a certain level, it will still have more parameters. This results in wasted computing resources and time. With the continuous progress of CNN methods, atrous convolutional A-CNN technology has shown better performance in extracting features. It has less parameter computation compared to traditional CNN methods. This is advantageous for large datasets. Figure 2 shows the workflow of A-CNN in the sports training big data platform, which is similar to that of CNN. The difference is that there will be fewer parameters in the convolution layer during the convolution operation.

3.3. The Principle and Introduction of the A-CNN and GRU Equation. The computational complexity of the LSTM method is large, and it will consume more time and computing resources. This is bad for deeper network layers. In order to reduce the number of parameters of the LSTM, researchers have discovered the GRU algorithm, which is also good at dealing with time problems. Figure 3 shows the application process of the GRU method in the sports training big data platform. Compared with the LSTM, the gate structure is changed from 4 to 2. Although the number of gate structures is reduced, it can still effectively process historical information as well as current information. It can also efficiently output historical information related to current state information. It can be seen from Figure 3 that the structure of GRU is relatively simple compared to the LSTM. However, the performance of GRU does not degrade on large datasets. There is a certain similarity in structure between the GRU and LSTM methods. The difference is that the number of gate structures is different, and there is also a certain gate structure calculation in the hidden layer of GRU. However, the reset gate of GRU and the forget gate of the LSTM have a similar role as the input gate.

It can be clearly seen from Figure 3 that GRU also has two gate structures, which are update gate and reset gate, respectively. Compared with the LSTM, it has two less gate structures. The hidden layer unit of GRU also introduces a gate structure, which can assist in the memory and selection of information.

Equations (1) and (2) show how the reset gate of the GRU is calculated. The reset gate will replace the LSTM's forget gate and input gate. It will also re-select and input the input information and historical information according to the size of the weight.

$$g_r = \sigma\left(W_r\left[h_{t-1}, x_t\right] + b_r\right), \tag{1}$$

$$\widetilde{h_t} = \tan h\left(W_h\left[g_r h_{t-1}, x_t\right] + b_h\right). \tag{2}$$

Equations (3) and (4) show the calculation criteria for the update gate of the GRU. It is similar in function to the output gate and update gate of the LSTM. It will continuously update the information that needs to be output according to the size of the weight.

$$g_z = \sigma\left(W_z\left[h_{t-1}, x_t\right] + b_z\right), \tag{3}$$

$$h_t = \left(1 - g_z\right)h_{t-1} + g_z\widetilde{h_t}. \tag{4}$$

Equations (5) and (6) show the method of derivation calculation for weights and biases. For A-CNN and GRU, this derivation method exists in each layer of their structure. Although the operations of the two methods are different, Equations (5) and (6) are general calculation guidelines.

$$\Delta\omega_{ji} = -\eta\frac{\partial E}{\partial\omega_{ji}}, \tag{5}$$

$$\Delta u_{ij} = -\eta\frac{\partial E\,\partial}{\partial u_{ij}}. \tag{6}$$

For A-CNN, the output size of features is somewhat different from CNN. This is also related to the convolution operation form of the hidden factor. Equation (7) shows how the output feature size of A-CNN features is calculated.

$$S_{\text{out}} = \left\lfloor\frac{S_{\text{in}} + 2\text{pading} - S_{\text{kenal}}}{\text{step}}\right\rfloor + 1. \tag{7}$$

In A-CNN, if there is a deconvolutional neural network, it is not impossible to obtain the original size; it needs to go through a certain convolution operation to obtain the original feature size. Equation (8) shows how the original feature size is calculated by deconvolution. Equation (9) shows a calculation criterion for the receptive field.

$$S_{\text{in}} = \left(S_{\text{out}} - 1\right) \times \text{step} + S_{\text{kenal}} - 2\text{pading}, \tag{8}$$

$$V_i = V_{i-1} + S_{\text{kenal}-i} \times \prod_{i=1}^{i-1}\text{step}_{i-1}. \tag{9}$$

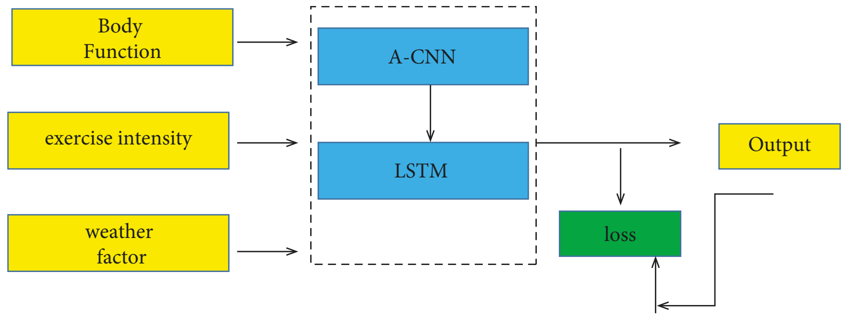

Figure 1: Design principles of A-CNN and GRU in the sports training big data platform.

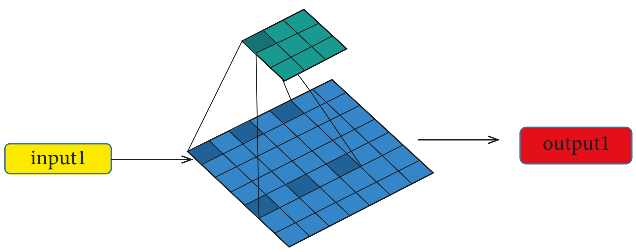

Figure 2: The working principle of the A-CNN algorithm.

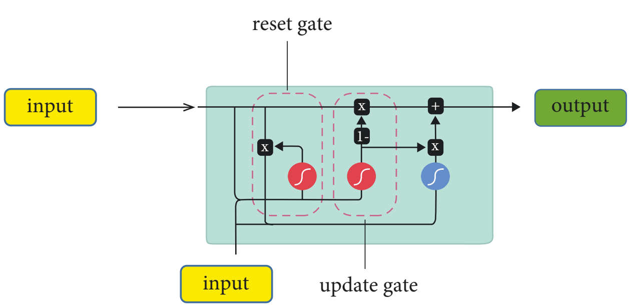

Figure 3: The working principle of the GRU method.

