Security and Communication Networks

Intelligent Interference Management for Safeguarding Next-Generation Wireless Networks

Lead Guest Editor: Panagiotis D. Diamantoulakis
Guest Editors: Zahid Halim and Dan Deng

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Retraction

Retracted: High-Concurrency and High-Performance Application of Microservice Order System Based on Big Data

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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] X. Zhou, X. Wu, and Y. Chen, "High-Concurrency and High-Performance Application of Microservice Order System Based on Big Data," *Security and Communication Networks*, vol. 2022, Article ID 3424283, 11 pages, 2022.

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Retraction

Retracted: Comprehensive Treatment of Urban Landscape Water Environment Based on Aquatic Plants Purification and Restoration

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Retraction

Retracted: Optimization of Economic Development Path in Western Region under Background of "the Belt and Road Initiative" Based on Intelligent Internet of Things

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Research Article

Accuracy Analysis of Sports Performance Prediction Based on BP Neural Network Intelligent Algorithm

Hong Yang and Changdi Luo

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With the increasing attention and popularity of competitive sports, the continuous progress of artificial intelligence, and deep learning theory, people's sports performance prediction technology for professional athletes or sports students is also developing. Accurate and effective prediction can help athletes and students to carry out more targeted training, so as to further improve their performance. BP neural network (BPNN) is a multilayer feedforward neural network (NN). Therefore, based on the BPNN algorithm, this work conducts a deep research on the prediction of sports performance. First of all, this work uses the three-layer structure of BPNN to design the algorithm and then selects the weight, oxygen saturation, systolic and diastolic blood pressure, the previous best score, the worst score in the past period, and the average score of one week before the examination as the feature vector of the input sample. The students' scores of two classes of physical education major in a university are selected as the prediction objects, and the time period of students' relevant information data is selected from September 2018 to December 2018. The quantity of hidden units is calculated to be 15 by training. After the successful construction of BPNN sports performance estimation method, the PSO search approach is utilized to enhance the BPNN sports performance prediction model. Finally, the relationship between the two classes' performance and the students' performance is analyzed. 49% of the total number of times the error of class A was predicted to be 0, and the number of times that the error of class B was 0 was 50%, 58%, and 75%, respectively. There is no strong linear correlation between sports performance and body weight, but a high correlation systolic, pulse pressure, and plasma oxygen levels. This shows that the BPNN sports prediction model established in this work has high accuracy in predicting sports performance.

1. Introduction

1.1. Background Significance. Sports achievement is not only related to the honor of athletes' career but also an intuitive reflection of sports skills. The prediction of sports performance is very important for athletes and coaches. It can provide data support for the development of scientific sports training programs. Artificial NN can deal with messy information very well [1]. An artificial NN is a computing system that mimics the NN of the human brain. Although not very efficient, they behave in roughly the same way. Especially BPNN, which has an excellent capacity to forecast, has seen extensive application in the forecasting industry. BPNN is a multilayer feedforward NN, and its main characteristics are as follows: the signal is forward propagated, and the error is back propagated. This work gives a new idea and direction for the research of sports achievement prediction, which has practical significance.

1.2. Related Work. BPNN has been widely used, and there are many related research results, aiming at the six-degrees-of-freedom joint angles challenge for the UR3 rover. Jiang et al. studied a back propagation (BP) NN algorithm based on particle swarm optimization (PSO), which overcomes some shortcomings of BPNN. The UR3 cobot is a small collaborative tabletop robot ideal for applications such as light assembly work and automated workbenches [2]. His

research on the convergence rate of the algorithm is not good enough. Determine the distance between two objects or calculate the area or volume, without learning how to read a tape or ruler reading [3]. According to the characteristics of the software defined network (SDN), Liu et al. proposes a technique for detecting DDoS attacks that combines PSO-BPNN with extended volatility and uses the generalized entropy method to predetect traffic on switches. DDoS refers to distributed denial of service attacks, which can forge the source IP address during the attack [4]. His research in the algorithm learning training, the selected training samples, and test samples are not suitable, not a very good training algorithm. Liao uses the ARIMA model to predict the linear theme of the series and then uses the BPNN model to estimate its nonlinear residual and combines them to form a combined model to predict the RMB exchange rate [5]. Although their research and application of BPNN are insufficient, they provide a very important reference for the study of this work.

1.3. Innovative Points in This Paper. To accurately predict sports performance and provide scientific data support for the formulation of efficient sports training program, this work makes a deep research on the construction of sports performance prediction model. The innovations of this study are as follows: (1) by improving the inertia weight, boundary value and initialization, and using the PSO search method, the resolution speed and optimization ability of the BPNN algorithm are optimized. (2) The successful BPNN model for predicting sports is used to predict the youngsters' athletic accomplishments majoring in physical education and the relationship between sports performance and body weight. Analysis is done on the blood pressure readings at the systolic and diastolic levels.

2. Neural Network and Intelligent Algorithm

2.1. Neural Network

2.1.1. Neurons and Activation Function. Supposing n input signals, $a_1, a_2, \ldots, a_n$, and the corresponding weight is $r_1, r_2, \ldots, r_n$ [6], the input vector A and the corresponding connection weight vector R are shown in

$$A = (a_1, a_2, \ldots, a_n), \tag{1}$$

$$R = (r_1, r_2, \ldots, r_n). \tag{2}$$

The weighted sum of the input signals obtained by the neuron is represented by net, as follows:

$$\text{net} = \left(\sum a_n r_n\right). \tag{3}$$

The activation function can realize the corresponding function of neurons, and the corresponding output can be obtained through calculation after receiving input. An artificial NN's perceptron, which runs on the neurons, is in charge of translating the input from the receptors to the outcome. There are four common activation functions: hyperbolic tangent, S-type, piecewise linear, and threshold function [7]. The threshold function includes step function and sgn function, whose expressions are shown in

$$f(a) = \begin{cases} 1, & \text{if } a \geq 0, \\ 0, & \text{if } a < 0, \end{cases} \tag{4}$$

$$\text{sgn}(a) = \begin{cases} 1, & \text{if } a \geq 0, \\ -1, & \text{if } a < 0. \end{cases} \tag{5}$$

The expressions of hyperbolic tangent, S-type, and piecewise linear function are shown in

$$f(a) = \begin{cases} a, & \text{if } a \leq 1, \\ 1, & \text{if } a \geq 1, \end{cases} \tag{6}$$

$$f(a) = \frac{1}{1 + \exp - (a)}, \tag{7}$$

$$f(a) = \frac{e^a - e^{-a}}{e^a + e^{-a}}. \tag{8}$$

2.1.2. The Structure of NN. There are three kinds of layered NNs: simple feedforward network, without feedback loop. Only the information from the preceding layer is received by each layer, which then processes the information in the hidden units before sending it to the output units [8]. The direction of information processing is unidirectional forward [9, 10]. The feedback of feedforward network's signal transmission can from the output layer to the input layer, and from the input layer to the output layer as well [11, 12]. Like the simple feedforward network, the inner interconnected feedforward network can only process the signal forward in one direction and has no feedback loop [13, 14].

Any two neurons in the interconnected NN can be connected with each other to form a fully interconnected network. Signals are transmitted repeatedly between neurons, and the state of the network is constantly changing. The initial signal state of this kind of NN needs several changes to reach equilibrium. According to the degree of interconnection, interconnected NNs can be divided into interconnected, locally interconnected, and sparsely connected [15]. In the interconnected network structure, there may be a connection path between any two nodes, so interconnection, local interconnection, and sparse connection are to subdivide the interconnection network according to the degree of connection of nodes in the network.

2.1.3. Learning Method of NN. Network topology and connection weight determine the function of artificial NN [16, 17]. In the training of NN, many samples and expectations should be input into the NN, the training and feedback should be carried out according to certain learning rules, the connection weights and thresholds of the NN should be adjusted constantly, and finally, the results should be output [18].

The learning methods of NN include supervised learning, unsupervised learning, and hierarchical learning [19, 20]. Supervised learning can be regarded as the original prediction model. It uses basic data training, inputs the data that needs to be predicted, and obtains the prediction results (whether continuous or discrete), then performs unsupervised learning, processes a bunch of data, performs data clustering according to their similarity, and finally performs hierarchical learning. There is a large amount of information for tutor learning. Besides inputting training samples, we also need to give the corresponding ideal output value. In this learning mode, the NN will produce output for each input. The actual output is compared with the ideal value to determine whether to continue learning and adjust the weight according to its error value.

Unsupervised learning does not need goals, and its weight parameters are automatically adjusted according to the network structure and learning rules, and the specific way given is determined by the specific network. Hierarchical learning needs less information, and it does not need to provide the expected output, but provides the approximate accuracy level of the actual output.

2.2. BPNN Learning Algorithm

2.2.1. Model Structure of BPNN. The back propagation (BP) NN learns and trains by changing per layer's weight matrix and criteria so that the predicted output of the network can continuously approach the expected output [21, 22].

The typical BPNN has three or multilayer structure, which includes the input layer, one or more hidden units, and the output layer. Typically, the cells within the buried layer activate in an S-type manner. The hidden layer connects the input and output and plays a decisive role.

Suppose there is an N-layer NN with sample X in the input layer. The input sum of neuron i in layer g is V_{ig}, the output is X_{ig}, Q_{ij} is the weight coefficient, and f is the activation function. Then, the relationship between the variables is shown in

$$X_{ig} = f\left(V_{ig}\right), \tag{9}$$

$$V_i^g = \sum Q_{ij} X_j^{g-1}. \tag{10}$$

2.2.2. Calculation Steps of BPNN. The calculation steps of the BPNN algorithm are generally divided into six steps: first, network initialization—determine the connection weight of each layer of the network, threshold, the number of network training, given the learning rate, error accuracy, and neuron activation function and input the training samples and the relative expected value.

Then, the sample pairs are selected in order from the sample set for training. Suppose that the input sample is x_n. The hidden layer's link value with the input layer is u_{ij}, and the threshold value of the hidden layer unit is s_j; then, the output value of each hidden layer cell is calculated:

$$y_j = f\left(\sum_{i=1}^{n} u_{ij} x_i - s_j\right). \tag{11}$$

The threshold value in the neuron model is written into the connection weight, so that $u_{0j} = -s_j, x_0 = -1$. Formula (11) can be transformed into

$$y_j = f\left(\sum_{i=0}^{n} u_{ij} x_i\right). \tag{12}$$

The outcome for every unit in the layer, including Z in between the concealed layer, and the cell cutoff s of the output units are used in the third phase to compute the output of every cell in the output units. The calculation formula is

$$O_k = f\left(\sum_{j=1}^{m} z_{ij} y_j - s_k\right). \tag{13}$$

Similarly, let $z_{0k} = -s_k$ and $y_0 = -1$; formula (13) be changed into

$$O_k = f\left(\sum_{j=0}^{m} z_{jk} y_j\right). \tag{14}$$

Calculating the gap between the observed and predicted output values and determining if it is smaller than the preexisting orbital radius constitute the required action. If it is less, return to step two and choose the subsequent sample to carry out the training. Fault away will be used if it is more, and the weight will be changed to lessen the discrepancy. The weight correction of output layer is

$$\Delta z_{ij} = -\mu \frac{\partial E}{\partial z_{ij}} = -\mu \frac{\partial E}{\partial \mathrm{net}_k} \cdot \frac{\partial \mathrm{net}_k}{\partial z_{ij}}. \tag{15}$$

2.2.3. Performance Analysis of BPNN Algorithm. Firstly, the convergence speed of the BPNN algorithm is slow because the selection of algorithm parameters may not be appropriate. A convergence of a sequence x_n to a means that, for any open set containing a, there is always a large enough N so that the tail after the array $x_n N$ term is fully contained within that open set. Another reason is the limitation of the algorithm itself. The error surface of the algorithm has a flat area, and the error gradient changes little. Even if the weight is adjusted, the error will decline slowly.

Secondly, the quantity of hidden neurons of connections inside this layer is hard to assess in BPNN. Without specific theory, we can only obtain approximate conclusions through experience or specific experiments. This has brought an indelible negative impact on the accuracy of BPNN algorithm.

In addition, the objective function of BPNN has minimal points. BPNN uses nonlinear activation function and considers global error. However, the existence of multiple minima will drop into the neighborhood limit throughout confluence. When learning for a certain time, the global error will not be reduced, but the accuracy of the algorithm has not reached the expected value.

2.3. Particle Swarm Optimization Algorithm

2.3.1. Particle Swarm Optimization Algorithm Flow. The PSO simulates the foraging behavior of birds. The optimal value of the problem to be optimized is regarded as the food that birds seek, and birds are regarded as particles with only speed and position. Particle target is to search in a certain space according to the requirements of the PSO algorithm and finally achieve or approach the best.

Suppose that there are m particles in the population in an N-dimensional target search space, the position of the i-th particle is $D_i = (d_{i1}, d_{i2}, \ldots, d_{iN})$, and the velocity of the particle is $V_i = (v_{i1}, v_{i2}, \ldots, v_{iN})$, where $i = 1, 2, \ldots, m$. If the historical optimal position of the particle is H_{best} and the global optimal position is G_{best}, then the particle's velocity and position update are

$$V_i^{i+1} = \varpi V_i^e + s_1 r_1 \left(H_{\text{best}} - D_i^e\right) + s_2 r_2 \left(G_{\text{best}} - D_i^e\right), \tag{16}$$

$$D_i^{e+1} = D_i^e + V_i^{e+1}, \tag{17}$$

where ϖ is the inertia weight, e is the current number of iterations, s_1 and s_2 are the learning factors, and r_1 and r_2 are the random numbers between [0, 1].

The flow of PSO is as follows.

The item health value is determined before the optimizer is initiated. The second stage involves updating the object's previous and world optimum values, determining if its velocity is inside or outside of the posted limit. The third step is to update the position of the particle and determine whether its position exceeds the constraint.

2.3.2. Advantages and Disadvantages of PSO Algorithm. PSO algorithm has the advantages of simple concept, less adjustment parameters, convenient implementation, fast convergence speed, and low requirements for computer configuration, so it has been applied in many practical engineering optimization fields. However, the PSO algorithm is not perfect, and there are still some shortcomings.

At present, the improvement of inertia weight can enhance the initial days of computer search's worldwide search capability. But these improved strategies lack strict theoretical proof. Some algorithms will slow down the speed of particles in the late stage of search, leading to the particles in the population to the optimal solution position. The nation's variety is increased within that means will be affected, and the search efficiency will be reduced, resulting in local optimization.

In the PSO algorithm, the parameter setting greatly affects the optimization results, and there is no specific parameter setting standard to solve the problem of different algorithms. In practical application, the improved PSO algorithm does not necessarily have good performance, but it often needs to be analyzed in combination with the specific situation of the problem.

When the improved particle PSO algorithm is used to solve the multimodal function problems, a multimodal function is a real-valued function that has multiple local maxima (peaks) in the considered interval. It often falls into the local optimum, and the particles cannot escape from the local optimal value in the search process and may be premature convergence. The convergence speed of the PSO algorithm cannot be improved when it reaches the specified solution precision, and both of them cannot be taken into account.

2.3.3. Improvement of PSO Algorithm. Based on the above analysis of the shortcomings of PSO algorithm, the improvement of PSO algorithm can start from improving the convergence speed and preventing falling into the local optimal value.

The reasonable selection of parameters in the PSO algorithm plays an important role in the optimization ability. Through the dynamic adjustment of parameters, the parameters in the algorithm can be controlled relatively well. The contraction factor Q is introduced:

$$\begin{cases} V_{ij}^{e+1} = Q * \left[V_{ij}^e + s_1 r_1 \left(H_{\text{best}} - D_i^e\right) + s_2 r_2 \left(G_{\text{best}} - D_i^e\right)\right], \\ Q = \dfrac{2}{\left|2 - s - s^2 - 4s\right|}, \end{cases} \tag{18}$$

where $s = s_1 + s_2$. The search ability of the algorithm is improved by enhancing the relationship between learning factor and inertia weight, and the convergence speed of the algorithm can be improved by properly adjusting the speed of particles. The time factor is added to the particle update formula, and the contraction factor and time factor are combined. The particle update formula is

$$\begin{cases} V_{ij}^{e+1} = Q * \left[V_{ij}^e + s_1 r_1 \left(H_{\text{best}} - D_i^e\right) + s_2 r_2 \left(G_{\text{best}} - D_i^e\right)\right], \\ D_{ij}^{e+1} = D_{ij}^e + \text{time} * V_{ij}^{e+1}. \end{cases} \tag{19}$$

In order to prevent the excessive concentration of particles and increase the active space of particles, the PSO algorithm can improve the optimization ability and avoid the emergence of local optimal value to a certain extent. The formula is as follows:

$$\begin{cases} \text{if } \text{fitness}_{\max}(x) - \text{fitness}_{\min}(x) < 1, \\ \text{pos}(x) = \text{rand}(\text{time} - 1), \end{cases} \tag{20}$$

where $\text{fitness}(x)$ is the fitness value of the particle x iteration and $\text{pos}(x)$ is the distribution function of the particle swarm.

3. Construction Experiment of the Prediction Model of Sports Performance

3.1. Construction of the Sports Performance Prediction Model Based on BPNN

3.1.1. Design and Parameter Setting of BPNN. The design of BPNN needs to start with the determination of the number of layers, the number of neurons, activation function,

connection weight, and threshold. In this work, BPNN is used to design the algorithm. Its structure is shown in Figure 1.

The BPNN prediction model established in this study mainly aims at the performance prediction of sports major students. Considering the factors affecting the sports performance, the weight, blood oxygen saturation, systolic and diastolic blood pressure, the best score in the past, the worst score in the past period, and the average score of one week before the examination are selected as the feature vectors of the input samples.

There are 18 input layer neurons and 6 output values, and the range of hidden layer nodes is 10–20. Through training, the number of nodes in the hidden layer is 15, the number of learning times is 2500, the target error is 0.001, and the learning rate is 0.4. S-type function is used for activation function, and train SCG function is used for training function.

3.1.2. Selection of Experimental Sample Data. In order to verify the stability and practicability of the BPNN algorithm, this work selects the students' scores of two classes of physical education major in a university as the prediction object so as to predict the sports performance of each student, arrange targeted training for it, and improve the performance. The number of students in class A and class B is 15 and 12, respectively. The selection period of students' relevant information data is from September 2018 to December 2018. The results of the students in these two classes are relatively stable in the selected time period, which can accurately reflect the overall performance of each student and has good predictability.

Taking into account the correlation between the two classes before and after sports performance, the body weight, blood oxygen saturation, systolic and diastolic blood pressure, best score, worst score, and one-week average score of the two classes were taken as input samples. Students' weight, blood oxygen saturation, systolic and diastolic blood pressure, best score, worst score, and average score of one week before the examination were taken as output samples on the eighth day, and then 100 training samples and 10 test samples were established.

3.2. PSO Algorithm Improved BPNN Sports Performance Prediction Model

3.2.1. Improvement of Inertia Weight. The inertia weight determines the inertia of particles to keep moving. Larger inertia weight can jump out of the local optimal solution, and smaller inertia weight is conducive to the enhancement of local optimization ability. In this work, the linear decreasing inertia weight method is selected. By setting the maximum and minimum inertia weight, the inertia weight is adjusted by combining the maximum iteration number and the current iteration number of the algorithm. The formula is as follows:

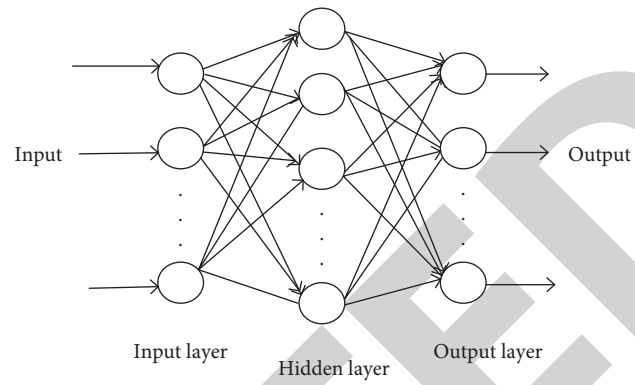

Figure 1: Structure of BPNN.

$$\omega = \omega_{\max} - \frac{\omega_{\max} - \omega_{\min}}{t_{\max}} * t, \tag{21}$$

where $\omega_{\max}$ and $\omega_{\min}$ are the maximum and minimum inertia weights, respectively, and t and $t_{\max}$ are the current iteration number and the maximum iteration number, respectively.

3.2.2. Improvement of Boundary Value and Initialization. The size of velocity boundary determines the search ability of particles; the larger the value, the stronger the search ability, but it is easy to ignore the optimal value; the smaller the value, the stronger the local optimization ability. In this work, through the training of sports performance prediction model, the range of weight and bias value is extracted and multiplied by magnification, and the corresponding speed boundary is calculated. In this work, 16% is taken as the multiple to determine the boundary value of each part of the particle.

There are relatively large differences in the weight and threshold range of the BPNN sports performance prediction model, so it is necessary to initialize the particle weight and threshold difference, and the initialization boundary range is mainly in the range of weight and threshold. Adjust formula (17), introduce velocity factor $\theta = 0.5$, and update particle position formula as follows:

$$D_i^{e+1} = D_i^e + \theta * V_i^{e+1}. \tag{22}$$

This formula enhances the inertia of particles and reduces the influence of velocity update on particles.

4. Discussion on Algorithm Performance and Result Prediction

The BPNN prediction model established in this study was trained. The body weight, blood oxygen saturation, systolic and diastolic blood pressure, best score, worst score, and average score of one week of students in class A and class B were taken as input samples. On the eighth day, body weight, oxygen saturation, systolic and diastolic blood pressure, best score, worst score, and average score of one week before the

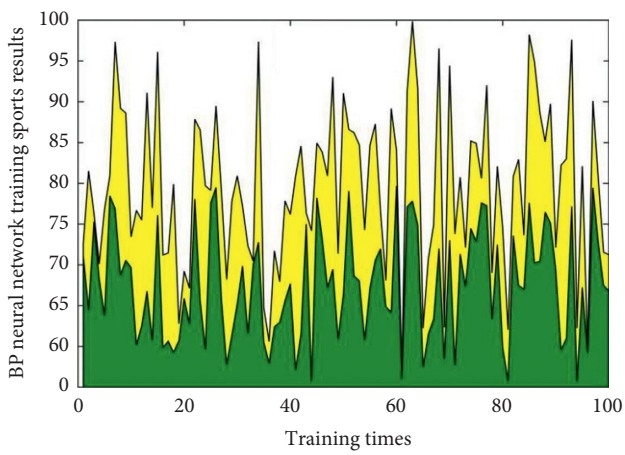

Figure 2: BPNN training results.

examination were used as output samples to establish 100 training samples. The training results are given in Figure 2.

As shown in Figure 2, the BPNN training results include 100 training samples, and the training samples are used for network training. In order to determine the number of nodes in the hidden layer, four processing schemes are proposed, and the number of nodes in the hidden layer is determined as 10–20. The minimum test root mean square error (RMSE) was obtained by training. In the figure, most of the average scores of class A is above 60, and the higher are even close to 80, indicating that the training results are good, while class B is obviously better, with the average training score basically over 75, and the highest is even close to 100, which may be because the overall physical quality of class B students is better.

As shown in Table 1, through training, when the number of nodes in the hidden layer is 15, the root mean square error of the test is the minimum, which is 2.893. When the number of nodes in the hidden layer is 12, the root mean square error is the largest, which is 6.208. With the change of the number of nodes in the hidden layer, the trend of root mean square error is as follows:

As shown in Figure 3, the most appropriate number of hidden layer nodes is 15, which can be used as the final parameter to build the NPNN sports performance prediction model.

4.1. Prediction Results

4.1.1. Class A Grade Forecast. Based on the data of the last week, this work forecasts the sports achievements of 15 students in class A and compares them with the actual sports achievements. Using the results of three different periods of time to predict, the full score of physical education score is 100, the predicted score is P1, P2, and P3, the actual score is R1, R2, and R3, respectively, and the difference is recorded as D1, D2, and D3.

As shown in Table 2, sometimes the predicted score is equal to the actual score, and the error is 0, and sometimes, there is a small error. The biggest error is 1.5, which is the difference between the predicted score and the actual score of A6 and A10 students. This work compares the change trend of the predicted and actual results of 15 students in class A. The results are as follows:

As shown in Figure 4, the students' physical education performance has the characteristics of individuation, the best score is A3, and the predicted and actual scores of three times have exceeded 90 points. After the error is counted, the accuracy of the prediction model in predicting the grade of class A is calculated.

As shown in Figure 5, 49% of the total number of times the error of class A was predicted to be zero, and the three times of prediction accounted for 11%, 20%, and 18%, respectively. The absolute value of error is 0.5 in 40%, 1 in 7%, and only 4% in 1.5. This shows that the BPNN prediction model has higher accuracy in predicting the sports performance of class A.

4.1.2. Predicted Score of Class B. Based on the data of the last week, this work forecasts the physical education achievements of 12 students in class B. The prediction method is the same as that of class A.

As shown in Table 3, sometimes the biggest error between the predicted score and the actual score of class B is 1.5, which is the difference between the predicted score and the actual score of B5 and B7 students. The results are as follows:

As shown in Figure 6, the best score of class B is B2, and the predicted and actual scores of class B are all higher than 94 points. The worst score of class B is B7. The error was counted, and the accuracy of the prediction model in predicting the grade of class B was calculated.

As shown in Figure 7, 50%, 58%, and 75% of the students predicted the grade of class B three times, and 33%, 17%, and 9% of them had absolute error of 0.5. This shows that the accuracy of the BPNN prediction model in predicting the sports performance of class B is also high.

4.2. Relationship between Performance and Each Feature Vector.

This work uses the BPNN model to predict the results of the two classes and analyzes the relationship between the weight, oxygen saturation, systolic blood pressure, and diastolic blood pressure. Ten students were randomly selected from two classes and numbered S1–S10.

As shown in Table 4, the values of eigenvectors of 10 students are different even if they have the same situation. Each feature vector needs to be analyzed to determine the specific relationship between it and performance. First of all, the relationship between students' weight and sports performance is analyzed.

As shown in Figure 8, the students whose weight is 65.8 kg have better physical performance than those who weigh 64.6 kg and 69.2 kg. This shows that there is no particularly strong linear correlation between students' weight and sports performance. Then, it analyzes the relationship between the students' blood oxygen saturation and sports performance.

Table 1: Result of hidden layer node parameters.

	Input layer node	Output layer node	Training function	Hidden layer node	RMSE
1	18	6	Train scg	10	5.112
2	18	6	Train scg	11	4.381
3	18	6	Train scg	12	6.208
4	18	6	Train scg	13	3.717
5	18	6	Train scg	14	5.014
6	18	6	Train scg	15	2.893
7	18	6	Train scg	16	5.711
8	18	6	Train scg	17	5.032
9	18	6	Train scg	18	4.916
10	18	6	Train scg	19	4.158
11	18	6	Train scg	20	5.062

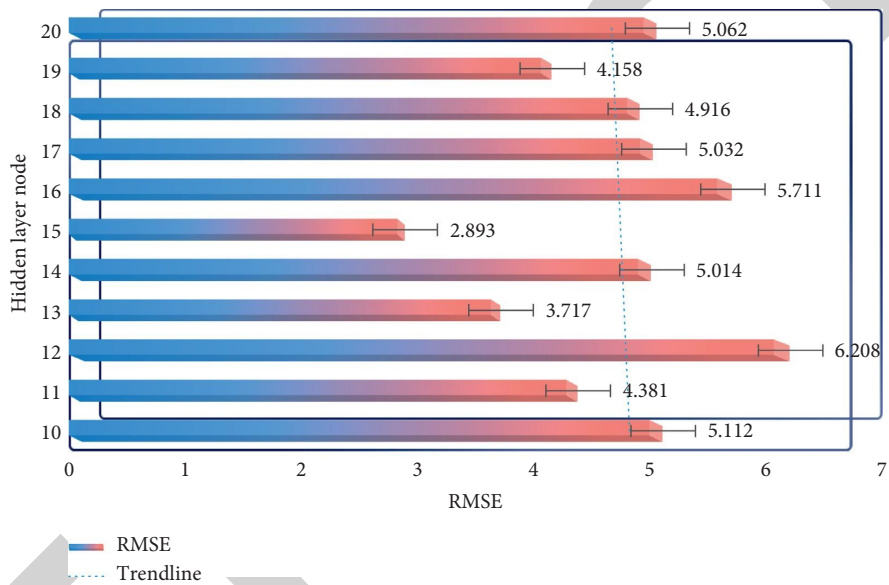

Figure 3: Root mean square error of the test under different hidden layer node parameters.

Table 2: Predicted and actual scores of class A.

Student number	P1	R1	D1	P2	R2	D2	P3	R3	D3
A1	83	84	−1	85	85	0	85.5	85	0.5
A2	79.5	79	0.5	83	82.5	0.5	80	80	0
A3	91.5	92	−0.5	92	92	0	94	93.5	0.5
A4	82	82	0	85	85	0	84	84	0
A5	78	78	0	81.5	82	−0.5	80	80.5	−0.5
A6	81	80.5	0.5	83	84.5	−1.5	84	84	0
A7	88	88	0	90	89.5	0.5	89	89	0
A8	71.5	72	−0.5	73	73	0	72	72.5	−0.5
A9	84	84	0	84.5	84	0.5	84	84	0
A10	90.5	90	0.5	91.5	91.5	0	92.5	91	1.5
A11	93	93	0	92	92.5	−0.5	91	91	0
A12	87	88	−1	89	89	0	90	90	0
A13	83	83.5	−0.5	85	85	0	84.5	83.5	0
A14	91	90.5	0.5	93	93	0	90	90.5	−0.5
A15	88	88.5	−1	89	88.5	0	91	91	0.5

As shown in Figure 9, when the students' blood oxygen saturation is stable and high, their sports performance is also higher. Among them, the student with the highest score and the highest oxygen saturation was the same person, namely, S3 student. When the blood oxygen saturation of the students is lower than 94% of the normal value, their sports performance has become the lowest of all students, only 73 points. This shows that there is a strong correlation between blood oxygen saturation and sports performance. Finally, the relationship between the students' systolic blood pressure and diastolic blood pressure and sports performance was analyzed.

As shown in Figure 10, the systolic blood pressure and diastolic blood pressure of the best achievers were 103.4 mm/Hg and 77.5 mm/Hg, respectively. The correlation between systolic blood pressure and diastolic blood pressure is high. When the systolic blood pressure is low and the diastolic blood pressure is high, it is easier for

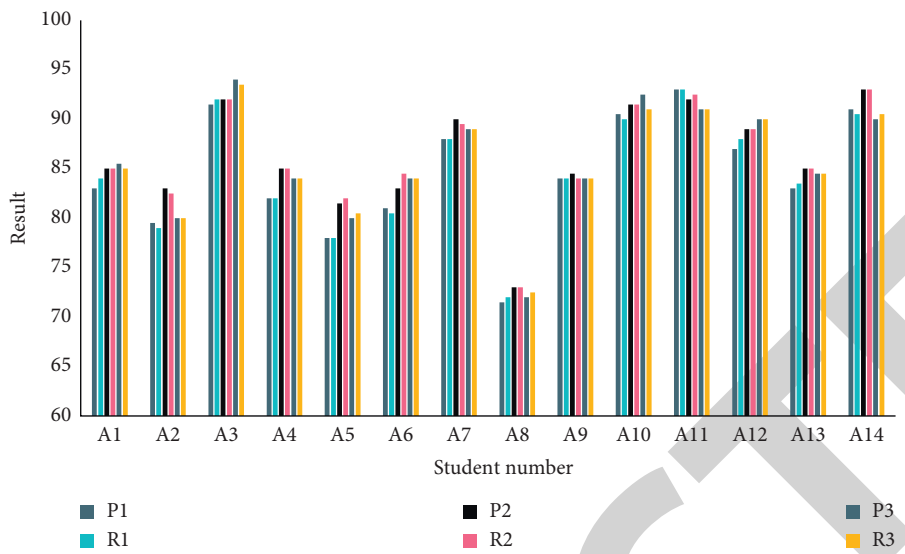

Figure 4: Comparison of predicted and actual scores of class A in three times.

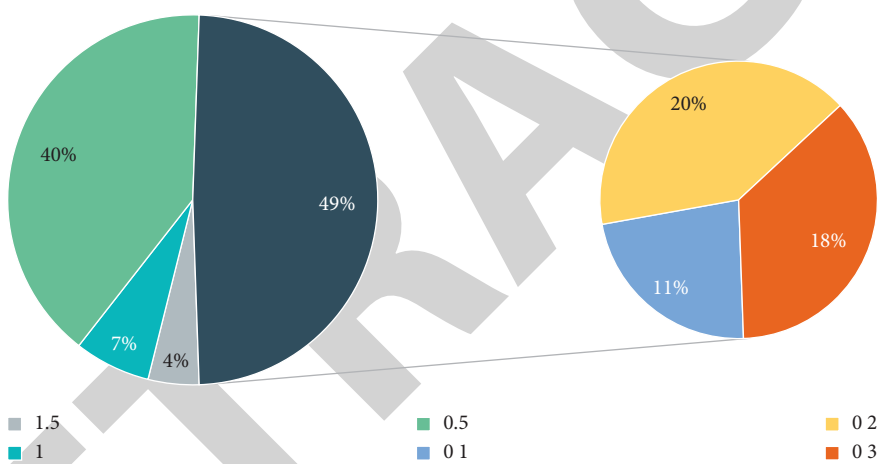

Figure 5: Prediction accuracy of class A.

Table 3: Predicted and actual scores of class B.

Student number	P1	R1	D1	P2	R2	D2	P3	R3	D3
B1	79	79	0	80	80.5	−0.5	81	81	0
B2	95	94.5	0.5	94	94	0	95	95	0
B3	88.5	88.5	0	90	90	0	89	89	0
B4	83	82.5	0.5	85	85	0	84	84	0
B5	90	91	−1	92.5	91	1.5	90	91	−1
B6	83.5	84	−0.5	84	84.5	−0.5	85	85	0
B7	79	79.5	−0.5	80	80	0	81	79.5	1.5
B8	82	82	0	82	83	−1	84	84.5	−0.5
B9	87	87	0	87.5	86.5	1	84	84	0
B10	90.5	90.5	0	91	91	0	92	92	0
B11	86	87	−1	87	87	0	89	89	0
B12	83	83	0	84	84	0	85.5	85.5	0

students to achieve better results. To sum up, in order to improve students' sports performance, it is necessary to pay attention to students' blood oxygen saturation, systolic blood pressure, and diastolic blood pressure and adjust training methods and rest time according to these data.

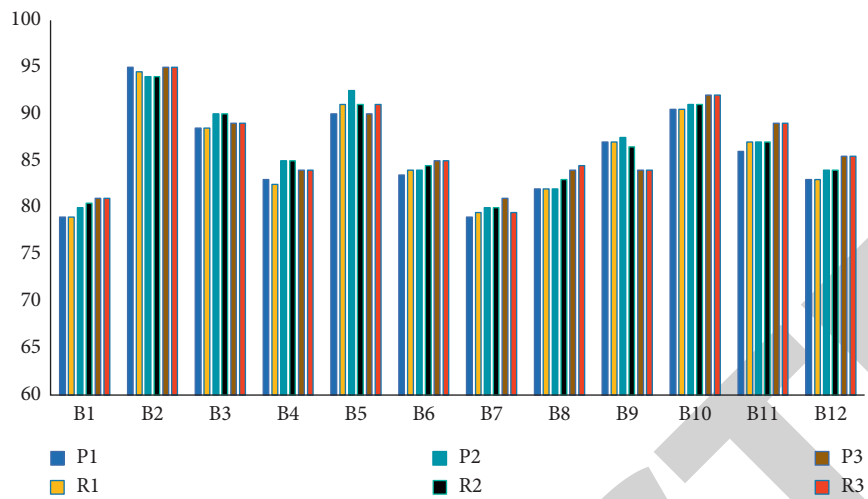

Figure 6: Comparison of predicted and actual scores of class B in three times.

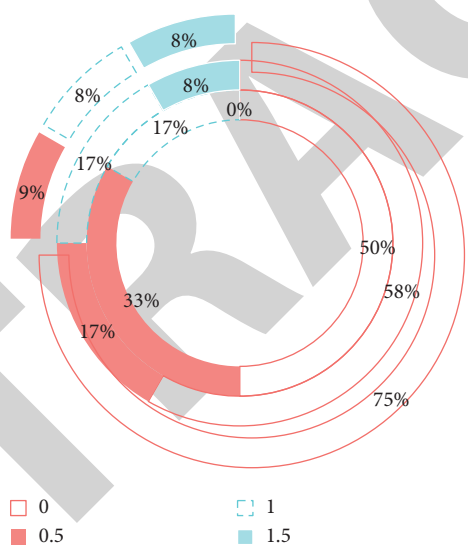

Figure 7: Prediction accuracy of class B.

Table 4: The relationship between sports performance and eigenvector.

Student number	Weight (kg)	Blood oxygen saturation (%)	Systolic pressure	Diastolic pressure	Sports achievements
S1	68.8	96.5	108.2	72.2	88
S2	65.4	97.3	108.7	73.6	89.5
S3	62.3	98.6	103.4	77.5	94.5
S4	68.5	98.1	104.5	77.1	93.5
S5	60.9	97	107.5	73	88
S6	62.5	97.5	104.8	75	91
S7	67.7	93.8	120.3	62.9	73
S8	69.2	95.7	116.4	65.3	83
S9	64.6	94.1	113.3	63.3	80
S10	65.8	97.4	105.1	75.8	91

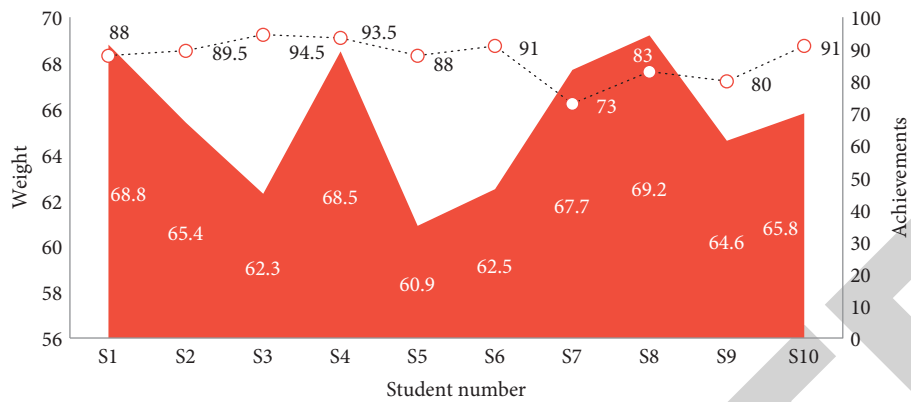

Figure 8: Weight and sports performance.

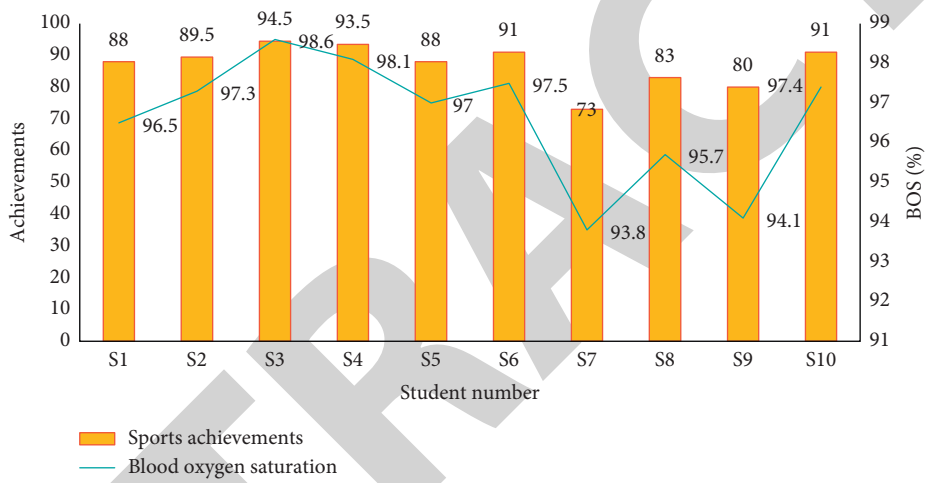

Figure 9: Blood oxygen saturation and sports performance.

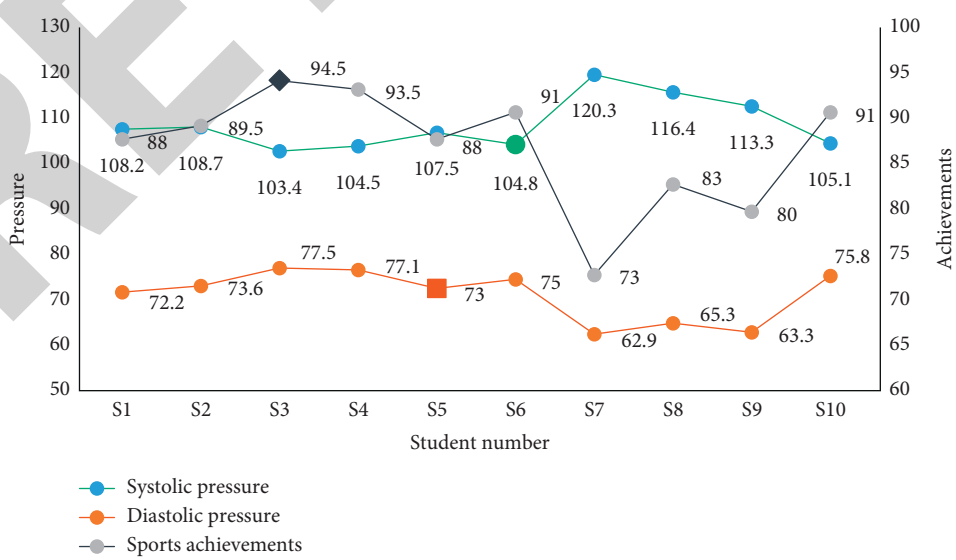

Figure 10: Systolic and diastolic blood pressure and sports performance.

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Retraction

Retracted: Prediction of Enterprise Economy by Network Communication Business Based on BP Neural Network in Big Data Security Environment

Security and Communication Networks

Received 26 December 2023; Accepted 26 December 2023; Published 29 December 2023

This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret 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 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] S. Kong, "Prediction of Enterprise Economy by Network Communication Business Based on BP Neural Network in Big Data Security Environment," *Security and Communication Networks*, vol. 2022, Article ID 1132270, 9 pages, 2022.

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Research Article

Prediction of Enterprise Economy by Network Communication Business Based on BP Neural Network in Big Data Security Environment

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From the environmental and security status quo faced by big data, although big data is unstructured or more difficult to filter and analyze, it does not mean that big data is necessarily more secure. In order to be invincible in the fierce market competition, an enterprise must conduct an in-depth understanding and investigation of the rapid changes in the market and economic development. The current era is already the Internet era. The arrival of the era of network communications has greatly facilitated people's lives. However, how to seize the opportunities in the era of network communication and make economic predictions based on actual situations are particularly important for enterprises. Therefore, we are required to make reasonable economic predictions of network communication services in order to seize opportunities and meet challenges. By analyzing the development and application of artificial neural network (NN), this article briefly introduces its development and principles. Based on the reality of a network communication industrial enterprise, it uses data modeling and comparative analysis to establish a logistic regression model, a decision tree model, and a BP NN. The model compares the customer types and data predictions of the enterprise's data traffic under the three models. From the results of the model analysis, it can be seen that in the analysis of the three models, the ROC curve analysis, the BP NN predicts that the cumulative hit rate in the ROC curve is wider. More users who can handle traffic services will be covered. In the cumulative customer lift analysis, under the first set of data (that is, when the depth is 20), the cumulative depths of the decision tree model, logic analysis model, and BP neural system prediction model are 2.5, 3.4, and 3.6, respectively. The BP neural system prediction model has the highest value of cumulative depth. In the cumulative capture response percentage analysis, the cumulative capture response percentage from low to low is the decision tree model and logic analysis. From BP NN prediction model, we can draw the conclusions. The network system can play a good role in forecasting and help enterprise managers make economic decisions.

1. Introduction

With the maturity, application and promotion of big data technology, and enterprises or government departments with important data assets increasingly recognize the concept of big data development, and data has become another core value asset after cash and technology. Data security is the core of the entire big data era, including personal privacy, business secrets, and even important national data. Once these sensitive data are tampered with or leaked, it will affect business operations at a light level, and even directly affect social security and national security steady development.