Equation (10) shows the activation function used in this study, which is typically placed in the last layer of the neural network. It will non-linearize the extracted features. Otherwise, all data will be output in a linearized manner.

$$a^l = \mathrm{ReLU}\left(z^l\right) = \mathrm{ReLU}\left(W^l a^{l-1} + b^l\right). \tag{10}$$

The loss function is a function that exists in every neural network structure, and it is also a driving force for gradient descent methods. Most loss functions use the mean square error function. Equation (11) shows the mean square error function used in this study, which will calculate the error between the predicted and actual values of the physical training parameters. Gradient descent will use this error to find the smallest gradient direction.

$$L = \mathrm{MSE}\left(q^{\mathrm{real}}, q^{\mathrm{pre}}\right) = \frac{1}{nm}\sum_{k=1}^{N}\sum_{j=1}^{M}\left({q_{kj}}^{real} - {q_{kj}}^{pre}\right)^2. \tag{11}$$

4. Result Analysis and Discussion

This study uses the A-CNN and GRU methods in the field of big data to design a sports training monitoring intelligent system for national health. It mainly solves the problem of lack of relevant data reference in the field of public health sports. The A-CNN method is used to extract relevant features of physical training, and it is also used to map the relationship between physical training parameters and training-related factors. This study mainly selected three characteristics: physical training, weather factors, and exercise intensity. The GRU method mainly extracts the temporal features of these three factors. This is also because weather factors and bodily functions are constantly changing over time. At the same time, the forming the dataset is also an important process. In this study, relevant sports training data and physical exercise parameters in Beijing were selected as the training and test sets. In order to ensure the accuracy of the test set, the test set of this study was also derived from the actual data. Not only does Beijing have a high population density, but the movement patterns here are diverse, and datasets with more features can also be collected.

In this paper, the A-CNN and GRU methods have been selected as methods for evaluating the sports training big data platform. The advantages of these two methods vary. A-CNN can extract features between physical function, exercise intensity, and weather factors. GRU mainly extracts the time relationship of these three. In order to verify the validity of the GRU method and verify the weather factors and the correlation between physical function and time, this study first used a single A-CNN method for training and testing. Figure 4 shows the error distribution of the three effects of physical training. In Figure 4, V1 represents the physical performance feature of physical exercise. V2 represents the exercise intensity feature related to physical exercise. V3 represents the characteristics of weather influencing factors. On the whole, the prediction errors obtained using a single A-CNN method can also meet the needs of the sports training big data platform, and the three prediction errors are all distributed within 3.5%. However, the prediction errors of these three influencing factors all exceed 2%, which is unfavorable for the accuracy and stability of the sports training big data platform. This shows that the features of the three factors are not fully extracted. This limits the application of the sports training big data platform in real life. From this point of view, A-CNN cannot fully meet the needs of the sports training big data platform for accuracy and reliability.

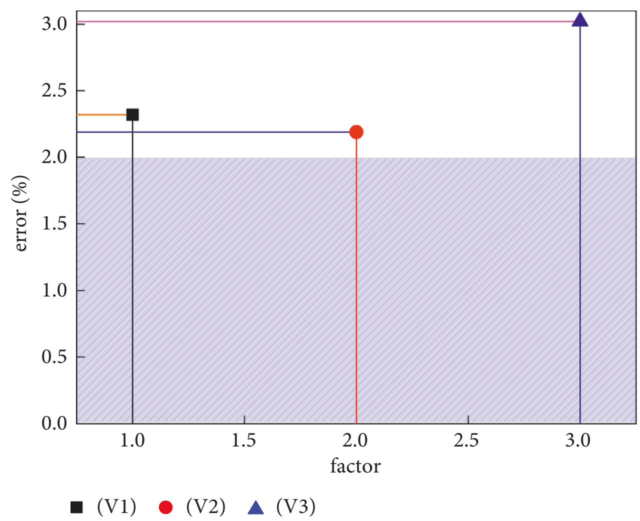

Figure 4: Prediction errors for the three features in the sports training platform utilizing a single A-CNN approach.

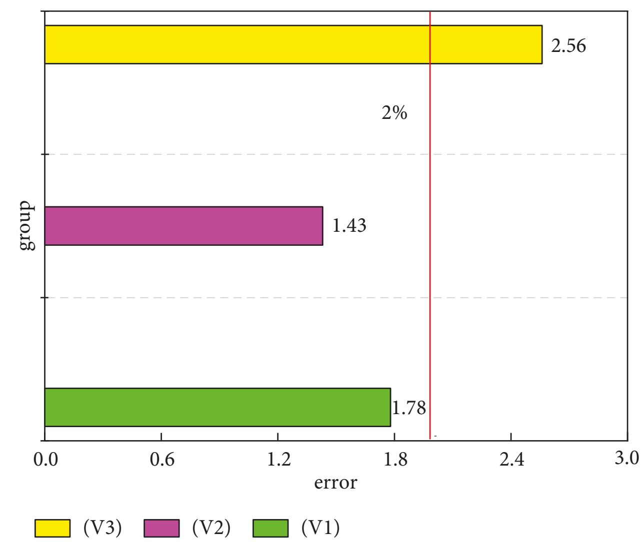

Figure 5: Prediction errors of the three features in the sports training platform using the A-CNN and GRU methods.

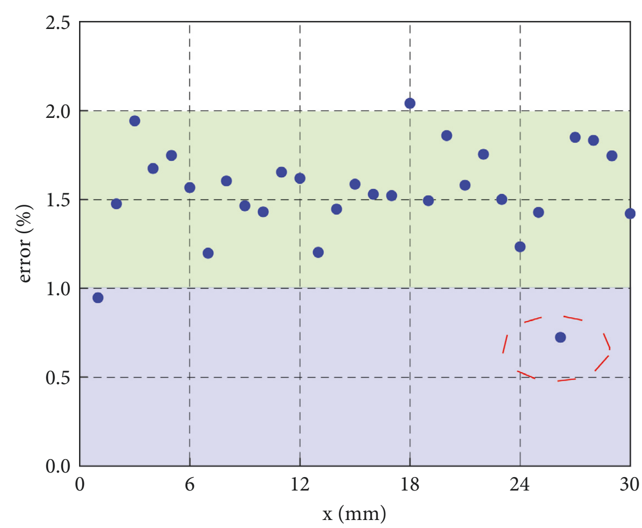

Figure 6: Distribution of scatter plots of the prediction errors for physical function.

Since a single A-CNN method cannot meet the needs of a sports training big data platform, it is necessary to consider the temporal correlation of physical exercise. After all, physical exercise is a long-term process, which is closely related to time. This study further predicts and analyzes these three factors using a hybrid A-CNN and GRU method. Figure 5 shows the prediction error of the three factors of the sports training big data platform using the A-CNN and GRU methods. The red line indicates that the prediction errors of the three characteristics of physical exercise are within the 2% interval. This will divide the prediction error by a 2% bound. This more clearly sees the effect of A-CNN and GRU. From Figure 5, it can be seen intuitively that the prediction errors of the three factors have been greatly reduced. This not only shows the importance of the GRU method to the sports training big data platform, but also further shows that the three factors of sports training have strong temporal correlation. When using the sports training big data platform, it is necessary to fully consider the time correlation. Prediction errors for both physical function and exercise intensity were reduced to less than 2%. The prediction error of physical function is 1.78%, while the prediction error of exercise intensity is only 1.43%. This is extremely accurate and reliable for the sports training big data platform. The forecast errors of weather factors remained at a high level, which may be related to the lack of data in the dataset.

The above analysis analyzes the relative accuracy of the sports training big data platform through the average prediction error. It selects 30 different sets of data to introduce the prediction distribution of the three factors of physical training. Figure 6 shows a scatterplot of prediction errors for physical performance features in the sports training big data platform. Overall, most of the scatterplot data are distributed within 2% of the data for the 30 groups of physical performance characteristics. Only one set of data has an error of more than 2%. However, the magnitude of excess is also relatively small. This fully shows that the A-CNN and GRU methods have extremely high accuracy in predicting the special physical function of the sports training big data platform, which is beneficial for practical applications. There were also two groups with prediction errors of less than 1% for physical performance characteristics. If the A-CNN and GRU methods are applied in actual training, they can accurately predict the relationship between physical function factors and physical exercise parameters.

Similarly, this study still selected 30 sets of data to analyze the prediction of exercise intensity using the A-CNN and GRU methods. Figure 7 shows the distribution of the predicted value and the actual value of the exercise intensity feature of the sports training big data platform. Exercise intensity is an important parameter for physical exercise, and the prediction accuracy of this parameter will determine the time and type of physical exercise. This is also a physical exercise feature that can be easily grasped. On the whole, the

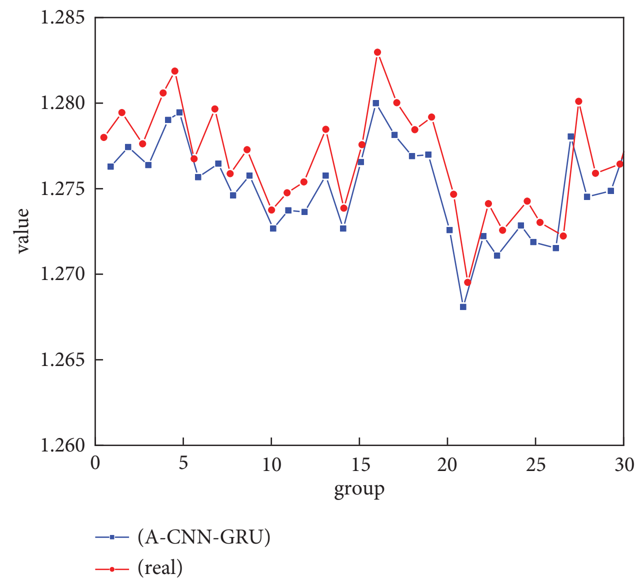

Figure 7: Distribution curve of the predicted value and the actual value of the exercise intensity feature.

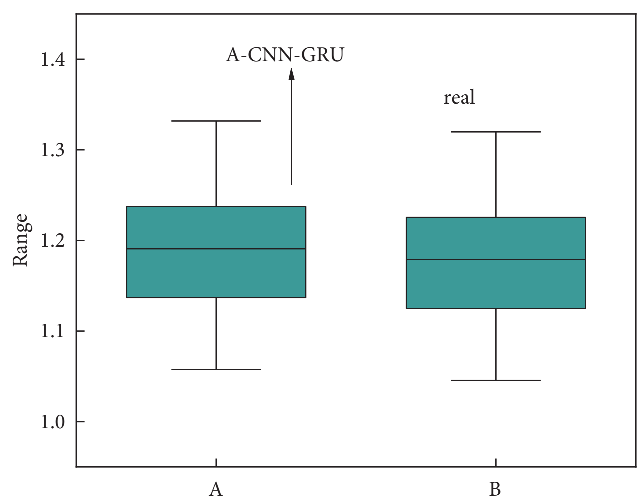

Figure 8: Prediction of weather characteristics of the sports training big data platform and box plot distribution of actual values.

eigenvalues of exercise intensity predicted by the A-CNN and GRU methods are consistent with the actual values regardless of the magnitude of the value or the change trend of exercise intensity. Although there are obvious fluctuations in the eigenvalues of exercise intensity, there are many peaks and troughs between two adjacent eigenvalues of exercise intensity. However, A-CNN and GRU still show better performance, which predicts the fluctuation of motion intensity better. This is better reliable for the application of the actual sports training big data platform.

The influence of weather factors on physical exercise is a relatively objective factor. However, it also has a greater impact on the effect of physical exercise. The weather factor has great variability, and its prediction in the sports training big data platform is also relatively large. This study chooses the form of box plot to show the effect of A-CNN and GRU in predicting weather factors. Figure 8 shows the box plot of the predicted and actual values of weather features in the sports training big data platform. A box plot can not only show the magnitude of the values, it can also show the distribution of two sets of values. On the whole, the predicted box distribution of weather factors is relatively consistent with the actual box distribution. The data value of the weather factor obtained by the A-CNN-GRU methods is relatively large, but the error between the two is relatively small. From the mean point of view, the distribution of the two is also smaller. Overall, the A-CNN-GRU methods can more accurately predict the weather characteristics in the sports training big data platform.

5. Conclusions

People's pursuit of life is constantly improving, and physical exercise is one of the more important manifestations. Physical exercise can not only improve physical health, it can also improve the happiness index of life. Both young and old have their own patterns of physical activity, mostly for their own hobbies and health. However, they paid little attention to the level of physical fitness that physical activity achieves. This is also because there are fewer parameters for them to compare and guide. This limits the purpose of physical exercise in public health. Physical exercise must have a certain scientific basis. It needs to carry out reasonable physical exercise according to factors such as physical function and weather. It is not that the greater the intensity of physical exercise, the better. Different groups have different levels of physical activity. This requires physical exercise parameters in a public health model for their reference.

This research uses the A-CNN and GRU methods in big data technology to design a physical exercise big data platform. It mainly uses the A-CNN and GRU methods to predict factors that are more relevant to physical exercise. This study mainly selected physical function, exercise intensity, and weather factors as the research objectives. For a single A-CNN method, although it can accurately predict the three characteristics of the physical exercise big data platform, the prediction errors of these three characteristics are also within a reasonable range. However, the prediction errors of factors such as physical function and exercise intensity are relatively high, which lacks certain reliability for the practical application of the physical exercise big data platform. For the hybrid A-CNN and GRU model, the prediction errors of physical function, running intensity, and weather factors are significantly reduced. The error of physical function and exercise intensity is less than 2%. The largest prediction error is only 2.56%, which is also related to the variability of weather factors. In general, the application of the A-CNN and GRU methods in the physical exercise big data platform is feasible, and it also has relatively high stability.