One of the key purposes of accounting management is the economy, which is an important indication for measuring an enterprise's operating conditions. Its goal is to give the leadership a solid and stable foundation on which to make decisions, to make better use of limited investment dollars, and to maximize the economic construction effect. Understanding the future cost level and its shifting pattern will help eliminate decision-making blindness through economic forecasting and make it simple for managers to select the best plan and make the best judgments possible. The important difficulties for businesses to achieve large profits include increasing economic forecasting and

management, enhancing the quality of cost management, and lowering operating costs. Forecasting the economy also aids in improving management predictability and cost control, hence supporting the enhancement of enterprise economic benefits.

Economic forecasting is a very important and complex task. Economic forecasting needs to infer the development trend of things based on historical data and current conditions, and based on certain theories and methods. Among the existing economic forecasting methods, time series forecasting and regression forecasting are the two most commonly used statistical methods. Because the economic system is affected by multiple influencing factors, it is a highly uncertain nonlinear system. The collection of historical data required for economic modeling is difficult, and the information is incomplete. To use traditional prediction methods to solve such problems.

Saraswathy found that the development of Internet technology has promoted the rapid development of the IT industry [1]. Kapil found that with the exponential growth of big data, it became more and more vulnerable to malicious attacks. These attacks can compromise the privacy, integrity, and availability of information systems. To counter these malicious intents, it is necessary to develop effective security mechanisms. He presents some important aspects of big data Hadoop security and privacy to increase the security of enterprise data [2]. Shunquan used a NN model to forecast how many tourists would visit a province. The number of tourists is an essential determinant of tourism's economic advantages and long-term development. As a result, forecasting the number of tourists has become a crucial part of tourism development planning. A forecast model of the number of tourists based on BP NN was built based on the number of tourists in a province for more than two decades, and the principles and methods of BP NN were applied [3]. Also, estimate the number of tourists expected to visit the province in the future. The BP NN model's Matlab simulation results show that the tourist number prediction model based on BP NN can accurately estimate tourist numbers.

This time based on the study of the application of the BP NN system in the economic prediction of network communication, taking a domestic network communication industrial enterprise as an example, this article briefly introduces the artificial NN, mainly introduces its concepts, principles, features, etc. Then, according to the actual needs of the enterprise, the economic forecast of the enterprise's traffic data is carried out, and the logistic regression model, the decision tree model, and the BP neural network model are used to compare the data traffic customer types and the data forecast results. According to the analysis results of the model, the BP neural system has a good application effect on the economic forecast of the enterprise.

2. Proposed Method

2.1. Overview of Artificial NNs. Artificial NN is a new information processing discipline, referred to as NN for short. It originates from the human brain nervous system and is an important way to simulate human intelligence. Although artificial NNs are not as complex as the human brain, there are two key similarities between them. First of all, the composition of the two networks is highly interconnected by the computable units; second, the connection between the processing units determines the function of the network [4]. The artificial NN is composed of simple information processing units (artificial neurons, referred to as neurons) interconnected to form a network, that receives and processes information, and its information processing is realized by the interaction between the processing units. Current NNs are mainly used in pattern recognition, image processing, nonlinear optimization, intelligent robots, language processing, predictive analysis, adaptive control, knowledge processing, cognitive science, etc. [5, 6].

The artificial NN processing flow is shown in Figure 1.

The main purpose of image preprocessing is to remove unnecessary information and retain useful information. Each artificial neuron has synapses, as shown in Figure 1. The artificial neuron gets the output of all neurons connected to it, and the signal to be generated is amplified connection strength [7]. The weighted total is compared to the net value of the neuron, and the fake neuron is triggered if it is bigger than the threshold [8, 9]. The signal is transferred to the higher-level neurons attached to it when it is triggered. The artificial NN's operation is primarily controlled by two factors: first, the network's structure, or how the artificial neurons are connected; and second, the artificial neurons' function. The second set of rules is the network learning and operation rules, which are the rules for adjusting the network's connection weights. The artificial NN research approach can handle large-scale parallel data processing, and has high fault tolerance, perception, memory, thinking, and reasoning abilities, as well as strong self-learning and adaptive abilities. It excels at learning from a wide variety of sources. Analyze statistical data and obtain macroscopic statistical laws. Therefore, the use of artificial NNs for economic forecasting can play an important role in correctly assessing the economic development level of a region, accurately predicting future economic development trends, and timely reflecting the effects of macroeconomic regulation and control [10].

The characteristics of the artificial NN mainly have the following four points:

(1) High-speed information processing and powerful information storage capacity. Artificial NNs have a large number of neurons related to each other, and neurons store and process information in parallel.

(2) It has a strong ability to deal with fuzzy data. Results are valid even if input data is missing, wrong, or unclear.

(3) Due to the robustness advantage of artificial NNs, when a single neuron is lost, biological NNs do not lose the memory of the original pattern. The strongest proof is that when the human brain is slightly damaged by accident, it does not lose all memory of the original thing. The same is true for

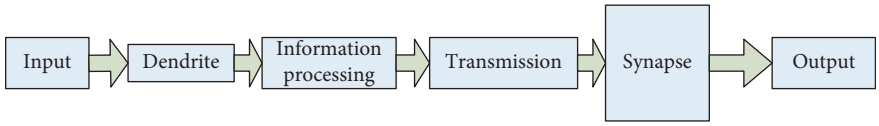

Figure 1: Flow chart of artificial NN.

NNs. For some reason, no matter which part of the neuron fails, it does not affect the operation of the overall network. The basic algorithm of NN has low convergence precision, slow convergence, no convergence, and difficulty in determining the network structure.

(4) Artificial NNs with highly nonlinear systems are different from current computers, breaking through the limitations of traditional linear processing computers [11, 12].

2.2. BP NN and Algorithm. The BP algorithm is still the most important and most widely used effective algorithm in automatic control. The BP NN is the error backpropagation network, which belongs to the forward multi-layer propagation and guided learning NN.

The BP artificial network model is part of the forward multi-layer artificial NN back propagation learning technique, which has three layers: input, output, and a learning layer. It's made up of multiple layers that are not visible. There are numerous neurons in each stratum. Connection weights and thresholds connect the neurons in each layer. In the same layer, there is no connectivity between neurons. A sort of supervised network is the BP network model. When data is entered into the network, it is first transferred from the input layer to the hidden layer node, then sent to the next hidden layer following the characteristic function, and ultimately passed to the output layer [13]. The neural unit's function is usually an s-type function:

$$f(x) = 1/1 + e^{-x}. \tag{1}$$

After identifying the structure of the BP network, train it by modifying the connection weight in the BP network and the network size (including n, m, and the number of hidden layer nodes) using the input and output sample sets. Realize the given input-output mapping connection and accurately approximate any nonlinear function. The BP network calculating method is based on the error backpropagation algorithm, which is made up of two processes: forward information propagation and back error propagation [14]. The movement of events in Figure 2:

It can be seen from Figure 2 that the neurons in the input layer are used as the starting point for information transmission. Hidden layer refers to the layers other than the input layer and output layer in the multi-level feedforward NN. The hidden layer does not directly receive external signals, nor does it directly send signals to the outside world. It is only required when the data is nonlinearly separated. The input layer receives the information, passes it to the middle layer, the middle layer converts it, and designs a multi-layer structure as needed to build a hidden layer, The information is subsequently passed to the output layer by the concealed layer. It will enter the erroneous back propagation phase if the actual output does not match the predicted output. The error flows through the output layer, correcting the weight of each layer via error gradient descent, and then returning to the hidden layer and input layer by layer. Constantly changing the weights and learning and training of the NN [15] is the process of information propagation. This process should be repeated until the error has been reduced to a bare minimum. To apply the network system to the practice of solving practical problems, we must first train the network system. The BP network system has its own unique training method, that is, the algorithm of the BP system, which is also the standard BP algorithm. The main idea is: for a set of input samples, the actual output is calculated by the BP NN, and the actual output and output of the BP network have used. The error between samples is corrected until the error of both reaches the set value of the network connection weight [16, 17]. This smaller value is called the fitting error, also known as the error function. Generally, the sum of squared errors between the actual output and the output samples is expressed as:

$$E = \frac{1}{n_3}\sum_{k=1}^{n_3}(t_k - z_k)^2. \tag{2}$$

In the formula, t_k is the sample output value and z_k is the actual output value. The so-called activation function is the function that runs on the neurons of the artificial NN and is responsible for mapping the input of the neuron to the output. The steps to train the BP network with the BP algorithm are as follows:

(1) Initialization of connection weight

At the beginning of the network training, the connection weight is unknown, and generally, a smaller random number is used as the initial value of the connection weight of each layer.

(2) Calculate the output value of neurons in each layer

$$\begin{aligned} y_j &= f_1\left(\sum_{i=0}^{n_1} w_{1ij}x_i\right), (j = 1, 2, \ldots, n_2), \\ z_k &= f_2\left(\sum_{j=0}^{n_2} w_{2kj}y_j\right), (k = 1, 2, \ldots, n_3). \end{aligned} \tag{3}$$

In the formula: f_1, f_2 for activation function, generally use the sigmoid function or linear function.

(3) Correction of connection weight

Gradient descent is a first-order optimization algorithm. The correction of the connection weight adopts the

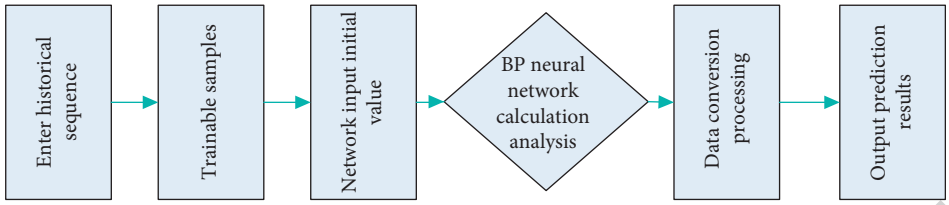

Figure 2: BP NN system process.

gradient descent method, each time the correction amount of the connection weight and the gradient of the error function.

It is proportional to the reverse transmission from the input layer to each layer. The connection weight correction amount of each layer is;

$$\Delta w_{2kj} = \eta(t_k - z_k) f_{2,} y_j, \ (k = 1, 2, ..., n_3; j = 0, 1, 2, n_2),$$
$$\Delta w_{1ji} = \eta(t_k - z_k) f_{2,} w_{2kj} f_{1,} x_i, \ (j = 1, 2, n_2; i = 0, 1, 2, ..., n_1). \tag{4}$$

In the formula, η is the learning rate; f_1, f_2 is the derivative of $f_{1,}, f_{2,}$ activation function The initial weight is added to the corresponding adjustment amount to calculate a new weight, and so on until the sum of squares of the output layer error reaches the set value [18].

The main purpose of parallel processing is to save time for solving large and complex problems. In order to use parallel processing, the program needs to be parallelized first. Parallel processing of information, data fusion, and self-adaptation. The standard BP algorithm is widely used, but it also has its shortcomings. The standard BP algorithm has the tendency to form a local minimum, the convergence speed is very slow, and the training period is long; it is easy to produce overtraining, etc [19, 20]. In order to make up for these shortcomings, people have made many beneficial improvements on the basis of the standard BP algorithm, such as the momentum method, conjugate gradient learning algorithm, LiebenbergMarquardt optimization method, and Bayesian regularized BP NN algorithm. Bayes' theorem is a theorem about the conditional probability (or marginal probability) of random events A and B.

The network communication business income is mainly concentrated in the Internet business income and mobile traffic business income With the continuous improvement of 4G networks and the introduction of 5G networks, along with the expansion of 4G and 5G mobile users, mobile Internet output traffic is close to 10 billion, and online consumer traffic through mobile terminals accounts for about 90%. According to the characteristics of daily traffic usage of users in the communications industry in the network communications business, this study takes the customer's demand for traffic as the index of this economic forecast study. Since the current 4G network has the widest distribution and the most perfect development, the flow business referred to in this article refers to the flow business based on the 4G network, and continues to analyze the customer flow business of a network communication company.

Many factors affect customers' handling of traffic services. Due to the differences in personal consumption needs and differences in consumption habits of users, plus the impact of whether home broadband, Wi-Fi and terminals are smart machines, although users must use some kind of main package business. The standard traffic package business is also decided based on the user's traffic demand and consumption capacity. The corresponding recommended traffic combinations are package A, package B, and package C. The month of the extracted data is a total of 9 months from January 20×9 to September 20×9. The data from January to August was analyzed as a sample, and the September data was predicted and compared with the actual results. In order to make the model prediction effect more intuitive, respectively, select the optimal model output results, and compare and evaluate the model effects.

3. Experiment Design and Simulation Analysis

3.1. Confirmation of Requirements. Solve the problem of forecasting the willingness to handle the traffic business portfolio, and determine the probability of whether the customer will handle the traffic business portfolio in different customer segments. This part is the preliminary preparation work and has been completed in the process of field investigation.

3.2. Data Preprocessing. Generate an input data source for the flow business portfolio willingness prediction, and select the non-downtime active communication customer of the enterprise as the customer group in the modeled sample data. The number of observations obtained for the total sample in September 2015 is 1637895, and the data types of all indicators have been converted to numeric types.

3.3. Build a Communication Traffic Business Combination Classification Prediction Model

3.3.1. Build a Logistic Regression Model. In the logical analysis model, whether the customer will handle the flow business combination, for the binary classification prediction problem, the value of the willingness to predict the value of P (x) is (0, 1). To solve P (x), you can use the sigmoid function, whose definition domain is $(-\infty, +\infty)$, and the value range is (0, 1). It is difficult to directly solve the sigmoid function, which is converted into a logistic function. Can be expressed as:

$$P(y = 1|x) = \pi(x) = 1/1 + e^{-g(x)}. \quad (5)$$

In the formula $\pi(x)$ describes the possibility of handling business combinations on the basis of each attribute value of customers. Use the EM module in SAS statistical analysis software to build the model. The parameter that the variable in SAS will be selected to enter is SLE, the parameter that the variable in SAS will remain in the selected variable combination is SLS, the entry of the new variable leads to the insufficient contribution of the old variable to the entire model, the SLS threshold will be This variable is eliminated. The default statistical significance level of parameters SLE and SLS is $P < 0.05$.

3.3.2. Build a Decision Tree Model. A decision tree is generally composed of block nodes, circular nodes, program branches, probability branches, etc. The block nodes are called decision nodes, and several thin branches are drawn from the nodes. The decision tree is a kind of classification process based on representative rules of representative examples. Although different customers have different combinations of attribute values, they ultimately correspond to the result of whether they will handle the flow business combination. The combination of different attribute values of customers can also be described as different judgment rules. The final judgment result is whether or not the business will be handled. The number of different attribute values of customers is not the same. When judging each attribute value, the final number of judgment rules is large. The decision tree algorithm determines the feature selection metric technology adopted at each internal node as the information gain rate. Information gain represents the difference between the experience entropy $H(D)$ of the training data set D and the experience condition entropy $H(D \mid A)$ of D under the given conditions of the variable value A, that is: first calculate the experience entropy $H(D)$:

$$H(D) = -\sum_{k=1}^{k} \frac{|C_k|}{|D|} \log_2 \frac{|C_k|}{|D|}. \quad (6)$$

Among them,$|D|$is the number of observations in the training sample data set,$|C_k|$is the number of the Kth classification result, where K is 2, Second, calculate the empirical conditional entropy $H(D|A)$:

$$H(D|A) = \sum_{i=1}^{n} \frac{|D_i|}{|D|} H(D_i). \quad (7)$$

Among them, because $|Di|$ refers to the number of samples of attribute A in i values, $|Di|/|D|$refers to the probability of attribute A taking i values, and finally, the information gain is calculated, the expression is given as:

$$g(D, A) = H(D) - H(D|A). \quad (8)$$

The information gain method is used for feature extraction in text classification, and words with relatively large information gain for a certain category are selected as the features of this category. The principle of feature selection using the information gain method: Calculate the variable with the largest information gain of all variables in the training data set. A large information gain indicates that the variable has a stronger classification capability. It can be seen that the information gain represents the degree to which the uncertainty of the information of class Y is reduced by learning the information of the variable A. The smaller the empirical conditions, the higher the purity of the partition. Use the EM module in SAS statistical analysis software to build a decision tree model. The input training data set does not use evidence weight values to replace each group of each variable, but directly uses the original discretized data results. Before the model is fitted, the EM module can optimally divide according to the type of attribute value. In order to compare the model output with the results of the logistic regression model, the decision tree model is built based on the data set of variables with information values less than 0.5.

3.3.3. Build a BP NN Model. Due to a large number of input attributes in this study, first adopt the principal component analysis data. In order to reduce the number of model input variables, the principal component analysis method is used to reduce the dimensionality to speed up the model fitting time. The role of principal component analysis is to generate a number of dominant variable combinations from the existing variable set, and can determine the size of these variable combinations. The obtained result is used as input, that is, the normalized sample data value is converted into the main component sample data, and then the data set is used as the input training data set. The principal component analysis is a statistical method. According to kolmogorov's theorem, when the input layer node of the BP NN is n_1 and the number of output layers is m, the number of hidden layer nodes k is selected as

$$\sqrt{(n_1 + m + 1)} + a, \quad (9)$$

where a can be selected from 1 to 10, and the value of m in this article is 2. In this study, the BP NN with a single hidden layer has a strong nonlinear conversion ability, which can improve the efficiency of model fitting. The EM module in SAS statistical analysis software is used to build an algorithm model based on BP NN. Since the number of input layer variables n_1 is 9, the number of output layer variables m is 2, so by

$$\mathrm{s}\,qrt\,(n_1 + m + 1) + a, \quad (10)$$

where a is set to 1, the number of hidden layer units is 5, the learning rate is set to 0.1, and the maximum number of iterations is 50.

3.4. Performance Evaluation and Performance Analysis Indicators. There are many indicators to evaluate the effectiveness of a model. In this study, we choose ROC linear analysis, lift, and response percentage. We use test data to evaluate the performance stability of the model, and select two indicators, K-S value and lift, for analysis. The ROC curve is composed of the predicted hit rate (TPR) and the false prediction rate (FPR). TPR represents how many of the

people who actually handle traffic business are correctly predicted to handle business. FPR represents how many of the people who have not actually handled traffic business are wrongly predicted to handle business. The area under the ROC curve is named using the AUC value and is used to evaluate the actual effect of the model. The range of AUC values is [0.5,1]. The larger the value, the more the ROC curve is toward the upper left corner, indicating that under the same threshold, the cumulative hit rate is greater than the cumulative error prediction rate, indicating that more will be handled Users of traffic services will be covered. This article uses the K-S value to test the user's ability to distinguish between traffic service portfolios and user non-service portfolios. If the K-S value is larger, it indicates that the ability to distinguish users from handling traffic services and users from not handling services is stronger, and the predictive model is better. The degree of promotion refers to that users are ranked in descending order according to the model probability and divided into 10 groups on average. The ratio of the event rate of each group to the overall event rate is the degree of promotion. The higher the lift of the first group, the better the model effect.

3.5. Linear Analysis Effect of Three Models ROC. The results of the ROC linear graphs of the three models are shown in Figure 3.

Figure 3 shows that the BP NN prediction model is positioned above the linear model analysis and decision tree models under the same cardinality, indicating that the BP NN model has a higher cumulative hit rate in the ROC curve under the same conditions. Because there will be more users handling the traffic business, the BP NN model's prediction effect will be better.

3.6. Analysis of the Effect of the Cumulative Lift of the Three Models. The effect of the cumulative lift of the three models is shown in Figure 4.

It can be seen from Figure 4 that under the first set of data (that is, when the depth is 20), the cumulative depth of the decision tree model, logical analysis model, and BP neural system prediction model are 2.5, 3.4, and 3.6, respectively. The cumulative depth of the model is the highest, which is better than the decision tree model. The logical analysis model is 44% and 8% higher, respectively, indicating that under the same prediction conditions, the BP model has the best prediction effect, followed by the logical analysis model, and the decision tree model is the worst.

3.7. Analysis of the Cumulative Effect of the Percentage Captured by the Three Models. The effect of the cumulative lift of the three models is shown in Figure 5.

It can be seen from Figure 5 that under the same cardinality conditions, the cumulative capture response percentages range from low to decision tree model, logic analysis model, and BP NN prediction model. When the cardinality is large enough, the logic analysis model cumulative capture response percentage trend When the cumulative capture

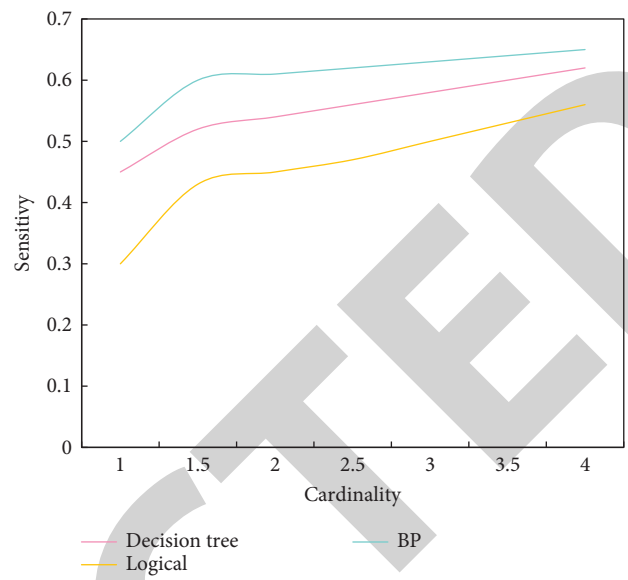

Figure 3: ROC linear analysis of three models.

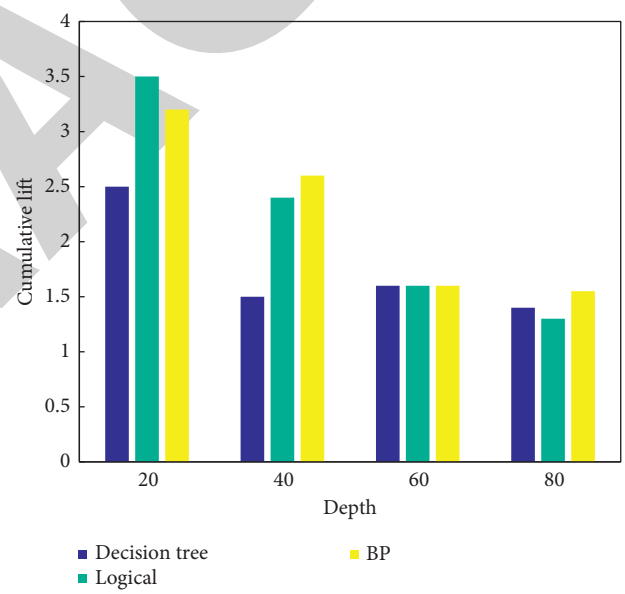

Figure 4: Analysis of the cumulative lifting graph of the three models.

response percentage of the near BP NN model is still lower than the cumulative capture response percentage under the BP prediction model, it can be concluded that the cumulative capture response percentage value under the BP NN model is the highest and the model prediction effect is the best.

The results of the three models of different value customer groups are shown in Figure 6.

It can be seen from Figure 6 that for the modeling samples of three subdivided customer groups, Choose the optimal model output results respectively for the model effect evaluation ratio. From the perspective of cumulative lift and cumulative response percentage, BP is used in high-value customer groups, medium-value customer groups, or low-value customer groups. The effect of the NN model is better.

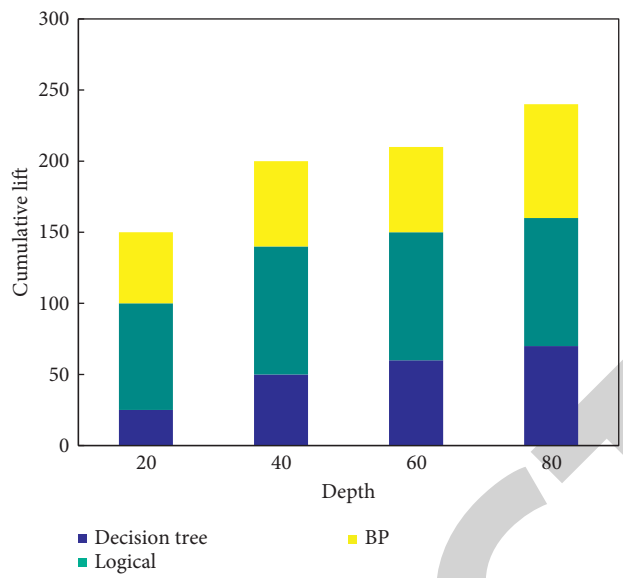

Figure 5: Analysis of the cumulative capture response percentage of the three models.

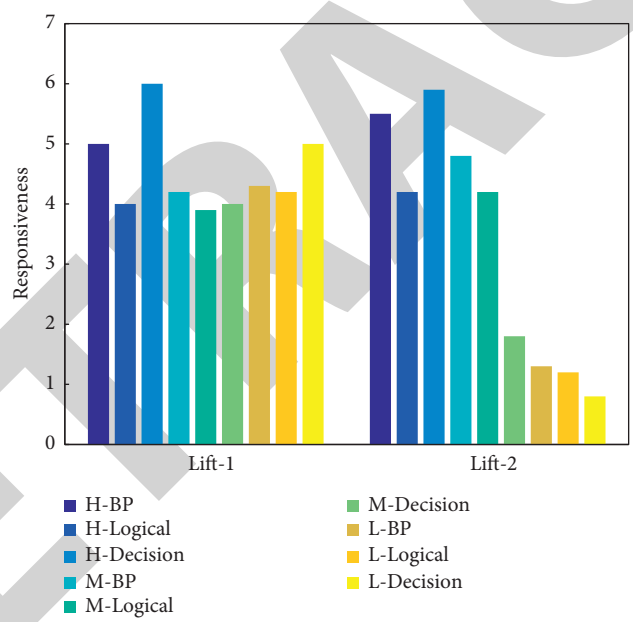

Figure 6: Results of three models of different value customer groups.

3.8. Analysis of the Performance Stability of the Three Models. The test data set was used to analyze the effects of the three model results. With the help of the K-S value, we can intuitively find a segmented interval with the largest difference in the prediction model and output the lift and cumulative lift of the test data set as an index to verify the performance stability of the model. The effect of the cumulative lift of the three models is shown in Table 1.

It can be seen from Table 1 that in low-value customer groups, the BP NN model is expected to have higher values, followed by logistic regression analysis, and the decision tree model is the worst. BP NN is expected to have the highest value. In the prediction of high-value groups, the predicted value of BP NN reaches 0.506988.

The lifting degree and cumulative lifting degree of the verification data output in the three models are shown in Table 2 (Table 2 selects the representative data with a depth of 10%)

It can be seen from Table 2 that the actual lift and cumulative lift corresponding to the top 10% of the users are the best in the BP model. Among the low-value customer groups, the BP NN model has a higher value from the actual lift and actual cumulative lift corresponding to the top 10% of users, followed by the logical review of the NN, and the decision tree model is the worst. And the cumulative improvement of the verification results is lower than the training results, and similar conclusions are obtained in the analysis of the middle and high customer groups. It can be

Table 1: Verify the maximum output K-S value in the three models.

Serial number	Segment name	Algorithm type	Maximum K-S value
1	High-value customer groups	Model 1	0.483745
		Model 2	0.322588
		BP	0.506988
2	Medium-value customer groups	Model 1	0.352912
		Decision tree	0.319108
		BP	0.378465
3	Low-value customer groups	Model 1	0.440798
		Model 2	0.381677
		BP	0.448482

Table 2: Verify the lift and cumulative lift of the output of the data in the three models.

Serial number	Segment name	Depth (%)	Algorithm type	Actual lift of each layer	Actual cumulative lift
1	High-value customer groups	10	Model 1	4.7565	4.7565
			Model 2	4.2728	4.2728
			BP	4.9730	4.9730
2	Medium-value customer groups	10	Model 1	4.3004	4.3004
			Model 2	3.8201	3.8201
			BP	1.3097	3.1407
3	Low-value customer groups	10	Logistic regression model	4.0064	4.0064
			Model 2	3.4012	3.4012
			BP	4.1220	4.1220

seen that from the two aspects of interpretability and model performance stability, the model results fitted with the BP NN model can be used to classify and predict mobile communication traffic services and marketing applications.

4. Conclusions

In recent years, with the rapid development of information technology, especially big data, it has become easier to collect, store, publish and analyze massive data. From the perspective of data security and personal privacy protection, big data applications also bring great hidden dangers to data security. Among the many security problems faced by big data, how to analyze and mine more value from big data and well protect the privacy and security of data is particularly important.

In the era of big data, data security has become the lifeblood of countries, governments, and enterprises. After entering the information age, data not only has the characteristics of diversification, but also the amount of information gradually increases which has become two issues that China's communication industry needs to pay attention to correct decision-making is the cornerstone to successful business management, and accurate prediction is the foundation of both decision-making and scientificity. We can only achieve "marketing based on demand and production based on sales" if we estimate the market scientifically and precisely. We can only exploit potential and cut costs by anticipating profits and costs in advance, allowing businesses to make appropriate arrangements in their company activities and support growth. In the strong market battle, businesses have a position. It must be stated that network communication has played a pivotal part in the development of today's period, as well as an essential role in the overall economic condition. Economic forecasting has an unparalleled impact on the development of businesses due to its foresight and practicality. Therefore, this article is based on the economic analysis and economic prediction of the network communication business industry, and its role cannot be underestimated. Based on the application of the BP network system in the network communication economic prediction, the comparative analysis of the application of logic analysis systems and decision tree models in this field, Demonstrated the role of the BP NN system in network communication economic forecast.

This article is based on the application research of the BP NN system in the economic forecast of network communication. It focuses on the reality of a network communication enterprise. According to its business type characteristics and enterprise reality, it first briefly introduces the concept and characteristics of artificial NN. Then, based on the characteristics of the enterprise, using its network communication flow index as the economic forecast index of this enterprise, respectively, established three sets of data prediction models, namely logistic regression model, decision tree model, and BP NN model, and compared the data traffic customers of the enterprise under the three models Type and data prediction.

According to the model test results in this study, the analysis results show that in the ROC linear graph analysis, under the same conditions, the cumulative hit rate of the ROC curve of the BP NN model is wider, and more users will handle traffic services will be covered. . In the analysis of the cumulative lift effect diagram, the analysis results show that at the same depth, the cumulative lift from high to low is BP NN analysis, decision tree model analysis, and logistic

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Retraction

Retracted: Basketball Object Extraction Method Based on Image Segmentation Algorithm

Security and Communication Networks

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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] H. Zhu and L. Liu, "Basketball Object Extraction Method Based on Image Segmentation Algorithm," *Security and Communication Networks*, vol. 2022, Article ID 3021682, 10 pages, 2022.

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Research Article

Basketball Object Extraction Method Based on Image Segmentation Algorithm

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Finding your favorite videos from massive sports video data has become a big demand for users, accurate sports videos can better help people learn sports content, and the traditional data management and retrieval methods using text identifiers are difficult to meet the needs of users, so the research on the extraction of sports objects in sports videos is of great significance. This paper mainly studies and proposes the basketball object extraction method based on image segmentation algorithm and can accurately analyze the trajectory of the basketball target. By modeling the video frame of basketball game, the basketball object is selected for segmentation and extraction. The extracted basketball object can be used for tracking the target in the basketball video clip retrieval system. At the same time, the segmentation and extraction of the basketball object are also the core part in the basketball video clip retrieval framework. Combined with the characteristics of basketball video images in the database, the algorithm extracts the image block variance and contrast to form the training feature vector, and the correct segmentation rate on the database is higher than 95.2%. The results show that this method has a good effect on the segmentation and extraction of basketball objects in basketball videos.

1. Introduction

1.1. Background and Significance. The key technologies of robots include target recognition and tracking, path planning, and multisensor information fusion. They are widely used in hotel service robots, autonomous driving, drone and missile interception, and other application scenarios. Among them, the identification and tracking of fast flying objects have great research and application value in the identification and tracking of suspicious targets in sports competition monitoring and adjudication and military confrontation. With the development of digital video technology, Internet technology, and broadband multimedia services, video has gradually become one of the mainstream carriers of information dissemination and a commonly used tool for people to obtain and record information; in this case, various new video application methods have also continuously emerged, and there has been an explosive and rapid increase in the volume of video data. People have put forward new and higher requirements for the storage, retrieval, and processing of video data. In order to make full use of video information, people want to consume video media in an adaptive manner, that is, to consume video media any way, at any time, and in any place. This consumption is not a passive consumption, and consumers of video media are also producer of video media. At the same time, due to the rapid development of communication technology, including the development of network technology, there are massive amounts of video on the Internet. Therefore, how to self-determine the outside world, interactively process information, and understand the content of information, how to obtain video information distributed on the global Internet according to needs, how to find video information of interest in massive videos, and how to organize knowledge through automatic learning and constitute a colorful interactive video content service have become the goal pursued by

people in the digital age. This makes the development of related technologies such as intelligent processing, effective organization, retrieval, and management of videos more urgent. Image segmentation technology can achieve accurate tracking of image targets and has a wide range of applications in motion capture and so on.

1.2. Research Status at Home and Abroad. In recent years, image segmentation methods based on graph theory have attracted a lot of interest from many scholars, and many researchers have focused on in-depth research on them. Image segmentation methods based on graph theory have a perfect theoretical background, and the segmented images have good results, which have also been widely used in image segmentation technology. After continuous research and efforts of researchers, image segmentation methods based on graph theory have developed today, and many improved methods have also been produced, which have made many contributions to image segmentation methods.

In 2004, someone proposed an isoperimetric cut method, whose idea was inspired by the classic isoperimetric problem [1]. To segment a good-quality image, the following conditions are met: the acreage of the area needs to be large, and the circumference of the area needs to be small [2]. For isolated points, the perimeter is very small, and at the same time the area is also small, so the cost of the cut set will not be the smallest, which effectively prevents the situation where the segmentation tends to be small regions or isolated points [3]. Isocyclic cut sets transform the feature vector problem of graph theory into a linear system problem of images, which improves the stability of the algorithm and runs faster [4]. When the image has multiple targets, the target needs to be iterated in depth, and the algorithm requires a large amount of calculation [5].

Someone trains a generative probability model, which adopts the method of unsupervised learning object class segmentation, in which Learning Object Classes with Unsupervised Segmentation is referred to as LOCUS [6]. The color and texture characteristics of different entities of the same type of objects are unstable, but their shape characteristics are relatively stable; in addition, the color and texture characteristics of individual entities are relatively stable, which is the premise of LOCUS assumptions [7, 8]. LOCUS combines low-level features such as colors, textures, edges, and top-level features such as shapes and postures through generative probabilistic models to simultaneously achieve object positioning, segmentation, and posture estimation [9, 10]. The biggest feature of this model is the ability of allowing large differences in appearance between different entities of the object. In order to avoid the hard decision of the object's pose, size, and segmentation during the calculation process, LOCUS iteratively updated its trust degree to achieve the optimization of these three aspects at any time [11, 12]. LOCUS trains the model by selecting a small number of unsegmented and labeled images and segmenting by inference. The purpose is to reduce human participation [13].

For the first time, someone used CRF in image pixel labeling. Pixel labeling refers to classifying pixels in an image according to a preset classification [14]. Both the input image segmentation and the label classification of the area can be achieved by pixel labeling [15, 16]. The use of context information to mark pixels is based on the principle that there is a great correlation between adjacent pixels. And it has different tag information at different image levels [17, 18]. For example, color and texture features are the basis for classifying pixels on local images; color and texture are commonly used for pixel classification; meanwhile, contour and shape features are the basis for classifying regions in the image [19]. In addition, according to the preset, the local characteristics between pixels classified into different categories will also be similar; for example, the water surface and the sky are blue; they have the same color characteristics; at the same time, noise easily affects the local features [20, 21]. Therefore, classification based on local features is not persuasive. At this time, the geometric relationship between the objects, the position of the object in the image, and other context information can be considered [22, 23]. The information labels on partial images have "ambiguity." It is obvious that the context information at a higher level is conducive to the elimination of this "ambiguity" [24]. Through the above investigations, the author describes the characteristics of the image at different levels, using the multiscale CRF method and further statistics of the degree of influence of their mutual relationship on pixel classification. The author uses the maximum likelihood to estimate the model parameters in the training process by increasing the gradient [25, 26]. At the same time, the maximum posterior probability is used to estimate the posterior distribution of the classification labeling conditions in the image segmentation process by Gibbs sampling, which is simple and easy to converge [27].

A variety of information in the active contour model is used to define a new energy function for image segmentation. These models aim to extract all potential objects from the background but at the same time also obtain nontarget objects and noise. Liu uses a sparse representation method to extract the target object. The original indicator function (binary function) relative to the level setting function is used to represent the foreground (value 1) and background (values 0). From another perspective, the indicator function can be represented by a linear combination of a set of basic functions. First, the label operator uses the indicator function in each iteration, and each connected region is represented by a basis function. Second, the linear combination of these basis functions is used to represent the object. Finally, through sparse constraints of basis function coefficients, object extraction is regarded as a sparse representation problem. At the same time, the corresponding improved orthogonal matching tracking algorithm is designed to obtain the ideal result [28]. His method is too complicated to solve the problem of efficiency in practical applications. Sun has proposed an improved ViBe algorithm to extract moving objects for the effects of ghosting in the visual background extractor (ViBe) and dynamic background. He improved the way by which the background was acquired during modeling to eliminate

ghosting. Detect the saliency of the previous M frames and synthesize a relatively real background. He improved the selection of thresholds in the model to reduce the impact of dynamic background. Adaptively, adjust the threshold according to the background complexity. In addition, finding the internal contour of the extracted object to be filled makes the detected target more complete [29]. His research method does not consider the problem handling when the moving object is blocked, and it is not comprehensive. In order to evaluate the accuracy of object extraction, Liping proposed several novelty measures that differ from the standard. First, based on the confusion matrix, he gave measures for the accuracy assessment based on the area and the number of objects. Secondly, he combines the similarity of multiple features to provide different accuracy evaluation measures. Third, in order to improve the reliability of the target extraction accuracy evaluation results, he designed two accuracy evaluation measures based on the differences in target details. Compared with existing methods, this method synthesizes feature similarity and distance difference, which greatly improves the reliability of target extraction evaluation [30]. Although the reliability of his method is very good, the processing time for the problem is too long to achieve the purpose of practical application.

The main work of this article is to describe the basketball video information description model and basketball video object extraction algorithm and discuss its application research. On the basis of reviewing and summarizing the existing results, a multilevel is proposed in the field of basketball video object description. Based on the sports video semantic object description model and combined with the video semantic information hierarchical description model, a multilevel basketball video object extraction algorithm is proposed.

2. Image Segmentation Algorithm and Object Extraction Method

2.1. Contour Extraction. The Snake model deforms the initial curve to obtain the target contour. From the mechanical point of view, when an object deforms, it must be subjected to force. The basic idea of the Snake model is to transform the curve drawing according to the image information into solving the optimal route problem. Therefore, the evolution of the curve in the Snake model must also be affected by different forces, that is, the internal force and the image force. The steps of the traditional Snake model are the following: first, manually point out some points in the image, which will be connected to each other to form an initial curve; then, the energy in the functional is minimized; that is, this process makes the initial curve like a target and contours are close. When the traditional Snake model forms the initial curve, the points in the image are $A(x) = [B(x), C(x)]x \in [0, 1]$. Among them, $B(x)$ and $C(x)$ represent the coordinates of each point when it is pointed out in the image where x is the independent variable. Snake uses these points to define the energy function and then relates the energy change to the deformation of the contour curve, which is defined as follows:

$$E_{\text{total}} = \int_s \left(\alpha \left| \frac{\partial}{\partial s} \overline{v} \right|^2 + \beta \left| \frac{\alpha^2}{\alpha s^2} \overline{v} \right|^2 + E_{ext}\left((\overline{v})(s) \right) \right). \quad (1)$$

Among them, $\alpha|\partial/\partial s\overline{v}|^2$ changes the shape of the curve, and $\beta|\alpha^2/\alpha s^2\overline{v}|^2$ bends the curve, which is a force that changes the initial curve. Extract Snake model by bending curve. What $E_{ext}((\overline{v})(s))$ can do in the traditional Snake model is only the characteristics of the area near the curve, such as the gradient in the image area, that is, the figure force:

$$E_{ext}(\overline{v}(s)) = P(\overline{v}(s)) = -|\nabla I(v)|^2, \quad (2)$$

where the force is the vertically acting force. When the curve evolves near the edge of the target shape, the gradient value in the outline of the curve will become larger and then lead to the minimum energy in the formula. According to the defined curve evolution equation, it can be understood that the point at this time will be stationary, not changes. Eventually, the curve will stop at the edge of the target shape, and of course the target contour you want to get is obtained. Of course, to achieve this goal, an important requirement is needed; that is, the target in the image can have more obvious edge features to prevent the curve from overflowing.

The various energies that change the shape of the curve in the Snake model are called internal force, and they can operate the various changes of the curve while ensuring the continuity and smoothness of the curve. And $E_{ext}(\overline{v}(s))$ is also called external force, which represents the change of the curve in the same area as the characteristics of its vicinity. The values of α and β in the formula also have a great effect. They respectively determine that the curve can be changed within a certain range of length and round plaque.

When the curve is initialized in the image, the points used are because of its randomness, so solving the minimum value of $E_{\text{total}}(V)$ is equivalent to the variational method in mathematics. In this stochastic situation, the final solution can be made through the Euler equations. Because the functional extremum condition of the differential expression is equivalent to the Euler equation, the solution of the Euler equation, which is to solve the extremum of the functional, goes a step further, making the deep variational problem more understandable and simple differential problem.

$$-\alpha'\overline{v}' - (\alpha - \beta)\overline{v}'' + 2\beta'\overline{v}''' + 2\beta'\overline{v}'''' = -\nabla P(\overline{v}). \quad (3)$$

Among them, $F = -\nabla P$ is external force. Through the discretization of the above formula, B(x) and C(x) are changed into linear systems with five diagonal matrices, and then they are solved. Of course, in actual applications, the initial curve of the Snake model is usually and manually calibrated around the target to form the initial curve, followed by the continuous solution of the energy function. Finally, the target contour curve is obtained as the target contour and can realize the detection and analysis of moving targets.

However, the Snake model only plays a pioneering role and proposes a new research direction for obtaining the target contour; that is, the curve is evolved into the target contour through the capability functional method. However,

it also has a lot of areas for improvement. First, the initial curve requires rigorous design and planning; otherwise it will definitely cause a great change in the final output. If the curve contains a concave shape, it will be difficult to divide, and it will easily converge to the local pole. If the topology of the curve changes, it will not be able to handle flexibly; secondly, the Snake model has poor robustness, it is easily affected by noise, and the accuracy of the obtained results is not high.

The parameterization of the line is a very difficult problem. For its serious shortcomings, after continuous research and development, the level set method based on the active contour model method was born. The curve evolution process of this method can be automatically split and merged. It has greater advantages and practical value than the Snake model.

2.2. Region-Based Object Identification Features

2.2.1. Fourier Painter. A series of boundary points in the image object area are regarded as a complex sequence. The Fourier transform of this complex sequence is called Fourier description sub-FD (Fourier description). Fourier transform is a linear combination of trigonometric functions or their integrals that can express a function that satisfies certain conditions. For any object, after normalization, it can avoid the dependence of the feature on position, size, and direction. However, the use of descriptors to represent the boundaries of objects, the amount of calculation, is relatively large; it is difficult to meet the real-time needs of actual needs.

2.2.2. Euler Number. Topological properties can be used to describe the shape of a planar object area, and Euler's number is one of the object's topological properties. The Euler number is a characterization of a vector bundle. If the number of holes in the object area in the image is and the connected part is, the Euler number is defined as

$$E = C - H. \tag{4}$$

Euler's number is invariant to rotation, scale, and translation.

2.2.3. Area Projection. In object shape analysis, object area projection is a very effective method. The projection of a two-dimensional image is a one-dimensional waveform whose value is the sum of the values of pixels along a specific direction. Taking character recognition as an example, the general equations for 0°, 90°, 45°, and 135° projection are

$$\begin{aligned} P(0^\circ, t) &= \int_R f(x,t)\mathrm{d}x, \\ P(90^\circ, t) &= \int_R f(t,y)\mathrm{d}y, \\ P(45^\circ, t) &= \int_R f(x, x-\sqrt{2t})\mathrm{d}x, \\ P(135^\circ, t) &= \int_R f(x, \sqrt{2t}-x)\mathrm{d}x. \end{aligned} \tag{5}$$

In the formula, $p(0^\circ, t)$, $p(90^\circ, t)$, $p(45^\circ, t)$, and $p(135^\circ, t)$ are the projections of the object areas in the above four directions, respectively, and are the pixel values.