Data Availability

*The dataset can be accessed upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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Research Article

Establishment of a Big Data Monitoring Platform for Cinema Opening in the Postepidemic Era from the Perspective of Public Health

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The emergence of COVID-19 has had a huge impact on people's lives around the world. With the vaccine and the effective policies of the government, the spread of the epidemic has been effectively contained. However, in the postepidemic era, public health and epidemic protection policies have forced the transformation of public places such as movie theaters. The cinema box office monitored by the traditional monitoring platform can no longer effectively reflect the opening of the transformed cinema. To make up for the shortcomings of the traditional monitoring platform, considering the large amount of data generated by the cinemas' online and offline platforms and public place codes, this study establishes an intelligent monitoring platform based on big data technology to monitor the opening of cinemas. The established intelligent monitoring platform can fully extract the feature information contained in numerous data collected from cinemas and output quantitative indicators that characterize the opening of cinemas based on the feature information. The performance of the established intelligent monitoring platform is analyzed through a case study. The research results show that the average relative error between the cinema opening indicators predicted by the intelligent monitoring platform and the real results is within 2%, which indicates that the intelligent monitoring platform has good prediction accuracy. In addition, the statistical analysis results show that the linear correlation coefficient between the predicted and real results is $0.9802 > 0.95$, which further indicates the feasibility of the established intelligent monitoring platform to monitor the opening of cinemas in the postepidemic era.

1. Introduction

Since 2019, the sudden arrival of coronavirus disease 2019 (COVID-19) has disrupted people's daily life [1]. Due to the rapid spread of COVID-19 and the great threat to people's health, various measures have been taken around the world to deal with the impact of COVID-19. In the background of the COVID-19 pandemic, politics, economy, and life around the world have been widely affected [2, 3]. In terms of politics, to curb the spread of the epidemic, policy responses have been introduced around the world, and protective measures such as vaccination, health code inquiry, and patient isolation and treatment have been adopted [4, 5]. These measures have increased the burden on the government and consumed a lot of manpower, material, and financial resources. On the economic front, due to the impact of the epidemic, stores, enterprises, and other offline units cannot carry out normal work and are facing bankruptcy. At the same time, the reduction of offline consumption has greatly affected the normal operation of the national economy. In terms of life, under the influence of the epidemic, public places cannot be opened normally, and large-scale events cannot be held normally, which makes people's spiritual needs unmet. In addition, due to the need for epidemic prevention and control, people's daily travel and shopping also have many inconveniences [6].

As a public place that provides leisure and entertainment, cinemas are also inevitably affected by the epidemic.

During the rapid spread of the epidemic, the government issued strict epidemic prevention and control policies, which forced the cinema market in various places to be suspended. At the same time, under the influence of the epidemic, many completed films were forced to withdraw because they could not be shown. This has impacted the capital chain of the film industry, making it impossible for subsequent projects to proceed smoothly. Due to the failure of the film production and the inability of the film to play normally, the film inventory is insufficient, which affects the subsequent broadcast of new episodes, leads to the cancellation of film-related publicity activities, and the inability of the project to proceed smoothly, etc., which will give film and television companies a series of chain reactions. Fortunately, with the development of vaccines and the effective implementation of epidemic prevention measures, the epidemic has been effectively contained [7, 8]. To improve people's quality of life, various public places such as cinemas have also been reopened. However, although cinemas have been reopened, their operating order is still affected by the epidemic prevention and control policies. In this study, we refer to the era when cinemas and other public places can open in an orderly manner as the postepidemic era.

In the postepidemic era, to provide people with leisure and entertainment while consolidating the public health protection network, cinemas have adopted a series of epidemic prevention and control measures. For example, formulate an emergency response plan for the epidemic and report abnormal situations promptly; reserve e-tickets online to reduce direct contact, and the attendance rate for each show does not exceed 75%; strictly enforce temperature checks; stages are staggered between halls to reduce audience gatherings. To maintain income in the postepidemic era, cinemas have increased the opening of supporting industries. For example, new formats such as trendy games, script killing, and immersive entertainment have been introduced into the cinema space; in addition, to maximize the place effect of cinemas, the development of multifunctional cinema complexes is also a current development trend. Cinema complexes centered on movie content can satisfy the interests of various groups of people, thereby attracting more consumers. Therefore, according to the above analysis, in the postepidemic era, the opening model of cinemas has changed to a certain extent compared with the traditional cinema opening model. To monitor the opening of cinemas in the postepidemic era, it is necessary to monitor not only traditional indicators such as cinema opening rates and box office revenue but also people flow indicators in cinemas. The monitored people flow indicator not only reflects the number of people watching a movie but can also reflect the number of people consuming other entertainment items in the cinema complex [9].

Currently, traditional cinema data monitoring platforms usually monitor the opening of cinemas by summarizing data from ticketing software and offline sales front desks. This traditional monitoring platform can effectively reflect the opening and revenue of cinemas without the impact of the epidemic. However, the transformation of cinemas in the postepidemic era makes this traditional monitoring platform limited in monitoring the flow of people in new entertainment projects. In addition, this traditional monitoring platform does not consider the impact of public health protection policies on the opening of movie theaters. Therefore, to cope with the limitations of traditional cinema data monitoring platforms in the postepidemic era, this study introduced big data technology to build an intelligent cinema opening monitoring platform. Compared with the traditional monitoring platform, the intelligent monitoring platform based on big data technology can make full use of the large amount of data information generated by the Internet platform [10] and extract the feature information that characterizes the opening of the cinema, thereby accurately monitoring the opening of cinemas under the public health protection policy in the postepidemic era.

This study will analyze the impact of public health protection policies on the opening of cinemas in the postepidemic era. At the same time, the advantages of big data technology in monitoring the opening of cinemas will be fully analyzed. In the process of analyzing the performance of the intelligent monitoring platform based on big data technology, the statistical parameters of relative error and linear correlation coefficient are used. This study is organized as follows. In Section 1, the impact of COVID-19 on public places such as cinemas is analyzed, and the deficiencies of traditional monitoring platforms in monitoring the opening of cinemas after the transformation of cinemas in the postepidemic era are expounded. The research status of platforms monitoring the opening of cinemas is presented in Section 2. Section 3 presents the established monitoring platform for the opening of cinemas based on big data technology and explains the relevant theoretical background. Section 4 analyzes the feasibility and performance of big data technology in monitoring the opening of cinemas. Section 5 summarizes the content of the study.