A lot of information about the rough appearance of the characters is included in the projection. The projection can detect strokes in a specific direction, and some characters can be strictly recognized by their projections, such as 1, 2, 5, and 7. Using projection technology, you can also detect other simple two-dimensional target parameters. For example, using the projection of the vehicle image, you can calculate the relative physical length. Using the projection of the edge image of the license plate image, you can locate the position of the license plate. The projection method is not invariant to object rotation.

2.3. Description of the Image. A graph uses topology to represent the association between edges and vertices and can also be defined as a set of edges and vertices. Geometry defines a graph as a collection of points (vertices) in space and lines (edges) connecting these points. Graph theory defines a graph as a pair $G = (V, E)$, where V represents the set of vertices and E represents the set of edges. Thus, Figure 1 can be expressed as follows.

$$V = (v_1, v_2, v_3, v_4), E = (E_1, E_2, E_3, E_4). \tag{6}$$

Among them, the edge can also be represented by two vertices. If the two endpoints of edge e are v_i and v_j, then edge e can be written as $e = (v_i v_j)$ and (v_i, v_j) represents the disordered pair of v_i and v_j. That is, both (v_i, v_j) and (v_j, v_i) express undirected edges with v_i and v_j as end points. This can be rewritten as

$$\begin{aligned} &G = (V, E), V = (v_1, v_2, v_3, v_4), \\ &E = \{(v_1, v_2), (v_1, v_3), (v_1, v_4), (v_2, v_3), (v_2, v_4), (v_3, v_4)\}. \end{aligned} \tag{7}$$

2.4. Calculation of Machine Vision. As shown in Figure 2, it is a schematic diagram of two methods of machine vision. The color representation of an image is represented by grayscale values. The gray value of the image represents the performance of the complex factors of various aspects in the natural world scene. These complex factors that affect the gray value of the image are the geometry of the real object, the reflectivity of the surface, the light environment at that time, and the direction and distance of the viewer from the object. When any of the above complex factors change, the image will be changed, because these factors determine the grayscale of the image. The nature of objects in the natural world has nothing to do with the above factors. No matter how far away the observer is from the object, the size of the object observed will change, but the size of the object itself will not change. Viewing the object from different directions will get different image, but the shape of the object will not change. The characteristics of objects that exist in objective facts are unchanged. These images are imaged on our retina and then input to the brain, so people feel that the objects are changing. The

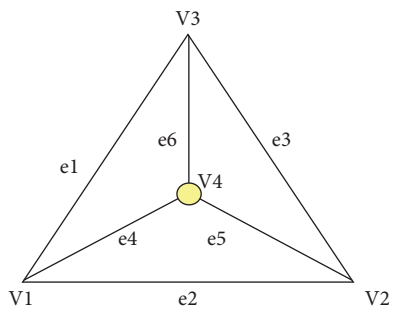

Figure 1: Undirected graph.

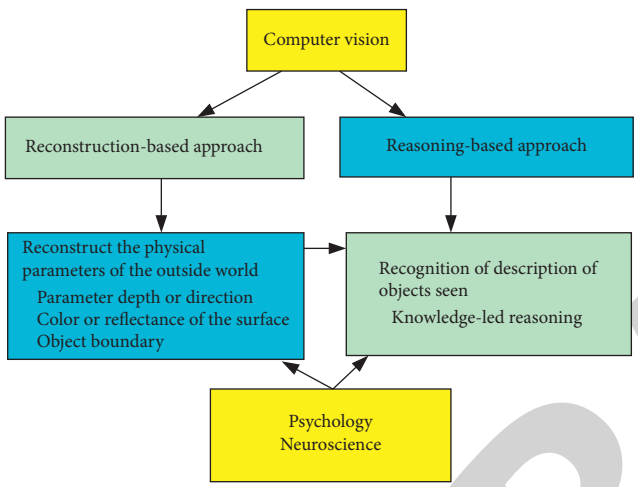

Figure 2: Two methods in computer vision.

external natural real world forms an image on the retina of the human eye, which is actually human perception of the natural world. The image obtained by this perception is constructed by gathering point data. Another point that is worth analyzing is that the characteristics of objects that people feel in the brain will not change. It is speculated here that human brain cells will converge many point-shaped data information into a complete body and restore the characteristics of the object, isolate the complex factors that affect image imaging, and obtain pure and clean data information that is only the most essential of the object. This purely clean data information that only belongs to the most essential objects will not be affected by factors such as the light environment, the distance and direction between the viewer and the object, and the reflectivity of the object surface, which is called constancy. In short, the visual brain nerve will not be based solely on the image formed on the retina in the natural real world but will identify objects based on the point data aggregation process and by separating those complex factors that affect image imaging.

2.5. Optical Flow Method. Optical flow method is to project each point on a moving object in three-dimensional space to the observation plane and express the motion information of the original object through the instantaneous velocity of each pixel on the observation plane. Mainly, used in computer vision and other image processing fields, it is very useful for motion detection, object cutting, calculation of collision time and object expansion, etc. A pixel in the time domain has a position shift at the next moment (or in the next frame), which can be understood as the instantaneous velocity (including size and direction) of the pixel, and the entire image is the frame image optical flow field. Reducing the optical flow field to three-dimensional space is the motion field of the physical objects in three-dimensional space. The establishment of optical flow method is based on two conditions: color consistency (luminance constancy assumption) and small motion (spatial smoothness assumption). For a grayscale image, consistent colors can be understood as consistent brightness values; small motion means that no large motion shift occurs for each pixel. As shown in Figure 3, it is a schematic diagram of the principle of optical flow method.

3. Experimental Design of Basketball Object Extraction

3.1. Experimental Environment Settings. Image segmentation is to extract areas of interest. In order to objectively evaluate the advantages and disadvantages of the method, this paper compares the method with traditional methods in terms of algorithm running time and segmentation accuracy. The experimental operating environment constructed in this paper is shown in Table 1.

3.2. Experimental Procedure. After the conditional random field optimization process, the final semantic segmentation map is obtained at this time, but it cannot be used to extract the contour because we know that the semantic segmentation map obtained at this time has 300 candidate regions, in which there may be one target, or there may be multiple targets. Therefore, they need to be further processed; existing image segmentation methods include threshold-based, region-based, and edge-based segmentation.

Then, we can know the specific pixel value of each target. For example, if the target is basketball, then it has pixel values of $R = 128$, $G = 128$, and $B = 128$. Different targets correspond to different pixels. First, we need to distinguish between different types of targets. Among them, pixel maps that contain two or more pixels are also classified as one, with the single same pixel value or different pixel values. The goals are grouped together for later processing. Through the upsampling process in the above section, there is another important position information that is also particularly important; because the pixel map at this time corresponds to the position in the original image, we can use the position information for preliminary processing.

In the same and single pixel image class, if the IOU threshold of the two pixel images is greater than 0.8, that is to say, the two are related or partially overlapped, then they are fused on the new background image processing. If pixels at the same location are same, the pixel will not be put into the corresponding position. If one is there and the other is not, it

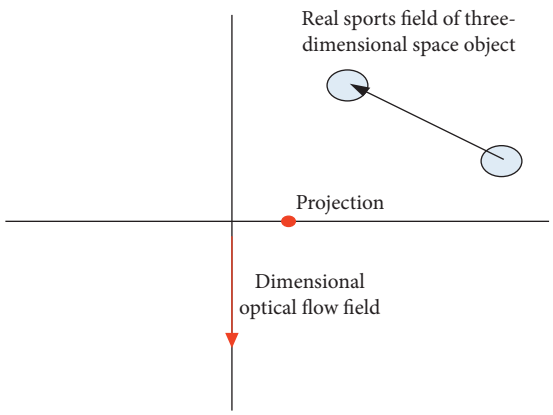

Figure 3: Schematic diagram of optical flow method.

Table 1: Experimental environment configuration table.

Lab environment	Configuration
CPU	Intel core i5 3.0 GHz
RAM	4 GB
Operating system	Windows 7 Ultimate
Open environment	Visual Studio 2013; MATLAB 2014b

will be filled in and so on until all the segmentation targets are executed. If the IOU value is less than the threshold of 0.8, the two are judged as different targets.

Pixel differentiation: the pixels at the same position of the two are unchanged, but, for pixels at different positions, it is necessary to fill the pixel values at the positions that have pixel values at different positions, so the target semantic segmentation after further fusion is divided into pixels. Further supplementary processing was carried out on the same time, and the final processing results were obtained at the same time.

4. Experimental Analysis of Basketball Object Extraction

4.1. Comparative Analysis of Accuracy Test. In this paper, the results of testing on VOC-2007 and 20012 are obtained by using PASCAL VOC-2012 as a training set and using the PASCAL VOC evaluation server. As shown in Table 2, it is clear that the method adopted in this paper achieves better results on the basis of DeepLab and the segmentation accuracy shown on the VOC-2012 test set is 9.5% higher than DeepLab.

In order to further illustrate the detection effect of small targets in the image, this article compares the results of the specific detection accuracy of various targets in the image on the data set with the results obtained by other methods, as shown in Figure 4. Obviously a detection and positioning effect based on the outline of the target is more accurate than that using a rectangular frame to detect the target.

4.2. Classification Analysis of Basketball Video Shots. The shots of the basketball video can be divided into the shots of the court area and the shots of the off-field area according to the areas presented therein. The field lens can be divided into far lens, medium lens, and close lens. The telephoto is a global perspective, which reflects the progress of each player's macrogame such as standing and running. The middle shot is basically a picture of the whole body of one or a few players, that is, the details of the player's collision and contention in the game. Close-up refers to the close-up of the athlete, that is, the close-up of the player's expression or physical contact. Figure 5 shows the action of the player when he shoots. Shots from outside the field include coaches, spectators, and referees.

Table 2: Comparison of accuracy test on data set.

Method	Test accuracy (%)
FCN-8s	63.7
CRF-RNN	66.5
DeepLap-CRF	66.8
VGG19-FCN	68.6
Deep squee Net-CRF	72.4
This research method	75.6

Since the close-up lens and the off-field lens are very similar, they can be judged by human semantics, and it is more difficult to distinguish them, and the meaning is not much different, so this article classifies these two kinds of shots into the same category. Since the video frames in the same video sequence will contain multiple shot types, it is impossible to determine the type of a shot based on a certain frame. In order to improve the accuracy of judgment and reduce errors, this paper uses the frame with the largest proportion to determine the type of shot. The purpose of image segmentation is to segment the lens image and analyze each frame to improve the accuracy of image analysis. As shown in Figure 6, the close-up shots of the players are shot.

Using the judgment standard proposed in this paper, the motion information difference curve constraint is introduced for extraction, 25 key frames are obtained, and the redundant information is reduced by 30%. As shown in Figure 7, an example of key frames extracted using this algorithm and a motion information difference map of the test video are given.

4.3. Image Processing Performance Analysis of Occlusion. It can be seen from the experimental results that the target tracking algorithm based on multifeature fusion can overcome the influence of morphological changes during target movement when tracking human targets and can reliably track targets in normal motion in complex scenes. During the tracking process, the relevant information in the object collection is updated in time to ensure the correct matching under the smooth change of the target feature. And, because the state information about the target is stored in the object set, even if the target disappears after reappearing temporarily, it can still be correctly identified and label-tracked.

For the occlusion problem, the occlusion determination criterion in this paper can give mutual occlusion targets and occlusion types, which is convenient for the next occlusion

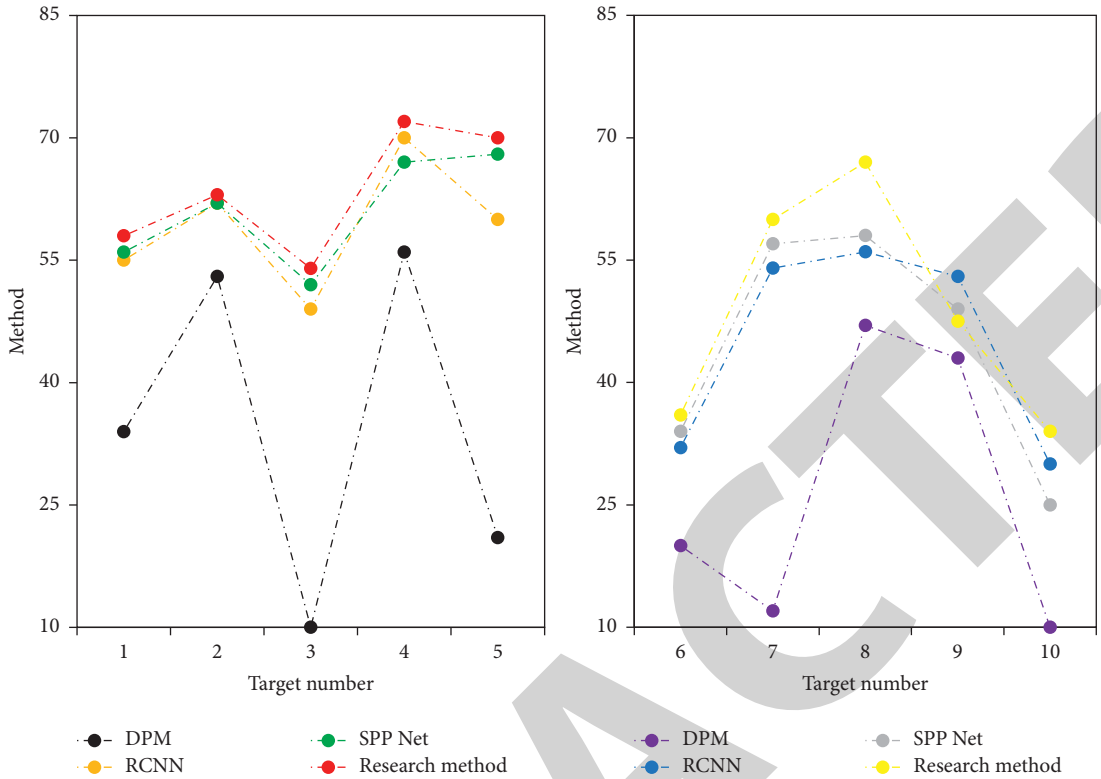

Figure 4: Various types of target detection effects.

Figure 5: Player shooting action.

Figure 6: A close-up shot of the player's shooting action.

processing. In terms of occlusion processing, the algorithm in this paper changes the method of dealing with the occlusion problem in a predictive manner in the previous algorithm, while, combining the direction of the target's movement, it makes full use of the effective brightness information of the exposed part of the occlusion target to

Figure 7: Basketball video key frames.

Table 3: Algorithm of performance comparison.

Image under basketball video	Threshold pair	Calculation time/s
Classic two-dimensional Otsu method	(126, 126)	0.14318
Algorithm for this study	(126, 126)	0.13714
MQPSO	(73, 100)	0.12811

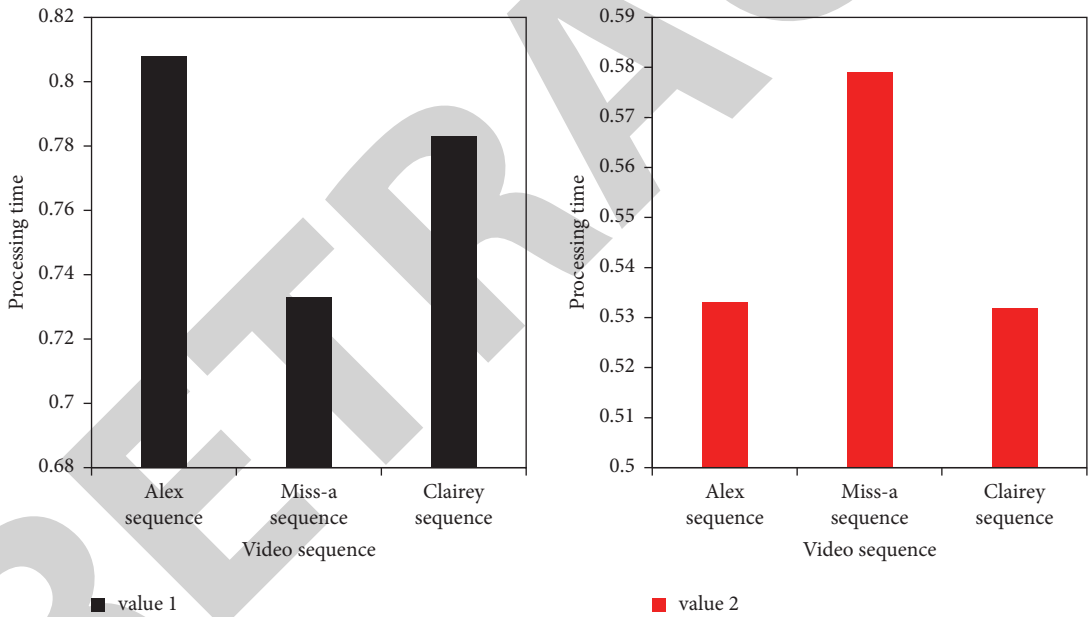

Figure 8: Relationship between cumulative frame difference and the processing time.

reduce the matching calculation of the occlusion part. The specific gravity can effectively deal with the problem of slight occlusion. For the occlusion between targets, by predicting the number of occlusion frames, the weighting formula can be automatically reversed in the second half of occlusion, which ensures the rationality of the calculation.

As shown in Table 3, for the images under the basketball video, the segmentation speed obtained by the algorithm proposed in this paper has been further improved. As shown in Figure 8, the algorithm uses the relationship between the time and the number of frames for the cumulative frame difference calculation of the three image sequences: Clairey, Miss-a, and Alex. The calculation time of the research algorithm is 0.13714s, which is shorter than other algorithms. Taking the Clairey sequence as an example, the number of areas obtained by using this algorithm to find the motion area is 28, which means that the subsequent processing will mainly be based on 28.

As shown in Figure 9, in terms of segmentation accuracy and running time, although this algorithm has no obvious advantage in time, from the point of view of the accuracy of the segmentation result, this algorithm has obvious advantages. And the threshold pair of this algorithm is higher and can accommodate more image information. Therefore,

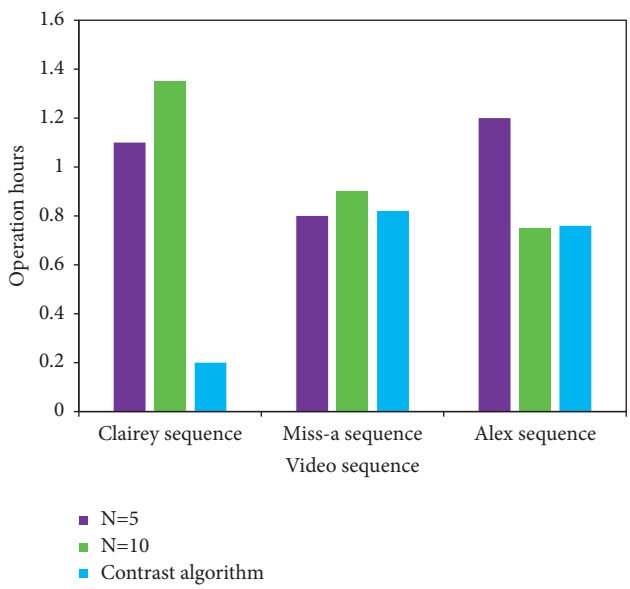

Figure 9: Running time comparison.

in general, this algorithm has better advantages than the comparison algorithm in the segmentation of moving objects in low bit rate video image sequences.

5. Conclusions

With the rapid development of multimedia technology, people's interest in the interactive function of video content has gradually increased. This paper analyzes the significance, background, and current situation of basketball image segmentation and recognition and based on the difficult environment of basketball video image classification analyzes the deficiencies and difficulties encountered in existing traditional image segmentation and recognition algorithms, aiming at studying these problems, and corresponding solutions were proposed.

This paper proposes a method for extracting basketball objects from basketball game video based on image segmentation algorithm. Through contour extraction and other techniques, each frame of the image is analyzed, and then the basketball target in the image is tracked. Experiments show that this method has the advantages of less interactive operations and high segmentation accuracy when segmenting and extracting basketball objects and it can be applied to segmentation and extraction of other ball objects.

This paper further improves the accuracy of segmentation and extraction of the basketball object in the video frame image by this method and applies the extracted basketball object to the basketball video clip retrieval system as the target tracking object, which provides an effective method for basketball video clip retrieval.

Data Availability

No data were used to support this paper.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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Retraction

Retracted: Effect of Multimodal Teaching on Language Comprehensive Ability under the Background of Artificial Intelligence

Security and Communication Networks

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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. Zhang, B. Chen, and X. Zhang, "Effect of Multimodal Teaching on Language Comprehensive Ability under the Background of Artificial Intelligence," *Security and Communication Networks*, vol. 2022, Article ID 3143528, 7 pages, 2022.

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Research Article

Effect of Multimodal Teaching on Language Comprehensive Ability under the Background of Artificial Intelligence

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Reading comprehension is an important language learning skill. In English class, we should pay attention to cultivating students' reading comprehension ability to help students improve their reading comprehension ability. The application of language service products of artificial intelligence has brought great challenges and opportunities to language teaching. This research starts from the current situation of the teaching mode of English language and literature reading under the background of artificial intelligence. The following four questions are mainly studied. Can the multimodal oral teaching model improve students' oral English performance? Has the students' spoken English improved in the three aspects of language content, language accuracy, and pronunciation and intonation? Does multimodal oral teaching have a positive impact on students' attitudes towards oral learning? How can students improve their English writing? This study uses two research methods, experimental research and questionnaire survey, to explore the above research questions through a 16-week multimodal oral teaching experiment. The subjects of the experiment were 61 non-English majors in two parallel classes in the first year of a university in Xi'an. The experiment is divided into three phases: pretest of oral test, implementation of multimodal oral teaching, and posttest of oral test. The experiment proved that most students (about 67.35%) did not show much interest in reading and writing in English. Only a few students (12.24%) like to read and write. It shows that after accepting the multimodal teaching experiment, the students' oral English scores have been significantly improved, which is reflected in the language accuracy, pronunciation intonation, and language content. The students' oral English learning attitude is positive after the multimodal oral teaching.

1. Introduction

With the continuous advancement of China's reform and opening up and the deepening of foreign cultural exchanges, English has become the most widely used language for China to integrate into the world. According to data, more than 75% of international affairs are conducted in English, and almost every major international conference is inseparable from English services. Under the current international trend, it seems you need to learn English; especially good oral English skills are becoming more and more urgent and necessary. In short, English is the need of a region's development and a window to the world. Research also shows that students now start to learn English in the third grade of elementary school. However, after years of language learning, the communication between students and others is still very weak.

Human language is a one-of-a-kind form of communication that reflects human people' highly evolved spiritual powers on a biological or psychological level, as well as their social and cultural advancement. Linguistics is the study of human instinctive language capacity by analyzing and studying spoken, written, and even sign language in order to better comprehend human nature. Linguistics is a field of study that may help you grasp not only the nature of human language but also its practical applications. The ultimate essence of linguistics is to discover the internal laws of human language. In language education, numerous dictionaries, grammar books, and textbooks for language learning are developed through an understanding of the language

itself, which enhances the ability to cope with challenges and errors experienced during the language learning process.

Heavy scientific and technical computations, for example, were originally performed by the human brain. Computers can now not only perform such computations but also do it faster and more precisely than the human brain. As a result, modern people no longer consider such calculations to be "difficult tasks requiring human intelligence to execute." It can be observed that the concept of complicated work evolves with the passage of time and technological innovation, and that the precise goals of artificial intelligence science also evolve with the passage of time. On the one hand, it continues to make new progress, while on the other, it shifts its focus to more relevant and demanding objectives. In recent years, artificial intelligence language products have come out one after another and are moving forward to the commercial market.

In traditional oral English teaching, teachers' teaching concepts are relatively backward, teaching methods are unified, teaching atmosphere is low, and students' participation is generally not high. These teaching methods often result in students not being able to speak English after several semesters of oral learning, and this learning has established a scientific and correct understanding. Therefore, teachers also need to think deeply about the current educational situation: whether the current language education model and language talent training model can meet the needs of foreign language talents in the future society. Various modes of oral teaching have important theoretical significance: teachers have a deep understanding of the relevant teaching theories of various modes, which helps to update outdated teaching concepts, enhance the understanding of relevant teaching theories, and expand methods. Applying the concept of multichannel teaching to actual classroom activities can improve the teacher's theoretical teaching level, improve the teacher's ability to integrate theory into practice, and also help improve the teacher's teaching skills and understanding.

Hashem I AT is a term used in smart city environment to describe the latest communication technology and intelligence-based applications. The Internet of Things enables cities to use highly networked services to integrate sensors, radio frequency identification, and Bluetooth in real-world settings, while big data enables cities to gain valuable insights from massive volumes of data collected from many sources. However, his research technique has weaknesses, resulting in incorrect conclusions [1]. According to Xu et al., the ongoing advancement and improvement of data mining technologies poses a serious threat to human privacy and security. People have started to perform substantial study on personal data protection (PPDM), which is a new research issue in recent years. The basic idea of PPDM is to modify the data and then make the data mining algorithm execute effectively without infringing on the personal information contained in the data and to protect the security of personal privacy. But PPDM cannot achieve complete information protection [2].

This study is broken into five sections. The first section is the introduction, which focuses on the research background, as well as the theoretical and practical implications of the findings. The second section is a review of the literature, which focuses on multimedia, multimodality, interdependence between the two, and the value of multimodal oral education. The discussion of the use of multimode in oral English education, the methods of oral teaching, and the many forms of oral teaching and explanation of the theoretical basis of multimode oral English teaching are included. The third part is research design. The research process is mainly the application process of multimodal oral teaching, which is explained in detail in the teaching steps and teaching cases. The fourth part contains the results and discussion. With the help of statistical data software SPASS22.0 (Statistical Product and Service Solutions software), the oral test scores of the control group and the test class were compared and analyzed, and the existing problems were discovered and discussed [3]. Through a questionnaire survey on the attitude of the experimental class, we found the application status of multimodal oral teaching and the understanding of students' attitudes. The fifth part is the conclusion of this research. This section contains the conclusions of the teaching experiment and instructions for future oral classes. Finally, we pointed out the research flaws in this study and our expectations for future research.

2. Foreign Language Teaching Methods under the Background of Artificial Intelligence

2.1. Research on Foreign Ecological Teaching Methods. The ultimate goal of ecology teaching is to let students think with the thinking of professional ecologists and have interdisciplinary thinking, cooperation skills, and communication skills. Educational ecology research can be traced back to the 1940s, which is an interdisciplinary field of ecological education integration. It attaches great importance to the knowledge of the relationship between the learner's behavior and the learning environment. Three spirits are emphasized here, namely, integration, connection, and balance methods. All in all, ecology is used here as a way of thinking, teaching, and thinking. We believe that the evidence of learning cannot be based on the causal (or related) connection between certain things to establish the content of the input and output. New methods need to be developed to observe the learning context and process and record reasonable or actual learning opportunities or occasions [4]. The research outlines three perceivable trends, and it highlights current contention issues and provides some useful insights. The research clarifies three academic trends [5]. They are method after method; method in method; and complexity method. Some concluding remarks may contribute to ecological construction [6].

2.2. Family Ecological Teaching Method. As mentioned earlier, ecology is not a single method or even a theory. It is

more of a worldview and a way of working. It can inspire a variety of research and practice [7]. Ecological education mainly includes three meanings: the principle, method, and purpose of education.

The ecological approach treats the learner as a whole, rather than a grammatical production unit. This includes doing meaningful things and saying, taking it seriously, taking responsibility, and being encouraged to meet challenges. Project, think critically, and control your own learning [8]. Chen et al. studied the application of artificial intelligence in health monitoring. They designed a "smart clothing" that can covertly collect various physical indicators of the human body and monitor the health of the human body at any time [9]. The article proposes teaching strategies [10] such as setting reasonable teaching goals and constructing scientific teaching content [11]. It is recommended that teachers make full use of network resources and encourage students to study cooperatively in the classroom [12]. Teachers should give positive comments to students and give encouragement in class. For this reason, some people propose an ecological teaching method [13], and improve the oral English teaching level of college students by establishing an ecological thinking-oriented college English teaching framework [14].

2.3. Methods of English Teaching Evaluation

2.3.1. Chromatographic Analysis Method. The chromatographic analysis method is an analysis method composed of chromatographic separation technology and appropriate detection means. It is an effective method to solve the problem of multiindex and multilevel weight. The calculation formula is

$$M_i = \frac{C}{\sum_{k=0}^{n} C_n}, \tag{1}$$

where C is the geometric mean of the index in row C_n.

2.3.2. Test Method. Reliability test refers to the reliability test of the questionnaire, which reflects the degree of the actual situation. Commonly used reliability test methods include retest reliability, parallel test reliability, parallel test reliability, and homogeneity reliability. The correlation coefficient of the two measurement results can be used to express the reliability. The retest reliability formula is as follows:

$$E_t = \frac{\sum xy - 1/n\left(\sum x\right)\left(\sum y\right)}{\sqrt{\left[\sum x^2 - 1/n\left(\sum x\right)^2\right]\left[\sum y^2 - 1/n\left(\sum y\right)^2\right]}}. \tag{2}$$

Among them, $\sum x$ and $\sum y$ represent the results of the previous and subsequent tests.

The formula for the significance test for comparing the difference between means is

$$\text{is: } t = \frac{x_1 - x_2}{\sqrt{\alpha_{x_1}^2 + \alpha_{y_1}^2 - 2r\alpha x_1 \alpha x_2 / n - 1}}. \tag{3}$$

Commonly used analysis methods for evaluator's reliability are Spearman correlation coefficient method, kappa coefficient method, Kendall harmony coefficient method, and Kronbach method's. According to the characteristics and ease of operation of this research, this study chooses the Kronbach's method to evaluate the reliability of evaluators. It is a set of commonly used methods to measure the reliability of psychological or educational tests. The calculation formula of Kronbach's method is as follows:

$$\beta = \left(\frac{K}{k-1}\right)\left(1 - \frac{\sum\sum x^2/n - \sum\sum (x)^2/n^2}{1 - \sum x_t^2/n - \sum x_t^2/n^2}\right). \tag{4}$$

3. Implementation of the Experiment

All the factors involved in the English writing teaching course play a unique role in this process. This section is an introduction to the realization of the experiment in this article.

3.1. Teaching Design. The three specific teaching procedures will be detailed in the following [15].

3.1.1. Import. Introduction is a very important part of the whole process, and it is related to the teaching preparation of teachers and students. First of all, the teacher sets the teaching goals of this course and clarifies the teaching principles used in this course [16]. Secondly, the teacher provides students with background knowledge of the course before presenting learning materials to students [17].

3.1.2. Statement. In this step, teachers will organize the learning materials and teach them according to their complexity and difficulty. Then, teachers should display learning materials through multimedia teaching equipment, such as Power Point or video display platforms. In addition, teachers should try their best to use verbal expressions to attract students' attention to the possible methods of teaching the language or non-verbal behavior [17].

3.1.3. Reflection and Summary. It is said that teachers can benefit from reflection after class. If teachers can take conscious action to think about the entire class and everyone in the classroom, if they can carefully check the interaction between teachers and students in the classroom, teachers will surely get a lot of information that has teaching and its effects [11]. Reflective exercises after class enable teachers to participate more in their teaching roles and work in teaching knowledge and facilitate them to cope with the lack of scientific facts and the uncertainty of knowledge in teaching disciplines [12, 18]. All teachers should be active in class. The teacher should review the main points of the teacher's language, teaching and summarizing their teaching experience.

Table 1: Analysis of students' interest and attitude towards writing.

(1) Teaching topic	Writing an essay according to the same direction as CET-4.
(2) Teaching objectives	How to make the students write a coherent and qualified essay.
(3) Key points	The important words, sentence structure, rhetorical devices, etc.
(4) Teaching aids	Computer, video projecting platform, and Power Point.
(5) Teaching method	Teacher-student discussion, student-student discussion, etc.
(6) Teaching procedure	There are nine steps in this teaching procedure.

3.2. Teaching Plan. This section outlines the teaching plan for this ecological teaching method. The figure below shows a clear teaching plan for this ecological teaching method [19].

In this study's experiment, it was used in college English writing. Table 1 shows that it may be generally divided into six segments.

3.2.1. Introduction. The teacher should carefully select the composition of the sample and show the composition class that has typical mistakes or mistakes commonly made by students as a whole.

3.2.2. Group Discussion. The teacher gives the students a few minutes to discuss their drafts to make their expressions and drafts more consistent. The teacher allows students to learn from other students and imitate other sentence structures and rhetoric techniques. Students can learn more about writing and revision by reading each other's drafts carefully.

Then, ask some students to give a speech about their ideas about writing on the topic and introduce key language points or sentence structures they might think of for a particular work.

3.2.3. Teacher Feedback. The teacher can show the model to the whole class and show the students how to write this kind of text. Moreover, teachers can provide students with more use of good sentence structure and rhetoric that can be used to achieve the desired goals in the writing process.

3.2.4. Composition Writing. With the help of key points and sentence structure instructions, ask students to write down their main ideas and their structure and then write down drafts of their own ideas. Students should draft their own drafts first and then take the first draft.

4. Data Analysis before the Questionnaire Survey

In order to find out the students' current English writing level and their writing attitude, the questionnaire is to test students' writing habits and strategies used in writing. We listed 15 questions in the questionnaire to clearly illustrate the student's performance in the last writing class. The 15-question questionnaire can be divided into four parts. Questions 1 to 4 are designed to test students' interest and attitude towards writing lessons. Questions 7 to 12 are designed to understand students' writing habits and writing strategies. The last three questions, questions 13 to 15, are designed to understand how students really feel about the previous writing class. Forty-nine questionnaires were distributed to the class, all valid. The results are shown in Table 2.

The first four questions in Table 1 and Figures 1 and 2 are designed to help you understand students' interest and attitude towards writing.

Through the analysis of Figures 1 and 2, it can be concluded that most students (about 67.35%) did not show much interest in writing in English. Only a few students (12.24%) like writing and writing. Among all subjects, only 10.20% of people think English writing is easy. The results show that most students do not like writing and most subjects have a negative attitude towards English writing. The result from question 4 shows that more than half (57.15%) of students do not like writing English lessons. Only 10% of the subjects are English writing classes and most students are not interested in English writing classes. From the results of questions 1–4, we can conclude that most students show little interest in English writing, hold a negative attitude towards English writing and lack confidence in English writing.

The two questions in Table 3 are designed to understand the motivation of students in the learning process before the writing teaching experiment. From the answer to question 5, it can be seen that only about 8% of the subjects have the impression that writing in English is important for improving other skills in English learning. More than half of the answers indicate that English writing has little importance in improving other English skills.

From Figures 3 and 4, we can draw a preliminary conclusion that most students do not think that English writing is an important skill for other languages. From question 6, we can see that most students (89%) think writing is just a heavy burden and will not arouse people's interest. For college students writing is just a task that can enable them to obtain academic grades. Only a small part of them are interested in English writing in daily life. They really like to express their true feelings and thoughts about specific events in English. From the data in questions 5 and 6, we can know that most students think they are forced to write in English by their teachers. We can conclude that correct and positive writing motivation is what students lack in the writing process, which makes them bear a heavy burden to complete the writing task.

5. Conclusions

Based on multimodal discourse theory, this paper discusses how to introduce multimodal teaching mode in the actual

Table 2: Analysis of students' interest and attitude towards writing.

Questions 1–4		Total	Percent	Total	Percent	Total	Percent	Total	Percent
Interest and attitude	1	6	12.24	10	20.41	26	53.06	7	14.29
	2	5	10.2	11	22.45	23	46.94	10	20.41
	3	2	4.08	12	24.49	29	59.18	6	12.24
	4	5	10.2	16	32.65	20	40.82	8	16.33

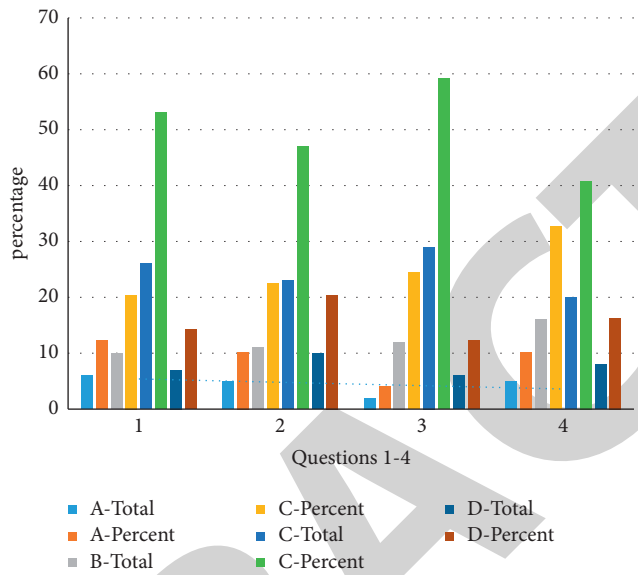


Figure 1: Analysis of students' interest and attitude towards writing.

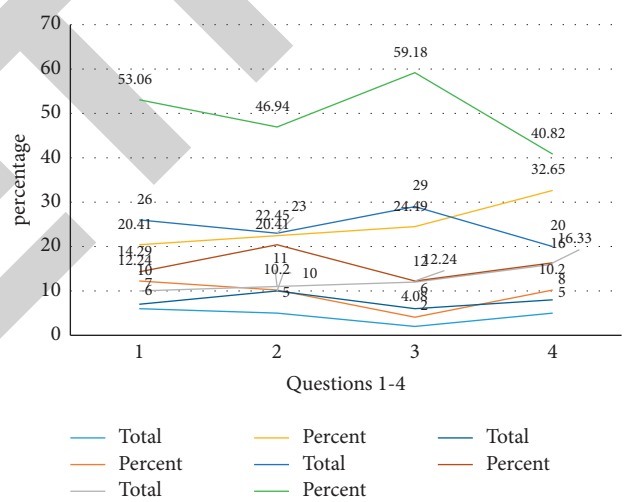
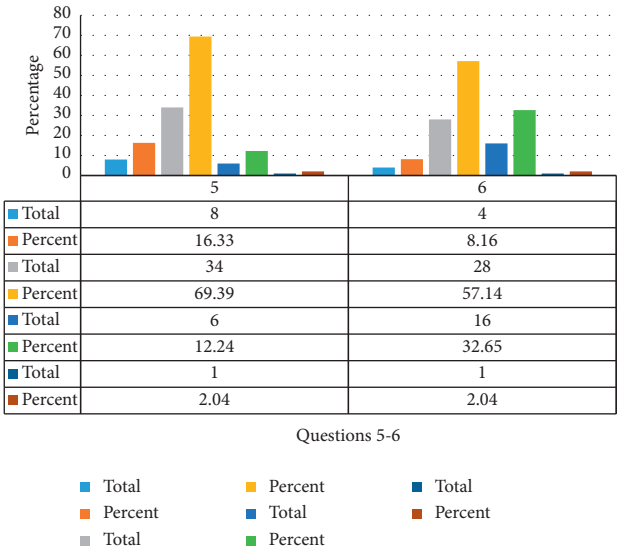


Figure 2: Analysis of students' interest and attitude towards writing.

Table 3: Analysis of students' motivation of writing.

Questions 5–8		Total	Percent	Total	Percent	Total	Percent	Total	Percent
Interest and attitude	5	8	16.33	34	69.39	6	12.24	1	2.04
	6	4	8.16	28	57.14	16	32.65	1	2.04



	5	6
Total	8	4
Percent	16.33	8.16
Total	34	28
Percent	69.39	57.14
Total	6	16
Percent	12.24	32.65
Total	1	1
Percent	2.04	2.04

Figure 3: Analysis of students' interest and attitude towards writing.

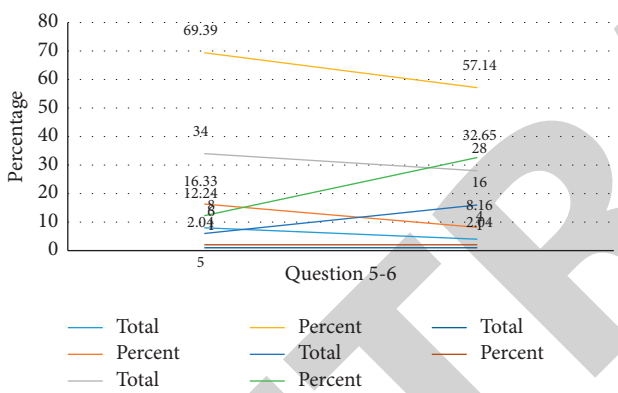


Figure 4: Analysis of students' interest and attitude towards writing.

process. In this section, the authors first summarize the conclusions of the teaching experiment, then explain the problems in the process of multimodal oral research and receiving education and teaching, and finally analyze and summarize the limitations of this research. In this study, the authors conducted an experimental study of multimodal oral teaching at Xi'an International Studies University. There are two independent variables in the experiment, which are two different teaching modes. First, the control class uses traditional oral teaching methods for teaching, while the experimental class uses a variety of teaching methods for teaching. The dependent variable is the student's oral test score, and the object can be analyzed in all dimensions of the student's performance through the object. From the previous discussion, it can be concluded that the ecological teaching method is conducive to students' performance in English writing in college composition writing. The present ecological teaching style is more suited to the teaching of college English writing than traditional teaching methods. The new teaching model is more effective than the traditional teaching method in teaching writing. To sum up, the application of artificial intelligence in language teaching is conducive to the optimization of students' learning experience and the improvement of learning effectiveness, which is conducive to the improvement of teaching effect.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Retraction

Retracted: Nonheritage Creative Product Design and Development and Marketing Strategies for Computer Vision and User Experience

Security and Communication Networks

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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] C. Liu, Z. Pan, C. Zhang, and W. Miao, "Nonheritage Creative Product Design and Development and Marketing Strategies for Computer Vision and User Experience," *Security and Communication Networks*, vol. 2022, Article ID 9685280, 10 pages, 2022.

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Research Article

Nonheritage Creative Product Design and Development and Marketing Strategies for Computer Vision and User Experience

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With the rapid development of economic and culture, intangible cultural heritage has gradually moved towards the public, and at the same time, many cultural and creative products have been derived. In the face of fierce market competition, nonheritage and creative products gradually occupied a certain market share with their unique cultural heritage and won the love of some consumers. However, at the same time, the development of nonheritage and creative products cannot keep up with the market that is changing with each other, and the design and development of cultural and creative products are far behind market changes. Moreover, the recognition of some consumers cannot improve the booming development of nonheritage creative products, and the future development of nonheritage and creative products is facing a serious crisis. Computer vision has absolute advantages in image processing, which can help nonheritage products for development and design, and further improve the quality of the product. In the process of designing and developing a certain product, our commonly used research method is user experience. User experience strategies can help us design cultural and creative products that fit the characteristics of the times from the perspective of consumers. This article introduces the basic architecture and guidelines of the user experience strategy. In addition, the main research object of this article is nonheritage and creative products, which aims to explore how to use various design thinking methods to develop more valuable products. On this basis, this article integrates computer vision technology in the process of designing and development of nonheritage cultural and creative products and supplemented by user experience strategies to further innovate the design concept of cultural and creative products. Experiments show that the design and development of intangible cultural heritage products based on computer vision and user experience can effectively improve product quality, and the product qualification rate basically reaches 90%. At the same time, this move can further stimulate consumers' desire to purchase, and their purchase intention can reach up to 72%.

1. Introduction

With the development of society, people's pursuit of beauty has been changing, which has also led to higher and higher requirements for product design. At the same time, since the development of intangible cultural heritage products, they have received widespread attention from the society, so people have high expectations and pursuits for them. However, the development of nonheritage creative products is far from the pace of the times, and its design and development links are seriously disconnected from the times. In this case, nonheritage and creative products must take advantage of the latest science and technology in order to adopt great development. Computer vision is one of the current hotspots, which can quickly respond to objects to the object. At the same time, computer vision also has a wide range of applications in image design. The connection between intangible cultural heritage and tourism, cultural and creative industries is very close. This is mainly reflected in the fact that the inheritance and innovative development of

intangible cultural heritage are closely related to the design and packaging of cultural creativity, and intangible cultural heritage is also the material and source of inspiration for the development of tourism cultural and creative enterprises. The two of them set off each other, and through the combination and collision of traditional and modern elements, cultural and creative tourism products have made great development. The development of nonheritage creative products can bring new opportunities to the development of the tourism industry, which has enabled the development space of the tourism industry. The research on nonheritage cultural and creative products is also conducive to the development of tourism.

After a series of experimental analysis, we can know that users are not very satisfied with the current experience of nonheritage creative products, with an average score of 3.35. At the same time, users have high recognition of cultural and creative products, and the recognition experience scores of nonheritage cultural and creative products are only 1.25. This shows that the product must have a good user experience and product recognition to be favored by users. The quality of computer vision and creative products has been strictly controlled. Among them, the qualification rate of the product has reached 80%. Among the products of the same batch, products based on computer vision often have a relatively low rate of residual, and the number of residual products is less than 10. In addition, different subjects hope that the product has different characteristics. From the perspective of indicators, users' concern about price is 7.2, which shows that the cheap products are often favored by consumers. But at the same time, we also see that consumers also attach great importance to the intrinsic value of products, and their level of care has reached 6.9. This fully shows that for nonheritage cultural and creative products, merchants must first ensure the quality of their products, and then further explore their intrinsic value in the process of design, and continuously enlarge the cultural connotation projected on the products to attract consumers to pay.

2. Related Work

Some scholars have made relevant analysis on the theme of the strategy in the process of product design and development and marketing, as shown in the following:

Fregidou-Malama M aims to handle the marketing of products and analyze how to achieve standardization and network development when marketing products. He applied the qualitative methods and semi-structural interviews, directly observes official documents and collects data. His research showed that the cultural and market environment can standardize the quality of the product and make the marketing components meet the needs of consumers. He contributed marketing literature based on context, trust, network, and adaptive product marketing model [1].

Shokrani used the structural equation model to study the effects of the relevant factors related to the service marketing portfolio on customer satisfaction. Then, the statistical methods such as Friedman's inspection and structural equation model were systematically compared, as well as decision-making technologies such as hierarchical analysis methods to determine the priority of the service marketing portfolio elements. In addition, he also used SPSS, expert selection, and smart PLS software to understand the role of effective marketing portfolio evaluation technology on marketing strategies [2].

Halme used the perspective of criticism analysis, and the theoretical framework of four legal strategies to analyze the legitimacy of a local marketing project implemented in North Carrelia, Finland, and how to use the strategic document of the project to use the way of discourse is built. The survey results show that several discourse strategies have been recognized. He introduced discourse as the core element of legitimacy, and put forward unique insights on the legitimacy of the marketing project [3].

Jan aimed to understand why traditional leading telecommunications equipment companies, such as Alcatel News have stagnated from the perspective of new product development (NPD), while the newcomers Huawei has achieved steady growth. He adopted the form of comparative case research. The survey found that the two companies had three significant differences in the development of new products. He emphasized some key NPD strategic issues and provided some inspiration for NPD managers [4].

The above research results involve problems, such as network-based marketing combination strategies, but we can see the one -sidedness and single nature of its results. Therefore, the article uses computer vision and user experience to study product development strategies, and also refers to some documents.

CW Dong used AdaBoost's improved ELM (extreme learning machine) hybrid algorithm (Ada-ELM) to clarify the nonlinear quantitative analytical relationship between the appearance of tea leaves and human sensory perception. He adopted the smallest daily multiplication and Ada-Artm, and established a linear and nonlinear prediction model for the appearance of chipy bar-shaped green tea, respectively, and compared the model performance. The results showed that the adaboost integrated algorithm can further improve the prediction accuracy and generalization of the ELM model [5].

WLD Chen aimed to comprehensively analyze and compare the preliminary study of computer visual methods of plant species. He described the application methods of the plant organs studied, as well as the characteristics of the research, is the shape, texture, color, edge, and leaf vein structure. In addition, he compared the method of classification accuracy based on the public dataset [6].

KADIR proposed a simplified computer vision application based on multilayer perceptors (MLP), which is used to accurately classify wheat particles into bread or hard alloys. First, he used image processing technology (IPT) to obtain the main visual characteristics of four-dimensional, three colors and five textures. Then he copied a total of 21 visual features from the 12 main features to diversify the input group and used for training and testing ANN model [7].

DECOST developed a powder raw material representation system for metal additive manufacturing (AM)

through application of computer vision and machine learning methods. When applied to eight commercial raw powders, the system classified powder images as the correct material system with over 95% accuracy. The system can also identify atypical powder images. These results showed that the microstructural characteristics of the powder are associated with the performance of AM process performance and define objective material standards based on visual images [8].

The above scholars have studied computer vision algorithms in plant species, wheat particles and commercial powder raw materials. The scope of research is very wide, providing a certain reference and reference for the research of this article. However, in the process of research, they only paid attention to the use of computer vision in image recognition and ignored other uses of computer vision.

3. Intangible Cultural Heritage Products and User Experience and Computer Vision

3.1. Intangible Cultural Heritage Products. Cultural and creative products have always been an effective carrier of traditional culture and an important communication channel for traditional culture. The design of intangible cultural heritage products is of great significance, and has a great role in promoting the inheritance and innovative development of intangible cultural heritage projects. It also provides a certain foundation for the establishment of local cultural and creative brands, which can effectively enhance the influence and popularity of urban culture [9]. Modern cultural and creative design needs to integrate the genes of intangible cultural heritage, and the premise is to retain the connotation of intangible cultural heritage elements. It then packs and promotes it through a series of creative designs to spread it to the masses, thereby generating economic value. At the same time, the business operation mode of intangible cultural and creative products can develop sustainably.

In recent years, the development of cultural and creative industries has shown a rapid and vigorous trend. Governments of various local governments have also actively guided and supported their development, and the creative atmosphere is great. But at the same time, there is still room for the improvement in the development of intangible cultural heritage products, brand building and operation, which requires a lot of time and energy. If the nonheritage creative products have reached a certain brand influence, it can become a business card and image spokesperson for a certain city [10]. According to the existing nonheritage creative product design cases, we can know that in the design process, we need to follow the principles of cultural nature, the principles of innovation, and the principles of practicality. According to the mapping relationship of the construction principle, we can get a framework of a cultural and creative product, as shown in Figure 1.

Nonheritage creative products mainly include text graphics, patterns, and cultural connotations. Generally speaking, the design strategies of nonheritage and creative products are mainly the following: first of all, in-depth market research, first understand the needs of consumers, and then design the corresponding design, including their daily production and life and emotional demands. The nonheritage creative products designed according to these elements can meet the trend of the times, and form a certain market competitiveness to win the favor of consumers. Of course, consumers who need to study are mainly people's masses, non-genetic inheritors, designers, and salespersons. It should be noted here that the designer should give the project a correct understanding. They need to design cultural and creative products that are in line with modern aesthetics, rather than the reproduction of the nonheritage project itself. Next, it needs to determine a specific theme, and then combine it with nonheritage, so as to take the purpose and plan for effective creation. This theme is the external manifestation of the spiritual core that designers want to tell the public [11]. In addition, the most important thing is to ensure the quality of design products, and then marketing under this premise. Nowadays, the rapid development of online media has brought a new opportunity to the sales of cultural and creative products. At the same time, the characteristics and essence of nonheritage products can also be displayed by establishing nonheritage cultural and creative industrial parks.

3.2. User Experience. The user experience is generated by the interaction between users and products through interaction. When it comes to user experience, we generally think of user experience strategy and user experience design. The basic philosophies of these two fields are different. Among them, the former refers to the analysis of the entire architecture of the product during the development stage; the latter focuses on the various needs, experience and feelings of users. In fact, there will be a lot of uncertain factors in the process of product development. Therefore, if these two can be cleverly combined, then you can achieve the business goals and attempts of the product more efficiently, so as to plan for the next plan [12]. Table 1 analyzes the user's experience needs based on the changes in the relationship between the user's user. From the table, it can be seen that the needs of the user experience can be divided into five levels: feeling, interaction, emotion, society, and self-needs.

In addition, the essential attributes of user experience strategy and experience design are also different. The essence of the former lies in critical thinking, while the latter focuses on thinking in design. In the design and development process of a set of products, the first key step is to determine the user experience strategy of this product. This can be explained at four levels: target users, market value, product features, and user experience. Specifically, the first step is to identify and verify target users, and then to conduct a competitive research to discover the value of product development. The third step is to pay attention to the primary and basic functions of the product. Finally, the result of analyzing the survey and improving the interaction of suppliers and users [13]. The quantitative model method of user experience is shown in Figure 2.

There are four basic principles that we need to adjust to when developing our UX strategy. The first is the successful

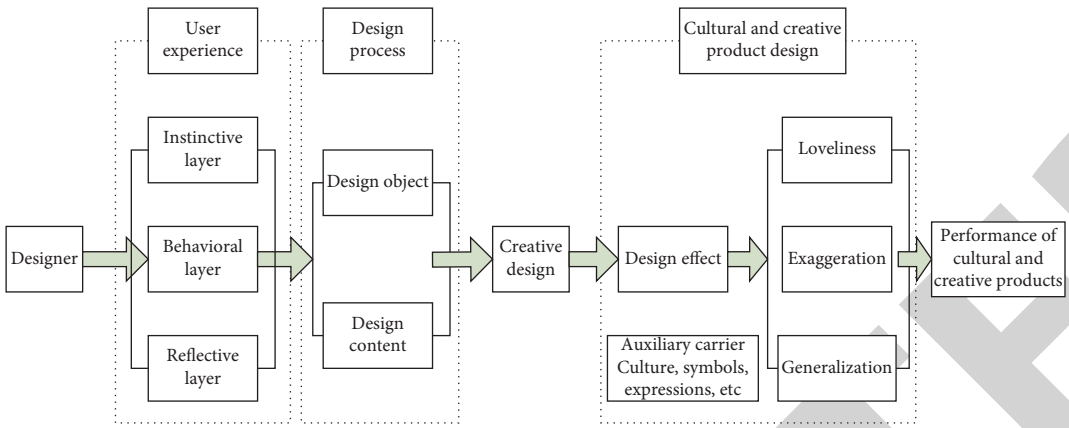

Figure 1: Cultural and creative product design framework.

Table 1: User-based product experiences demand analysis.

User process / Demand type	First use	Continuous use	Stop using	Recycling
Basic demand	Good sensory experience	Timely information feedback	Fault to be eliminated	Provide recycling channels
Expected demand	Easy to use and learn	Efficient human–computer interaction	New and more valuable choices	Provide methods for recycling
Surprise demand	Natural one-step	Accurate perception and recommendation	Free trial service for new products	Intimate door-to-door service

Figure 2: Quantitative model of user experience.

business cases and strategies on the market. Business strategy is an important guarantee for a company's sustainable and healthy development. In terms of design, business strategies play a very critical role in the extremely intense market environment. It can guide the entire direction of product design, so as to clarify the market positioning of a certain product and achieve the business goals of the product [14]. Product development and design principles based on user experience strategies mainly include the following points: value claims must be reasonable, value innovation must be reasonable, user research must be reliable, and user experience must be improved. Product developers should consider costs and prices, and integrate the practicality and innovation of the product, and develop based on potential users.

The user experience drives the future development direction of the product and determines the commercial vitality of the product. However, the key to successfully formulate an effective business strategy is the business model that conforms to the operating status of the enterprise. Under normal circumstances, designers based on user experience need to help products developers to study and analyze, and each element in the business model is interconnected and exist in the form of a list, as shown in Figure 3. This can be prepared for the later product

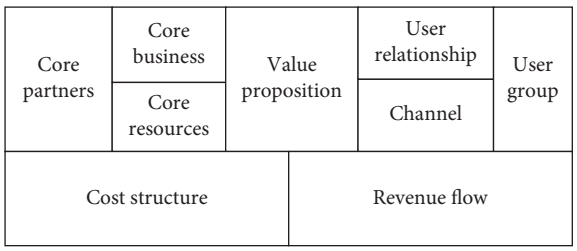

Figure 3: Business model canvas.

experience, and can ensure that it occupies a certain position in the market, thereby achieving the sustainable development of the product. In the process of product development and design, most enterprises usually use the innovative theory of the existing user experience business model on the market to obtain the data value of users and clarify the loyalty to use household groups [15].

With the development of the market, people have begun to combine product design and marketing. In traditional sense, the design of user experience is mainly concerned about user interaction and art design, and ignores the development of customers, the participation of users, and the effective construction of business models, which just determines the success of product marketing. The main tasks of

the user experience designer are: designing and designing the artistic beauty of the product's control interface and user conversion route, in-depth market research and learning and improved user experience satisfaction [16]. Based on different experience levels, the needs of users' attention are different, which will also have a certain impact on the design of the product. The specifics are shown in Table 2.

In the market environment, the quality of the product will play a vital role in the success or failure of the product, but in addition to the factors, other factors of the product will bring different experiences to users. Among them, the four important elements that directly affect the user experience are shown in Figure 4. The brand, culture, functionality, and usability of a product are four important elements that directly affect the user experience [17]. Among them, the brand's brand represents the quality of the product to a certain extent. The culture of the product reflects the inherent value condensed in the product. The functionality and availability of the product are the core elements that directly affect the user experience.

3.3. Computer Vision. The main scientific research of computer vision is how machines can "see" like people. Specifically, the use of cameras and computers and other devices instead of people's eyes, thereby conducting a series of operations on the target, including identification, tracking and measurement, and then transmitting the processing results to the instrument for detection. The study of computer vision aims to establish an artificial intelligence system that can obtain the desired information from pictures and data. The information mentioned here refers to the information that can be used to help make a decision, so it is also a perceptual science. Computer vision has very strong autonomy, objectivity, and repeatability. This technology began in the 1950s, and the main purpose at that time was to identify and analyze images. Over time, it has developed to the level of analysis of object structures that can be analyzed. Today, the fusion application of computer vision and graphics is increasingly reflecting advantages [18].

Computer vision simulation objects are mainly creatures, and three-dimensional information is obtained by simulation. Once the machine is equipped with a visual application effect, then its prospects can be imagined that it must be very broad. Computer vision is both the engineering field and a challenging important research area in the science field. Today, computer vision has become one of the focuses of relevant researchers. There are many ways to classify computer vision, and the factors are different, and the classification is different. Its application field is very wide, including fingerprint technology, chromosomal identification on the organism, detection of integrated circuits, intelligent robots, medical CT, which are built in two-dimensional images and three-dimensional objects [19]. For example, in the field of robotics, if it needs to study the parts of the machine, it can be used in the form of X-rays and laser. It describes the target, including its texture, color, and shape, and a model is established.

The three main tasks of computer vision lie in the recognition, detection, and division of goals, which are currently recognized by academic circles. First, image recognition is also called image classification, which is to identify and classify an object of research based on its characteristics. Its specific process is: enter the picture that needs to be recognized first, and then output the category of this image. For example, the machine at the high-speed intersection recognizes and charges your license plate number; there are also face recognition of people common in daily life, such as WeChat and Alipay's face payment function. Second, the target detection is mainly to detect the specific location and attributes of the target. It is developed on the basis of image recognition [20]. Third, the target segmentation consists of the two parts: semantic segmentation, and individual segmentation. The difficulty of these three major applications has gradually upgraded to simulate and track human behavior. However, computer vision also faces certain challenges and problems.

Products often need to conduct a final quality inspection before the market, but in a complex environment, artificially difficult to distinguish the subtle color differences of the product and the defects of the product [21]. Therefore, the use of computers for automatic identification and tracking can maximize saving manpower and material resources and improve the product's qualification rate. Before the product is tested, the graphics of the product need to be collected. The division and collection of graphics can be functionalized to:

Table 2: Product design factors at different experience levels.

Experience level	Product design factors
Sensory experience	Beautiful appearance Comfortable material Reasonable process Reliable structure
Behavioral experience	Comfortable and efficient use Easy and fun to operate Reasonable function
Emotional experience	Cultural needs Aesthetic needs

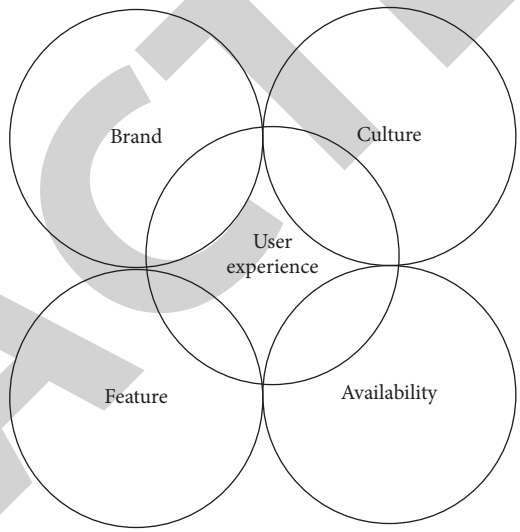

Figure 4: Four elements of user experience.

$$g(i,j) = \frac{\sum f(m,n)}{M}. \tag{1}$$

$g(i,j)$ means the collected image, $g(i,j)$ represents the pixels in the area. However, the graphs directly collected by the camera often have much noise. In order to improve the accuracy of recognition, a certain strategy needs to be used for noise reduction and optimization of graphics. The preprocessing process of graphics is shown as follows:

$$\begin{aligned} f(m,n) &= \frac{Q}{A}\left[f_A(i,j)\right], \\ Q &= \frac{M}{A}\left[f_A\left(i+x-\frac{m+1}{2}, j+y-\frac{n+1}{2}\right), (x,y) \in A\right]. \end{aligned} \tag{2}$$

Among them, the original graphic is represented by $f(i,j)$, and the optimized image indicates $f(m,n)$, Q represents the median filter module. During the processing process of the image, under the action of the medium value filter, the pixels of the image are divided into odd points and even points, where A represents the collection of even points.

After simply preparing the image, we need to further enhance the details of the image. Compared with the filter, the sharpness makes the details of the image richer and enhance the overall effect of the image. The process of image sharpness can be described as:

$$\begin{aligned} \nabla^2 f &= \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}, \\ \frac{\partial f(i,j)}{\partial x} &= \Delta_x f(i,j) = f(i,j) - f(i-1,j), \\ \frac{\partial f(i,j)}{\partial y} &= \Delta_y f(i,j) = f(i,j) - f(i,j-1). \end{aligned} \tag{3}$$

In the above formula, $f(x,y)$ represents the image before sharpening, ∇^{2f} indicates the difference, and its physical interpretation is the difference of unit coordinates in the vertical direction. However, in the process of image acquisition, the color of the image is easily affected by light, so we also need to eliminate the trouble caused by light.

The estimation algorithm of illumination can be expressed as:

$$f(x) = \varpi^T \phi(x) + b. \tag{4}$$

Among them, $\phi(x)$ represents the objective function, and ϖ represents the weight. This method of illumination estimation uses the least squares method, which aims to establish a regression model.

The representation of the Lagrange polynomial of the regression model is as follows:

$$L(w,b,e,a) = J(w,e) - \sum_{i=1}^{M}\left[a_j \phi(x)\right], \tag{5}$$

$$w = \sum_{i=1}^{M} \phi(x_i), \tag{6}$$

$$a = y_k y_l \phi(x_k)^T \phi(x_l). \tag{7}$$

In the Laglang Japanese style (for the power equation expressed in a broad system), a is the Lagrange multiplier. According to the minimum structure of the structure, we can get regular parameters and random errors e.

By solving the above Lagrange Japanese style, we can get:

$$\begin{aligned} y &= f(x) = \sum_{i=1}^{M} a_i K(x, x_i) + b, \\ K(x, x_i) &= \exp\left\{-\frac{\|x - x_i\|^2}{2\sigma^2}\right\}. \end{aligned} \tag{8}$$

Among them, a here is a solution of the formula (6), which represents the light factor at this time. σ is the width of the core function, and its value is greater than zero. However, we noticed that in the formula (7), there is no exact expression of $\phi(x)$, so we use the feature vector to get the value of its approximation, which can be expressed as:

$$\phi(x) = \sqrt{\frac{1}{n}\sum_{j=1}^{n}\left(y_{ij} - x_{ij}\right)^2}. \tag{9}$$

Among them, y_{ij} represents the predicted light angle and conditions, x_{ij} represents the real light angle. After getting relevant data, we use the weighted method to integrate the light model. The weighted algorithm can be expressed as:

$$\begin{aligned} H(x) &= \sum_{i=1}^{T} w_i h_i(x), \\ w^T &= \left(\int \left|\frac{\partial^n f^\sigma(x)}{\partial x^n}\right|^\rho \mathrm{d}x\right)^{1/\rho}. \end{aligned} \tag{10}$$

Based on this, the estimation model of light has begun to take effect, and it can achieve unsupervised self-operation. Among them, T represents the number of training, w represents weight.

On the basis of the light estimation model, we can identify the color differences and flaws of the color of the image based on the relatively accurate computer vision. Products exposed to light often produce differences in color, but the way in which differences are recorded varies from product to product. In order to standardize the difference and unify the data structure, we adopt a more authoritative color difference evaluation system to represent the color difference. The color difference evaluation standard is depicted in Table 3.

4. Product Strategy Resolve Based on Computer Vision and User Experience

In order to promote nonheritage creative products targeted, we first need to understand the experience and choice of users' current nonheritage creative products. Then, on this basis, product adjustment and upgrades are made targeted to

Table 3: Color difference evaluation standard.

Chromatic aberration	Color difference	Perception	Grade
0~0.5	Subtle	Extremely small	1
0.5~1.5	Small	Slight	2
1.5~3.0	Generally	Obvious	3
3.0~6.0	Larger	Extremely obvious	4
>6.0	Big	Strong	5

fully meet consumers' expectations for nonheritage and creative products. Among them, the user's experience in nonheritage and creative products is given in Table 4.

As given in the table, users are not very satisfied with the current experience of nonheritage creative products, with an average score of 3.35. In addition, users have high recognition of cultural and creative products, and the recognition experience scores of nonheritage cultural creative products are only 1.25. This shows that the product must have a good user experience and product recognition to be favored by users.

Different populations will have different psychology of nonheritage and creative products, which will directly affect their choice of products. Therefore, it is necessary for us to understand the degree of acceptance and love of consumers of different occupations for nonheritage creative products. Among them, consumers of different occupations on nonheritage and creative products are given in Table 5.

This table shows that consumers of different occupations have different choices for nonheritage and creative products. Among them, for students and cultural groups, they are more willing to pay for nonheritage in-cultural products, and their degree and acceptance have basically reached 6.9. In addition, for non-genetic staff, they are the crowds who are most willing to create and purchase nonheritage creative products. However, not all groups have a positive attitude towards nonheritage and creative products like the above two groups. Among them, for some freelancers, they are more reluctant to invest money into nonheritage and creative products, and for some small and microenterprises, they are not willing to make related consumption.

In the product design and development stage, product design based on computer vision can maximize product quality and reduce product defect rates. In order to further improve the quality of the product, we also need to strictly control the quality inspection of the product to minimize the color difference of the product. Comparison of computer vision recognition accuracy under different methods is shown in Figure 5.

This figure shows that the average recognition accuracy of DE-GWO-SVM is the highest, and it can reach 97.14%, which shows that it has the most detailed distinguishing color difference. Among them, the recognition accuracy of GWO-SVM is slightly better, and the comprehensive recognition accuracy can reach 95.17%. In addition, we can see that the recognition accuracy of ELM is relatively low, which shows that it has a certain shortage of non -linear relations.

Table 4: User experience of non-legacy creative products.

Project	Feedback	Score1	Score2	Average score
Experience	Fine	3.1	3.6	3.35
Resolution	Not good	1.1	1.4	1.25
Reducibility	Very good	7.2	6.6	6.9
Features	Good	4.5	4.0	4.25
Quality	Fine	4.1	3.9	4.0

Table 5: Consumers of different occupations' choice of non-legacy cultural and creative products.

	Degree of liking	Acceptance	Level of worry	Purchase index
Entrepreneur	5.2	6.6	1.2	0.6
Student	4.3	6.9	2.4	5.6
Educators	5.1	7.2	5.1	6.1
Heritage bearer	7.9	8.9	6.1	9.2
Freelance	2.1	3.4	0.6	0.5
Other	3.4	4.1	1.1	1.2

In the process of product design, we often need to process various colors, so clustering and dividing colors can effectively reduce the misuse of colors. At the same time, with the help of computer vision, we can further strengthen the division of colors and reduce the impact of light on product color. The final pass rate and quality inspection of the product are shown in Figure 6.

Figure 6 shows that the quality of computer vision and creative products has been strictly controlled. Among them, we can clearly see that the product's qualification rate has reached 80%. And in the same batch of products, products based on computer vision often have relatively low residual rates, and the number of residual products is less than 10.

The product can officially enter the market after completing the final quality testing and factory packaging. But unlike the quality inspection session, this time it is not professional quality inspectors but our consumers that test the practicality and applicability of products. Cultural and creative products themselves have strong cultural attributes, so this determines its product positioning and market positioning. The quality of the product can only illustrate the characteristics of the product itself, but the ultimate mission of the product still needs to be favored by users. The quantitative index based on user experience is shown in Figure 7.

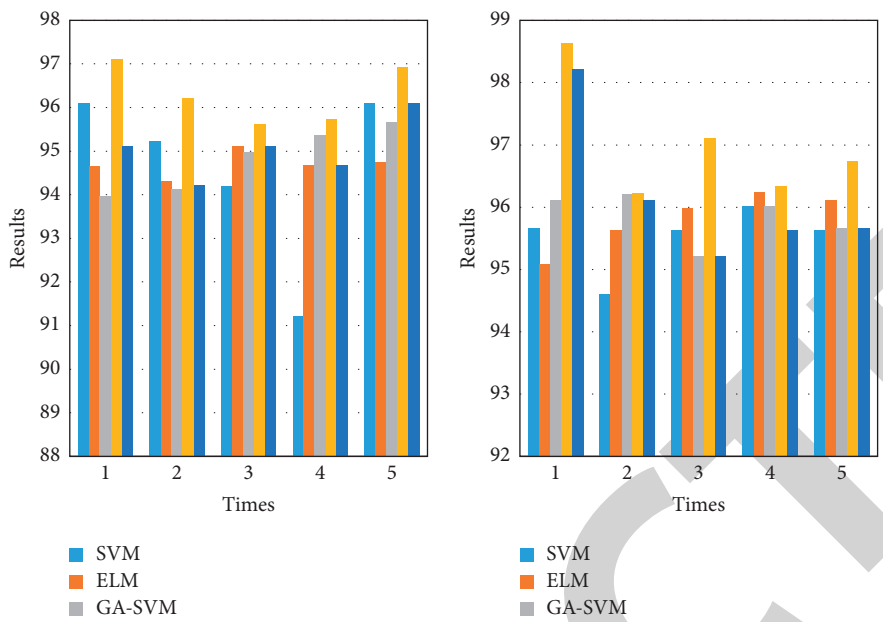

Figure 5: Comparison of recognition accuracy of different methods.

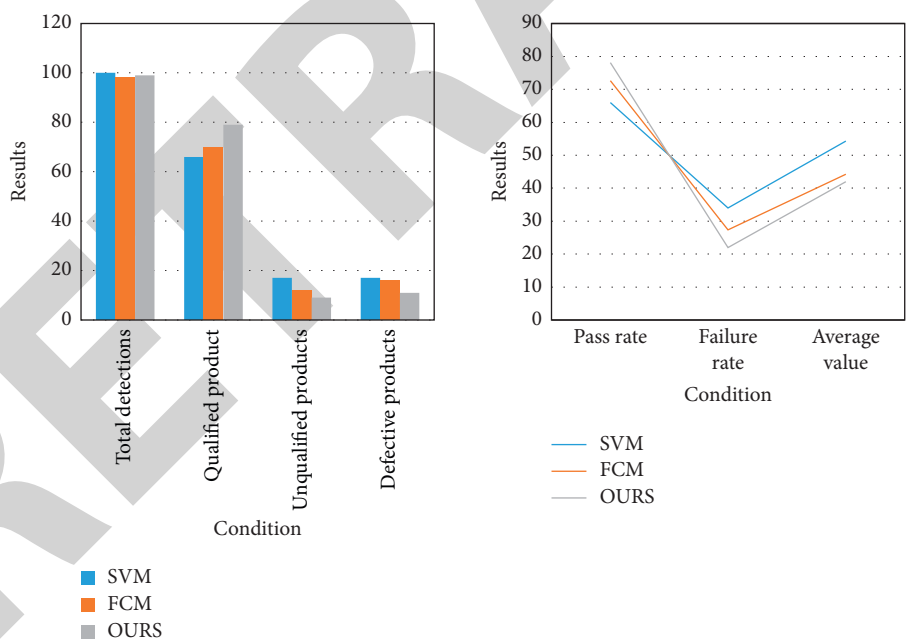

Figure 6: Qualification rate and quality inspection.

The figure shows that different subjects hope that the product has different characteristics. Among them, users mainly hope that products can gather ornamental and practicality, and the price of best products is not too expensive. From the perspective of indicators, users' concern about price is 7.2, which shows that the cheap products are often favored by consumers. But at the same time, we also see that consumers also value the inherent value of the product very much, and their attention has reached 6.9. This shows that for ordinary products, merchants need to make choices between value and cost. At the same time, for cultural and creative products, merchants should further tap their internal value, continuously enlarge the cultural connotation projected by the product, and attract consumers to pay.

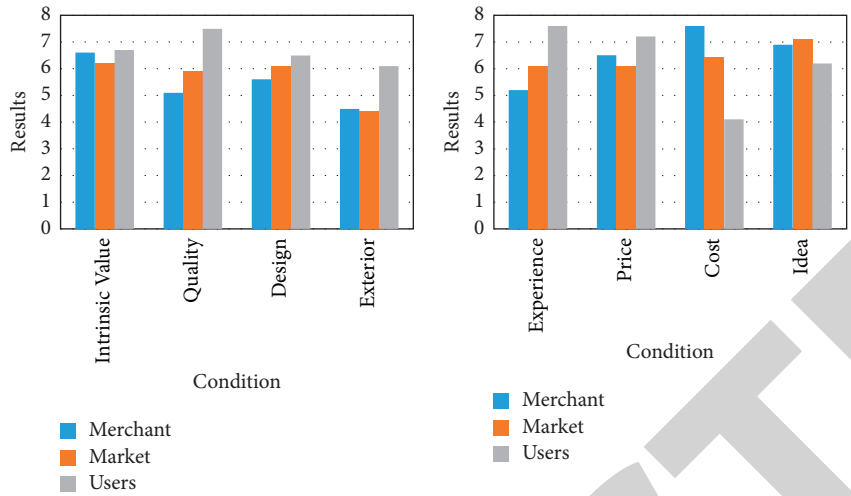

Figure 7: Quantitative indicators of products based on user experience.

5. Conclusion

During the design and development of the entire product, the user experience strategy plays a support and dominant role. It contains business strategies, marketing strategies, product strategies, and other related plans and plans. The article starts from nonheritage and creative products, which first introduces its core concepts and related development status, and then the article is based on user experience strategies. From this level, relevant suggestions are made for the development of nonheritage-based creative products. Secondly, the article focuses on analyzing the role of computer vision in the design and development of intangible cultural heritage products, and innovates the quality inspection method for it. Based on this, the article further proposes to amplify the cultural connotation of intangible cultural heritage products and tap their core values. This provides a certain reference for product development designers, which can make them develop better products in the development of better products, and also promote the protection and reasonable development and utilization of nonheritage cultural relics. The design and development of cultural and creative products cannot be limited to the level of industrial efficiency, but should also improve the uniqueness and market share of the product. However, due to time, the article did not study the consumer psychology of consumers when buying nonheritage creative products. In the future, this article will analyze the factors that affect the development of nonheritage and creative products from multiple levels, and are committed to promoting the development of nonheritage culture.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no potential conflicts of interest in this study.

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Retraction

Retracted: Application of Digital Image Processing Technology in Textile and Garment Field

Security and Communication Networks

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.-R. Shih, "Application of Digital Image Processing Technology in Textile and Garment Field," *Security and Communication Networks*, vol. 2022, Article ID 7971811, 9 pages, 2022.

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Research Article

Application of Digital Image Processing Technology in Textile and Garment Field

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In order to study the shortcomings of traditional manual inspection of clothing, improve the quality of clothing. A method of applying digital image processing technology in the field of textile and clothing is proposed. This method combines computer digital image technology to propose an image processing and measurement process technology based on the Labview platform. Through the effective combination of neural networks and support vector machines, methods such as deep learning can better realize the recognition and classification of clothing images. According to a random interview survey of 80 people, 78 people think that the quality of clothing is the most important, and 2 people think that beauty is the most important. The experimental results show that the digital book processing technology platform can further improve the accuracy of clothing detection.

1. Introduction

With the continuous development of computer technology, the new technology represented by digital image processing technology can deeply process the image with the help of computers and other digital technologies, so as to better help people identify and extract the required data information [1]. Compared with the traditional manual technology, this technology has good image reproduction performance, higher processing accuracy, better adaptability, and stronger flexibility. Since the late 1980s, digital image processing technology has been gradually applied to the field of textile and garment inspection, and with the development of computer technology, this technology is becoming more and more mature [2]. And this technology has stronger technical advantages in clothing detection, classification, and evaluation compared with traditional manual detection. With the help of digital image processing technology, it can deeply study the defect points, flatness, and style characteristics of clothing, and effectively avoid the problems and disadvantages of traditional manual detection. Therefore, starting with computer digital image technology, the image processing, and measurement process technology based on the Labview platform is proposed. At the same time, combined with neural networks, support vector machines, deep learning, and other methods, it can better realize the recognition and classification of clothing images [3]. The system architecture is shown in Figure 1.

2. Literature Review

Jia et al. said that in today's world, all countries attach great importance to environmental protection and constantly develop green products [4]. Zu et al. believed that colored cotton, as a typical green product, has become one of the hotspots in cotton research [5]. In 2001, the output of colored cotton in China accounted for about one-third of the global output. Noor et al. said that the output of colored cotton in China has accounted for 16% of the world [6]. At present, China has become the largest colored cotton production base in the world. However, Kohan et al. believe that the research on all aspects of Chinese colored cotton is still in the preliminary stage and a lot of work needs to be done [7]. Saad et al. said that since the optical fiber terminal plays an important role in the optical fiber communication system, the quality requirements for the optical fiber terminal are becoming more and more stringent, which requires a better method to detect the optical fiber terminal [8]. At present,

the traditional detection method mainly depends on the manual use of magnifying glass and contour and size detection tools. It not only has low detection efficiency and low accuracy but also has high requirements for the professional quality of detection workers. It has great limitations in modern society with the increasing degree of automation. Sharma et al. believe that although there is some improved testing equipment in the market, it has not been well popularized and applied due to high price, bulky equipment, and weak operability [9]. Therefore, we need to develop a new set of optical fiber terminal detection systems with high-cost performance and practicability.

Secim Karakaya et al. said that the research of cultural relics digital service platform mainly uses digital means to digitally store, manage and display cultural relics in the museum [10]. Rahman et al. said that the concept of museum resource digitization originated in the United States in the 1990s. It is a new model for the preservation and utilization of cultural heritage formed under the background of the continuous development of information technology [11]. At present, a lot of research work has been carried out on the digitization of museum resources. For example, it studies the application of Internet + thinking in the field of museums, and designs and implements the museum visualization platform; using digital technology, the management information system of cultural relics in a museum is realized, and the unified management of cultural relics information, warehouse information, expert information, and cultural relics flow is realized; the characteristics of the digital museum are studied, and the application of computer technology in the digital museum is studied; taking the digital construction of cultural relics in Liangzhu Museum as an example, this paper introduces the digital construction mode of cultural relics in the museum from three spatial dimensions: digital record, digital display, and digital communication.

In the late 1980s, digital image processing technology began to be applied to textile inspection and became more and more mature. With the in-depth research of digital image processing technology, some researchers began to apply it to the field of clothing, such as clothing defect inspection, clothing flatness inspection, clothing style feature recognition and classification, and so on. Using digital image processing technology to detect and classify clothing effectively avoids the problems of low efficiency, high cost and uncertainty of traditional manual detection methods, and makes the results more objective and efficient.

3. Method

3.1. Image Processing. Processing and identifying the collected sample terminal image is a vital part of this measurement system [12]. In order to obtain the terminal edge contour, which is convenient for size measurement, we need to carry out a series of processing on the sample image before measurement, including image graying, image denoising, image edge detection, and so on. The system image processing process block diagram is shown in Figure 2.

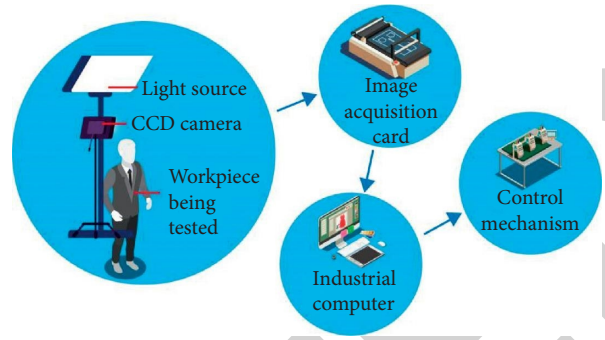

Figure 1: Overall structure of the system.

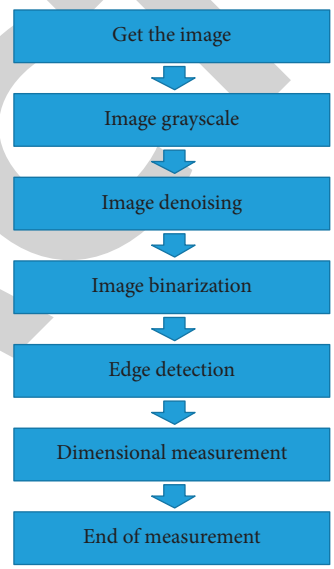

Figure 2: Block diagram of image processing process.

Because the collected image is a color image, it cannot well reflect the morphological characteristics of the image during processing, so before a series of image processing, it is necessary to carry out gray processing on the sample image to convert it into a gray image convenient for subsequent processing. The process of image graying is a process of converting color images into grayscale images [13]. Because the image measurement mainly depends on the accuracy of image edge structure feature extraction, it requires that the gray information around the image edge cannot be destroyed in the process of graying. However, in real life, there are great differences in the brightness information of images collected from workpieces with different materials, which makes it impossible for us to use a specific grayscale model for grayscale. Therefore, the graying of the image not only needs to take a variety of methods but also needs to select the appropriate graying algorithm according to the image edge type and the actual situation. The same as the gray image, the binary image only needs one data matrix, and only two gray values are taken for each pixel. Binary images can be stored in Unit8 or double type. The functions in the toolbox that use binary images as return results use

Unit8 type [14]. In MATLAB, the conversion relationship between various image types is shown in Figure 3.

At present, in the process of image processing, the commonly used color image formats include RGB, HSV, HLS, and so on. Since they are all composed of three primary colors, we can adopt the following methods for graying:

(1) NTSC TV system zero degree formula is

$$Y = [0.299 \;\; 0.587 \;\; 0.144][R \;\; G \;\; B]^T. \quad (1)$$

(2) The brightness formula of PAL TV system is

$$Y = [0.222 \;\; 0.707 \;\; 0.071][R \;\; G \;\; B]^T. \quad (2)$$

(3) CIE three primary color relative brightness equation is

$$Y = [1 \;\; 4.5907 \;\; 0.0601][R \;\; G \;\; B]^T. \quad (3)$$

(4) The color components of each channel are averaged:

$$Y = \left[\frac{1}{3} \;\; \frac{1}{3} \;\; \frac{1}{3}\right][R \;\; G \;\; B]^T. \quad (4)$$

A color image is represented by one of the three primary colors. Expressed by the maximum of the three primary colors:

$$Y = \mathrm{Max}[R \;\; G \;\; B]. \quad (5)$$

In the process of image acquisition and transmission, it is inevitable to encounter noise and interference, resulting in a certain degree of distortion [15]. Therefore, before processing the image, it is often necessary to filter and denoise the noisy image to make it smooth. According to different requirements and the diversity of noise, there are many filtering methods for us to choose from, and each has its own advantages and disadvantages. Therefore, using appropriate filtering methods to denoise noisy images is also an important link that cannot be ignored in this detection system [16]. Firstly, this section introduces two common filtering methods in the spatial domain-mean filtering and median filtering, analyzes their filtering principles and uses two denoising methods to filter the sample image, compare their differences, and choose the best.

3.1.1. Mean Filtering Method. Mean filtering is a local processing algorithm in spatial domain, which is used to smooth the image. Assuming that $f(x, y)$ is the original image, S is a neighborhood of points (i, j), M is the number of pixels in neighborhood (i, j), and $g(x, y)$ is the image obtained after filtering, the mean value can be expressed by filtering:

$$g(x, y)\frac{1}{M}\sum_{(i,j)\subset s} f(x, y)x, \quad y = 0, 1, 2, \ldots, N-1. \quad (6)$$

The mean filtering algorithm is relatively simple, and the calculation speed is very fast [17]. However, the smoothing effect of mean filtering is mainly determined by the neighborhood radius used. Generally, the larger the neighborhood radius is, the more blurred the smooth image is, which will lead to weaker and weaker image information, which is not conducive to the subsequent processing of the image. The commonly used 3×3 and 5×5 mean filter templates are shown in Figure 4.

The optical fiber terminal images are filtered by means of templates of 3×3 and 5×5, respectively [18]. When a 3×3 template is used to smooth the image of the optical fiber terminal, the effect is good, while when a 5×5 template is used to process, the edge and details of the image appear obvious blur, which is not suitable for subsequent processing.

3.1.2. Median Filtering Method. As a nonlinear filter, the median filter does not need image statistical characteristics in the actual operation process, so it is particularly convenient to use. Compared with linear filtering, it can reduce the image blur caused by filtering to a certain extent. We often use the median filtering method for image noise scanning and pulse interference removal [19]. The principle of median filtering is to use the median value of the gray value of each point in the sliding window (the neighborhood is an odd number of points) to replace the gray value of the pixel at the center of the window. Assuming a one-dimensional sequence with a sliding window length of L (L is an odd number), the median filter is performed on it, which is expressed by a mathematical formula:

$$Y_i = \mathrm{Med}(f_{i-v}\cdots f_{i-1}f_i f_{i+1}\cdots f_{i+v}). \quad (7)$$

As shown in formula

$$i \in z, V = \frac{(m-1)}{2}. \quad (8)$$

Similarly, the median filtering of two-dimensional data can be expressed as

$$Y_i = \mathrm{Med}(X_{\mathrm{ij}}). \quad (9)$$

Generally, two-dimensional median filter has a better noise suppression effect than one-dimensional median filter. The two-dimensional median filtering windows have different effects. In practical application, we should select the filtering window according to the specific content of the image to be processed [20]. Similarly, in the process of median filtering, we should also pay attention to the size of the window used, and choose the best according to the specific filtering effect. The commonly used size is 3×3, 5×5, 7×7, etc. The images of optical fiber terminals are processed by median filtering with templates of 3×3 and 5×5, respectively.

3.1.3. Comparison between Median Filtering Method and Mean Filtering Method. Median filter and mean filter are commonly used filtering algorithms, both of which have a smoothing effect. Among them, median filter is suitable for removing impulse interference, while the mean filter is good

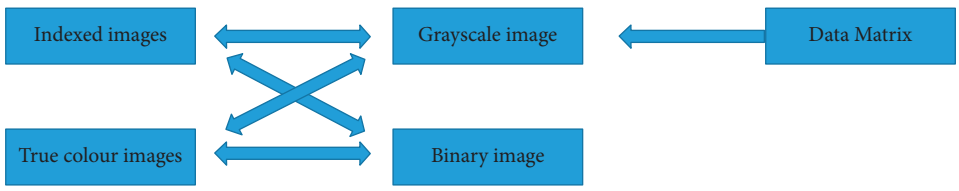

Figure 3: Conversion between image types.

$$\frac{1}{9}\begin{bmatrix}1&1&1\\1&1&1\\1&1&1\end{bmatrix} \qquad \frac{1}{25}\begin{bmatrix}1&1&1&1&1\\1&1&1&1&1\\1&1&1&1&1\\1&1&1&1&1\\1&1&1&1&1\end{bmatrix}$$

Figure 4: 3×3 and 5×5 mean filter template.

at suppressing random noise, which has its own advantages and disadvantages.

In contrast, the mean filter is easier to implement, while the median filter needs a long calculation time. The median filter method and the mean filter method are, respectively, 3×3, 5×5, 7×7 templates to filter and measure the average time-consuming as shown in Table 1.

From Table 1, we can see that with the increase of the user window, the time consumption of the median filter and mean filter has increased significantly, among which the time consumption of the median filter has increased more. However, when using 3×3 templates, the median filter takes slightly less time than the mean filter.