2. Related Work

COVID-19 has brought a severe impact on the global economy and people's lives. With the epidemic under control, many researchers studied the impact of the virus and epidemic prevention and control policies on the economy and life since the epidemic outbreak. As COVID-19 raged around the world, Feng et al. [11] analyzed the relationship between epidemic prevention and control and economic development. They constructed a measure of the effectiveness of pandemic containment and analyzed the relationship between epidemic prevention and control policies and GDP growth in multiple countries based on the constructed measure. The results of the analysis showed that to control the epidemic, the economic development of most countries has been negatively affected. In addition, Alkandari et al. [12] analyzed the impact of COVID-19 on people's lives. By reviewing recent research results, this paper analyzed the impact of the epidemic on people's lives from the perspective of mental health and analyzed the reasons for this impact. Then, based on the analysis results, corresponding measures are proposed to improve people's quality of life under the public health prevention and control policy. Under the influence of the epidemic, public places such as movie theaters are inevitably under control. Then, to explore the impact of public health prevention and control policies on the box office revenue of cinemas, Kim [13] proposed a nested logit model. Based on the proposed model, this paper analyzes the impact of epidemic prevention and control policies in public places on the box office of cinemas. Subsequently, Valck and Damiens [14] analyzed the impact of epidemic spread and public health protection policies on public activities involved in the film industry. Based on the analysis results, this paper described the development opportunities of the industry under epidemic prevention and control. Under the epidemic prevention and control policy, traditional box office monitoring methods cannot fully reflect the opening of movie theaters. Consider the application of big data technology in enterprises, explore how to improve the competitiveness of small and medium-sized enterprises in epidemic prevention and control based on big data technology, and use big data technology to improve the business operation ability of epidemic prevention and control enterprises [15, 16]. Although big data technology has been applied in other fields in the post-epidemic era, there are still gaps in monitoring the opening of cinemas. Therefore, this study makes full use of a large amount of data generated by the cinema platform, such as platform ticket data and public place code data, and exerts the feature extraction ability of big data technology, trying to develop a big data monitoring platform to monitor the opening of cinemas.

3. Monitoring Platform for the Opening of Cinemas in the Postepidemic Era

3.1. The Importance of Big Data Technology in Improving the Monitoring Platform of Cinemas. The epidemic has brought an unprecedented impact on the business model of public places such as cinemas. Although the spread of the epidemic has been effectively contained through a series of measures, in the postepidemic era, public places such as cinemas are constrained by public health protection policies, and their regular movie screening revenue has shrunk significantly compared to before. Under the influence of epidemic prevention and control policies in the post-epidemic era, cinemas have innovated and transformed their business models to increase revenue. A variety of entertainment items have been added to the transformed cinemas, while traditional cinema opening monitoring platforms mainly monitor traditional indicators such as movie ticket sales data and attendance rates, which have limitations in monitoring the flow of people in cinemas. Due to the large time uncertainty of the flow of people in the cinema and the consumption behavior of these mobile people sometimes cannot be accurately recorded, the traditional monitoring platform cannot accurately reflect the actual opening of the cinema. The emergence of public place codes in the postepidemic era has made people's access to public places traceable. The place codes in cinemas will also generate a large amount of code scanning data when people enter and exit the cinema. Therefore, this study introduced big data technology to improve the monitoring accuracy of cinema openings. The monitoring platform based on big data technology has the function of the traditional monitoring platform to record the sales of movie tickets. Moreover, the intelligent monitoring platform can obtain the data of people flow in the cinema by analyzing the code scanning data of the public place code.

3.2. Big Data Technology-Based Monitoring Platform for the Opening of Cinemas. Based on the sales data of e-tickets generated by the Internet platform, as well as the scan code data information of public places under epidemic prevention and control, big data technology can give full play to its data mining capabilities and extract feature information that characterizes the opening of cinemas from these data. Because the collected big data information contains not only picture information but also sequence information that changes with time, while CNN and LSTM are more suitable for extracting the feature information contained in these two kinds of data, this study adopts the CNN-LSTM hybrid network to extract the feature information contained in the big data that reflects the opening of cinemas. CNN and LSTM are two commonly used network structures in deep learning (a branch of big data technology) [17, 18]. Among them, CNN can extract the feature information contained in the images collected in the cinema [19], and LSTM can extract the time-related feature information contained in the time series data collected by the Internet [20]. The cinema opening monitoring platform based on the CNN-LSTM hybrid network is shown in Figure 1.

As can be seen from Figure 1, the established intelligent monitoring platform consists of two parts: the data acquisition system and the deep learning framework. The data collection system can collect data related to movie viewings, such as ticket sales data from online platforms and offline sales front desks of cinemas, and attendance data for each movie screening. In addition, the data collection system can also collect data on the flow of people in the cinema, such as code scanning data in public places and picture data reflecting the flow of people in cinema image systems. Based on the data obtained by the data acquisition system, CNN-LSTM can extract feature information that reflects the opening of cinemas contained in the data and output indicators representing the opening of cinemas in its network output layer. Based on the indicators in the output layer of CNN-LSTM, the opening of the cinema can be monitored.

In the following, a brief introduction to the CNN-LSTM framework adopted in this study is given.

The two network structures, CNN and LSTM, are good at feature extraction in different ways. For CNN, it is proposed to improve image recognition performance. Moreover, its weight-sharing feature greatly reduces the number of trainable parameters in the network, thereby reducing the complexity of the network. In addition, the translation invariance of CNN enables it to fully extract the

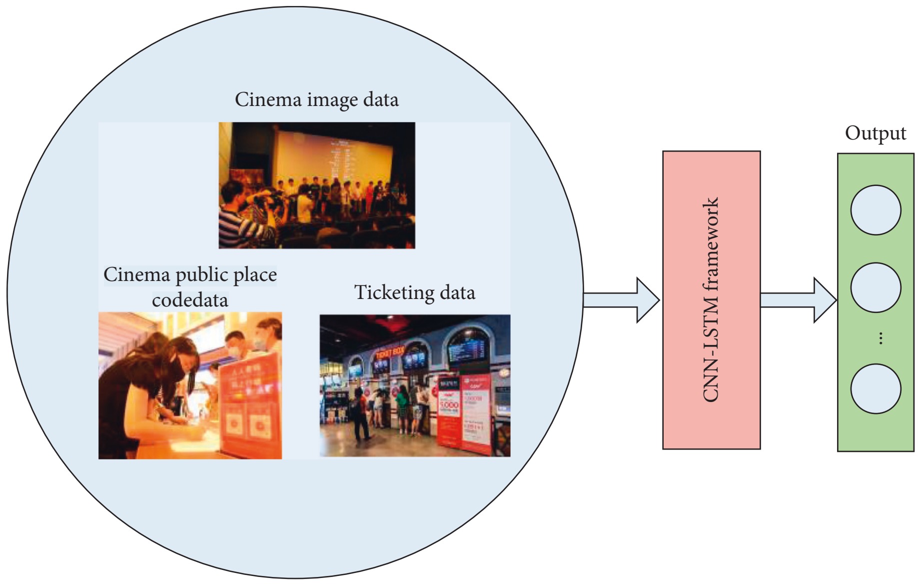

Figure 1: Intelligent cinema opening monitoring platform based on CNN-LSTM.

local correlation feature information of adjacent locations in the input. Therefore, in the established intelligent monitoring platform, CNN can fully analyze the feature information contained in the collected cinema image data. On the other hand, LSTM is obtained by improving RNN, which alleviates the long-term memory decay problem of RNN. Therefore, LSTM has good performance when dealing with long sequence correlation problems. According to the above analysis of CNN and LSTM, although CNN can extract the image feature information contained in the collected data since the collected data also contains time-related sequence information, it is not enough to use CNN alone. Therefore, LSTM is added to the intelligent monitoring platform to extract the time-correlated feature information contained in the big data, thereby improving the monitoring accuracy of the cinema open monitoring platform.