3.2. Image Segmentation. We often use the following two methods for image segmentation: one is image segmentation based on threshold selection, and the other is image segmentation based on edge detection. The image segmentation algorithm based on edge detection is vulnerable to noise. Although the image is preprocessed, there will be noise that affects the edge segmentation.

3.3. Threshold Segmentation. For gray threshold segmentation, we must first determine a threshold to distinguish the object from the background. The pixels within the threshold belong to the target object, and the pixels outside the threshold belong to the background; or on the contrary, the pixels within the threshold belong to the background, and the pixels outside the threshold belong to the target object [21, 22]. Using this method to segment the image with obvious differences between target and background, the effect is very good. When the target and background in the image have completely different gray sets: the target set and background gray set, the two gray sets can be segmented by a gray level threshold t. In this way, the threshold segmentation gray level method can be used to segment the image and segment the target area and background area. This segmentation method is called the gray threshold segmentation method.

Set the gray value range of image $f(x, y)$ as $[a, b]$, and find an appropriate threshold in $F(x, y)$ with certain criteria:

$$t\,(a \le y \le b). \tag{10}$$

Thus,

$$g(x, y) = \begin{cases} 1, & f(x, y) \ge t, \\ 0, & f(x, y) < t. \end{cases} \tag{11}$$

Or

$$g(x, y) = \begin{cases} 1, & f(x, y) \le t, \\ 0, & f(x, y) > t. \end{cases} \tag{12}$$

Set the threshold gray value range as $[t_1, t_2]$

$$g(x, y) = \begin{cases} 1, & t_1 \le f(x, y) \le t, \\ 0, & \text{other}. \end{cases} \tag{13}$$

The principle of threshold segmentation can be expressed as

$$g(x, y) = \begin{cases} Z_E, & f(x, y) \in Z, \\ Z_B, & \text{other}. \end{cases} \tag{14}$$

Before selecting the threshold, we usually need to draw the gray histogram of the image. If only the histogram corresponding to the two regions of the target and the background is bimodal and has an obvious valley bottom, we can take the gray value corresponding to the valley bottom point as the threshold T, and then segment the image according to the threshold, so as to segment the target from the image. Of course, we will inevitably encounter the situation that the gray distribution of the target and background is too scattered or their distribution is partially staggered, which makes it difficult to select the threshold with the help of a histogram, and other methods need to be taken to determine the threshold t. The following centralized methods are also based on gray histogram. The difference is that it is not determined manually, but through a certain algorithm, so as to eliminate the influence of thought factors [23]. Figure 5 is a gray histogram of a general image, where i represents the gray value, k is the threshold, $h(i)$ represents the number of occurrences of each pixel in the image, N represents the number of gray values of the image, and n is the total number of pixels in the image.

The clustering method and minimum measurement method are introduced below.

Clustering method: in this method, the threshold K is determined by the following formula

$$k = \frac{\mu_1 + \mu_2}{2}, \tag{15}$$

Table 1: Time-consuming comparison.

Filtering method	Template size	3×3	5×5	7×7
Mean filtering		19.1	39.3	101.3
Median filtering		15.4	130.1	490.4

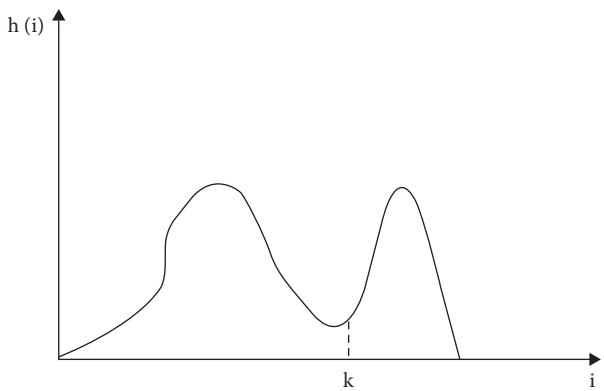

Figure 5: General image gray histogram.

where μ_1 is the average value of pixel values in the range of 0 to K, and μ_2 is the average value of pixel values in the range of $K+1$ to 255.

Minimum measurement method: the threshold K of the minimum measurement method is the gray value that minimizes the value of the following formula:

$$\sum_{i=0}^{i=k} h(i)\left|i-\mu_1\right| + \sum_{i=k+1}^{i=N-1} h(i)\left|i-\mu_2\right|. \tag{16}$$

The edge detection operator is realized in the form of template convolution. The gradient operator needs the combination of two templates to form a complete operator. Common gradient template operators are shown in Figures 6–8.

$$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \qquad \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$$

x direction y direction

Figure 6: Robert operator.

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} \qquad \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

x direction y direction

Figure 7: Sobel operator.

$$\begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & -1 \\ 1 & 0 & -1 \end{bmatrix} \qquad \begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{bmatrix}$$

x direction y direction

Figure 8: Prewitt operator.

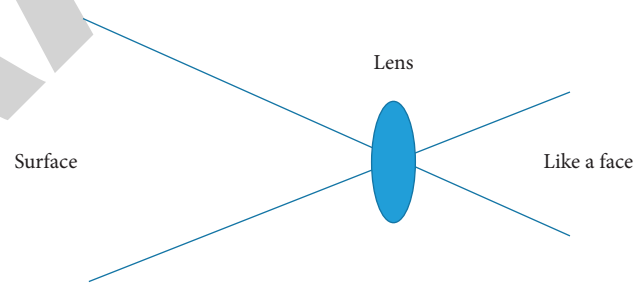

Figure 9: Schematic diagram of lens imaging.

3.4. System Function and Technology. The system function and technology are mainly composed of a CCD camera, light source, image acquisition card, Labview image processing software, and computer. Its working process is as follows: firstly, the CCD camera is used to collect the image information of the sample terminal and transfer it to the image acquisition card to convert it into an electrical signal to realize the digitization of image information. Then, Labview image processing software is used on the computer to process the digital image, obtain its contour, size, and other information, and then measure it [24]. Finally, the measurement results are compared with the sample parameters to judge whether they meet the requirements and complete the whole measurement process.

Due to the complexity of measuring objects and the diversity of lighting equipment, there is no general machine vision lighting equipment for us to choose. Therefore, we should choose the actual measured object and experimental conditions in order to obtain high-quality images. Therefore, the design of the lighting system should include two aspects: the selection of light source and the design of the lighting scheme.

The selection of light source equipment should not only consider the service life and luminous efficiency of the light source but also select the geometric shape, uniformity, luminous spectrum, memory illumination brightness, and other characteristics of the measured object. Light sources are generally divided into visible light sources and invisible light sources. Common visible light sources include a fluorescent lamp, incandescent lamp, sodium lamp, led, mercury lamp, etc.

There are four main indicators of lenses, namely, focal length, field of view, working distance, and depth of field. According to the focal length, we often divide the lens into wide-angle lens, standard lens, and long focal length lens. The depth of field is directly affected by the focal length, viewing angle, and minimum working distance. If the focal length is small, the depth of field is large, and if the minimum working

distance is far, the depth of field is small [25]. In the visual measurement system, we should try to choose the lens with a short working distance, small lens distortion, and large field of vision. We should try to choose the lens with a short working distance, small lens distortion, and large field of vision. In addition, our commonly used zoom lens can be divided into: "1/3," "2/3," "1/2" and "1" in rules. When selecting the zoom lens, we should pay particular attention to that: the specification of the camera must be less than that of the lens.

3.5. Software Design of Detection System

3.5.1. System Software Design Process. According to the size measurement requirements of optical fiber terminals, the software design flow of the system is shown in Figure 10:

Because the system is designed based on Labview platform, we make full use of its modular design idea to modularize the whole design process. The system program is mainly composed of the main program and function module subroutine. Among them, the function module subroutine includes the image acquisition module program, image processing module program, and size measurement program; The main program is responsible for presenting the whole measurement process to the operator on the front panel for operation [26].

3.5.2. Design of Image Acquisition Module. First, initialize the camera, then cache the collected image into the data buffer, and enter the image processing module for processing after the current cycle.

3.5.3. Image Denoising. In the process of image acquisition and transmission, it is inevitable to produce noise, which will have a certain impact on the image, which requires us to take appropriate methods to denoise the image. The process of denoising is the process of filtering. Labview gives us many filtering algorithms to choose from, including linear filtering and nonlinear filtering, as well as spatial filtering and frequency domain filtering. The system adopts two commonly used filtering methods in spatial domain-mean filtering and median filtering to filter and select the best.

3.5.4. Image Binarization. Binarization is to convert the gray value of the digital image into 0 or 255 by setting the threshold to become a black-and-white image. Among them, the gray value greater than the threshold is converted to 255, and the gray value less than the threshold is converted to 0.

3.5.5. Edge Detection. After binarization, the gray value of the image is only 0 and 255. Edge detection can make us clearly see the outline of the terminal. The quality of the edge detection algorithm directly affects the complexity and accuracy of the measurement algorithm.

3.5.6. Dimension Measurement. Size measurement is the ultimate goal of the whole system. Its process is as follows: firstly, the processed terminal images are scanned in rows and columns respectively, and the pixels with a gray value not 0 in each row (column) of the digital image are counted and stored in a new array. The obtained statistical array value of pixels is the distance between image edges. Because the sample terminal is not a standard two-dimensional object, we draw the histogram of the new array and sample the data of the smooth segment. Finally, average the collected data to obtain the required terminal length (width) [27], as shown in Figure 11.

4. Results and Analysis

It is complex and costly to use the method of thread removal or digitizer to analyze the clothing style. The use of digital image processing technology cannot only quickly identify and classify the style information of clothing images but also realize the conversion between style maps and structure maps. Among them, the commonly used clothing pictures are clothing style drawings and clothing object drawings.

For the extraction of clothing contour, a fuzzy clustering algorithm is proposed to recognize and classify clothing styles, but this method is only suitable for the recognition of local contour segments. The combination of Fourier descriptor and support vector machine is used to identify clothing styles, which cannot only identify many kinds of clothing styles quickly and effectively, but also has good robustness, but it cannot correspond to the clothing contour one by one; By extracting the curvature extreme points from the clothing contour curve to represent the clothing contour shape, a clothing style recognition method based on the contour curvature feature points is proposed. The algorithm is simple to operate, and can more intuitively show the characteristic information of clothing contour.

The most commonly used method in texture feature extraction is the gray level co-occurrence matrix, which can better reflect the texture information of the image, and the principle is simple and easy to understand [28]. Based on this, a texture feature extraction method combining a local two-mode algorithm and gray level co-occurrence matrix is proposed in the literature. This method has good anti-rotation. When the clothing image rotates, this method has higher detection efficiency and accuracy than the traditional texture feature extraction method. In order to improve the accuracy of image recognition, a parallel fusion method based on contour and texture features is proposed in the literature to extract the structural and statistical features of clothing images. This method can recognize and describe clothing style images more comprehensively [29].

The traditional methods to identify the types of clothing fabrics include the hand touch method, combustion method, microscope observation method. These methods need the help of clothing objects, and are vulnerable to environmental factors. Garment fabric recognition based on image processing technology mainly extracts fabric attributes from garment fabric images for simulation, so as to achieve the purpose of fabric recognition. Fabric simulation is carried out by using the garment fold information extracted from the fabric images of different materials and different yarn

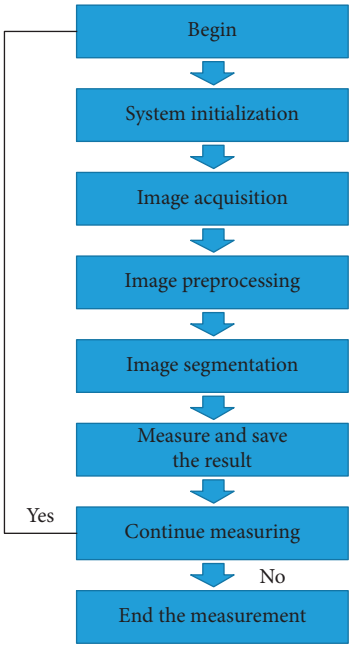

Figure 10: System software design flow chart.

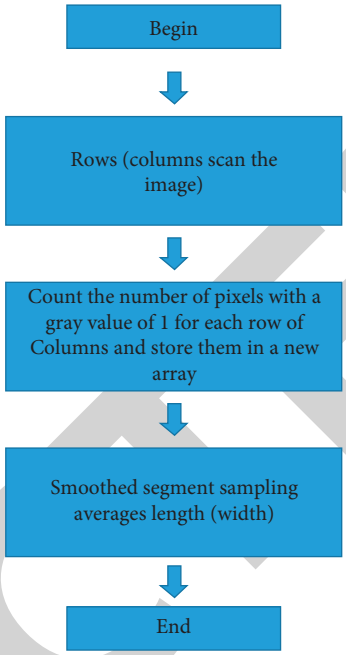

Figure 11: Flow chart of dimension measurement.

counts. The effect of the simulation image and the physical image is compared to realize the garment fabric recognition. This method has high accuracy, but it needs repeated simulation experiments to achieve the ideal effect, and the recognition efficiency is low.

With the development of information technology, many designers begin to design fabric patterns and clothing with the help of design software. With the help of image processing technology, emotional semantic recognition of clothing fabric images cannot only provide emotional judgment for designers but also provide a reference for consumers. The fabric color and texture features are used to represent the fabric's emotional semantics, the expression of features and semantics is constructed, and the recognition and classification of fabric image emotional semantics are realized by a support vector machine. On this basis, combined with image feature extraction and classification algorithm and dynamic link technology, a web-based fabric image emotional semantic recognition module is developed. This method provides a simple and easy retrieval method for customers and meets the emotional needs of consumers when selecting goods.

Clothing modeling evaluation usually adopts a subjective evaluation method, and the evaluation results cannot be quantified. In addition, the individual aesthetic differences lead to the poor consistency of the evaluation results. The common method of image-based garment modeling evaluation is to use image processing software to extract the evaluation indexes reflecting garment modeling from garment images from different angles, such as fold, angle, curvature, and so on. Combined with the correlation between subjective evaluation index and evaluation grade, an evaluation system is established.

In view of the disadvantages of subjective evaluation, the literature attempts to quantitatively evaluate the influence of different fabric properties on skirt modeling such as A-line skirts, pleated skirts, and ultra-short skirts by using image processing technology. Photoshop, MATLAB, and other software are used to process and analyze the appearance images of skirts in different directions, extract the indicators reflecting skirt modelings such as area, length, angle, and fold, and construct the evaluation system by combining the methods of principal component analysis and factor analysis. Through the above methods, curvature analysis is proposed to objectively evaluate the roundness of the lapel collar. The fold line of the back neckline is extracted from the gray image by Photoshop software, and four characteristic indexes in the target curve are extracted by ugnx10.0 software, including the number of turns, the maximum value of curvature range, the sum of curvature range and the coefficient of variation of curvature range, so as to characterize the roundness of the lapel.

With the development of image processing technology, some researchers also try to use images to analyze the relationship between human body and clothing contour. The definition of human body section width feature is proposed to identify clothing profile. AdaBoost algorithm is used for face recognition to obtain face size information, and then threshold segmentation, denoising, and human body proportion division are carried out. The width of each section is extracted by line-by-line scanning, and the clothing profile is represented by each width proportion. This method uses shape proportion to quantify clothing contour and has high recognition degree. The pixel statistics of terminal width obtained by scanning are shown in Figure 12:

In order to solve the difficulty of fitting online shopping, virtual fitting technology has attracted more and more attention. At present, the common virtual fitting systems are mainly divided into three categories: virtual fitting mirror,

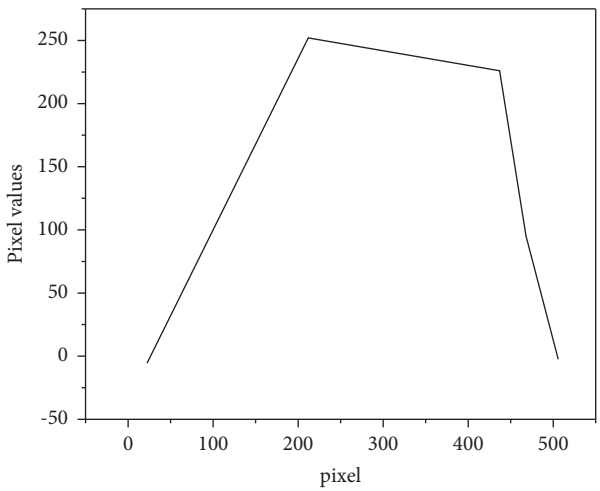

Figure 12: Terminal width pixel statistics.

which uses the user's Avatar to directly replace the fitting model's Avatar and shows the fitting effect through simple local body shape adjustment; Somatosensory fitting mirror, matching the segmented clothing image on the collected user image; the three-dimensional digital fitting system obtains the user's three-dimensional information through the three-dimensional data acquisition device and matches the three-dimensional clothing model to the constructed human model. Virtual fitting mirrors and somatosensory fitting mirrors can realize the virtual fitting display effect only through simple image preprocessing, image segmentation, image matching, and other methods, but users can only see the two-dimensional dressing effect. At the same time, due to individual differences, the matching effect has great defects. According to a random interview survey of 80 people, 78 people think that the quality of clothing is the most important, and 2 people think that beauty is the most important. The experimental results show that the digital book processing technology platform can further improve the accuracy of clothing detection. It proves that the application of digital image processing technology in the field of textile and clothing is feasible, effectively solves the quality problem of clothing inspection, can meet the needs of merchants for high and accurate clothing quality inspection, and can make up for the low detection ability of traditional artificial clothing, and improve the factory's quality. Work efficiency. The human body and clothing information in the three-dimensional digital fitting system comes from the three-dimensional point cloud image, which can show the three-dimensional dressing effect. The matching effect is good, but it is time-consuming and poor in real-time.

5. Conclusion

It proves that the application of digital image processing technology in the field of textile and garment is feasible, effectively solves the quality problem of garment detection, meets the needs of merchants for high and accurate garment quality inspection, makes up for the low detection ability of traditional artificial clothing, and improves the work efficiency of the factory. Combined with the current application research of image processing technology in the field of clothing, it is found that the simulation of clothing fabric material and touch is the key problem in the current virtual fitting. Due to the unique texture structure of clothing fabrics, fabrics with different materials and attributes have their own unique texture characteristics. For material simulation, the image processing algorithm is proposed to obtain the spectrum distribution image of clothing fabric, extract the texture feature parameters according to the change of spectrum information, and reconstruct the image combined with reverse engineering technology to realize the virtual simulation of clothing fabric material. In addition, the tactile simulation of fabrics is still a major difficulty and focus in future research. Nowadays, intellectualization is the focus of research in the field of clothing. Consumers are more and more inclined to intelligently recommend clothing matching in line with their own style. Therefore, combined with image automatic acquisition technology, image processing technology, virtual fitting, neural network, and expert system, it is the trend of future research to build an integrated clothing style recognition and matching recommendation system. Based on the current research situation of digital image processing technology in the clothing field, realizing the virtual simulation of clothing fabric touch and building an intelligent clothing matching recommendation system is the research focus of realizing intelligence and integration in the clothing field. Therefore, we should combine the existing research with new theories and technologies to make the garment field develop in a more intelligent and integrated direction.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest with any financial organizations regarding the material reported in this manuscript.

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Retraction

Retracted: A Study on Factors Influencing the Use of Unmanned Driving Technology Based on TAM Model

Security and Communication Networks

Received 8 January 2024; Accepted 8 January 2024; Published 9 January 2024

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) Manipulated or compromised peer review

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. Meng and T. Dong, "A Study on Factors Influencing the Use of Unmanned Driving Technology Based on TAM Model," *Security and Communication Networks*, vol. 2022, Article ID 6861323, 6 pages, 2022.

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Research Article

A Study on Factors Influencing the Use of Unmanned Driving Technology Based on TAM Model

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Unmanned driving technology, as an emerging digital, intelligent technology that is future-oriented, provides practical solutions to a number of transport issues. Compared with traditional manual driving, unmanned driving technology features higher entertainment and conformity, as well as higher risks and new types of cost. To study user acceptance of unmanned driving technology, the paper makes an analysis of statistical significance and regression, with a number of factors as independent variables, including perceived usefulness and perceived ease-of-use (as required by TAM), and perceived enjoyment, perceived risk, perceived cost, and conformity (extension of TAM), and usage intention as dependent variables. The results show the acceptance degree of different factors of driverless technology and provide suggestions for the development of more acceptable driverless functions by users.

1. Introduction

The autonomous vehicle ensures a more smooth mobility in the future. The technology could alleviate heavy traffic, reduce emissions, make parking easier, and reduce the costs of transport, new road, and infrastructure. It could also benefit older persons and persons with disabilities.

In terms of functionality and operational convenience, autonomous driving falls into five levels ranging from 0 (manual driving) to 5 (high automation). Most vehicle manufacturers now focus on Level 2, at which vehicles are equipped with assistance functions for motor steering and acceleration. Drivers of such vehicles are able to be freed from some tasks, but they must be prepared for controlling the vehicle in case of emergency. Meanwhile, they are responsible for most critical security functions and the full surveillance of surroundings.

In terms of enjoyment and fashion, among all the technologies in the world, unmanned driving technology is in the spotlight. Its R&D has been unfolded across high-tech companies based in Silicon Valley, emerging tech startups, and large vehicle manufacturers. The technology also arouses attention and curiosity among the public.

In terms of risk and cost, however, unmanned driving technology is challenged by multiple issues, especially those related to security. The world has seen a lot of incidents caused by the Level 2 autonomous vehicle, even the death of drivers, pedestrians, and traffic policemen. Take the autonomous vehicle of an American manufacturer, for example. In 2021, it has been involved in a number of road accidents in China. On February 21, due to brake failure, it rear-ended two other cars on 341 National Highway, Nanyang, Henan Province. On March 11, it hit the wall for the similar reason in Haikou, Hainan. In another crash that happened on May 17, it ran into two traffic policemen, one of whom died. These accidents, coupled with many consumer rights campaigns against the manufacturer, have triggered hot debate online.

Hence, it is worth studying the public's acceptance of unmanned driving technology and relevant considerations, including functionality, convenience, enjoyment, risk, and cost.

2. Research Model and Research Hypotheses

2.1. Research Model. The technology acceptance model (TAM) is an extension of the theory of reasoned action (TRA), proposed by Davis in 1989 [1]. It focuses on user attitude and behavioral intention to use the new technology. What TAM focuses on and its scope can help us analyze users' attitude towards autonomous driving and their behavioral intention, as well as factors affecting the use of this feature.

TAM suggests that behavioral intention determines specific user behaviors and attitudes to use the new technology and is determined by perceived usefulness and perceived ease of use. Perceived usefulness refers to the degree to which a person believes that using the technology would enhance his/her job performance, and perceived ease-of-use refers to the degree to which a person believes that using the technology would be free from effort. Regarding autonomous driving, perceived usefulness means the user believes the feature can upgrade his/her driving skills and experience to a certain extent, and perceived ease of use means the convenience of operation. Both of them will affect the use of the feature.

2.2. Research Hypotheses

2.2.1. TAM-Based Hypothesis. Perceived usefulness and perceived ease of use are one of the most important indicators of the TAM model. It explains whether the practicality and ease of use of new technologies affect users' purchase intention. For unmanned driving technology, perceived usefulness refers to whether unmanned driving technology has actual functions or efficiency improvement for people's driving, while perceived ease of use reflects the difficulty of operation of unmanned driving technology. Therefore, we make the following assumptions:

H1: perceived usefulness has a significant positive impact on purchase intention.

H2: perceived ease of use has a significant positive impact on purchase intention.

2.2.2. Perceived Enjoyment-Based Hypothesis. In their 2014 research on the fully automated car, Payre et al. found that the pursuit of driving-related sensation also has an important impact on the use of the technology [2]. An enjoyable driving experience may lead to much higher user acceptance. In an era when people consider science and technology as the primary productive force, the use of new technology during the transition towards a digital society also draws great attention. Therefore, to what extent does autonomous driving, as a novel and trendy technology, impact users' choice is worthy of study. Hypothesis is as follows:

H3: perceived enjoyment has a significant positive impact on purchase intention.

2.2.3. Perceived Risk-Based Hypothesis. To use a new technology to challenge existing lifestyle, it is necessary to take into account perceived risk. Jansson has discussed safety and privacy in relation to autonomous driving, which unquestionably are factors hindering the use of the technology [3]. Zhang and others considered that initial trust and two types of perceived risk, that is, perceived safety risk (PSR) and perceived privacy risk (PPR), constitute key determinants of autonomous vehicle acceptance. Individuals, society, and surveillance & regulation bodies shall always have an eye for personal security regarding the use of autonomous driving technology [4]. Hypothesis is as follows:

H4: perceived risk has a significant negative impact on purchase intention.

2.2.4. Perceived Cost-Based Hypothesis. Tang found that people are not very enthusiastic about paying additional bills for using autonomous driving technology [5]. After all, vehicle purchase and use are already expensive. Facing the option to apply this novel technology, users need to take the cost into account. Once the technology is applied, some paid assistance features are also required. If the user considers the cost too high, he/she may refuse such service. Hypothesis is as follows:

H5: perceived cost has a significant negative impact on purchase intention.

2.2.5. Conformity-Based Hypothesis. Conformity refers to the process whereby people change their minds or behaviors under outside influences. According to research findings, online consumers of digital technology are more likely to conform to others. Generally speaking, the more people around them drive autonomous vehicles, the more willingly consumers would use the function. The growing market share of new energy vehicles and the brand-new vehicles equipped with digital technology is playing an imperceptible yet transformative role in motivating people to buy such cars. Hence, the impact of conformity on use intention must be considered. Hypothesis is as follows:

H6: conformity has a significant positive impact on purchase intention.

3. Scale Design and Data Collection

3.1. Scale Design. Building on the R&D results of TAM, and combining the features of unmanned driving technology, the paper designs measurement items for each variable of the theoretical model and eventually develops a measurement item list as shown in Table 1. The study applies the questionnaire method to validate the research model. The questionnaire falls into two parts. The first part involves the demographics of the respondents, including gender, age, education background, and driving experience. The second part involves the measurement items of all variables in the research model, each rated by the 5-point Likert scale. The survey was conducted online, and 301 copies of the effective questionnaire were withdrawn. Demographic statistics of the respondents show that there is an almost even split between males (about 50%) and females (about 50%), and the 25–40 age group is the largest. Most respondents have received vocational education or undergraduate education.

Table 1: Questionnaire.

Variable	No.	Measurement item	Source
Perceived usefulness	YA1	Autonomous driving (AD) is helpful when I'm too exhausted to drive.	Fagnant D. J. [6]
	YA2	The superiority of AD meets my needs when I drive.	
	YA3	AD and manual driving can both satisfy my needs.	
	YA4	AD enables people with poor driving skills to avoid potential accidents.	
Perceived ease of use	YB1	With AD, instead of MD, drives become more relaxed physically and mentally.	C. F. Chen [7]
	YB2	AD is easier to use than MD.	
	YB3	AD is easier to learn than traditional MD.	
	YB4	I'm proficient in operating the phone and other systems supporting AD.	
Perceived enjoyment	YC1	AD brings me a new experience.	Payre W. [2]
	YC2	AD can ease my driving stress.	
	YC3	I'll enjoy AD's high-tech vibe.	
	YC4	The AD-oriented trend is bound to sweep the world.	
Perceived risk	YD1	I'm afraid AD has security issues.	J. Jansson [3]
	YD2	I'm afraid AD might be out of control.	
	YD3	I'm afraid AD might be hacked.	
	YD4	I'm afraid bad communications network and other factors might influence driving.	
Perceived cost	YE1	AD increases the cost of the vehicle.	Krueger [8]
	YE2	I need to pay for more vehicle software service if I apply AD.	
	YE3	AD's unpredictability will result in more traffic accident requiring damages.	
	YE4	I have to learn more emergence responses if I apply AD.	
Conformity	YF1	I'd like to have a try if someone I know has an AD vehicle.	Zhang [9]
	YF2	I'll accept AD if it is used by most of the public.	
	YF3	I'd like to have a try if someone I know speaks high of it.	
	YF4	I think AD is cool.	
Intention to use	YG1	I'll buy an AD vehicle.	Gefen D. [10]
	YG2	I'll add AD feature to my vehicle.	
	YG3	I'll depend on AD more than MD.	

Table 2: Test of reliability and validity.

Second-level indicator	Number of terms	Cronbach's alpha	Kaiser–Meyer–Olkin	Statistical significance	Chi-square	Degree of freedom
Perceived usefulness	4	0.892	0.839	0.000	701.463	6
Perceived ease of use	4	0.947	0.800	0.000	1321.927	6
Perceived enjoyment	4	0.972	0.861	0.000	1737.610	6
Perceived risk	4	0.993	0.845	0.000	3129.441	6
Perceived cost	5	0.990	0.907	0.000	3432.655	10
Conformity	4	0.966	0.838	0.000	1585.521	6
Intention to use	3	0.901	0.756	0.000	581.878	3

A majority of them have a driving experience of two years or above.

4. Result Analysis

4.1. Analysis of Reliability and Validity. Reliability refers to the consistency or stability of a measure [11]. The study applies Cronbach's alpha to check the reliability of the measurement model. In the fundamental research, Cronbach's alpha value of 0.70 or higher indicates a good data reliability, which can be used for further analysis. The reliability results of the paper are shown in Table 2. Cronbach's alpha value of each factor is higher than 0.70 [12, 13], indicating that the measure is reliable.

Validity refers to the extent to which the measuring tools accurately measure what they are supposed to measure, including content validity and structure validity. Since the questionnaire of the study is designed based on measurement items adopted by the previous study, the content has a strong validity. The study applies Kaiser–Meyer–Olkin (KMO) and Bartlett's test of sphericity to check structure validity, with the KMO value of each variable higher than 0.7 [14], and Bartlett's test value is significant. Both reliability and validity are significant, and this indicates that each variable in the measurement model has great structure validity [15].

4.2. Analysis of Correlation and Regression. The paper conducts a Pearson correlation analysis of six factors including perceived usefulness, perceived ease-of-use, perceived enjoyment, perceived risk, perceived cost, and conformity, as well as the use intention factor. Analysis results are shown in Table 3. Obviously, perceived usefulness and perceived ease of use have an insignificant correlation with intention to use while, for other factors, the impact is significantly positive.

Table 3: Variable correlation.

Variable		Perceived usefulness	Perceived ease of use	Perceived enjoyment	Perceived risk	Perceived cost	Conformity	Intention to use
Perceived usefulness	Pearson correlation	1	0.499	0.044	−0.052	−0.017	−0.044	0.020
	Sig. (2-tailed)		0.000	0.444	0.367	0.775	0.450	0.724
	Number of cases	301	301	301	301	301	301	301
Perceived ease-of-use	Pearson correlation	0.499	1	0.090	0.001	−0.046	−0.007	0.007
	Sig. (2-tailed)	0.000		0.121	0.980	0.425	0.910	0.903
	Number of cases	301	301	301	301	301	301	301
Perceived enjoyment	Pearson correlation	0.044	0.090	1	−0.100	0.009	0.349	0.306
	Sig. (2-tailed)	0.444	0.121		0.082	0.872	0.000	0.000
	Number of cases	301	301	301	301	301	301	301
Perceived risk	Pearson correlation	−0.052	0.001	−0.100	1	−0.014	−0.115	−0.249
	Sig. (2-tailed)	0.367	0.980	0.082		0.807	0.046	0.000
	Number of cases	301	301	301	301	301	301	301
Perceived cost	Pearson correlation	−0.017	−0.046	0.009	−0.014	1	0.087	−0.244
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.000
	Number of cases	301	301	301	301	301	301	301
Conformity	Pearson correlation	−0.044	−0.007	0.349	−0.115	0.087	1	0.517
	Sig. (2-tailed)	0.450	0.910	0.000	0.046	0.132		0.000
	Number of cases	301	301	301	301	301	301	301
Intention to use	Pearson correlation	0.020	0.007	0.306	−0.249	−0.244	0.517	1
	Sig. (2-tailed)	0.724	0.903	0.000	0.000	0.000	0.000	
	Number of cases	301	301	301	301	301	301	301

Table 4: Regression results with intention to use as the dependent variable.

Independent variable	Standardized regression coefficient	T-value	Statistical significance	Significant or not
Perceived usefulness	0.020	0.354	0.724	No
Perceived ease of use	0.003	0.053	0.958	No
Perceived enjoyment	0.321	5.864	0.000	Yes
Perceived risk	−0.244	−4.357	0.000	Yes
Perceived cost	−0.246	−4.388	0.000	Yes
Conformity	0.529	10.786	0.000	Yes

Table 5: Summary of hypothesis testing.

Hypothesis	Content	Yes or no
H1	Perceived usefulness has a significant positive impact on intention to use	No
H2	Perceived ease of use has a significant positive impact on intention to use	No
H3	Perceived enjoyment has a significant positive impact on intention to use	Yes
H4	Perceived risk has a significant negative impact on intention to use	Yes
H5	Perceived cost has a significant negative impact on intention to use	Yes
H6	Conformity has a significant positive impact on intention to use	Yes

In addition, regression results of each independent variable and intention to use as the dependent variable are shown in Table 4. Regression results of other hypotheses are shown in Table 5.

4.3. Summary of Hypothesis Testing Results. The results of hypothesis testing are included in Table 5, which, together with the above analyses, confirm the relationship between variables of the theoretical model constructed in the paper.

5. Analysis and Conclusion

Surprisingly, in terms of the analysis results of statistical significance and regression, perceived usefulness and perceived ease-of-use have no correlation and regression relationship with unmanned driving technology. On the contrary, perceived enjoyment and conformity have a significant positive impact on the technology. Also, perceived risk and perceived cost have a significant negative impact. In this regard, currently, what drives people to accept unmanned driving technology, a new technology that is novel and trendy, is mainly enjoyment and conformity. Its popularization also motivates more people to have a try. Risk and cost constitute two major barriers for acceptance. Usefulness and ease of use, that is, functionality and convenience, are not critical factors for now [16].

It is surprising that perceived usefulness and perceived ease of use are not the acceptable factors when people use the self-driving technology, for they are the most important indicators of the technology acceptance model. But if we return to the original problem analysis, which is what, after all, attracts new users trying to use self-driving technology, it can be found that the interest and user experience of unmanned driving technology are the most important factors in this period of time. However, with the popularization of autonomous driving technology, the usefulness and ease of use of unmanned driving technology will eventually become significant factors for people to accept it.

Regarding the risk and cost of unmanned driving technology, users' top concerns are privacy security [17], driving safety, communications stability, and software cost. On the one hand, for companies seeking for technological improvement, these concerns may be inspiring. On the other hand, they will hinder the universal access to this technology. More importantly, companies in the sector shall carry out in-depth research so as to make the technology's functions more useful and easier to use. Though research shows that regarding this novel technology, currently usefulness and ease of use have less impact on users, it can never win over and retain users by its novelty in the long run [18]. This poses challenges to companies.

In conclusion, unmanned driving technology will be a new trend in the future. At the current phase, it has already become a focus of high-tech companies. Once it is mature, we will see the technological transformation and industrial restructuring in vehicle manufacturing, transport, energy, entertainment, and other industries [19]. However, user attitude from the survey indicates that people will not get rid of manual driving and turn to driverless vehicles just because of the functionality and convenience of unmanned driving technology. What lies behind this shift now are novelty and conformity. But the pattern will change. While functionality and convenience lack attraction, cost and risk are negative factors that require users' consideration. The two also impede the popularization of unmanned driving technology. Relevant companies may conduct targeted improvement of unmanned driving technology based on this study, which is informative for the technology's large-scale application.

Data Availability

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

Conflicts of Interest

The authors declare no conflicts of interest.

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Retraction

Retracted: English Teaching Evaluation Model Based on Association Rule Algorithm and Machine Learning

Security and Communication Networks

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret 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 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. Yin and Z. Xu, "English Teaching Evaluation Model Based on Association Rule Algorithm and Machine Learning," *Security and Communication Networks*, vol. 2022, Article ID 2305013, 11 pages, 2022.

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Research Article

English Teaching Evaluation Model Based on Association Rule Algorithm and Machine Learning

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At present, Chinese colleges and universities have a clear understanding of the importance of teaching quality evaluation. They regard the evaluation of teaching quality as an important part of teaching management. This paper aims to study how to analyze and study English teaching evaluation based on association rule algorithm and machine learning and study the model. This paper raises the question of English teaching evaluation. This question is based on modelling studies. So it expounds the concepts and related algorithms of association rule algorithm and machine learning. This paper designs and analyzes a case study of the English teaching evaluation model. The experimental results show that taking a university as the empirical object for specific analysis, according to the evaluation system established in the research, the final score of the questionnaire is 89.2 points, and the English teaching evaluation result is a good grade.

1. Introduction

With the fast advancement of the size of advanced education, the nature of instructing has turned into a critical issue. Instructions to successfully and impartially assess the showing nature of school instructors are one of the central points of interest in the examination of universities and instructive organizations lately. Teachers' teaching quality assessment is an effective measure for schools to improve the overall teaching quality. It effectively adapts to teaching behavior, optimizes the structure of teachers, and promotes the improvement of teachers' teaching level and the systematic and scientific management of teachers.

Teachers' teaching quality assessment can create suitable direction and motivation for teachers to improve their own ability, and can promote the improvement of teachers' teaching quality and teaching level, and further develop the quality of education. Along these lines, it is of incredible importance to lead top to bottom and efficient exploration on the current showing assessment model and to make an appropriate showing assessment model on this premise.

The innovation of this paper: (1) This paper combines association rule algorithm, machine learning, and English teaching evaluation. It introduces the theory and related methods of machine learning in detail. It mainly introduces decision tree algorithm, random forest, and multiple linear regression. (2) In the face of English teaching evaluation index, it constructs the English teaching evaluation system.

2. Related Work

Showing assessment is the judgment of educators' instructing and understudies' learning esteem. It has become an important part of school teaching management and teaching process. Villanueva K A described the practice of teaching assessment in national engineering programs to understand and assess the current state of practice [1]. Wu took the "College English" course as an example to discuss the relationship between blended teaching and ideological and political teaching and analyzed the teaching method of blended teaching. He also put forward suggestions on the reform of the evaluation system in two parts [2]. Zhang

utilized GIS versatile terminal to examine the homeroom showing assessment and direction framework. He made showing more viable through his exploration on instructing assessment [3]. Ruslim explored the relationship between teaching evaluation and lecturer performance [4]. In light of AI, Liu momentarily presented the foundation and current circumstance of instructing assessment. He likewise presented exhaustively the significant calculation standards for information examination and demonstrating utilizing information mining innovation and AI strategies [5]. Myerholtz *L* explored the existing and desirable characteristics of teacher instructional assessment systems from the perspective of key stakeholders [6]. Liu mainly studied a rule extraction algorithm based on incomplete multiexpert fuzzy language form decision context [7]. Sheng established a theoretical framework for judging the validity of teaching evaluation scores on the basis of item response theory [8]. However, they did not conduct a multifaceted discussion and did not establish a model with practical application significance.

3. Methods Based on Association Rule Algorithms and Machine Learning

3.1. Machine Learning

3.1.1. Overview. In the field of machine learning and data mining, classification has always been a very important research direction. The purpose of the classification operation is to generalize and analyze the selected data set to obtain a model or function used in the classification operation. This classification model or function can correspond to a known class label for the sample data to be classified. Both classification and regression algorithms can be used in forecasting research. However, different from the regression algorithm, the output result of the classification method is discrete data, which is the value of the category to which the sample data belongs. The regression method outputs continuous data or ordered values [9, 10].

The core of regression algorithm and classification algorithm is to obtain predicted value based on input value. The difference between the two algorithms is the type of output value. The output of the regression algorithm is a continuous variable, while the output of the classification algorithm is a discrete variable.

3.1.2. Decision Tree Algorithm. Decision tree algorithm is one of the most commonly used machine learning algorithms. It is the process of sorting or regressing data through a variety of operating rules [11]. Decision tree can be divided into classification decision tree and regression decision tree classification. Decision trees classify discrete variables and regression decision trees perform regression calculations on continuous variables. An example of a decision tree is shown in Figure 1.

The decision tree algorithm builds a tree, a data structure, to discover possible classification or regression rules in

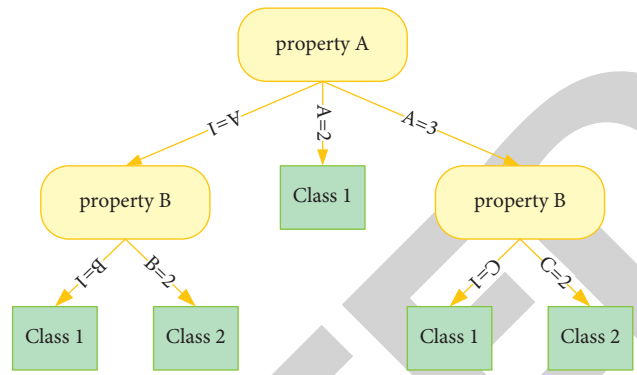

Figure 1: Decision tree legend.

the data. The core of the decision tree algorithm is to ensure that the constructed decision tree must have the characteristics of high accuracy and small scale. The first is the generation of decision trees: it requires dividing the dataset to be trained into decision trees. The second is the pruning of the decision tree: it uses the pruning technology to detect the decision tree generated in the previous step. This is mainly to use the validation set to test the classification and regression rules of the decision tree and remove those branches that affect the accuracy [12, 13].

The steps of the decision tree algorithm are as follows:

(1) It starts with a single node of the training set.

(2) If the attributes all belong to a set, it marks the tree node to be a leaf.

(3) Otherwise, the algorithm will select the attribute with the most powerful classification ability as the current node of the tree.

(4) The training will be divided into many subsets according to the difference of the attribute values of the nodes currently to be divided, and each attribute value is divided into a branch. It recursively executes the previous steps to construct a decision tree for the subsets obtained by the previous steps.

(5) It stops the classification step when one of the following conditions is met: all samples to be trained are classified into the same class. All properties are already used when dividing the samples. If a branch does not contain already classified samples, then it divide the larger number of samples into a leaf.

Because the C4.5 algorithm has the ability to perform calculations on continuous variables, the C4.5 algorithm is used when selecting attributes. When selecting attributes for division, the C4.5 algorithm uses the information gain rate for consideration. This avoids the selection defect of attributes with many values when using information gain. The information gain rate is defined as follows:

$$GainRatio(Z) = \frac{Gain(Z)}{SplitInfo(Z)}. \quad (1)$$

Gain(Z) is the information gain, and its formula is as follows:

$$Gain(Z) = Info(Q) - Info_Z(Q). \quad (2)$$

And SplitInfo(Z) is the split information value, and its formula is as follows:

$$SplitInf(Q) = -\sum_{b=1}^{u} \frac{|Z_B|}{|Z|} \times \log_2\left(\frac{|Z_B|}{|Z|}\right). \quad (3)$$

Decision tree algorithm has the advantages of high classification accuracy, simple generation algorithm, anti-noise data, and good robustness. It has been extensively studied and explored by researchers in the field of machine learning.

3.1.3. Random Forest. Random Forest is a machine learning method developed by a professor at the University of California, Los Angeles in 1995. Random forest is a modern machine learning technique. It has both classification and regression functions and can also perform autonomous learning [14].

Random forest is a basic learner with a decision tree as the bottom layer, and then a method of selecting random attributes is added when training the decision tree, and finally, these basic learners are built using Bagging ensemble. The process framework of random forest is shown in Figure 2, and the algorithm steps are as follows:

(1) It uses a sampling technique to select m data from the training set.

(2) It selects z attributes using random attribute selection technique and then selects an optimal node to build a decision tree. z is generally $\log_2 p$, and p represents the total number of attributes.

(3) It repeats the above two steps n times to create n decision trees.

(4) These n decision trees form a random forest.

(5) It obtains the final output result through voting method.

3.1.4. Multiple Linear Regression. The multiple linear regression model is one of the commonly used algorithms for solving regression problems.

The univariate linear regression model is suitable for use when only one variable has a large effect on the outcome. In practical regression problems, the results are rarely affected by a single variable, so multiple linear regression works well in practice [15].

Assuming that there is a linear relationship between the target variable Y and multiple variables X_1, X_2, ..., X_j, the relationship between Y and X_1, X_2, ..., X_j can be calculated by a linear function, which is called a multiple linear regression model. Its formula system form is as follows:

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \ldots \alpha_j X_j + \eta. \quad (4)$$

Y is the target variable, X_1 , X_2 , ..., X_j are j variables, $\alpha_b (b = 0, 1, 2, \ldots, j)$ is the $j+1$ parameters to be solved, and η is the random error term.

The linear formula between the expected value of the target variable Y and the variables X_1 , X_2 , ..., X_j is the overall regression formula. Its formula system form is as follows:

$$E(Y) = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \ldots \alpha_j X_j. \quad (5)$$

For m groups of observations X_{1a}, X_{2a}, ..., X_{jb}, $Y_a (1, 2, \ldots, m)$, the formula is in the following form:

$$Y_a = \alpha_0 + \alpha_1 X_{1a} + \alpha_2 X_{2a} + \ldots \alpha_j X_{ja} + \eta_a, (a = 1, 2, \ldots, m). \quad (6)$$

Its matrix form is as follows:

$$\begin{bmatrix} Y_1 \\ Y_2 \\ \ldots \\ Y_a \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ \ldots \\ 1 \\ X_{11} \\ X_{12} \\ \ldots \\ X_{1m} \\ X_{21} \\ X_{22} \\ \ldots \\ X_{2m} \\ \ldots \\ \ldots \\ \ldots \\ \ldots \\ X_{j1} \\ X_{j2} \\ \ldots \\ X_{jm} \end{bmatrix} \begin{bmatrix} \alpha_0 \\ \alpha_1 \\ \ldots \\ \alpha_j \end{bmatrix} + \begin{bmatrix} \eta_1 \\ \eta_2 \\ \ldots \\ \eta_m \end{bmatrix}, \quad (7)$$

where Y_a is the observation matrix vector of Y, X_{jm} is the observation matrix vector of variables X_1, X_2, ..., X_j , α_j is the regression coefficient matrix vector, and η_m is the random error term matrix vector.

The multiple linear regression model contains multiple variables, and multiple variables act on the target variable Y at the same time. If it wants to evaluate the influence of one of the variables on the target variable Y, it must be stipulated that the quantitative analysis and calculation should be carried out under the condition that the other variables remain unchanged. Therefore, the regression coefficients in the model are partial regression coefficients. It can also be said that when other variables are fixed, the influence of one of the variables on the target variable Y can be viewed.

Since parameters $\alpha_B (b = 0, 1, 2, \ldots, j)$ are all unknown, X_{1a}, X_{2a}, ..., $X_{j\tau}$, $Y_a (1, 2, \ldots, m)$ can be used to estimate

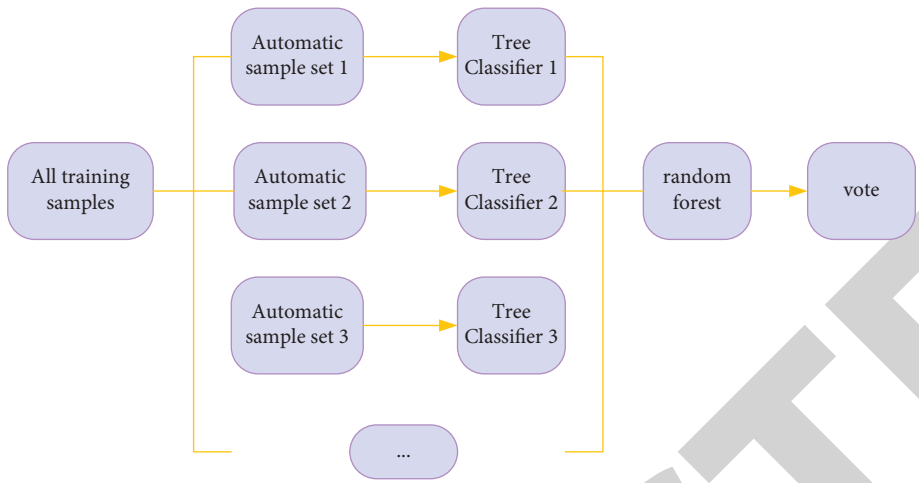

Figure 2: Random forest process frame diagram.

them. Assuming that after the calculation, the obtained parameter estimate can be expressed as $\widehat{\alpha}_B\,(b = 0, 1, 2, \ldots, j)$, then the parameter $\widehat{\alpha}_B\,(b = 0, 1, 2, \ldots, j)$ in the above regression formula can be replaced by $\alpha_B\,(b = 0, 1, 2, \ldots, j)$, then the multiple linear sample regression formula is as follows:

$$\widehat{Y}_a = \widehat{\alpha}_0 + \widehat{\alpha}_1 X_{1a} + \widehat{\alpha}_2 X_{2a} + \ldots + \widehat{\alpha}_j X_{jm}, \tag{8}$$

where $\widehat{\alpha}_b\,(b = 0, 1, 2, \ldots, j)$ is the parameter estimate, while $\widehat{Y}_B\,(b = 0, 1, 2, \ldots, j)$ is the sample regression value of Y_a.

Residual e_τ is the difference between the estimate of the target variable obtained from the multiple linear sample regression formula and the true value Y, The system of equations for residual e_τ is defined as follows:

$$e_\tau = Y_a - \widehat{Y}_a = Y_a - \left(\widehat{\alpha}_0 + \widehat{\alpha}_1 X_{1a} + \widehat{\alpha}_2 X_{2a} + \ldots + \widehat{\alpha}_j X_{jm}\right). \tag{9}$$

The multiple linear regression model has the following advantages:

(1) The model can be constructed simply and conveniently

(2) If the data are determined, the calculation result of the model is unique

(3) The model can quantitatively evaluate the degree of correlation between each variable

3.1.5. Naive Bayes Algorithm. Naive Bayes algorithm is a very representative machine learning classification algorithm, and it is also a classic classification method based on probability theory. Naive Bayes has the characteristics of simple and easy-to-understand principles and easy implementation. Therefore, the Naive Bayes algorithm is applied in many fields [16, 17]. In the Naive Bayes algorithm, it is considered that each feature attribute is independent of each other, and there is no interdependent relationship.

Structure diagram of the Naive Bayesian model is shown in Figure 3.

For a given training data set, it first assumes that each feature attribute is independent of each other and learns the joint probability of input data and output class. It then uses Bayes' theorem to calculate its posterior probability based on the sample to be classified by this model. The category value corresponding to the maximum posterior probability is the final classification result of the sample to be classified. Assuming that the feature attributes are independent of each other, the posterior probability is as follows:

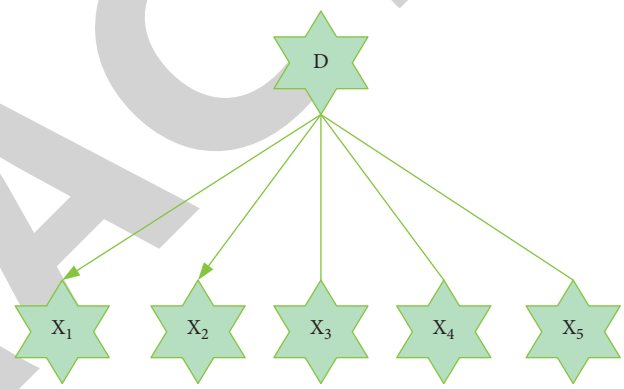

Figure 3: Schematic diagram of the structure of the Naive Bayes model.

$$P(d|s) = \frac{P(d)P(s|d)}{P(s)} = \frac{P(d)}{P(s)} \prod_{a=1}^{m} P(s_a|d). \tag{10}$$

The formula of Naive Bayesian classification is as follows:

$$h(s) = \arg\max P(d) \prod_{a=1}^{m} P(s_a|d). \tag{11}$$

Preparing a guileless Bayes classifier is to involve the information in the preparation dataset to compute the earlier likelihood of each class and the restrictive likelihood of each quality. The formula for working out the earlier likelihood of a class is as per the following:

$$P(d) = \frac{|C_d|}{|C|}. \tag{12}$$

In the formula, $|C_d|$ represents the total number of samples whose class label is d in the training data set C, and $|C|$ is the total number of samples in the training data set.

The calculation of conditional probability depends on the type of data. If the data of the feature attributes are discrete values, the conditional probability is the ratio of the a-th feature attribute value of the class label d in the training data set to the total number s_a of samples $|C_{d,s_a}|$ to the number of samples $|C_d|$ of the class label d. The formula is as follows:

$$P(s_a|d) = \frac{|C_{d,s_a}|}{|C_d|}. \tag{13}$$

If the feature attribute is continuous data, according to the probability density function, it is assumed that the conditional probability obeys the normal distribution:

$$P(s_a|d) = \frac{1}{\sqrt{2\pi\delta_{d,a}}}\exp\left(-\frac{(s_a - \vartheta_{d,a})^2}{2\delta_{d,a}^2}\right), \tag{14}$$

where $\vartheta_{d,a}$ is the mean on the a-th feature attribute in category d and $\delta_{d,a}^2$ is the variance on the a-th feature attribute in category d.

3.2. Data Mining

3.2.1. Concept. Data mining (DM for short) is simply to mine or extract knowledge from a large amount of data [18]. Data mining is also known as knowledge discovery from database (KDD for short). It is a complex process of extracting and mining unknown and valuable patterns or laws from a large amount of data. The process is shown in Figure 4.

As should be visible from Figure 4, the whole information mining process incorporates various mining stages. What's more, information mining is only one of the primary advances. Although information mining is only an important stage in the whole information mining process, but the expression is just a significant stage in the entire information mining process. However, the expression "information mining" has been broadly utilized and for the most part acknowledged in the fields of industry, media, and data set research. Data mining is the discovery of interesting knowledge from large amounts of data in databases, data warehouses, or other information repositories.

3.2.2. Classification Algorithm: Support Vector Machine. The SVM can correctly classify all training samples such that the points in the training samples are closer to the grading surface to the longest distance from the grading surface. Solving the optimal separating hyperplane is the basis of the support vector machine, which enables the training data to be divided correctly and the geometric spacing is maximized. For linearly separable datasets, the basic idea and formalized convex quadratic programming problem are as follows:

$$\begin{aligned} &\max_{wb} \chi \\ &s.t. y_i\left(\frac{w}{\|w\|}\cdot x_i + \frac{b}{\|w\|}\right) \geq \chi, i = 1, 2, \ldots N, \end{aligned} \tag{15}$$

where $\chi_i = y_i((w/\|w\|)\cdot x_i + (b/\|w\|))$ defines the geometric space of the hyperplane relative to the sampling point (x_i, y_i), and $\chi = \min_{i=1,2,\ldots N} \chi_i$ is the minimum value of the geometric space of the hyperplane at all sampling points.

$$\begin{aligned} &\min_{\alpha} \frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N}\alpha_i\alpha_j y_i y_j (x_i \cdot x_j) - \sum_{i=1}^{N}\alpha_i \\ &s.t. \sum_{i=1}^{N}\alpha_i y_i = 0 (0 \leq \alpha_i \leq C, i = 1, 2, \ldots N). \end{aligned} \tag{16}$$

Among them, the penalty parameter $C > 0$, and the most E solution is $\alpha^* = (\alpha_1^*, \alpha_2^*, \ldots, \alpha_N^*)^T$.

For nonlinear classification, the interinstance inner product can be turned into a kernel function. For x, k in any input space, we have the following equation:

$$Z(x, k) = \varphi(x)\cdot\varphi(k), \tag{17}$$

Support vector machines have been widely used in neuroscience and bioinformatics because the algorithm can handle high-dimensional data well. Its main disadvantage is the large amount of calculation and easy overfitting.

3.3. Association Rule Algorithm

3.3.1. Introduction. One of the most widely used methods in data mining is association rules. It mainly studies the problem of what implies what. Here are some basic concepts.

(1) Items and itemsets: each field in the data table has a different value, and each value is an item. A set of objects is described as a set of elements, while a set of k objects is represented as a set of k elements.

It sets item set $A = \{A_1, A_2, A_3, \ldots, A_l\}$ because the itemset contains l items, so is called an l-itemset, such as {English, mathematics} is a 2-item set.

(2) Transaction: transactions are a subset on itemset A, i.e., $W \subseteq A$. It is represented by the identifier WAS, and the database transaction set is composed of transactions, represented by S.

(3) Support number and support: the support count is the number of times the itemset X appears in the transactional database, represented by ϕ_x. Support (support) is the ratio of the support number of the itemset to the total number of transactions in the transaction database, which can be represented by X.sup or supprt(X). The calculation of support is shown in the following formula:

$$\sup port(X) = \frac{\phi_X}{|S|}, \tag{18}$$

where $|S|$ represents the total number of transaction database transactions.

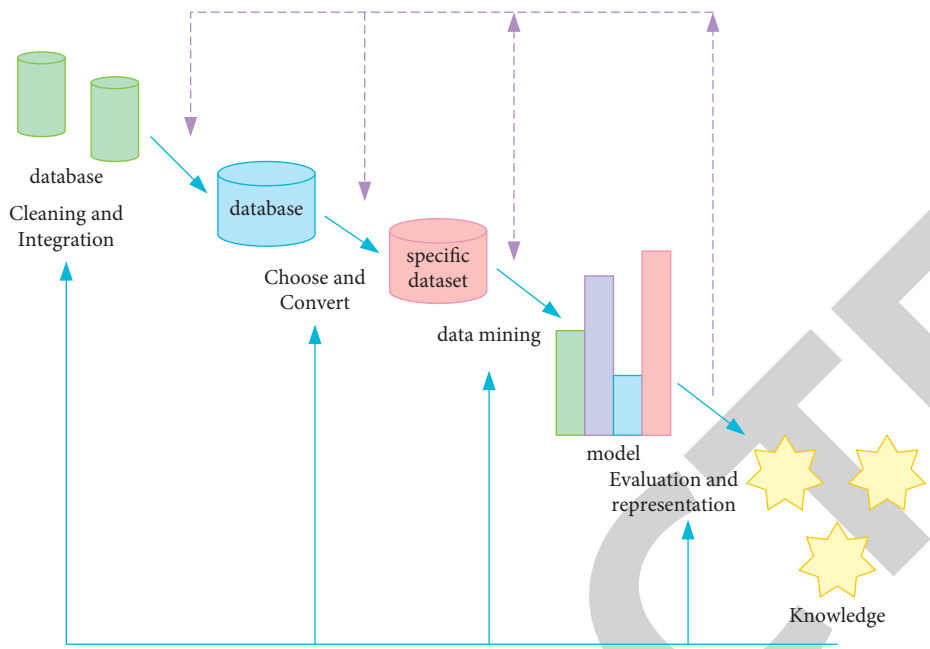

Figure 4: Schematic description of the whole process of knowledge mining.

Minimum user-defined support can be represented by min_sup.

(4) Confidence: confidence is a feature of association rules. The trust degree of association rule $X \Rightarrow Y$ describes that a transaction in the transaction database contains both X and Y and can be represented by $conf(X \Rightarrow Y)$. Its calculation method is shown in the following formula:

$$conf(X \Rightarrow Y) = \frac{support(X \cup Y)}{support(X)}, \tag{19}$$

Likewise, the minimum confidence level is set by the user and can be represented by min_conf.

(5) Frequent itemsets: if an itemset X has a relationship: $\phi_x \geq \min x\_\sup * |S|$ or $support(X) \geq \min x\_\sup$, then X is called a frequent itemset or a large itemset. The core work of mining association rules is to find frequent itemsets.

(6) Association rules: an association rule is an implication $X \Rightarrow Y$ of the form, where $X \subseteq A$ and $Y \subseteq A$, it is used to describe the implicit relationship that exists between the data items in the transaction database. X is its predecessor and Y is its successor.

Its support degree $support(X \longrightarrow Y)$ is greater than or equal to the specified minimum support degree min_sup, that is, the transaction number of $support(X \longrightarrow Y) * |S|$ in the transaction database contains both X and Y.

Its confidence level of $conf(X \Rightarrow Y)$ is greater than or equal to the set minimum confidence level min _conf, that is, there is a possibility of $conf(X \Rightarrow Y)$ that the transaction in the transaction database contains Y when it contains X.

3.3.2. Excavation Process. The main work of association rules includes the following two aspects:

(1) It finds frequent itemsets: it finds itemsets whose help degree is more noteworthy than or equivalent to the base set by the client. For rules that require constraint semantics, it looks for itemsets that conform to the specification.

(2) Generating association rules: the association rules are generated from the frequent itemsets found in step 1, and the confidence of these association rules is not less than the minimum confidence given by the user. If there is a frequent item set L, it is necessary to check each nonempty subset X of L in turn, generate an association rule $x = L - X$, and obtain the confidence level of the association rule. It retains the association rules whose confidence is not less than the minimum confidence and discards the rest. According to the nature of association rules, this step can be simplified to first check the largest subset of L as the antecedents of the rule. It is only necessary to test smaller subsets when the conditions are met [19].

Because the process of generating association rules no longer scans the transaction database, the first step in the mining process is to discover frequent itemsets.

The whole process of mining association rules can be simplified as shown in Figure 5.

3.3.3. Classification. Association rules are the first problem involved in data mining, and it is also a major trend in the development trend of data mining. In the early days, data mining was primarily concerned with defining and designing algorithms for relevant rules. As more and more researchers join in the study of association rules, there are thousands of association rules papers in various forms, showing a state of blooming. According to the different dimensions of the connection rules, they are divided into the following types (Figure 6).

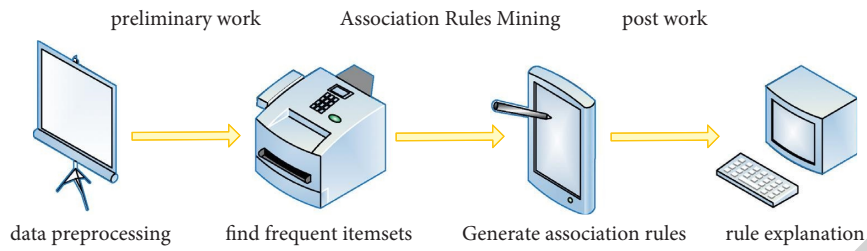

Figure 5: Association rule mining process diagram.

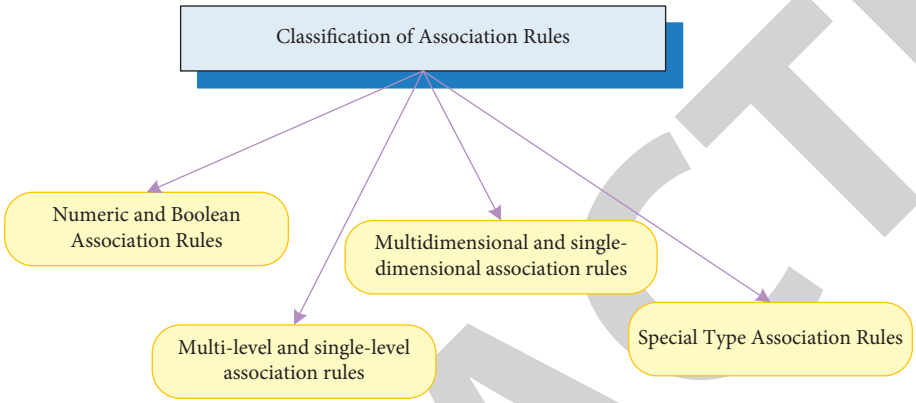

Figure 6: Classification of association rules.

4. Experiment and Analysis of the English Teaching Evaluation Model

4.1. Constructing the English Teaching Evaluation System. According to the requirements of the "National College English Curriculum Guidance Outline", China aims to strengthen the educational evaluation concept of continuous improvement between teachers and students. It applies modern sociology, pedagogy, and other theories [20], starting from various conditions and related aspects of English teaching, as shown in Figure 7(a).

Physical education in colleges and universities is an important part of education. Its teaching quality directly reflects the school's teaching level and even affects the reform of the entire educational process. The index content of the evaluation system is mainly composed of five indicators: lesson preparation, teaching content, teaching attitude, teaching effect, and teaching organization (Figure 7(b)).

The hierarchical structure model of English teaching evaluation is divided into three-level indicators, including one level-1 indicator, five level-2 indicators, and 20 level-2 indicators. The first level index is the target level, that is, the comprehensive evaluation of English teaching. The second level index is the main factor layer, including lesson preparation, teaching content, teaching organization, teaching attitude, and teaching effect. The third level indicator is the secondary factor layer. It includes reasonable preparation of teaching plans, reasonable design of teaching methods, adequate preparation of venue equipment, sufficient understanding of students' situation in teaching, active teaching in classroom atmosphere, reasonable progress of physical education courses, large amount of teaching content, accurate teaching content, passwords, movements, novel teaching content, reasonable use of venue equipment, the continuity of the teaching process is strong, the course progress is reasonable, the teachers are proficient in basic teaching skills, get out of class is on time, the students are the main body, the communication between teachers and students in the classroom is good, the students have mastered the sports skills they have learned, the content is interesting, the students' physical and mental exercise are exercised, and the students' interest in sports learning is improved.

It uses the collective survey method to determine the importance of each indicator for five 2-level indicators. It divides the importance of each indicator into five levels (5 points for very important, 4 points for more important, 3 points for general, 2 points for not very important, and 1 point for very unimportant): very important, relatively important, general, not very important, and very unimportant, respectively. It judges the importance of each index in the evaluation system according to the scores of 10 experts. A ratio below 0.70 indicates that the indicator is not very important. The judgment results are shown in Tables 1 and 2.

Finally, an English teaching evaluation index system including twenty 3-level indicators and five 2-level indicators was constructed through the screening of level 2 and level 3 indicators; they are shown in Table 3.

4.2. Demonstration of the English Evaluation System in a University. The questionnaires for leaders or teachers and students in this paper are designed according to the three-level indicators in the evaluation index system. The issues

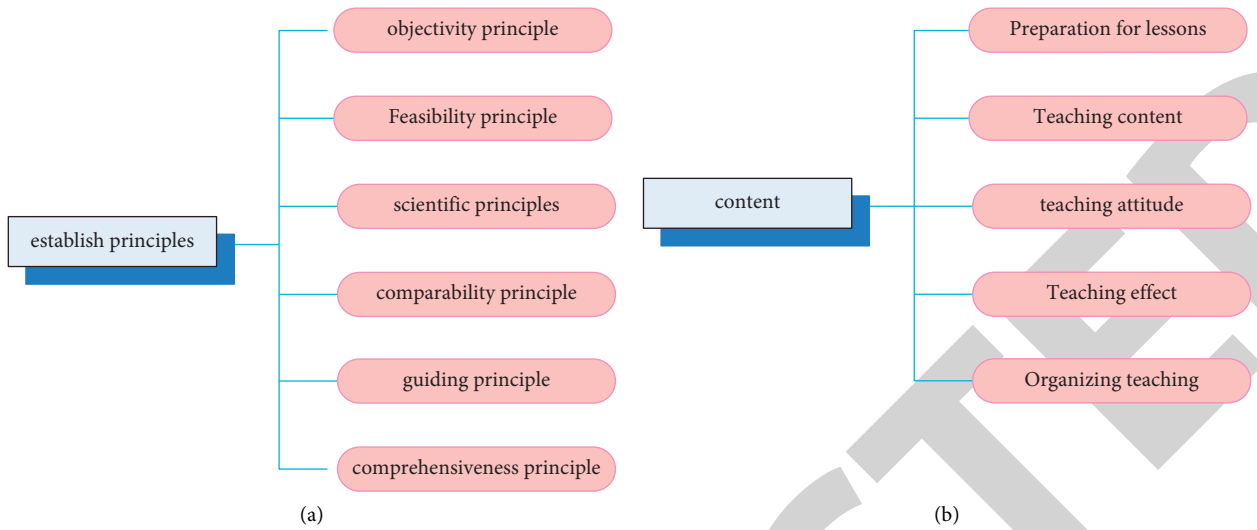

Figure 7: English teaching evaluation system. (a) Principles of establishing English teaching evaluation indicators. (b) Contents involved in the English teaching evaluation system.

Table 1: Experts' views on the importance of secondary indicators of English teaching evaluation.

Secondary indicators	Relative importance					Total	Full score	Ratio
	5	4	3	2	1			
Preparation for lessons	7	2	1			46	50	0.92
Teaching content	8	2				48	50	0.96
Teaching organization	9	1				49	50	0.98
Teaching attitude	7	2	1			46	50	0.92
Teaching effect	9	1				49	50	0.98

Table 2: Experts' views on the importance of the three-level indicators of English teaching evaluation.

Three-level indicator	Relative importance					Total	Full score	Ratio
	5	4	3	2	1			
Reasonable writing of lesson plans C11	3	5	2			41	50	0.82
Reasonable design of teaching methods C12	5	1	4			41	50	0.82
Textbook resources are well prepared C13	4	3	3			41	50	0.82
Fully understand the situation of students in teaching C14	5	2	2	1		41	50	0.82
Interesting teaching content C21	5	1	4			41	50	0.82
English course progress is reasonable C22	8	1	1			47	50	0.94
The teaching content has a large amount of information C23	7	3				47	50	0.94
Correct teaching content C24	5	4	1			44	50	0.88
Novel teaching content C25	3	5	2			41	50	0.82
Teachers are proficient in basic teaching skills C31	5	2	2	1		41	50	0.82
Be on time for class and end of get out of class C32	2	3	2	3		34	50	0.68
Active classroom atmosphere C33	4	3	3			41	50	0.82
Student-centered C34	6	2	2			44	50	0.88
Good communication between teachers and students in the classroom C41	6	4				46	50	0.92
Students master the English knowledge they have learned C42	8	2				48	50	0.96
Students' English ability is improved C43	7	3				47	50	0.94
Students' interest in English learning increases C44	10					50	50	1.0
Reasonable use of teaching materials C51	6	2	2			44	50	0.88
Strong continuity of teaching process C52	9	1				49	50	0.98
Scientific rigorous C53	9	1				49	50	0.98

involved are classified and transformed accordingly according to the subject of the evaluation. It finally forms two related questionnaires for leaders (i.e., teachers) and students, respectively.

It uses the established English teaching evaluation model, compares it according to the unified Saatyl-9 judgment matrix standard scale, and constructs six judgment matrixes. The weight of English teaching evaluation

Table 3: English teaching evaluation structure model.

	Secondary indicators	Three-level indicator
English teaching evaluation system	Preparation for lessons B1	Reasonable writing of lesson plans C11
		Reasonable design of teaching methods C12
		Textbook resources are well prepared C13
		Fully understand the situation of students in teaching C14
	Teaching content B2	English course progress is reasonable C22
		The teaching content has a large amount of information C23
		Correct teaching content C24
		Novel teaching content C25
	Teaching organization B3	Interesting teaching content C21
		Student-centered C34
		Active classroom atmosphere C33
		Teachers are proficient in basic teaching skills C31
		Be on time for class and end of get out of class C32
	Teaching attitude B4	Students' interest in English learning increases C44
		Students master the English knowledge they have learned C42
		Students' English ability is improved C43
		Good communication between teachers and students in the classroom C41
	Teaching effect B5	Strong continuity of teaching process C52
		Scientific rigorous C53
		Reasonable use of teaching materials C51

Table 4: $B1$, $B2$, $B3$, $B4$, and $B5$ judgment rectangle matrix for A.

A	$B1$	$B2$	$B3$	$B4$	$B5$
$B1$	1	1/3	1	1/5	1/5
$B2$	3	1	3	1/3	1/3
$B3$	1	1/3	1	1/5	1/5
$B4$	5	3	5	1	1
$B5$	5	3	5	1	1

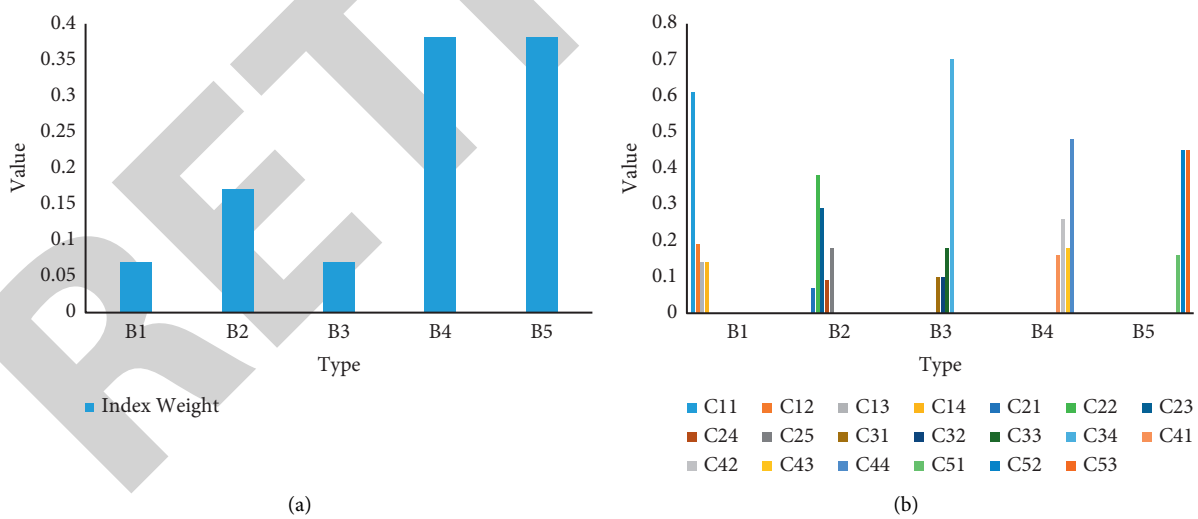

Figure 8: Comparison of indicator weights. (a) Comparison. (b) Weight value comparison.

index adopts "Delphi method." It invited 10 experts in the field of English teaching. After three rounds of expert questionnaires, it finally calculated the indicator weights. This paper takes the calculation method of $B1$, $B2$, $B3$, $B4$, and $B5$ for the judgment rectangular matrix of A as an example (Table 4).

The index weights are calculated according to Table 4, and the comparison is shown in Figure 8(a). It calculates the weights of the remaining five rectangular matrices, and the weight value comparison is shown in Figure 8(b).

A random questionnaire survey was conducted among 231 students. Among them, 121 girls and 110 boys were all

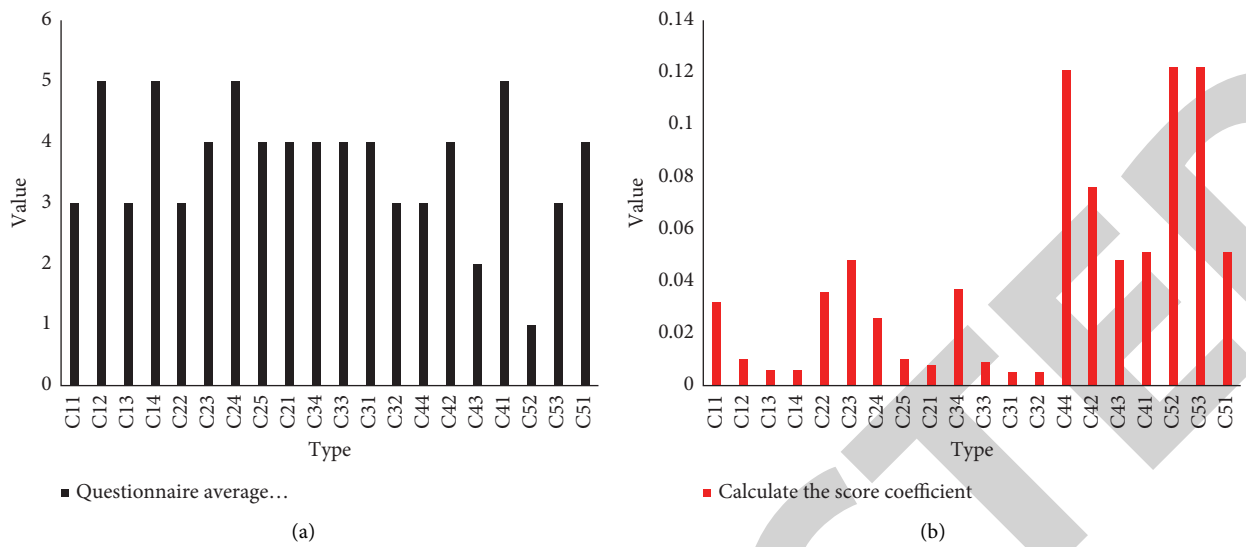

Figure 9: Questionnaire data graph. (a) Questionnaire recovery. (b) Calculation of the score coefficient.

valid questionnaires, and the questionnaire recovery rate was 100%. The survey statistics are shown in Figure 9(a).

It divides the average score of the questionnaire in the statistical situation table by five (because there are 5 secondary indicators). The obtained value is multiplied by the corresponding total weight value and multiplied by 100% to obtain a final score of 89.2 points. The student's questionnaire results rated the teacher as good. The final score is more scientific and more reasonable than the primary score, as shown in Figure 9(b).

5. Discussion

This paper analyzed how to conduct research on English teaching evaluation based on association rule algorithms and machine learning. This paper expounds the association rule algorithm and machine learning concepts and algorithms; studies machine learning; and explores data mining. It also analyzes the applicability of association rule algorithm and machine learning in teaching evaluation through experiments.

There are many common teaching evaluation systems, most of which evaluate the behavior of teachers, while the learning process and effects of students are rarely mentioned. Simultaneously, the work process of carrying out showing assessment is bulky, and it frequently needs to finish an enormous number of information estimation undertakings. Subsequently, how to utilize present-day science and innovation to lay out a total, objective, and feasible classroom teaching evaluation system and optimize the evaluation process is an important problem that needs to be solved urgently.

Based on the principle of English teaching evaluation, it uses the Delphi method to collect indicators through expert questionnaires to determine the English teaching evaluation model. It calculates the weight coefficient of the index according to the calculation index weight coefficient and establishes a matrix of relative importance one by one in combination with the implementation status of the English teaching evaluation by experts. It has a certain scientific basis, thus avoiding the artificial subjective intentionality of the evaluation in most studies.

6. Conclusion

Information investigation is indivisible from information mining, which is a progression of examination and handling of information. The information is examined in mining structure on the guideline of affiliation rules. The use of related information has gotten broad consideration, so how to work on the functional proficiency of affiliation rules has generally been the focal point of exploration. The utilization of information mining innovation in the field of schooling has not been read up for quite a while. As individuals focus on this innovation, it is accepted that its execution in the field of instruction will turn out to be increasingly broad, and it will assume a gigantic part in advancing schooling change and advancement.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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Retraction

Retracted: Exploring the New Mode of Teaching Computer-Aided Environmental Art Design Courses

Security and Communication Networks

Received 3 October 2023; Accepted 3 October 2023; Published 4 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] W. Zhen, "Exploring the New Mode of Teaching Computer-Aided Environmental Art Design Courses," *Security and Communication Networks*, vol. 2022, Article ID 3437810, 10 pages, 2022.

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Research Article

Exploring the New Mode of Teaching Computer-Aided Environmental Art Design Courses

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Environmental art design course is the main direction of practical teaching. Therefore, the teaching reform and practical research of environmental art design based on CAD have been carried out. Innovative environmental art design courses, taking into account the differences of student groups, formulate the teaching methods of introductory courses, formulate the comprehensive topics of curriculum design, expand the knowledge base, improve the professional curriculum system, and strengthen the horizontal connection between curriculum teaching and computer design to meet the diversified needs of different student groups. Environmental art design also requires that before formal construction, with the help of computer-aided function, establish architectural drawings and analyze the rationality of each construction process. In view of the current situation and further development prospect of computer-aided application design, designers should improve the application level of graphics software. This paper is mainly committed to optimizing environmental art design teaching through computer, making full use of artificial environment design, improving the efficiency of computer performance technology, avoiding too single final design effect, so as to enhance the appeal of ecological art and meet people's aesthetic needs.

1. Introduction

CAD, as a practical professional course, actually uses theoretical knowledge to solve practical problems so that only the practical skills of students are improved [1–3]. The environmental art design course has some connection with environmental design construction, environmental design drafting, and environmental design construction.

Although colleges and universities have implemented different degrees of reform for environmental art design courses, and the actual teaching finds that most students are still unable to design environmental design drawings independently after graduation or even a few years, according to the analysis of front-line professional teachers on the current situation of teaching professional courses, it is believed that the current teaching contents of colleges and universities have the problem of disconnection with social development, teaching resources, and the lack of timeliness of information obtained, although textbooks and teaching materials are constantly [4]. Although the textbooks are constantly adapted and new technologies are constantly introduced, they are not yet popularized when teachers carry out teaching [5]. Teachers cannot use computer technology or a variety of drawing software to provide students with professional teaching, students still follow the traditional learning concept in learning, with low innovation and lack of targeted teaching methods and ideas, the arrangement of practical courses and theoretical courses is not reasonable, and the design of the teaching system of the course cannot be completed and most students have strong design theoretical ability, but are unable to connect with social demand positions [6].

In the process of carrying out computer-aided environmental art course teaching development, the understanding of the shortcomings and deficiencies of traditional teaching courses is important [7]. The traditional single teaching, mainly relying on the teacher's demonstration, through the item-by-item operation of each tool command in the design software, requires students to follow the teacher's demonstration order to operate again, and this

teaching mode is too mechanized [8]. Therefore, the course design should change the single teaching process, the teacher in the process of course explanation, not only focus on the operation of the software but also need to achieve good teaching effect through the adjustment of the operation process, and establish a close connection between technical design and other subjects to ensure the coherence of teaching links [9]. While improving students' professional and technical skills, focusing on the overall expression of artistic features, there is a problem of lack of relevance of teaching examples in teaching design and practice, innovate traditional teaching methods, and organize several teaching contents to guarantee students' enthusiasm and initiative [10].

Targeted analysis of various types adheres to the skills training as the basis, theoretical explanations as an aid, to optimize the traditional service concept through the command design, and smooth and natural mastery of basic technical operations [11]. Combined with the drawing instructions issued by the teacher to edit the software interface, computer-aided environmental art design course, to focus on the drawing software knowledge, in the diverse design principles into environmental psychology, engineering, lighting design and a variety of architectural principles, through the comprehensive display of effect drawings, to improve the artistry of the course design [12].

Teachers need to take the improvement of students' aesthetic concepts and professionalism as the basis, and through the effective application of computer drawing software, to ensure that designers can bring into play their creative and imaginative abilities to achieve more desirable design effects [13]. The establishment of the teaching structure can graduate who enter the workplace should be proficient in applying computer drawing software to ensure the design creativity of environmental art and improve the beauty of the overall environment [14]. In the process of performance drawing design, the design principle of combining technicality and artistry should be adhered to, and the concept of modern green design should be incorporated. CAD belongs to a technical means of environmental performance, and designers need to clarify the specific operation process of drawing software, master the rich content of art design principles and cultural knowledge, and improve their professional skills [15]. Build a standardized human living environment, combine the different characteristics of the environment has, convey the rich artistic information, improve the artistic infection, focus on the emotional reflection of the designers, in the process of environmental appreciation clear designers want to express the artistic emotions [16].

The main reason for students' lack of creative thinking is the lack of confidence in the originality of environmental design and the lack of creative inspiration in completing the design tasks assigned by teachers, and the presentation of some valuable creative points is the basis for ensuring the quality of environmental design. Therefore, teachers need to guide students to think about environmental art from different perspectives, not to build spaces entirely according to their personal preferences, but to develop perfect design solutions combined with the main needs of users, to guide students to be innovative and self-transcendent, and to lay a strong foundation for the effective application of creative design thinking, therefore, original thinking training needs to be integrated into traditional course design. Hand skills are the basic skills necessary for environmental art designers to master, therefore, teachers need to cultivate students' innovative thinking development ability, ensure the design quality of environmental art solutions, and help students develop their pioneering thinking.

2. Related Work

Environmental art design is a highly practical and complex comprehensive discipline, which involves many disciplines such as architecture, design, and art. Environmental art design is a human-centered design discipline and creates an ideal spatial environment to serve people's social and family life. However, as a new industry, environmental art design has not yet established a characteristic teaching system. It should be combined with practical, innovative thinking, from the teaching mode, curriculum system, teaching training objectives, teaching content, and other aspects of a comprehensive, systematic innovation, highlighting the comprehensive quality of training for students, strengthen the practical nature of professional teaching.

To comprehensively improve the effect, combine the current social development with the specific requirements of environmental art design, cultivate designers with high professional quality and strong artistic cultivation, and ensure the stable design. In the process of teaching and design to improve students' artistic aesthetic ability, master complex environmental art performance techniques, combined with the specific construction environment to develop a reasonable architectural rendering, to solve the current problems and deficiencies in computer-aided environmental art.

The following analysis of the common CAD in environmental art design: AutoCAD, 3D MAX, Photoshop.

2.1. AutCAD. The effective application of AutoCAD can ensure that the traditional two-dimensional drafting, based on the completion of the basic three-dimensional design tasks, is a more widely used CAD drafting software, and AutoCAD as the mainstream drafting technology has obvious design advantages in the effect of the drawing.

Designers for environmental art design drawing process, the accuracy of the data will affect the final artistic efficiency and overall design quality, if the drawing results are not accurate, it is likely to cause engineering rework, extend the design period and cause a waste of resources [17].

The outstanding advantage of AutoCAD application is the powerful drawing ability, and its application can ensure the quality of drawing and the accuracy of the final data, the application of Auto CAD software in environmental art design, covering a large number of projects, including interior design of AutoCAD [18].

The interior design is an important part of the interior environment, and the functional characteristics of the AutoCAD software and the requirements of the environmental atmosphere need to be analyzed before the design of drawings, and the planning tasks need to be completed in conjunction with the relevant design standards [19]. As an important element of the spatial environment, the interior environment design needs to analyze the existing performance characteristics of the spatial environment and clarify the special characteristics of AutoCAD software.

Environmental art design is considered from many aspects such as artistic value, functional value, and aesthetic value. It integrates spiritual factors in the process of interior environment design, adjusts the architectural structure to ensure the overall style of the interior environment, and creates a good environmental atmosphere [20].

2.2. 3D MAX. The effective application of 3D MAX software in environmental art design can create a good environmental animation display effect, and 3D MAX as animation software, with powerful design functions as a support, to complete structure settings, the basic configuration requirements are low, in the system to install the production plug [21].

The system structure is set up on the basis of the PC system, which requires low basic configuration, and the production plug-in is installed in the system to ensure the functionality of the software process, and the role animation production function of 3D MAX software is used to carry out the stacking of modeling steps to improve the flexibility of the production of design models and to complete the basic animation quality requirements [22].

3D MAX is also an important program in the production of games, films, and videos and has a high value in architectural design. 3D MAX aids work in environmental art design to show a more detailed interior environment and the outdoor effects of each element added to the production of environmental animation [23].

2.3. Photoshop. The application of Photoshop software can ensure the authenticity of scenery and creates a good environmental art atmosphere. After finishing the drawing of the design effect, the staff needs to post-process the various processes of the effect with the help of Photoshop software, which has powerful environmental image processing capabilities [24].

Many digital images in the rendering are composed of pixels, using Photoshop's processing technology to edit and modify the quality of the image, using more advanced drawing tools, and strive to improve the picture editing effect. 3D MAX rendering is only a rough data pattern, in the process of real scenery design, 3D MAX is difficult to get the desired technology Photoshop supports the production of real scenery to create a good environmental art atmosphere [25]. Among the elements in the interior space, such as plants and furniture, can be added to the effects in the form of real images with the help of Photoshop software.

3. Methods

The teaching system structure of environmental art design course at this stage is shown in Figure 1.

Compared with the same majors abroad, China's environmental art design majors started late, and most colleges and universities have only opened environmental art design majors in the past ten years. At present, the basic courses and professional courses of environmental art design majors in our universities are still relatively weak, and there is a serious disconnect phenomenon, and the research of environmental art "professional theory" is very lacking. At present, the teachers of environmental art majors in China's universities are not strong enough, and the teaching managers also lack attention to the professional theory, which leads to a serious lack of design guided by "professional theory".

Traditional art and design education is influenced by examination-based education, and although it has a strong systematic teaching mode, it is far from foreign countries in terms of creative cultivation. Other teaching links in the classroom lack new ideas and are too programmed, and the teaching content is too limited and single, and there are problems in the teaching process that emphasize skills but not thinking, performance but not creativity, and results but not process.

To improve the teaching situation, an environmental art design teaching unit based on CAD is proposed in Figure 2.

According to the actual needs of teaching, we design the training objectives of environmental design and design talents suitable for students' development, integrate the requirements of schools, professional courses, teachers, and society for students' learning, establish a teaching organization structure with deep interdisciplinary integration, provide a teaching support platform for professional courses, further enhance the communication between students and teachers, improve the framework of professional courses and teaching system, use CAD technology, propose targeted teaching for different student groups, improve students' practical application ability, improve students' entrepreneurship and education development capital chain, enhance the degree of adaptation between students and social demand positions, and transform the traditional closed indoctrination teaching without delay.