In the CNN-LSTM framework, the forward propagation formula of CNN is

$$a^l = f\left(z^l\right) = f\left(W^l * a^{l-1} + b^l\right), \tag{1}$$

where W^l and b^l represent the weights and biases of the lth layer, respectively; z^l and a^l represent the input and output of the lth layer, respectively; and f represents the activation function of the network layer. To alleviate the abnormal gradient problem in network information propagation, this study uses the ReLU function as the activation function in convolutional layers [21], where the mathematical expression of the ReLU function is

$$\mathrm{ReLU}\,(x) = \max\,(0, x). \tag{2}$$

It can be seen from equation (2) that the output value of ReLU can be greater than 1, which can promote the propagation of gradient information. In addition, * represents a convolution operation on weights and network layer inputs, and the operating principle of convolution operation in convolutional layers is presented in Figure 2. As can be seen from Figure 2, the convolution operation is actually the sum of the elementwise products between the weights and the input of the convolutional layer. Moreover, Figure 2 indicates that the convolutional layers can extract locally relevant information within the convolution kernel size range.

For LSTM, it adds three gated control structures compared to the traditional RNN: forgetting gate, input gate, and output gate [22]. The structure diagram of LSTM is shown in Figure 3.

The mathematical expressions of the three gated structures are

$$f_t = \sigma\left(W_f \cdot x_t + W_f \cdot h_{t-1} + b_f\right), \tag{3}$$

$$i_t = \sigma\left(W_i \cdot x_t + W_i \cdot h_{t-1} + b_i\right), \tag{4}$$

$$o_t = \sigma\left(W_o \cdot x_t + W_o \cdot h_{t-1} + b_o\right). \tag{5}$$

where W_f and b_f represent the weights and biases of the forgetting gate, respectively; f_t, i_t, and o_t represent the output of three control gates; and σ represents the sigmoid activation function.

The outputs of the three control gates can be obtained through the nonlinear calculation of equations (3)–(5). At this time, the state and output of the LSTM unit can be further calculated, and the calculation formula is

$$C_t = f_t \circ C_{t-1} + i_t \cdot C'_{t-1}, \tag{6}$$

$$h_t = o_t \circ \mathrm{ReLU}\left(C_t\right). \tag{7}$$

Equations (6) and (7) are the state and output of the LSTM unit, respectively, where ∘ represents the elementwise product operation.

The above is a brief description of CNN and LSTM. With the feature information extracted by CNN and LSTM, it is

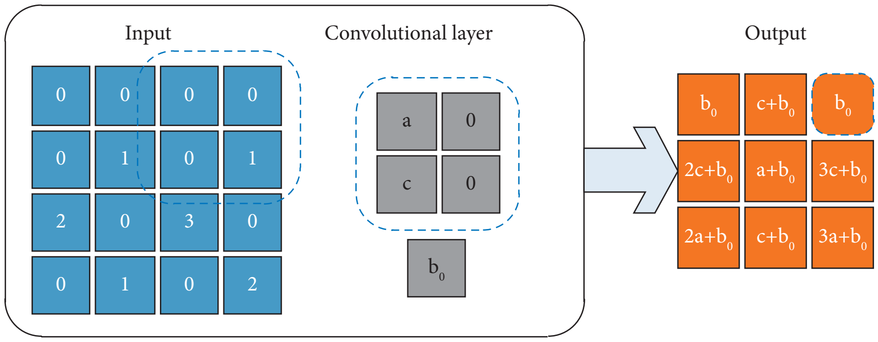

Figure 2: Specific process of the convolution operation.

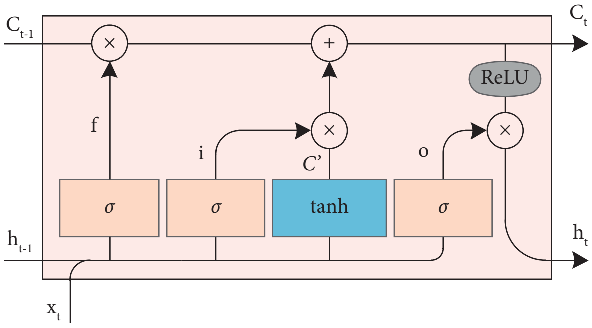

Figure 3: The structure of the LSTM cell.

also necessary to establish a mapping relationship between the feature information and the cinema opening indicators. In this study, to improve the generalization performance of the network, fully connected layers are adopted to realize this mapping relationship. The expression of the fully connected layer is

$$a^l = f(z^l) = f(W^l a^{l-1} + b^l). \quad (8)$$

Since multiple indicators are required to quantify the opening of cinemas, the softmax activation function is used in the output layer of the CNN-LSTM framework, and its expression is

$$a^l = \text{softmax}(z^l) = \frac{\exp(z_i^l)}{\sum_{i=1}^{K} \exp(z_i^l)}, \quad (9)$$

where K represents the number of quantitative indicators. As indicated in equation (9), all output values of the softmax function are in the range (0, 1), which can improve the training efficiency of the network.

With a large amount of data representing the opening of cinemas, in the process of training CNN-LSTM, a loss function needs to be calculated to evaluate the training progress of CNN-LSTM. Since the prediction of cinema opening indicators is a regression problem, the loss function based on mean square error is adopted in this study, and its expression is

$$\text{Loss} = \frac{1}{S} \sum_{s=1}^{S} \sum_{i=1}^{K} \left(y_i^{\text{pre}} - y_i^{\text{real}}\right)^2, \quad (10)$$

where S represents the number of samples participating in the network training and y^{pre} and y^{real} represent the predicted value of CNN-LSTM and the real value of the evaluation index, respectively. According to equation (10), Loss can represent the comprehensive error of multiple indicators in all samples.

4. Results of Analysis and Discussion

In the postepidemic era, from the perspective of public health, this study establishes an intelligent monitoring platform based on CNN-LSTM to monitor the opening of cinemas. The established intelligent monitoring platform takes into account the characteristics of cinemas after the transformation of the postepidemic era and also considers the health code data under the public health protection policy as big data information. To explore the monitoring accuracy of the intelligent monitoring platform established in this study on the opening of cinemas in the postepidemic era, we conduct a case study in this section. Since big data technology requires a large amount of data as support, we take 5,000 cinemas as the research object and use a large amount of data from these cinemas to train CNN-LSTM. The data collected from these cinemas include the picture data of the cinema image system, the online and offline ticket purchase data, and the scan code data of the public place code. To evaluate the opening of cinemas, three indicators such as attendance rate, cinema revenue, and people flow are selected as the output of the intelligent monitoring platform. Since the three quantitative indicators have different dimensions, to improve the performance of the intelligent monitoring platform, the three indicators are all normalized. The normalization processing method used in this study is the 0-1 normalization method, and its expression is

$$\text{Norm}(y) = \frac{y - \min(y)}{\max(y) - \min(y)}. \quad (11)$$

Through 0-1 normalization, the value ranges of the three quantitative indicators are unified as (0, 1); then, the distribution of the quantitative indicators is closer to the data distribution of the CNN-LSTM output layer, which is beneficial to improving the training efficiency of the network. Note that to maintain the availability of the evaluation indicators, it is also necessary to denormalize the normalized indicators and finally use them as the output of the intelligent monitoring platform.