3.1. Innovative Teaching Thinking of Environmental Art Design Course. Through the analysis, mastering the necessary innovation ability and spatial appreciation ability is the main goal of the course teaching because the students at the beginning of the school year have less knowledge of environmental design, and students come from different regions, spread the social and cultural differences, and understand different levels of environmental design culture. To respond to the requirements of the information age, CAD technology is introduced, and students are instructed to use computers to analyze environmental design drawings in detail, and overview courses are arranged to unify students' cultural communication channels, such as "History of the origin of environmental design in China and abroad", "Introduction

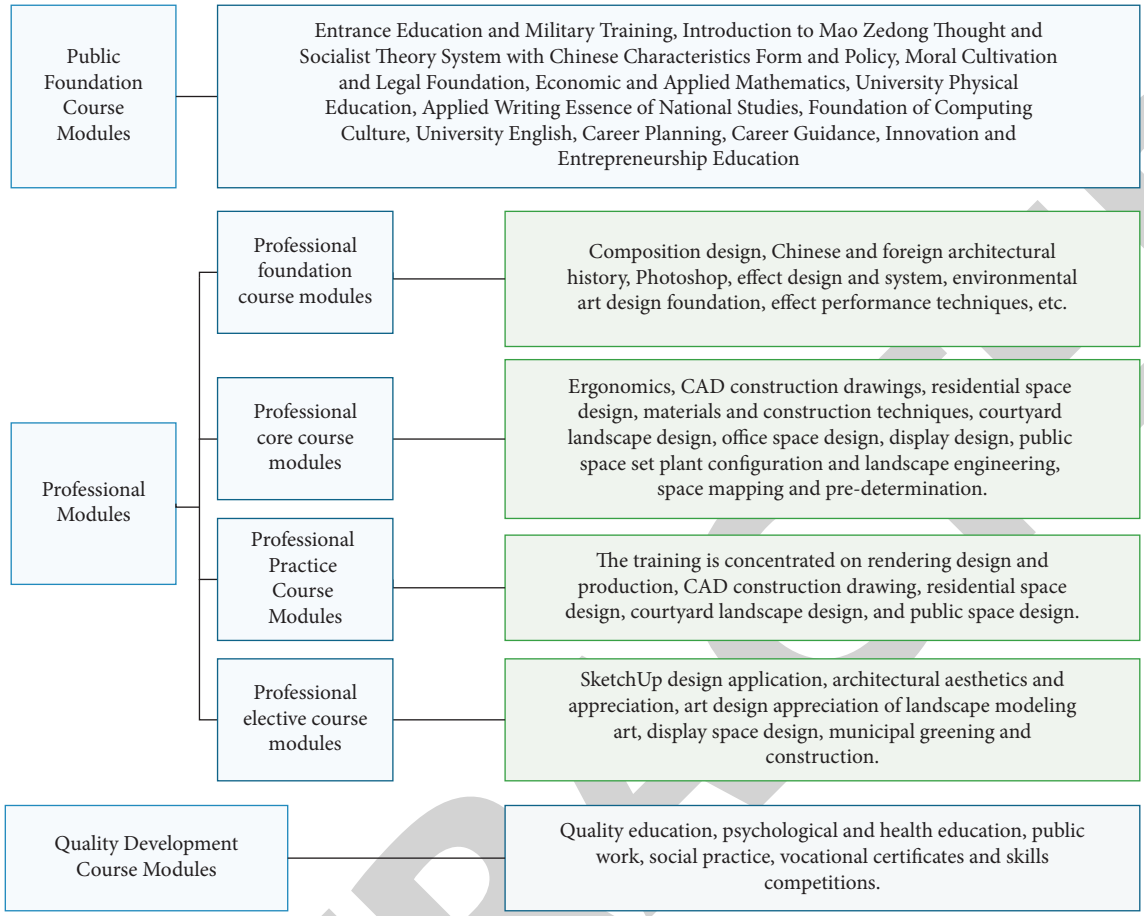

Figure 1: The framework of the modular curriculum teaching system of environmental art design majors.

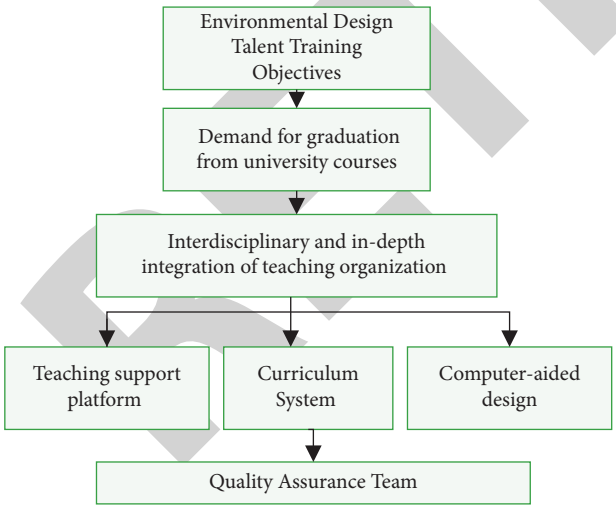

Figure 2: New teaching model of environmental art and design course.

to environmental design based on the cultural characteristics of local environmental design," students are reshaped from the history of regional environmental design to the formation of the environmental design industry at many levels, establishing a correct cognition, guiding students to gradually form an independent environmental design thinking, and improving their innovation ability and inspiring them to the course will help students to develop an independent environmental design thinking, improve their innovation ability, and inspire them to design spatial environments.

Switching the traditional teaching thinking and respecting the differences between student groups, in addition to arranging the necessary computer drafting courses, students should also strengthen their ability to express their environmental design on the computer. It is assumed that students only have the ability to think creatively about environmental design, but lack the ability to express their thinking, although they can complete the environmental design drawings as required, the content is lacking in vividness and flexibility. Therefore, we should adopt the open traditional classroom approach to cultivate students' ability to use computer drawing and regularly carry out CAD drawing software learning for students to improve their ability to express their creative thinking, so that the environmental design course can be more vivid and enhance students' interest in learning.

3.2. Designing Guiding Course Teaching Ideas. The degree of difficulty, novelty, and scope of environmental art design course teaching can directly affect the learning effect of students, so we should design guiding course teaching ideas and propose scientific and reasonable course teaching topics.

Next, establish cooperative relationship with several environmental design industries within the market, and students can refer to the recent design results of enterprises in the process of designing with computer-aided environmental design drawings, design guided course teaching ideas, and accumulate students' practical experience. The design of teaching ideas is shown in Figure 3.

As shown in Figure 3, teachers can introduce examples of enterprise design from environmental art design courses, guide students to analyze the design ideas of the results, combine students' learning perceptions, ask students targeted environmental design design-type questions, encourage students to use computers, give full play to their creative abilities, use a variety of computer drawing software, put forward their own design conjectures, guide students to complete environmental design solutions, provide students with market research resources, organize data about environmental design, verify the feasibility of the drawings or results of the design in the market distribution application, summarize the problems that arise in the design process, set up discussion groups so that students can communicate with each other, summarize the main points of the design class and the innovative points in the process of completing the design, by the teacher according to the focus of the class, and appropriate extension of knowledge points The teacher will deepen students' understanding of environmental design and expand students' design ideas.

3.3. Design Course System Based on CAD Technology. Based on CAD, improve the practical courses, transfer the traditional teaching classroom to the environmental design construction site, create a variety of learning conditions for students, integrate the teaching schedule of the course, lead students to visit the site to see the shape of a variety of parts or accessories in environmental design objects, improve students' sense of space, make the traditional classroom more abstract or difficult to understand the professional knowledge of popularization, and deepen students' design ability.

Since the practice courses are usually arranged outdoors, at the beginning of the design practice courses, the professional teachers guide the students to complete the self-study of the professional courses on the teaching platform and clarify the learning tasks that students need to complete in the practice courses through the communication and discussion among students. In the classroom, teachers provide students with environmental design drawings of the visited areas and carry out analysis of environmental design features to ensure that the teaching system is targeted in the implementation. In the course of implementation, students are guided to think more and observe more, to use computer ideas and environmental design construction principles to find their own potential problems in learning, to fully integrate theory and practice, to be summarized by the teacher's professional knowledge when necessary, to review the practical learning process with the help of multimedia teaching tools, and to supplement the learning content ignored by students. The teacher will review the practical learning process with the help of multimedia teaching tools and supplement the learning content that students have neglected.

3.4. Strengthen the Horizontal Connection between Course Teaching and CAD. Improve the extension of professional knowledge, strengthen the horizontal connection between multiple courses of environmental art design, integrate environmental design construction and CAD, reasonably arrange the class time of practical courses and theoretical courses, so that teachers can grasp the dynamic learning trends of students while completing the teaching tasks of the courses, and guide students to solve the practical problems in course learning. Building a student learning platform, teachers can upload market research data and survey reports to the platform in the form of compressed files and introduce a variety of computer drawing techniques to improve students' ability to use computers while deepening their spatial understanding of graphic images. The integrated teaching mode of design establishes a direct connection between different disciplines, enables students to get systematic training in learning, improves students' motivation to learn, builds a new mode of student learning interaction, enhances students' overall representation and cognitive ability of environmental design, cultivates students' innovative and creative ability, and cultivates applied talents for the development of the environmental design industry.

4. Case Analysis

Based on the university level, with the integration of new ideas of education reform, universities have raised the importance of teaching environmental art design courses, whether at the level of teacher team construction or the level of university orientation, there are different degrees of improvement, market service departments have been added to regularly carry out research activities of the industry in the market development trend, which can improve the connection between teaching resources and the market according to the real-time situation of industry development.

Based on the student level, most of the students said in the survey that they have established the correct knowledge of the industry development and professional learning and can strictly follow the teaching arrangement of the teachers, follow the teaching steps of the professional teachers, and assist the teachers to complete the teaching objectives with high quality and high efficiency. In addition, based on the teaching needs of universities, some teachers choose to go to environmental design enterprises in the market for continuous training, in order to improve their academic professional ability and develop their own correct professional ethical quality as the standard, and participate in diversified environmental design market research activities, so as to provide students with more professional and perfect teaching resources.

Based on the demand of enterprises and deepening of teaching reform measures, enterprises can provide 50–70 students with jobs in colleges and universities every year according to the job demand, which effectively alleviates the current situation of employment difficulties of graduates. At the same time, the relevant enterprise managers have suggested in the survey that students who have studied through the teaching reform have a higher degree of adaptability to the

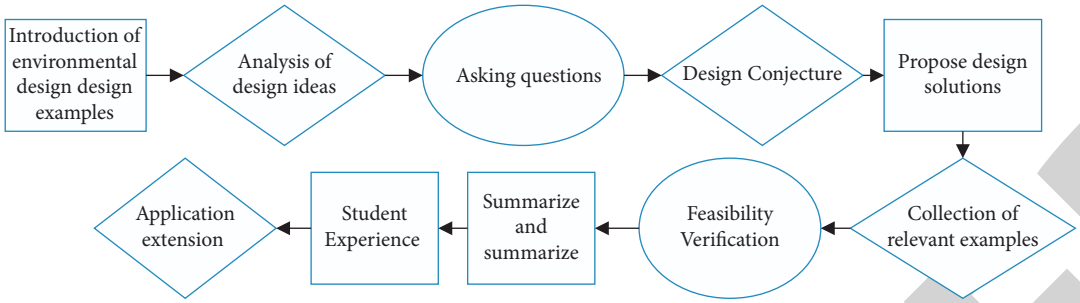

Figure 3: Guided course teaching ideas.

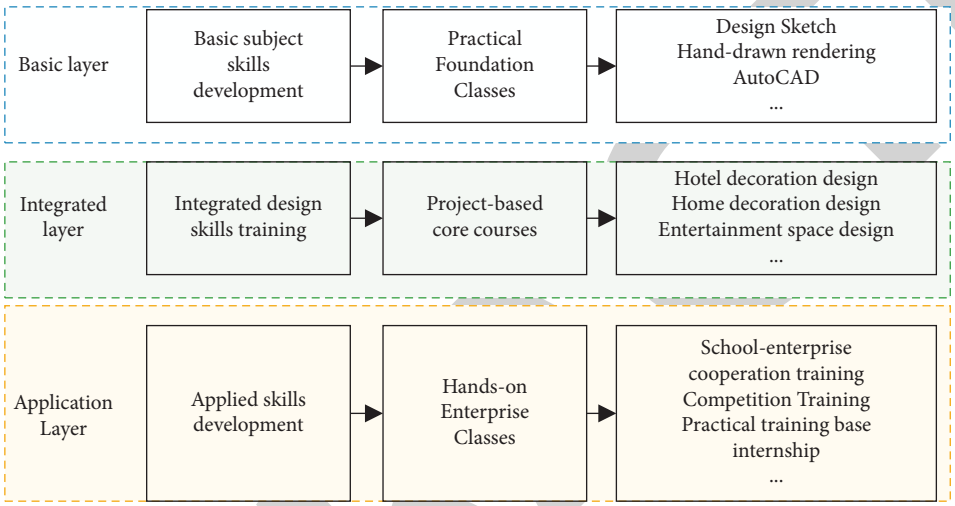

Figure 4: Job competence-based curriculum system.

internal positions of enterprises, and compared with the early employed students, this group of students can adapt to the working atmosphere of enterprises more quickly in their positions, and then integrate into the internal collective, which improves the practical application ability to use computers.

At present, environmental art and design education is 3 years, the training mode is generally two and a half years of school study plus half a year of enterprise internship, and the curriculum system is generally basic courses, professional foundation courses, and professional courses. In order to cultivate job-competent talents, the curriculum is key to align with the actual work project. According to the spirit and requirements of the current curriculum reform and the problems of curriculum design, this paper constructs a "three vertical and three horizontal" job-competent teaching curriculum system: the first stage is practical basic courses, the second stage is project-based core courses, and the third stage is practical enterprise courses, as shown in Figure 4.

4.1. Teaching Ideology. The main teaching idea of project-driven mode is "student-led and teacher-led". Students should become the main body of learning, make students more willing to believe themselves as a designer, and enjoy the learning process more, so that their self-drive can be enhanced.

In addition, students are the main body to control and advance the teaching progress. During the teaching process, teachers should improve and revise the teaching plan according to the students' project progress and seize the teaching moment when the progress is stagnant and students are in a cognitive dilemma. This is because the efficiency of the teacher's instruction is greatly enhanced when the students' eagerness to get out of the status quo is at a high point.

4.2. Teaching Objectives. With innovative thinking and practical skills; at the level of process and method, require students to learn the learning method of inquiry learning, independent learning, and be able to actively obtain learning resources; at the level of emotional attitude and values, require students to have a strong interest in design and have a realistic level of emotional attitude and values, and students are required to have a strong interest in design and a realistic and innovative attitude.

Specifically, taking "3ds Max Software Fundamentals and Applications" course as an example, for environmental art design students, its teaching objectives are to be able to proficiently use 3ds Max software operation skills to complete effect drawing, creatively express design concepts, and stimulate interest in design expression.

4.3. Teaching Procedures and Essentials. Teaching procedure refers to the specific operation steps, specific rules, and teaching schedule in the course of implementation. Take "3ds Max software foundation and application" as an example, set the project case as 120 m^2 space design (120 m^2

three bedroom design/120 m^2 restaurant space design), and the teaching procedure and main points of the course are as follows (see Table 1).

In this course, Module 1 focuses on familiarizing students with project design cases, as they have not had a systematic study of design theory, so the instructor provides the basic planes on which the students can base their suggestions for optimization. This takes into account the objective learning base of the students and also gives them room to play with their designs.

At the end of Module 2, it is necessary to plan grouping design teaching tasks according to a process scoring and divide students into work groups and home groups according to their ability to accept new knowledge, so as to reasonably distinguish the difficulty of the tasks.

Module 3 still emphasizes the role of the students, who provide the furniture style and the overall layout of the project design case, and the teacher assists the students to complete the design expression by teaching them how to use the software and techniques.

Module 4 also requires the students to give their own design examples of the space and color palette, and the instructor will give suggestions on the style and color scheme, while the students will try to use their own solutions to give material mapping, feel the shortcomings of the solutions and make changes. Module 4 is a difficult part of the software technology, but not a difficult part of the design, so the focus is on helping students to complete the software skills, the teacher teaches lighting arrangement and debugging methods, allowing students to simulate the design expression under different light senses such as day, night, cool, and warm tones, in order to help them use lighting to set the mood.

An important guarantee for the model to work is that students must use their off-class time to complete the given tasks, and therefore it is emphasized in the rules. The off-class time is communicated through the cloud classroom online, which not only requires students to submit their proposals on time during the off-class time but also requires the teacher to complete the proposal instruction online at the agreed time so that the teaching time can be truly expanded and the given teaching task can be completed.

The in-class time is mainly used by the teacher to plan the teaching content rationally based on the materials submitted by the students, which requires the teacher to not only teach the textbook part but also help the students analyze most of the difficult problems they encounter in their self-inquiry, thus allowing the students' main role to be fully played. Students are also able to help each other solve noncommon problems after grouping, which helps to reduce individual students' blind spots in knowledge, which also enhances students' cooperative learning ability.

4.4. Support System. For practical professional software courses, the realization of project-driven teaching mode requires hardware and software support systems; otherwise, no system can be formed and no good teaching effect can be achieved.

(1) Software learning resource library. Teachers need to collect software teaching videos, software demonstration videos, model libraries, material libraries, parameter reference data, reference libraries and a series of learning resources, the learning resources should have clear categorization, easy to use characteristics.

(2) Multimedia platform in class. School multimedia classrooms need to have teacher-student interaction software, computer configuration to meet teaching needs, real-time updated software and Internet access conditions, project-driven teaching mode also requires full communication between students, so the seating arrangement should also be more flexible.

(3) Effective off-class communication platform. Mobile Internet should be used for teaching, project-driven teaching mode needs to rely on time to complete tasks in class, and it is especially important to establish a perfect platform for teacher-student interaction in class, in which teaching software such as Blue Ink Cloud Class and Cloud Classroom should be widely popularized to ensure instant interaction and communication between students and teachers in class.

4.5. Evaluation of Teaching and Learning. Teaching evaluation is mainly for skill evaluation, "skill" is what the American educational psychologist Robert Mills Gagne (1916–2002) called operational skill, which is divided into three levels of learning: one is the level of imitation, including demonstration and specific guidance under the prototype. The first is the level of imitation, which consists of performing operations with prototypes and specific instructions, simulating and modifying the objects provided. The second is the independent level, which includes performing operations independently, making adjustments and improvements, and trying to make connections with existing skills. The third is the level of transfer, which includes applying existing skills in new situations and understanding the applicability of the same skill in different situations, etc.

According to the information processing theory of Gagne (Robert Mill s Gagne, 1916–2002), the project-driven CAD course teaching evaluation also starts from the above points and contains two parts: one is the degree of mastery of basic software skills, which is mainly reflected in the level of imitation, and basic knowledge mastery level. The first is the mastery of basic software skills, which is mainly reflected in the level of imitation, basic knowledge mastery level. The second is the completion of the project, which is mainly reflected in the level of creative expression, application level.

In this paper, we designed a table of teaching evaluation and its methods (see Table 2). The test questions are divided into subjective and objective questions, and the subjective questions are graded by both students and teachers.

The CAD course is different from the case teaching method in traditional teaching. Rather than simply inserting a case, it incorporates a real project throughout, which requires teachers to change their lesson planning and also

Table 1: "3ds Max software foundation and application" course teaching procedures and essentials.

	Module	Lesson time	In-class lecture	Inquiry in class	Specifications
1	Project analysis/task breakdown	4	Project requirements, floor plan layout, 3D software basic interface layout	Floor plan optimization and expression (any form)	Each person participates in the project, and the real case is not restricted to the form and technique of expression
2	Project basic modeling	6	Project wall modeling skills and basic principles of space planning	Try other 2 or more space planning forms	The teacher provides a packet of materials, students submit their plans through the cloud classroom at the specified time, and the teacher makes timely suggestions online and plans the lesson according to the students' needs
	Project hard modeling	8	Modeling skills and style analysis of hard furnishings required for project planning	Determine 2 styles in groups, complete 2 styles of hard furnishings modeling tasks	
	Project soft modeling	8	Modeling skills of soft furnishings and furniture arrangement analysis required for project planning	Complete furniture modeling for 2 styles, find furniture style information, collect pictures	
3	Project model material mapping	10–12	Software mapping skills and different material parameters settings, color matching principles	Make material mapping of the completed hard and soft furnishings in different styles and modify and improve the plan	Students submit a schedule for completion, and the teacher makes corrections based on student completion and plans the lesson according to student needs
4	Project lighting parameter setting	10–12	Software lighting parameter settings and lighting arrangement methods required for different atmospheres	Set up lighting for 4 different atmospheres on the model, rendering local effects and overall large images	Students submit different styles of renderings, and the teacher provides guidance

Table 2: Teaching evaluation and its methods.

Type of test questions		Description	Example	Evaluation method
Objective questions		The format is computer-based, and the types of questions are fill-in-the-blank, multiple-choice, and judgment questions	3ds Max software in the move command shortcut key is ()	Paper test, the score is a percentage system
Subjective questions	Imitation level	Simple imitation of the knowledge taught in class, project completion is less than 60%	The project only appears in the classroom demonstration content and cannot be reasonably used	1. Score percent evaluation; 2. Project evaluation includes overall completion, model, material, lighting, creative effect of the five aspects; 3. The student's name will be hidden
	Application level	Use the teacher's packet appropriately, learn the knowledge required for the project and apply it independently, and complete the project at a level of 60% to 80%	The project has the same model or material, lighting and other elements not taught in the class and the use of reasonable	
	Innovation level	The project design is creative, the project expression is unique, and the project completion level is 80%~100%	The project has all the elements of reasonable use and unique creativity, with a sense of design	

requires students to have a basic sense of design. In today's teaching process, all these conditions are available.

(1) Teacher level. The concept of "student-led and teacher-led" has been popularized, and teachers are very receptive to this concept and have had similar experiences. The difficulty of the teaching model lies in the introduction of specific cases and the embedding of knowledge points, which are similar to the case-based teaching and are not new to teachers.

(2) Student level. Students often have a basic understanding of their major and are no longer unfamiliar with the term design when they are exposed to the course. Although their design skills are not strong, it does not affect their absorption and digestion of the knowledge points of the software course. At the same time, students already have strong learning and self-inquiry ability, as long as they are driven by interest, they are able to complete the absorption and transformation of knowledge. In addition, the small class size of about 30 students in the university also facilitates the model and helps to decompose the project tasks.

(3) Technical level. The teaching mode requires the joint participation of teachers and students both online

and offline. With the existing cloud classroom, blue ink cloud class, social platform, and sufficient online course resources, teachers and students are fully able to achieve instant interactive communication during nonclassroom time.

Therefore, the teaching model is a new attempt derived from the mature teaching concept applied to specific courses, which has both subjective and objective bases and is highly feasible.

5. Conclusion

Based on CAD, this paper studies the reform and practice of environmental art and design teaching and improves professional curriculum system and ensure the smooth development of diversified teaching activities. Through the analysis of this paper, insisting on student-oriented and innovative design is the basic purpose of the curriculum teaching reform, and only by improving students' practical application ability and cultivating their innovative and entrepreneurial consciousness can we ensure the effectiveness of talent cultivation. Although the teaching reform strategy proposed in this paper has achieved partial success in actual teaching, it is still necessary to follow the development needs of the times in the later development, establish a multi-course cross-teaching system, guarantee the high enthusiasm of students in the learning process, and then provide excellent talent support for the development of the market environment design industry.

Data Availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Conflicts of Interest

The author states that this article has no conflicts of interest.

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Retraction

Retracted: Optimization of Economic Development Path in Western Region under Background of "the Belt and Road Initiative" Based on Intelligent Internet of Things

Security and Communication Networks

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. Jiao, "Optimization of Economic Development Path in Western Region under Background of "the Belt and Road Initiative" Based on Intelligent Internet of Things," *Security and Communication Networks*, vol. 2022, Article ID 9116484, 12 pages, 2022.

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Research Article

Optimization of Economic Development Path in Western Region under Background of "the Belt and Road Initiative" Based on Intelligent Internet of Things

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The Internet of things is a network that can realize the information interaction between all independent inanimate objects. It is a network that allows people to experience how to talk with objects. Its emergence is a milestone of world information technology. With the development of the Internet of things, more and more research is carried out on the basis of the Internet of things, and the economic development of the western region should seize the opportunity of the Internet of things and find a suitable development path. This paper mainly studies the optimization of the economic development path of the western region under the background of the "the Belt and Road" to help the western region develop rapidly. This paper puts forward the interactive development path of industrial clusters and new urbanization. Through the simulation data, the total GDP and per capita GDP of the western region in the next few years are analyzed and summarized. The data show that under this method, the total GDP and per capita GDP of the western region will increase by more than 30% every year in the next five years, and will continue to rise.

1. Introduction

With the development of society, the development of intelligent Internet of things has reached a new height. A large number of researchers have studied the Internet of things. It applies the Internet of things to all places and enables the rapid development of all parts of society. However, Western China has not been developed and its economy is underdeveloped. Inner Mongolia, Xinjiang, Yunnan, Guangxi, Tibet, and other border and western regions serve as the main strategic fulcrum of China's "the Belt and Road" construction. It is not only a leading area for China to establish a comprehensive opening-up layout, but also an important gateway and link for connectivity between China and many neighboring countries and Eurasian countries. It has a special strategic position and key significance in the national strategy. It is an important opportunity for the economic and social development of the central and western regions. Therefore, under the strategic opportunity of China's "the Belt and Road", it is very important for the western region to give full play to its regional advantages. This has led many researchers to start to study the "the Belt and Road" to find the optimal path for economic development, so that the economic development of central and Western China can develop rapidly under the background of the "the Belt and Road".

The content of this paper has far-reaching theoretical and practical significance. Firstly, in terms of basic theory, this paper tries to analyze the development opportunities and challenges faced by the central and western regions of China under the background of the "the Belt and Road" by using the circle structure theory. This paper studies the economic development path of mutual development between industrial clusters and new urbanization, determines the internal logical relationship between them, and makes an empirical analysis on the economic development level of central and western regions of China. It puts forward policy suggestions to improve the interactive effect between industrial clusters and new urbanization in central and Western China, so as to realize the overall improvement of

the competitiveness of industrial clusters and the quality of new urbanization. It is another attempt to expand the theoretical system of industrial clusters and new urbanization. In terms of social practice, due to the continuous improvement of the scale of industrial clusters and the level of new urbanization in various provinces and cities in the central and western regions, it still faces certain quality problems and development bottlenecks. It determines the future development trend of industrial clusters in the western region and a series of measures in the process of new urbanization. It can promote the efficient industrial upgrading and transformation in the western region. This paper provides a theoretical basis for the construction of new urbanization and provides support for China's regional coordinated development.

This paper mainly takes the total GDP and per capita GDP of the western region in previous years as the initial comparison. Then, it built models in Inner Mongolia, Xinjiang, Sichuan, Yunnan, and Shaanxi. Through the simulation of intelligent Internet of things, this paper analyzes the general situation and growth rate of total GDP and per capita GDP of Inner Mongolia, Xinjiang, Sichuan, Yunnan, and Shaanxi in the next few years. Then, the advantages and disadvantages of the initial development path of the new-type industrial cluster are compared with the feasibility of the new-type industrial cluster. The innovations of this paper are as follows. (1) This paper compares the total GDP and per capita GDP of the eastern and western regions and analyzes the problems existing in the western region. (2) Through some existing data, this paper constructs the model of the western region, and then makes a large-scale analysis of the situation of the western region in the next few years through the Internet of things. (3) This paper forecasts through the experimental data, and then gives the matters needing attention and suggestions in the western region under this development path according to the predicted data.

2. Related Work

At present, a large number of researchers have studied the intelligent Internet of things. Santos proposed an intelligent personal assistant based on the Internet of Things, which can be used to assist people in many daily activities [1]. Kim and Lee studied existing solutions for establishing and managing trust in network systems and proposed an efficient and scalable trust management approach for IoT based on locally centralized, globally distributed trust management [2]. Zhu et al. studied mass sports fitness based on the Internet of Things and smart systems. With intelligent information collection devices, digital terminals can monitor health status at any time [3]. Dan et al. used the Internet of Things technology to simulate the sports training model, and put forward a computer multimedia simulation sports training model design method based on fast exploration control of posture change space [4]. Sun et al. studied the network security technology of smart information terminals based on the mobile Internet of Things, and compared the current main encryption algorithms of mobile Internet [5]. But they are more expensive to make.

In addition, some researchers have studied the optimization of economic development path in the western region under the background of "Belt and Road". Wang et al. studied the logistics system of land and port from the point of view of belt and road, and put forward the comprehensive gravitational model of foreign trade between multiple land ports at the land intersection [6]. Zhang made a regression analysis on China's foreign direct investment and export trade data of Belt and Road countries [7]. But the subjects were not very persuasive. Yang et al. studied the path optimization of mobile sensor networks to improve the accuracy of estimating stationary targets [8]. Krishna et al. mainly studied the best reliable ordered routing path between source and destination nodes in MANET, and presented a hybrid algorithm [9]. But their methods are not comparative.

3. West Area "Belt and Road" Method under the Intelligent Internet of Things

3.1. Intelligent Internet of Things. The concept of the Internet of Things first appeared in people's view in the 1990s. The development of the Internet of things is mainly divided into four stages. The first stage is the primary stage of the Internet. The second stage is the development stage of the Internet. The third stage is the expansion stage of the Internet; The fourth stage is the embedded development stage. The emergence of the Internet of Things has enabled the world to realize the legend that all things in the world can be freely connected. It is not an accident. Many researchers have studied the Internet, radio frequency identification RFID, code standards for electronic products, and wireless communication technology to find their commonalities. Based on these technologies, the Internet of Things has become a powerful and vital information technology [10]. Ultimately, the Internet of Things is a network that enables the exchange of information among all independent inanimate objects, as well as a network that enables people to experience how to talk to objects. Its appearance is a milestone in world information technology [11]. It is used in many areas, as shown in Figure 1.

Each of these areas accounts for as shown in Table 1.

The Internet of Things is built on the basis of the Internet, which not only has a variety of characteristics of the Internet, but also extends its more prominent features. The basic features of the Internet of Things are perception, reliability, and intelligence. It is mainly reflected in the following three aspects [12, 13]. (1) Perceptibility is mainly reflected in the identification and communication of the Internet of Things. Throughout the Internet of Things, there are a large number of sensors, each of which is a source of information. The sensor accepts information and identifies it through a specific protocol meter. (2) Reliability is mainly reflected in the reliability of information transmission. Through cloud computing, fuzzy identification, and other technologies, it can reliably transmit and issue timely instructions corresponding to the changes of various things. (3) Intelligent Internet of Things is the communication between things. It is not interfered by people, that is, not

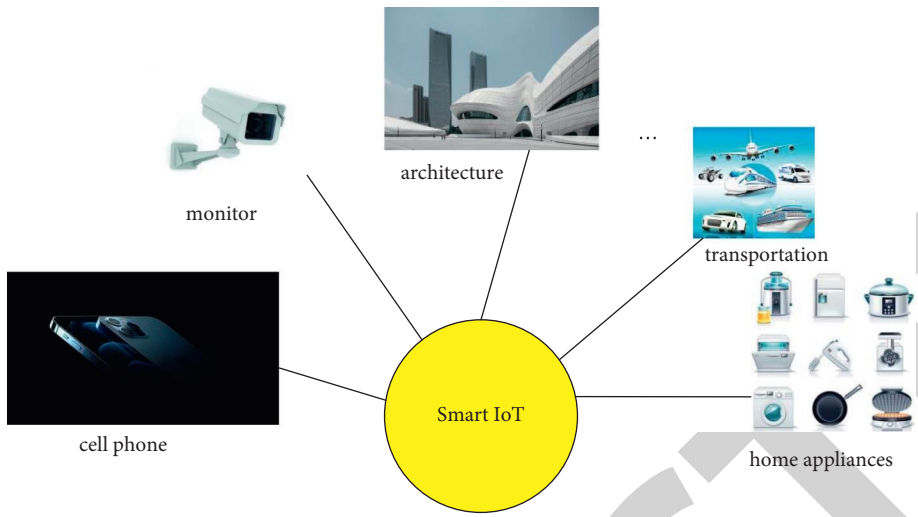

Figure 1: Internet of Things domain map.

authorized by people, but only a kind of conscious control. The Internet of Things transmits, analyses, and processes information through various technologies, and ultimately makes intelligent decisions through intelligent control.

The Internet of Things involves many technical fields such as software, hardware, communication, and security. Its main technology includes three aspects: identification technology, communication technology, and network technology. Coding technology can be said to be a supporting technology of the Internet of Things. The implementation of the Internet of Things can be achieved on the basis of coding technology. The identification technology applied in the description of the device is based on the characteristics of the item; it is the physical implementation of the item code. Communication protocol means that the delivery of communication services must comply with the rules already stipulated. In the process of communication, the communication protocol plays a major role as a standard specification. Both parties follow the communication rules agreed upon beforehand to ensure the secure recognition of language in the computer-network connection. It can be seen that the communication protocol is essential in the communication process. Networking technology is a combination of Ethernet technology and ATM LAN technology. Ethernet is very flexible and convenient; it can combine many different topological structures of the object media into one. It is a dominant network technology currently widely used [14]. Because of the Internet of Things, technology is related to free space loss. All fields are pursuing the ideal omnidirectional antenna, whose free-space loss calculation formula is

$$\frac{p_i}{p_r} = \frac{(4\pi fd)^2}{c^2}, \tag{1}$$

where p_i represents the signal power of the transmission antenna, p_r receives the signal power of the antenna, D represents the distance between antennas, C represents the speed of light, and f represents the carrier frequency.

The Internet of Things (IOT) system is complex in structure and uses many fields of technology, such as computer software, electronics, and sensors. Depending on the direction of data flow and processing, the hierarchy is divided into three layers: the perception layer, the network transport layer, and the application layer [15]. The perception layer is located at the bottom, which is the of perception data. The network transport layer is located in the second layer, which is used to transmit data. It is used to transfer and process information. The application layer is at the top, which is the content. By analyzing and processing information and using intelligent control, it realizes intelligent decision-making and transmits data, as shown in Figure 2.

Table 1: Percentage in all fields.

Area	Transportation	Home appliances	Mobile phone
Proportion	16.4%	34.8%	9.8%
Area	Surveillance	Building	Others
Proportion	8.5%	23.5%	7%

3.2. Western Regions in the Background of Belt and Road. In the "Belt and Road" strategy, "Belt" refers to the "Silk Road Economic Zone" and "Road" refers to the "Maritime Silk Road of the 21st century". The ancient Silk Road has always played a decisive role in trade between China and other countries. It is a bridge and channel to promote cultural exchange among countries [16]. The Silk Road Economic Zone is not only a way of economic trade and cultural exchange, but also a new mode and policy of cooperation. The development of the Silk Road Economic Zone has undergone a long period of exploration, and there is a more consistent view on the division of Chinese regions. Through the full communication and docking of economic policies of countries along the "the Belt and Road", they jointly participate in the formulation of guidelines and policies to promote regional cooperation. It enables the problems in mutual cooperation to be solved in consultation. It provides policy support for practical cooperation and the implementation of large-scale projects, as well as through cooperative school

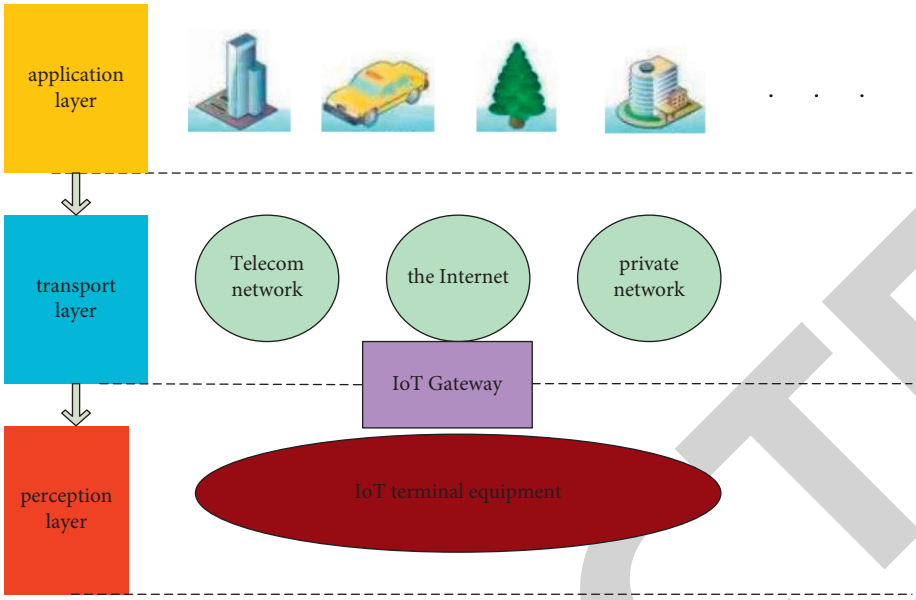

Figure 2: Internet of Things system architecture.

running, tourism cooperation, scientific and technological cooperation, information communication of infectious diseases, and other measures. It promotes friendly exchanges between countries along the line and lays a public opinion foundation for deepening bilateral and multilateral cooperation.

The "Belt and Road" strategy regards economic and trade cooperation as the cornerstone and principal axis of the national strategy and adheres to the concept of open and inclusive cooperation. It utilizes the strategic cooperation of government agencies along the line, the network of infrastructure, the cooperation of investment and operation, the establishment of currency and investment and financing systems, and the extensive economic interaction and cooperation of the people in the region. It will encourage all regions to make full use of their respective resources, cooperate and complement each other, and jointly promote pan-Asian and Eurasian regional cooperation to a new height [17].

The western region includes 12 provinces in China. Since the strategic concept of the Silk Road Economic Zone was put forward in November 2013, the western region is still in the initial stage from the overall framework to the specific implementation. At present, a considerable amount of policy support and regional planning have been issued, and the effect of implementation needs to be improved. However, there is a large gap compared to the east, as shown in Figures 3–5.

It can be seen that the total GDP in the eastern region is more than twice as high as that in the western region, and the growth rate of GDP in the western region continued to decrease from 2016 to 2021. GDP per capita is also growing slowly, much less than the eastern region. Therefore, the western region should seize the opportunity of the Internet of Things and find a good economic development path to increase GDP.

3.3. Optimizing Economic Development Path. This paper mainly analyses the two methods of new urbanization and industrial cluster, and then summarizes and optimizes the interactive development of industrial cluster and new urbanization, which is a more comprehensive economic development path.

Industrial cluster refers to the clustering of complementary or competitive enterprises in a certain geographic location, with the same industrial links and internal industrial division among enterprises. It is different from both market relations and internal relations of enterprises, and it is a new form of organization [18]. There are many ways to measure industrial cluster index, such as spatial Gini coefficient, location quotient, enterprise clustering index, and index system. Among them, the larger the spatial Gini coefficient is, the higher the degree of industrial clusters, which is a simple and universal method. However, there are some drawbacks. When there are large enterprises in a region, the spatial Gini coefficient is also very large, but it does not form an industrial cluster, so it is not very common now. Enterprise clustering index is evolved from "rough industry clustering index". It takes into account the impact of industry enterprise size and regional hierarchy. The construction of the index system is basically measured by the number of enterprise units, industrial value-added, the number of employees, sales income, and so on. Location quotient is an improved method based on the spatial Gini coefficient. It is used to evaluate regional excellent industries, also known as specialization rate. That is, the proportion of the relevant value (output value, employment number, etc.) of an industry in a region divided by the total output value or employment number in a region in the whole country, which is compared with the national average level. When the location quotient is greater than 1, it shows that it leads the national level and has a higher degree of industrial cluster, which is also the commonly used method now. Based on the

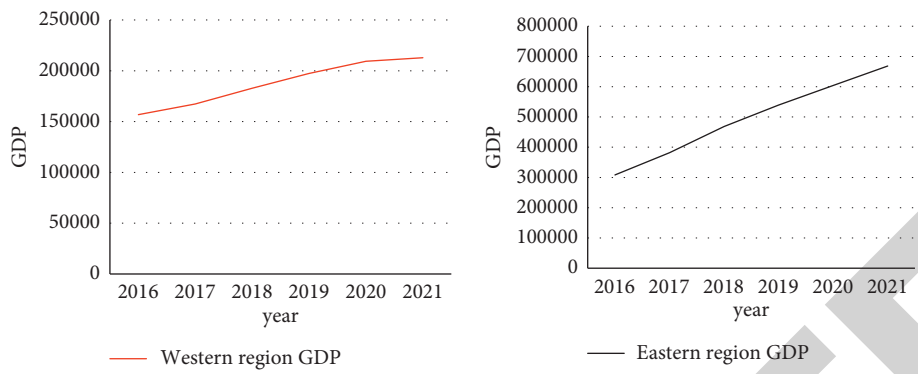

Figure 3: GDP in the East and West ($100 million).

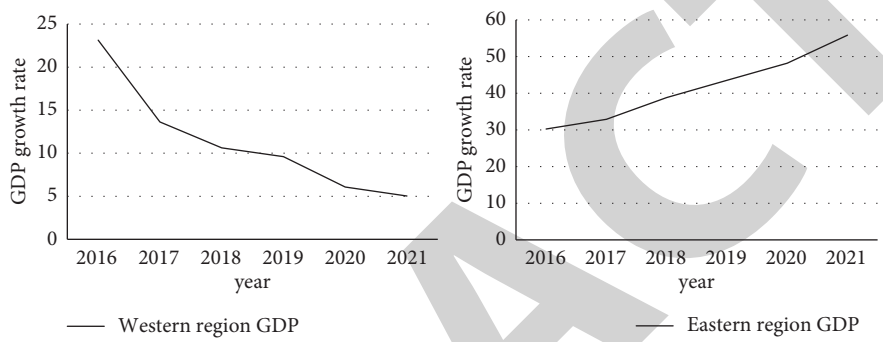

Figure 4: East-West GDP growth (%).

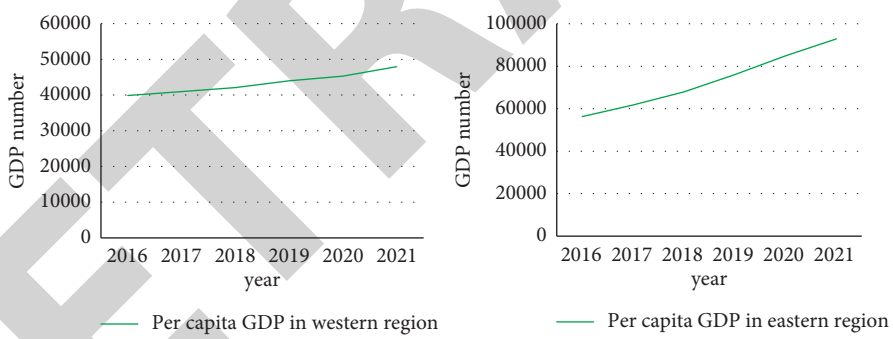

Figure 5: GDP per capita in the East and West (Yuan).

availability and operability of data, this paper takes the method of location quotient. The formula for calculating the location quotient is

$$Q = \frac{N_1/A_1}{N_0/A_0}. \quad (2)$$

Among them, N_1 represents regional specific industry income, N_0 represents regional industrial business income above scale, A_1 represents national specific industry business income, andA_0 represents national industrial business income above scale.

When $Q > 1$, we can think that the degree of industrial centralization in this region is higher, when $Q < 1$, the degree of industrial cluster is lower, and the value of location quotient can reflect the relative specialization level of an area.

Based on the formula of this location quotient, the location quotient of some provinces in Western China from 2016 to 2021 is calculated, as shown in Table 2.

Urbanization is characterized by a large number of people concentrated in cities and towns, so it was also called Population Urbanization in the early years. New urbanization is a new pattern of urbanization proposed on the basis of this imbalance and unsustainable development. The main focus is on the improvement of the quality of life, the optimization of living environment, and the vigorous construction of infrastructure. It is not only a population gathering, but also an industrial gathering and adequate supply of urban facilities [19]. In the process of urbanization, urbanization is the key initial stage. New urbanization can not only solve the problem of unbalanced and uncoordinated development, but also promote

Table 2: Location quotients of Western provinces, 2016–2021.

Years	2016	2017	2018	2019	2020	2021
Inner Mongolia	0.21	0.20	0.24	0.19	0.23	0.22
Xinjiang	0.17	0.19	0.17	0.20	0.18	0.16
Sichuan	0.82	0.80	0.91	0.86	0.81	0.88
Yunnan	0.19	0.20	0.22	0.18	0.19	0.26
Shaanxi	0.67	0.62	0.71	0.68	0.72	0.66

the overall development of urban and rural areas. It is the key channel to alleviate urban diseases. It is also an important road to achieve economic transformation and upgrading [20]. It fills part of the data with SPSS missing value analysis. It calculates the weight by the entropy method, and then calculates the comprehensive score of the new urbanization in 2016–2021. The results are shown in Table 3.