With the processed data, the effectiveness of CNN-LSTM in predicting cinema opening indicators can be explored. Meanwhile, in this section, the necessity of adding LSTM to the intelligent monitoring platform is evaluated by comparing CNN-LSTM and the traditional CNN. In the process of evaluating the prediction performance of the network, the relative error is adopted to evaluate the difference between the predicted and real results. The formula for calculating the relative error is

$$\mathrm{RE} = \frac{\mathrm{abs}\left(y^{\mathrm{pre}} - y^{\mathrm{real}}\right)}{y^{\mathrm{real}}}, \tag{12}$$

where abs is the operation for calculating absolute values. With a CNN structure alone, the average relative error distributions between the predicted and real indicators are shown in Figure 4. In Figure 4, "1," "2," and "3" of the horizontal axis represent the three indicators of attendance, cinema, and people flow, respectively. As can be seen from Figure 4, the average relative error between the predicted and real values of the cinema revenue indicator is relatively large, reaching 3.12%. The average relative errors of the predicted and real values of the other two indicators, attendance and people flow, are 1.89% and 2.31%, respectively. Although the average relative error of the three indicators is less than 5%, the average relative error of the cinema revenue indicator exceeds 3%, so there is still a gap for improvement.

To present the difference between the CNN-LSTM structure and CNN alone in predicting cinema opening indicators, the average relative error between the three indicators predicted by CNN-LSTM and the real values is calculated. The average relative errors between the predicted and real values of the three indicators are shown in Figure 5. It can be seen from Figure 5 that the average relative error levels corresponding to the three indicators are relatively close. Comparing Figures 4 and 5, it can be seen that compared with CNN, CNN-LSTM has improved the prediction accuracy of the three indicators, especially for the cinema revenue indicator, the average relative error reached 1.99%. At the same time, the other two indicators have also been improved to a certain extent, which are 1.55% and 1.71%. The reasons for the superiority of CNN-LSTM over CNN in the prediction of the three indicators can be explained as follows. The three indicators, especially the cinema revenue data, have time-related characteristics, so adding LSTM, which is good at extracting time-correlated features, to the intelligent monitoring platform is beneficial to improving the monitoring accuracy of cinema opening indicators.

Figure 5 indicates that the average relative errors for the three cinema opening indicators are all within 2%. However, the cinema revenue indicator is very close to 2%. Since revenue indicators are very critical in reflecting the opening of cinemas, to more intuitively present the prediction performance of the intelligent monitoring platform for cinema revenue indicators, Figure 6 shows the relative error between the predicted and real values corresponding to the 15 samples. As can be seen from Figure 6, the relative error between the predicted and real values of the cinema revenue indicator is basically within 2%, and only the relative error corresponding to the two samples is slightly greater than 2%, but the relative error of these two samples is still within 2.5. Therefore, the prediction results of the cinema revenue indicator indicate that the intelligent monitoring platform based on CNN-LSTM is feasible for monitoring the opening of cinemas.

To further analyze the performance of the intelligent monitoring platform based on CNN-LSTM, the correlation between the predicted cinema attendance and the real cinema attendance is compared. Figure 7 presents the

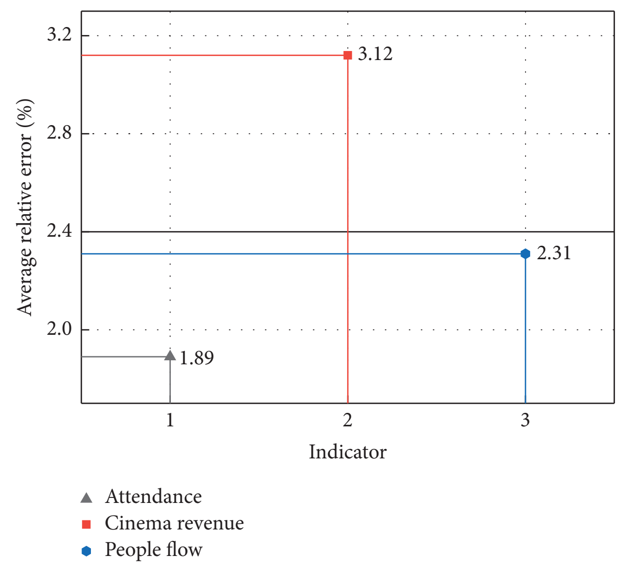

Figure 4: Average relative error distributions between the predicted and real indicators under the CNN structure.

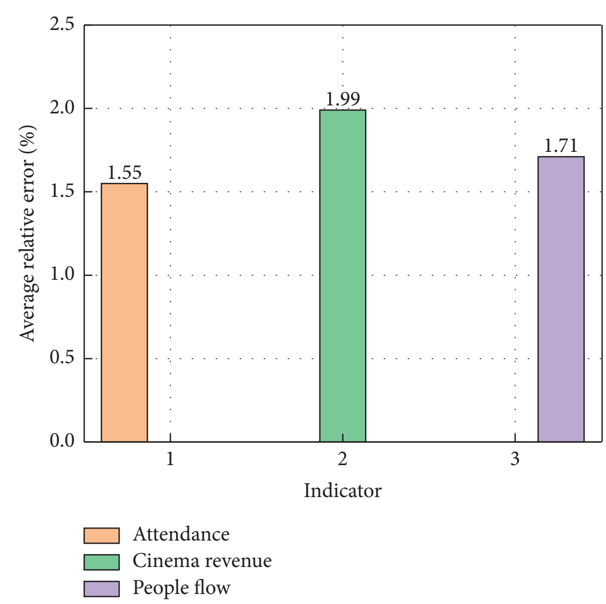

Figure 5: Average relative error distributions between the predicted and real indicators under the CNN-LSTM structure.

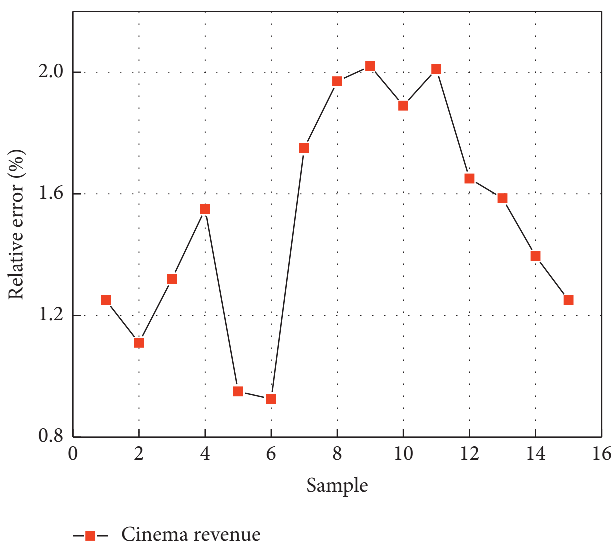

Figure 6: Relative error distributions between the predicted and real cinema revenue indicators corresponding to the 15 samples.

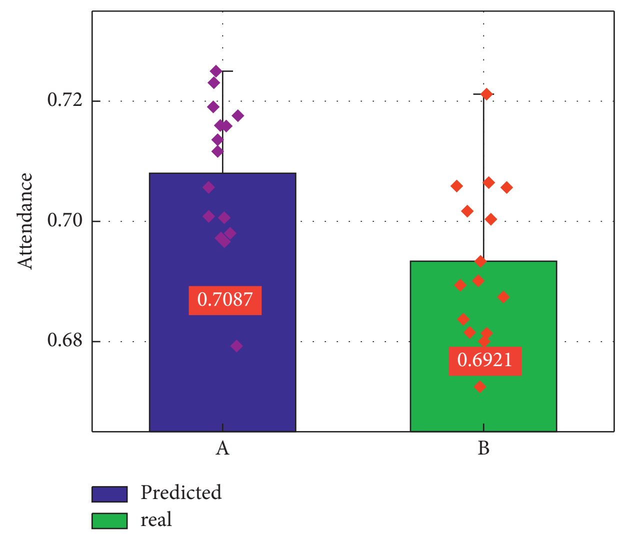

Figure 7: The distribution of the predicted and real cinema attendance rates corresponding to 15 samples.

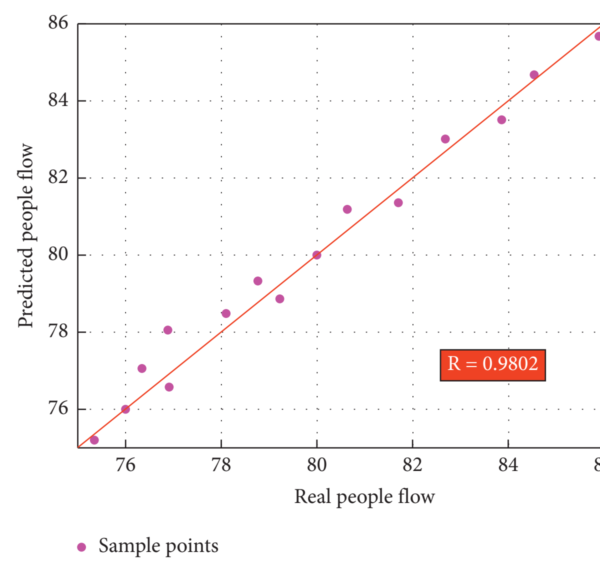

Figure 8: Correlation relationship between the predicted and real people flows.

predicted and real cinema attendance results for 15 samples. Among them, the green area corresponding to A represents the real cinema attendance, and the blue area corresponding to B represents the cinema attendance predicted by the intelligent monitoring platform. It can be seen from Figure 7 that the average of the predicted and real cinema attendance rates are 0.7087 and 0.6921, respectively, and the predicted and real attendance data distributions corresponding to 15 samples are very close. Since the attendance rate close to 0.7 is very different from the attendance rate close to 1 in the nonepidemic period, the prediction results show that the intelligent monitoring platform based on CNN-LSTM can effectively extract the feature information that characterizes the public health protection policy, thereby making the predicted value of the attendance rate that is very close to the real value under the epidemic background. Therefore, the prediction results of the cinema attendance indicator further indicate that the established intelligent monitoring platform has good accuracy in monitoring the cinema opening indicators.

For the human flow indicator, this study uses statistical analysis methods to analyze the predictive performance of the intelligent monitoring platform. Figure 8 shows the correlation relationship between the people flow predicted by the intelligent monitoring platform and the real people flow. The two coordinates of the data points in Figure 8 represent the real and predicted people flow. As can be seen from Figure 8, the data points are basically close to the line $y = x$. In addition, the calculation results of linear correlation show that the linear correlation coefficient between predicted and real people flow is 0.9802. As indicated in reference [23], a linear correlation coefficient greater than 0.95 indicates a strong linear correlation between the predicted and real results. So, based on the distribution of data points and the calculation of the linear correlation coefficient, there is a strong linear correlation between the predicted and real people flow. Therefore, the calculation results of linear correlation further validate that the established intelligent monitoring platform can accurately predict the opening of cinemas from the perspective of statistical analysis.

5. Conclusions

COVID-19 has brought unprecedented changes to people's lives. The easy-to-spread nature of the virus makes the public health protection system face a severe test. Although the vaccination of vaccines and the improvement of medical facilities have kept the epidemic at a generally controllable level, in the postepidemic era, there are still a series of restrictions on activities in public places. Under the public health and epidemic protection policy in the postepidemic era, cinemas have to transform to maintain normal income levels. Due to the impact of epidemic prevention and control measures, the business model of cinemas has changed. Conventional monitoring platforms usually focus on monitoring box office changes but cannot accurately monitor the opening of transformed cinemas. To overcome the shortcomings of traditional monitoring platforms, this study introduced big data technology to analyze the feature information contained in the numerous data collected from cinemas and establishes an intelligent monitoring platform based on CNN-LSTM to monitor the opening of cinemas.

When analyzing the data, the intelligent monitoring platform based on CNN-LSTM not only considers the box office data collected by cinemas under the traditional business model but also considers the impact of public health and epidemic protection policies on the opening of cinemas in the postepidemic era. In the intelligent monitoring platform, the framework composed of CNN and LSTM can extract the picture information collected from the cinema imaging system and the feature information contained in the box office data collected from the cinema sales platform and can also analyze the characteristic information of people flow contained in public place codes under epidemic prevention and control. Based on the extracted feature information, the intelligent monitoring platform can output quantitative indicators that characterize the opening of the cinema. This study analyzes the performance of the established intelligent monitoring platform in predicting the opening of cinemas through a case study. The research results show that the CNN-LSTM-based framework has better prediction performance than the CNN framework alone, especially for the prediction of cinema revenue indicators with time-related characteristics. In addition, most of the relative errors of the intelligent monitoring platform's predictions on the three indicators such as attendance, cinema revenue, and people flow are less than 2%, which indicates that the predicted and real cinema opening indicators are in good agreement. Besides, the statistical analysis results show that the linear correlation coefficient between the predicted and real people flow is 0.9802, which indicates that there is a strong linear correlation between the people flow predicted by the intelligent monitoring platform and the real result. Therefore, from the perspectives of relative error and statistical analysis, it is confirmed that the established intelligent monitoring platform has good performance in monitoring the opening of cinemas.

Data Availability

The data set can be accessed through the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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