Among them, the entropy method is an objective weighting analysis method. It was originally derived from thermodynamic analysis and has since evolved into a measurement method for calculating weights. It mainly determines the index weight according to the information size of the objective value, which can effectively avoid subjective judgment, and is calculated as follows.

Because there may be a lot of data, there needs to be a standard, data standardization:

$$\begin{aligned} &X_{ij} - \min\{X_j\}, \\ &X'_{ij} = \max\{X_j\} - \min\{X_j\}. \end{aligned} \tag{3}$$

Once the data is standardized, it has to calculate the percentage of each indicator for each region:

$$p_{ij} = \frac{X'_{ij}}{\sum_{i=1}^{m} X'_{ij}}. \tag{4}$$

Then, the information entropy is calculated according to the proportion of the index:

$$e_j = -K \sum_{i=1}^{m} \left(p_{ij} \times \ln p_{ij}\right), \tag{5}$$

where i represents the sample and j represents the indicator. To some extent, the upper-form information entropy can be used as a scale of comparison for these data, but there may be a lot of errors, and then their weights can be calculated for comparison.

$$W_j = \frac{d_j}{\sum_{j=1}^{n} d_j}, \tag{6}$$

where d_j is derived from information entropy, i.e.,

$$d_j = 1 - e_j. \tag{7}$$

The e_j in formula refers to the information entropy of the j th index. The higher the score, the better the development.

$$Y_{ij} = W_j \times X_{ij}, \tag{8}$$

where i is the sample, j is the indicator, and X_{ij} is the jth indicator for the ith region.

Table 3: Comprehensive score of new urbanization from 2016 to 2021.

Years	2016	2017	2018	2019	2020	2021
Inner Mongolia	0.50	0.51	0.48	0.45	0.44	0.46
Xinjiang	0.46	0.44	0.45	0.48	0.46	0.45
Sichuan	0.44	0.43	0.42	0.43	0.45	0.44
Yunnan	0.31	0.29	0.27	0.25	0.24	0.25
Shaanxi	0.52	0.46	0.45	0.48	0.44	0.45

Then this paper studies the circle structure based on these theoretical studies. Among them, the circle structure theory mainly regards the city as a dynamic and developing entity with spatial form, with a certain population size (except agricultural population). They participate in various economic activities spatially and in the form of multiparty relations. There is a threadlike relationship between the levels of the circle, which is influenced by the spatial "distance decay law". The whole region has gradually evolved into a kind of aggregation and diffusion in one, the core area is mainly the regional pattern of built-up areas. As the circles continue to expand to the surrounding areas, the changes from urban to rural areas are also reflected in different aspects of life, entertainment, living environment, and so on, showing a very regular derivative change. The city and its surrounding areas are basically divided into three parts: inner circle, middle circle, and outer circle. The inner circle is the center of the city, the most densely populated area with the best economic development. It is dominated by the tertiary industry. The middle circle is a compromise between urban and rural areas, which is between the two, and it is dominated by the secondary industry. The outer circle is dominated by the primary industry, which is the gathering place of agriculture, animal husbandry, and ecological environment.In the primitive society, hunting and harvesting dominated, and tribes began to form. Because of the different living environment and resources, the tribes have different characteristic industries. In the agricultural era, small villages and towns appeared. The production mode of large machines has gradually replaced the handicraft workshops, and the production has achieved scale, showing the characteristics of high efficiency. Articles are abundant, industry-centric cities are gradually forming, populations are clustered in the same area, sharing the same infrastructure and social services. With the rapid development of these cities, the downstream industries of these industries develop simultaneously in the surrounding areas. Peripheral agriculture is supplied to the city, and products of the city are supplied to the periphery. With the development of economy, income disparities and other factors that meet human needs have caused cities to expand. The cost of living and production of enterprises in cities with secondary industry as the main factor increases. As industries move out to surrounding cities, the crowding out effect of cities appears, forming a middle circle. The central circle begins to develop the high value-added stage of the industrial chain, that is, the tertiary industry such as financial industry and service industry [21], as shown in Figure 6:

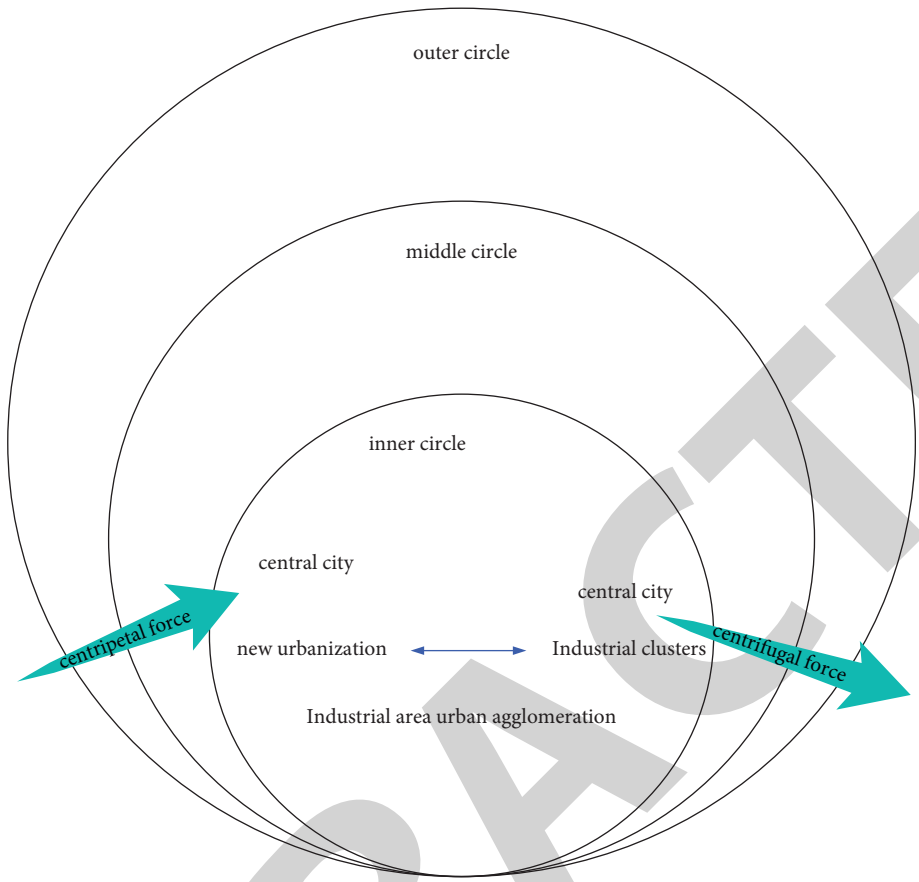

Figure 6: Structure.

According to the circle structure theory, the effect of cities on economic growth decreases with the increase of spatial distance, that is, the areas far away from cities are subject to more spatial restrictions, and the leading role of cities is less. In the process of mutual promotion and development between the new urbanization and industrial clusters in the western region, the industrial structure changes of the central cities in the western region will also synchronize with the development progress of the new urbanization. It is a problem that can be alleviated by "Belt and Road" to break the limit of space distance and promote the city to achieve economic development on a larger scale. It can promote good interaction between new urbanization and industrial clusters [22]. As a national initiative, Belt and Road focuses on creating an open market environment in the Inland areas, especially in the western regions. The western region has been lagging behind the eastern region for a long time due to natural characteristics, factor endowment and other factors, market size and demand are limited, economic growth is slow, and industrial structure transformation is lagging behind. It provides a good external environment for the industrial development and transformation in the western region. As China's bridgehead connecting the Middle East and Europe, the western region is easier to form industrial clusters and improve the competitiveness of industrial clusters in the face of large-scale international market demand and fierce international competition. The research shows that there are two formation modes, endogenous industrial cluster and exogenous industrial cluster. Endogenous reasons generally refer to the interest-driven industrial clusters, that is, first of all, with increasing market demand, key enterprises entering the market, and enterprises pursuing external and scale economy. Its gradually concentrated production of this growth-oriented industry is easier to drive other industries throughout the region, and it promotes related industries to gradually develop and cluster in a certain region. The comparative advantage between regions and historical factors together promote the formation of industrial clusters in a region. The exogenous factors mainly consider the industrial clusters formed after the guidance of government policies. So on the one hand, the "the Belt and Road" is an exogenous factor; on the other hand, the "the Belt and Road" initiative has opened up the international market [23].

4. Optimizing Economic Development Path of Western Region under Background of "Belt and Road"

4.1. Route Evaluation. Through analysis and evaluation path, it needs to build evaluation index, collect data, determine index weight, as well as calculate score. This paper determines the route results by sorting the values, as shown in Figure 7.

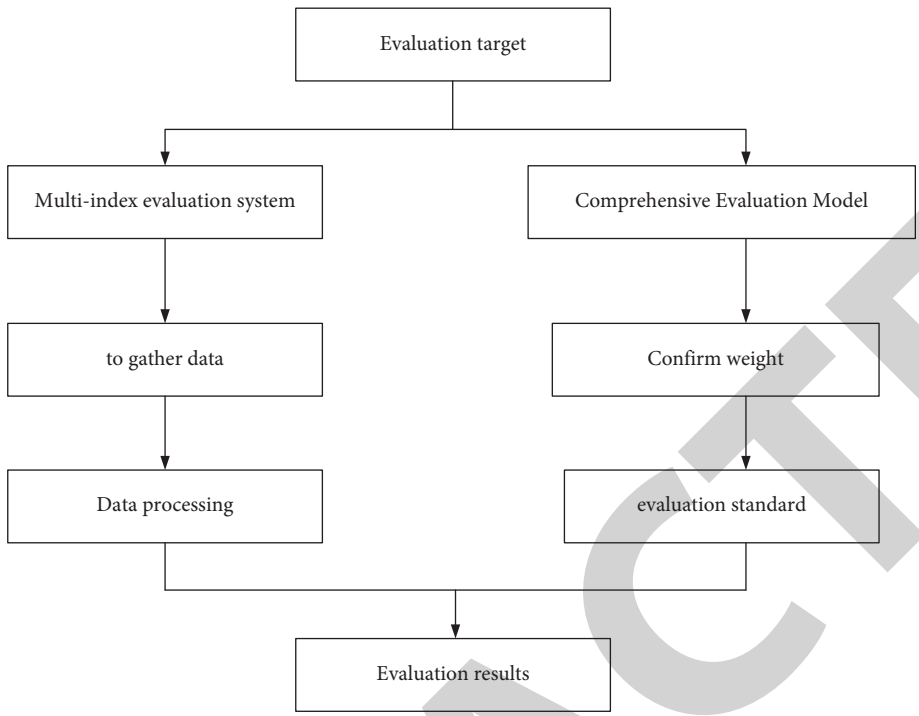

Figure 7: Evaluate route flowchart.

In this paper, the preprocessing of evaluation index is to make different dimensions of the index can be converted into the same type. The preprocessed indicators become the same type of data that can be added or multiplied. This paper mainly builds and analyses the models of Inner Mongolia, Xinjiang, Sichuan, Yunnan, and Shaanxi, and the model formulas are as follows:

$$\begin{aligned} \mathrm{NUNMG} &= 0.35 + 0.41 \times \mathrm{ICNMG} + u, \\ \mathrm{NUXJ} &= 0.42 + 0.41 \times \mathrm{ICXJ} + u, \\ \mathrm{NUSC} &= 0.26 + 0.41 \times \mathrm{ICSC} + u, \\ \mathrm{NUYN} &= 0.28 + 0.41 \times \mathrm{ICYN} + u, \\ \mathrm{NUSX} &= 0.18 + 0.41 \times \mathrm{ICSX} + u, \end{aligned} \tag{9}$$

where u refers to the random interference term.

Moreover, the consistency method adopted in this paper is to use linear transformation to change the inverse index into positive index, such as x_i as the inverse index and y_i as the transformed index:

$$y_i = \frac{1}{x_i}, \quad (i = 1, 2, 3, \ldots, n). \tag{10}$$

Before using the index system to make the evaluation, there is still an important basic work to be done, no dimension. In this paper, before converting the actual value of the index, the critical value of the corresponding index needs to be selected. It then uses the threshold value to compare with the actual value of the index, and uses such a linear transformation formula to transform the actual value of the index into the evaluation value. Generally, they are transformed by the following formulas:

$$y_i = \frac{\max x_i - x_i}{\max x_i - \min x_i}. \tag{11}$$

or

$$y_i = \frac{x_i - \min x_i}{\max x_i - \min x_i}. \tag{12}$$

The evaluation value decreases with the increase of the index value, which is used to reverse the dimensionalization of the index.

Among them, the mutual gravity between cities is an important factor to measure the degree of economic ties between cities, and it is also an important indicator of regional economic spatial development. In this paper, the gravitational model is used to select 10 major node cities and calculate the strength index of economic connection between the two places to further analyze the economic and spatial status of the Northwest region. The index of strength of spatial economic links is

$$F_{ij} = \frac{P_i Y_i + P_j Y_j}{D_{ij}^2}. \tag{13}$$

Type P is nonagricultural population (10,000 people), Y is nonagricultural value (100 million yuan), D_{ij} is the straight-line distance between the two places (kilometers), and F_{ij} is the strength of economic connection between cities. Some of the following city names are denoted by A, B, C, etc. Figure 8 shows the distance between the two cities.

As shown in Table 4, it is mainly the economic quality and attractiveness of some cities.

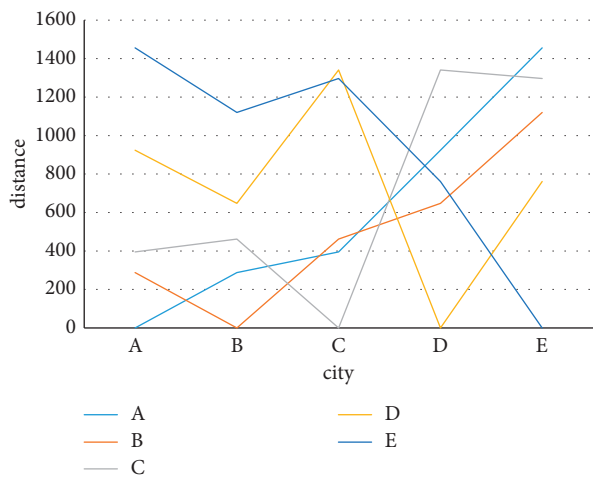

Figure 8: Distance map of two cities.

Table 4: Economic quality and gravitation.

City	A	B	C	D	E	F
Economic quality	684	152	97	150	386	453
Economic gravity	0.42	0.19	0.07	0.25	1.14	0.81

As shown in Figure 8 and Table 4, the distance, economic quality, and economic gravity between the two cities are clearly given, which can help with the subsequent experimental data.

4.2. Data on Economic Development Path Optimization. Based on the good interaction between new urbanization and industrial clusters, this paper establishes a multi-index evaluation model. It then simulates the experiment under the Internet of Things and analyzes the data. In addition, a questionnaire has been prepared, as shown in Table 5.

This paper conducts a simple questionnaire through the Internet. After about two or three weeks, the questionnaire is collected and the data is analyzed. A total of about 3,000 questionnaires were collected, of which 60% were in the East and only 40% were in the west. Figure 9 shows the specific data.

It can be seen that most people in the eastern and western regions think this method is feasible.

These data are then used for simulation experiments, and then compared with GDP and GDP per capita over previous years, as shown in Figures 10 and 11.

Based on the above data analysis, it can be seen that more than 75% of people think that the interactive development of new urbanization and industrial clusters is more than 50% feasible. In fact, the simulation analysis also shows that the development of this method in the next few years is very good, GDP continues to rise, and the growth rate is more than 15% higher than in previous years. And the annual growth is expanding. In the sixth year, it will reach more than 40%, which may be improved in the future, so that the western region can develop rapidly. Therefore, the interactive development method of new urbanization and industrial clusters can play a role in the development of the western region.

4.3. Recommendations. The western region, as the core area of "Belt and Road", is a representative region in China's inland open economy. It is an important area for China to achieve economic connectivity and road interconnection in the Middle East. It is the most important part to undertake industrial transfer in the eastern region. In order to successfully complete the 13th Five-Year Plan and realize industrialization and urban-rural integration, the development of the western region should be supported by the "Belt and Road" strategy and policy. It actively promotes the good interaction between new urbanization and industrial clusters and creates a perfect external environment. This paper will elaborate policy recommendations and strategies from the following aspects.

4.3.1. Enhancing the Promotion of New Urbanization by Industrial Clusters in the West. By adjusting the industrial structure, it can promote industrial transformation and upgrading. The industrial structure in the western region is mainly secondary industry, the proportion of primary industry is still large, and the tertiary industry is developing slowly. Traditional industries are mainly extensive. It mainly depends on the excessive consumption of resources, low-cost labor force, and so on to promote economic development. With the progress of society and the increase of labor costs, the country has joined the global economic division of labor system. The extensive economy has been hampering the development of the western region's economy. By vigorously developing strategic emerging industries, they will transform to tertiary industry on the basis of their unique industrial base and resource advantages in the western region. It takes high-tech and other high-output, high-quality, high value-added development models as the core. On the one hand, it can attract enterprise clusters and solve the employment problems in the process of new urbanization. On the other hand, it can speed up industrial transformation and promote rapid economic growth.

4.3.2. Enhancing the Promotion of New Urbanization to Industrial Clusters in the West. It takes urban agglomerations as its carrier and rationally arranges the hierarchy of cities and towns. In the layout of urban group planning, there is no close connection between cities, and there is a phenomenon of faults. Radiation-driven effect of central cities is not obvious. Therefore, the government should rationally arrange the hierarchy of cities and towns with urban clusters as its carrier. First, it needs to clarify the central and surrounding cities. Through the study of the geographic location and surrounding environment of the central city, it can rationally plan the city functions and build a characteristic city. Secondly, considering the relationship between the central cities, it maximizes the coordination mechanism between cities and rationally arranges the urban hierarchy. On the one hand, the construction of urban

Table 5: Questionnaire.

1. How feasible do you think the interactive development of new urbanization and industrial clusters is in the western region?
A. 75–100% B. 50–75% C. 25–50% D. 0–25%
2. If the western region adopts the interactive development method of new urbanization and industrial clusters, how much will the GDP of the western region increase in the next few years?
The first year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The second year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The third year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The fourth year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The fifth year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
3. If the western region adopts the interactive development method of new urbanization and industrial clusters, how much will the per capita GDP of the western region increase in the next few years?
The first year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The second year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The third year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The fourth year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
The fifth year: A. 100–200% B. 75–100% C. 50–75% D. 25–50% E. 0–25%
4. Are you from the eastern region or the western region?
A. Eastern region B. Western region

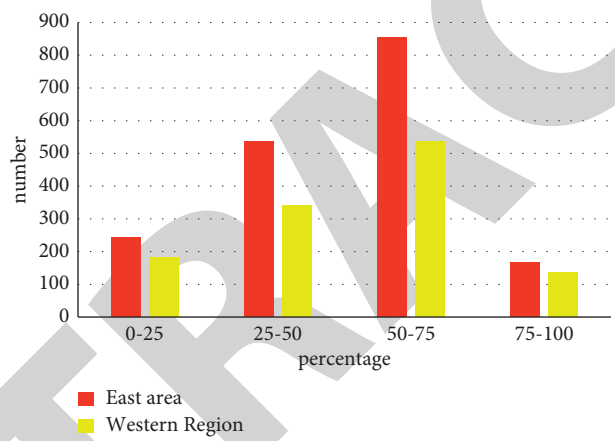

Figure 9: Data maps considered viable in the East and West.

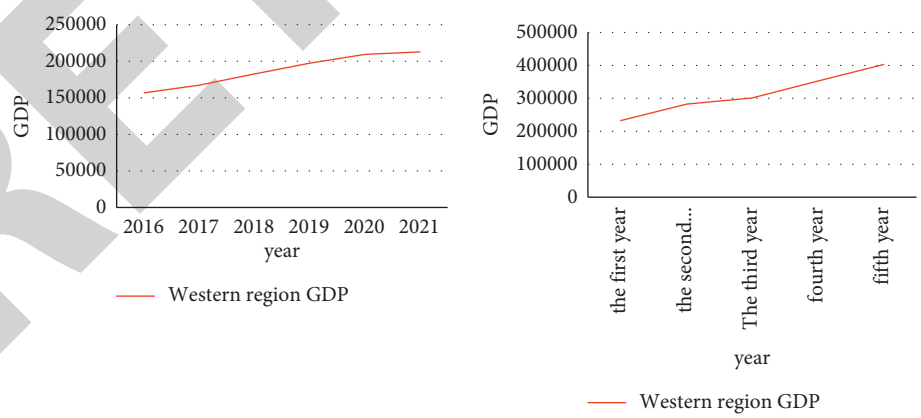

Figure 10: Comparison of GDP in West China.

agglomerations can promote the links between industries, achieve regional coordinated development, lengthen the industrial chain, and promote industrial clusters. On the other hand, the establishment of urban hierarchy can optimize the industrial layout and realize industrial ladder development. With the government as the leading role and the market mechanism as the guide, it will increase the support of infrastructure construction and public service platform. It uses rich information exchange, the wisdom and technology of colleges and universities to attract enterprises to enter. It creates more employment opportunities and realizes economic prosperity.

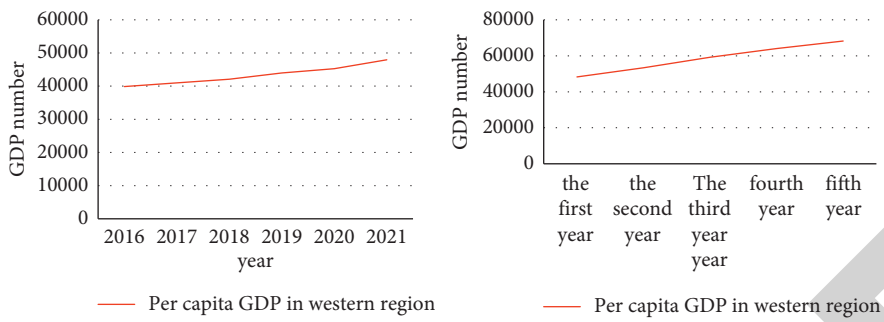

Figure 11: A comparison of GDP per capita in the western region.

5. Discussion

This paper mainly takes the gross GDP and per capita GDP of the previous few years in the western region as the initial comparison, and then conducts a large-scale survey through the questionnaire method to analyze the questionnaire data. Then this paper builds models in Inner Mongolia, Xinjiang, Sichuan, Yunnan, and Shaanxi. The general situation and growth rate of gross and per capita GDP in Inner Mongolia, Xinjiang, Sichuan, Yunnan, and Shaanxi in the next few years are simulated and analyzed by the Intelligent Internet of Things. This paper then compares with the initial quantity to compare the advantages, disadvantages, and feasibility of the economic path of the interactive development of industrial clusters and new urbanization. However, there are still some deficiencies in this paper. This paper mainly analyses the gross and per capita GDP of Inner Mongolia, Xinjiang, Sichuan, Yunnan, and Shaanxi from 2016 to 2021. This may lead to some errors in model building and data analysis. In addition, the questions in the questionnaire can be more detailed. There are also data based on the Internet of Things, which may be different from the actual, but the reliability is still high.

6. Conclusion

This paper analyses the difference between the gross and per capita GDP in the East and West. The gross and per capita GDP in the West are significantly lower than that in the East in 2016–2021. This paper then simulates the development of the western region based on the interactive development of industrial clusters and new urbanization through the Internet of Things. The experimental data show that in this way, the gross and per capita GDP of the western region will increase by more than 30% annually in the next few years. This is still the first simulation data, and may increase by more than 50% in many years. Moreover, in the future, there will be more and more research on the optimization of economic development path in the western region under the background of "Belt and Road", and the western region will also develop better and better.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest regarding the publication of this article.

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Retraction

Retracted: Design of Game Data Acquisition System Based on Artificial Intelligence Algorithm

Security and Communication Networks

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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Research Article

Design of Game Data Acquisition System Based on Artificial Intelligence Algorithm

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Game data collection system is a tool used to collect the behavior data of users about the game. It can be used for data analysis of user behavior so that game manufacturers can keep abreast of market dynamics and popular trends, and they also can have a deeper understanding of the behavioral habits and psychology of player user groups. The defects of the current data acquisition system include that the data are not encrypted. The network transmission efficiency is relatively low. The acquisition speed is slow, and the settings cannot be dynamically changed. This paper proposes to study how to enhance the acquisition ability and improve the analysis efficiency in the design of data acquisition system for solving these problems. Therefore, on the basis of artificial intelligence algorithm, this paper designs a game data collection system by using artificial neural network algorithm, support vector algorithm, and cluster analysis algorithm, which solves the basic problem of slow data collection in current data collection and plays a role in improving the efficiency of network transmission. The experimental results in this paper show that when the number of data is more than 300, the time-consuming time reaches more than 68 ms. When the number of written data is more than 300, it takes more than 181 ms. When the number of deleted data is more than 300, it takes more than 236 ms. From the above data, it shows that the designed game data collection system is rapid and efficient.

1. Introduction

With the rapid development of mobile Internet technology and the popularity of smartphones in recent years, China's mobile game industry has also seen rapid development. The current data collection method is to implant relevant collection tools in the game to obtain real-time user game behavior data, to understand market dynamics and popular trends, so that the behavioral habits and psychology of the player user group can be grasped more deeply.

China's game industry has also developed rapidly. The game market is gradually transitioning from the incremental market to the stock market. How to snatch existing game users to increase game revenue has become the biggest challenge for game manufacturers. Therefore, based on artificial intelligence algorithm, this paper applies it in the research of game data collection system, which can greatly improve the optimization and operation efficiency of the game, expanding the analysis of market channels, so that precise marketing can be carried out.

The game data collection system designed by artificial intelligence algorithm in this paper has the following major innovations:

(1) It can not only collect general data that all mobile games need to use, but also collect custom data customized for business needs according to the configuration files issued by developers. Developers only need to add this tool to project dependencies through Gradle, and call the tool's initialization code in application to complete the tool integration.

(2) Using the non-buried point solution can quickly and automatically obtain a large amount of inspiring user operation information, which is of great value in game applications dominated by user interaction. Through analyzing the user's behavior data, the click

probability of the user on the corresponding interface of the application can be quickly analyzed, so that the research and development engineers can make more in-depth optimization for some function points that users pay much attention to.

(3) It also improves tool stability. The number of crashes brought to the game due to insufficient tool stability should be minimized to avoid additional problems for developers. Tool usage should be as simple and understandable as possible. The interface for users to call should be as simple as possible to reduce the learning cost for developers to integrate this tool.

2. Related Work

Artificial intelligence is a branch of computer science that attempts to understand the essence of intelligence and produce a new type of intelligent machine that can respond in a manner similar to human intelligence. Research in this field includes robotics, language recognition, image recognition, natural language processing, and expert systems, etc. Artificial intelligence has been used in many fields. Wang et al. proposed a new hybrid approach that used an ensemble data fluctuation network (DFN) and multiple artificial intelligence (AI) algorithms, which was called the DFN-AI model [1]. Majetta et al. described a method of generating large amounts of data and using it to find the relationship between a room controller and a certain room. Simulation scenarios with different room location, usage, and controller models could be defined and developed with it [2]. Wang has built a linguistics artificial intelligence teaching model with improved machine learning algorithms. The efficiency of the teaching process was improved according to the teaching needs of linguistics. A pedagogical evaluation was conducted, and an MCTS-based root cause analysis algorithm was also optimized [3]. Grath et al. intend to investigate the clinical utility of applying deep learning denoising algorithms to standard wide-field optical coherence tomography angiography (OCT-A) images [4]. Zakaria et al. discussed the optimization of hyperparameters for both models. Then sensitivity analysis and uncertainty analysis were performed. The model's ability to predict river levels with different lead times (1, 3, 6, 9, 12, and 24 hours) was then investigated [5]. Sebastianelli et al. aimed to describe a new tool to support agencies in implementing targeted responses, which was based on quantitative and multiscale elements to combat and prevent emergencies, such as the current COVID-19 pandemic [6]. Liu et al. presented a crowd-sourced inference method with variational tempering that obtains the ground truth. Both worker reliability and task difficulty level were taken into account, and local optima was ensured [7]. Mirotta et al. focused on interpreting fuel rod behavior during power pulses using an online fuel motion monitoring system called a hodoscope [8]. The study of Nowakowski et al. included a simulation of e-waste collection requests in Tokyo, Philadelphia, and Warsaw, which was the algorithm used to compare various city, street, and building layouts. The results showed that the best of the four algorithms was simulated annealing to facilitate mobile on-demand collection of e-waste, and the worst was tabu search [9]. Barcelos et al. introduced a new current-based method to identify bearing damage, applying artificial intelligence algorithms. Experiments and field tests showed promising results, validating the method for bearing damage diagnosis [10]. The work of Prabakaran introduced a new current-based approach that applied artificial intelligence algorithms to identify bearing damage. Experiments and field tests presented promising results, validating this method for the diagnosis of bearing damage [11]. Mihai et al. in the paper aimed to develop three machine learning algorithms. It could significantly improve the drug discovery process, which was possible to combine computer scientists and drug development experts [12]. The landslide susceptibility maps produced by Chen et al.'s research could be used to manage landslide hazards and risks in counties, township, and other similar areas [13]. However, the above-mentioned field research on artificial intelligence algorithms only stays in the theoretical part, and the practicality is not strong.

3. Artificial Intelligence Algorithms

3.1. Artificial Neural Networks. Overview: the term "Artificial Neural Network" (ANN) is derived from biomedical neural networks. A neuron can establish connections with multiple surrounding neurons through dendrites and axons to receive, process, and transmit information [14]. The human body's complex nervous system is built on hundreds of millions of neurons. Therefore, building a neural network that mimics the biological nervous system can help understand and capture the information implicit in the data. A single neuron model is shown in Figure 1.

The forward transmission of neuron information can be represented by

$$y = f\left(w_i x_i + b\right). \tag{1}$$

In formula (2), X_i represents the input signal; w_i represents the weight; b represents the bias part; y represents the signal output. The commonly used activation function is the sigmoid function as

$$f\left(x\right) = \frac{1}{1 + \exp\left(x\right)}. \tag{2}$$

In traffic forecasting, traffic data are input into the forecasting model as a time series. First, the training of the model needs to be completed. Then the trained model is used to make predictions. Usually, the optimization objective can be set as the error:

$$E\left(x\right) = \frac{1}{2}\sum_{i=1}^{N} y_i\left(x_i\right) - y_i\left(x_i\right)^2. \tag{3}$$

In formula (3), $y_i(x_i)$ represents the output data; y_i' (x_i) represents the target data; and N represents the number of data. Neural networks have often been used in combination with other optimization algorithms in traffic prediction in previous studies to obtain better prediction models [15].

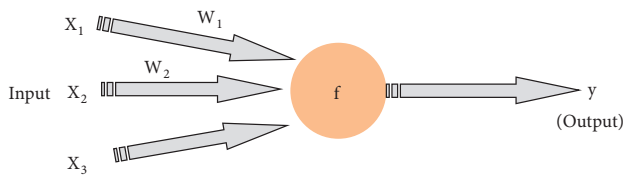

Figure 1: Single neuron structure.

3.2. Support Vector Machine Algorithm. Support vector machine (SVM) is a class of generalized linear classifiers that perform binary classification on data by supervised learning. It is a classifier with sparsity and robustness. Originally developed for solving linearly separable problems, support vector machine algorithms were developed on the basis of statistical theory and then gradually extended to the nonlinear case.

The mapping from the input feature space to the k-dimensional space in nonlinear classification is as

$$x \in R^l \longrightarrow y \in R^k. \tag{4}$$

The classification can be done using

$$g(x) = w^T x + w_0 = \sum_{i=1}^{N_s} \lambda_i y_i x_i x + w_0. \tag{5}$$

In formula (5), N_s represents the number of support vectors. Typical choices of kernel functions are as

$$K(x,z) = \left(x^T z + 1\right)^q, q > 0, \tag{6}$$

$$K(x,z) = \exp\left(-\frac{x - z^2}{\sigma^2}\right), \tag{7}$$

$$K(x,z) = \tanh\left(\beta x^T z + \gamma\right). \tag{8}$$

After a suitable kernel function is selected, the mapping to a higher dimensional space is implicitly defined. The Wolfe double optimization task becomes

$$\max\left(\sum_i \lambda_i - \frac{1}{2}\sum_{i,j} \lambda\lambda y y K\left(x_i, x_j\right)\right) \sum_i \lambda_i y_i = 0. \tag{9}$$

The resulting linear classification is as follows:

$$\text{If} g(x) = \sum_{i=1}^{N_s} \lambda y K(x_i, x) + w_o(<)0, x \in w_1(w_2). \tag{10}$$

Figure 2 shows a nonlinear SVM architecture, where the number of nodes is determined by the number of support vectors.

The SVM algorithm has great advantages in dealing with problems with smaller sample sizes. In case of larger problem design or when dealing with multiclassification problems, it is difficult to implement due to the complex solving process and the large amount of computation [16].

3.3. Cluster Analysis Algorithms. Meaning: agglomeration refers to the division of a collection of physical or abstract objects into multiple classes or groups, so that all objects belonging to the same class have a high degree of similarity, while objects in different classes are quite different [17]. The dissimilarity is calculated according to the attribute value of the described object, and the distance is the most commonly used measure. The class to be divided into clustering is unknown, which is different from classification, that is, clustering is an unsupervised observational learning. It is a data reduction technique that groups together variables or cases with similar data characteristics. It can be used in the development and research of data storage technology in the design and research of game data acquisition systems, and can construct Mysql database by using cluster analysis algorithm.

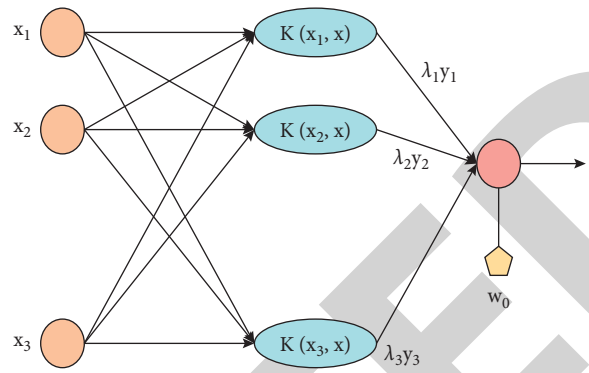

Figure 2: SVM architecture of kernel functions.

Suppose that $x = (x_1, \ldots, x_p)$, $y = (y_1, \ldots, y_p)$ are two points in space whose Minkowski distance is

$$d(x,y) = \left(\sum_i^p x_i - y_i^m\right)^{\frac{1}{m}}, \quad m > 0. \tag{11}$$

When $m = 1, 2, \infty$, three commonly used distances are obtained:

(1) When $m = 1$, it is the absolute value distance as

$$d(x,y) = \sum_i^p x_i - y_i. \tag{12}$$

(2) When $m = 2$, it is the Euclidean distance as

$$d(x,y) = \sum_i^p \left(x_i - y_i\right)^2. \tag{13}$$

(3) When $m = \infty$, it is the Chebyshev distance as

$$d(x,y) = \max_i x_i - y_i. \tag{14}$$

Minkowski distance satisfies the following three properties as

$$d(x,y) = d(y,x), \tag{15}$$

$$d(x,y) \le d(x,z) + d(z,y), \tag{16}$$

$$\text{If} x \ne y, d(x,y) > 0, d(x,x) = 0. \tag{17}$$

It should be noted that Minkowski distance is only limited to measure the similarity between numerical individuals and cannot be used to measure the similarity of attribute individuals. Observing the expression of Min's distance, it is easy to know that Min's distance is easily affected by larger data and ignores data with smaller values [18]. Min's distance often has a large error when there is data with a large value in a certain sample. In addition, Min's distance does not eliminate the effect of dimension. Since there is a linear correlation between the data, it will affect the distance between them. To eliminate this effect, the researchers propose the Mahalanobis distance based on the covariance between the data. Two vectors are randomly selected from the sample, and their Mahalanobis distance is as

$$d(x, y) = (x - y) \sum_{-1} (x - y)^T. \tag{18}$$

(1) It is often necessary to discriminate the effect of a certain kind of clustering in practice. The standard function of clustering used is as follows.

Between-class dispersion sum of squares functions:

$$J = \sum_{j}^{k} \left(C_j - C\right)^T \left(C_j - C\right). \tag{19}$$

In formula (19), k represents the number of clusters; c_j represents the class center of a cluster; c represents the sample center.

(2) Within-class dispersion sum of squares functions:

$$J = \sum_{j=1}^{k} \sum_{i=1}^{N_i} x_i^{(j)} - c_j^2. \tag{20}$$

In formula (20), $x_i^{(j)}$ represents an individual (sample data point) in cluster j; c_j is the cluster center; k is the number of clusters set according to prior knowledge; N_i represents the sample capacity of cluster j; $x_i^{(j)} - c_j$ represents the distance from $x_i^{(j)}$ to the class center c_j.

Therefore, it can be seen from the above method that the artificial neural network algorithm can play a role in helping it establish the framework of the data acquisition system in the framework of the data acquisition system. The support vector machine method can help the establishment of the reporting module in the data acquisition system. The cluster analysis algorithm can help the design of data storage services, and the data acquisition system designed by the above algorithm is of great significance at present.

4. Construction and Design of the Data Acquisition System

4.1. Acquisition Process. The entire data collection tool collection process starts after the data collection tool SDK is initialized when the app starts. When the app is installed for the first time, it obtains and reports the information required for app channel statistics. When it is started for the first time today, it will report yesterday's PV data and startup times and other total data from yesterday. Otherwise, it will report the application profile data that needs to be counted for this startup, such as the startup time and the duration of the application used after the last startup. The collection of real-time data such as player behavior occurs after the application is started and when an interaction event occurs during the player's operation. After the original touch event is generated, the original event information needs to be matched with the information of the view layer. Then, the target data are obtained by step-by-step reflection according to the data path, and after finding the original interaction event of the data, the data are reported according to the reporting policy. The data analysis module processes the data and generates data files, and the interaction module grabs the data files and uploads them to the server. The overall workflow of the data acquisition tool is shown in Figure 3.

4.2. Outline Design of Technical Architecture. From the perspective of technical implementation, the mobile game application data collection tools are mainly divided into two parts: One part is data collection, and the other part is data reporting. Among them, the core part is data collection. The data collection and data reporting are connected to the SQLite database through the Handler message mechanism. This section will introduce the outline design of the technical architecture of the mobile game application data collection tool in two parts: the outline design of the technical architecture of data collection and the outline design of the technical architecture of data reporting.

4.3. Outline Design of Data Acquisition Technology Architecture. The overall technical architecture adopts a top-to-bottom transmission design. The mobile game application receives touch events from the user, and the system calls the callback method of the related event when the event occurs. Since the custom AOP code has been inserted into the header of the callback method by means of byte code instrumentation at compile time, the AOP code acts as a proxy to perform data collection and processing operations for related events [19]. After the data collection is completed, the collected relevant data are distributed through the handler message delivery mechanism to distribute the messages of the user operation events, and the messages are cached in the message queue. The outline design of the data acquisition technology architecture is shown in Figure 4.

4.4. Outline Design of Data Reporting Technical Architecture. The data reporting part defines the data reporting policy, which determines whether the current data needs to be reported. The data sources include the current in-memory cached data from the Handler message distribution center and the historical data stored in the SQLite database. The schematic design of the data reporting technology architecture is shown in Figure 5.

As can be seen from the figure, the data reporting technology includes the current in-memory cached data

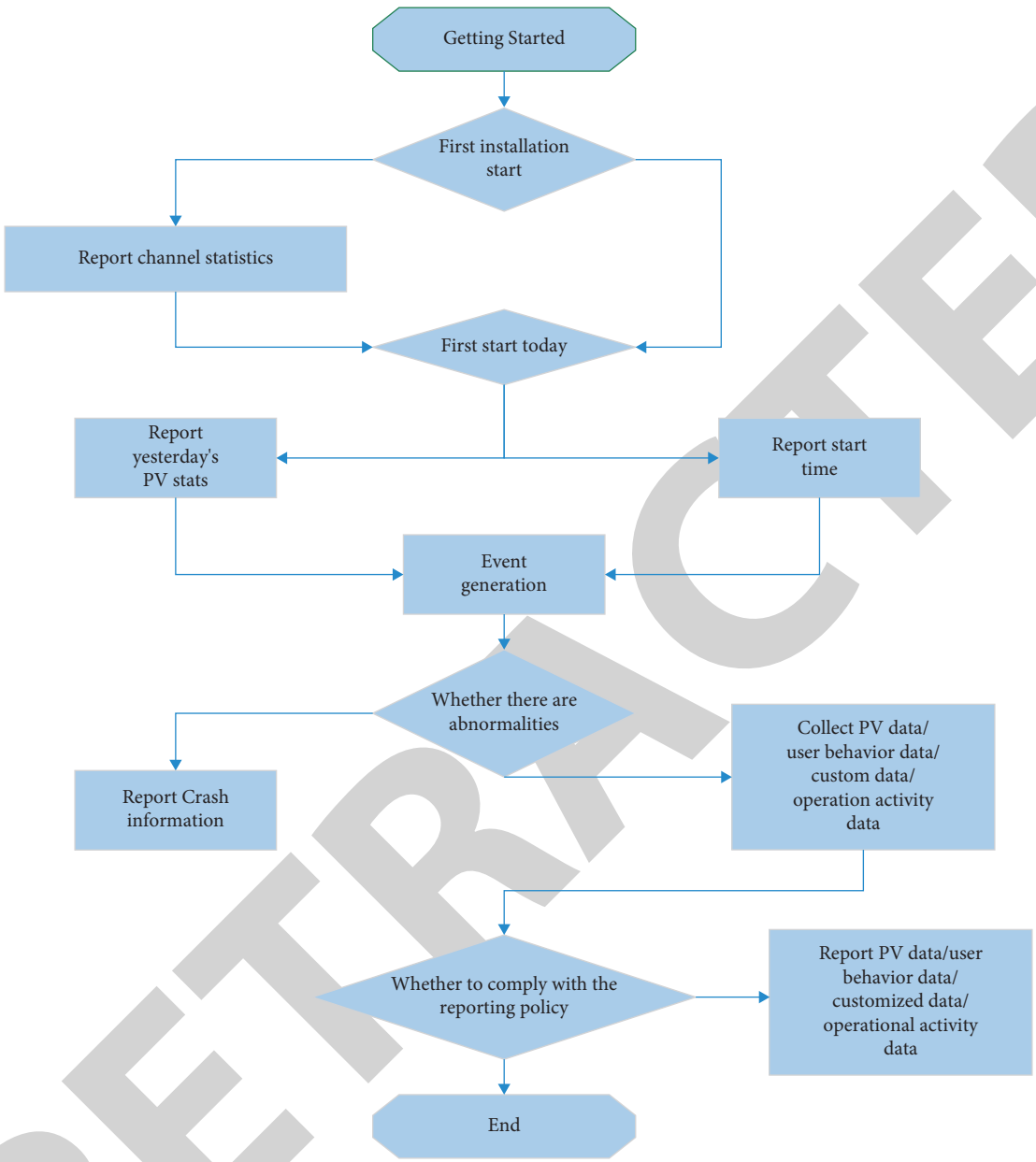

Figure 3: Workflow diagram.

from the Handler message distribution center and the historical data stored in the SQLite database, which are loaded into the data storage server through the Kafka cluster.

4.5. Outline Design of the General Data Acquisition Module. The general data collection module is responsible for collecting general data. This module will introduce the collection of general data from four parts: application overview, channel statistics, user equipment, and PV statistics.

4.5.1. Application Overview. The application profile mainly collects crash information, supplemented by application version, device identification information, usage time, and startup times. Crash information plays an essential role in the development process. By collecting crash information, it can count the stack information of various exceptions that occur in user scenarios. Developers repair crashes in time to reduce the frequency of crashes, which can improve the stability of the application and improve the user experience. The model class design of the application profile is given in Table 1.

4.5.2. Channel Design. Channel statistics mainly count the channel from which the application currently used by the user is downloaded. The purpose of obtaining geographic location information is to better statistically analyze the geographic distribution of the user. To realize channel statistics, this paper designs a custom multichannel packaging tool. It writes the channel information in the generated

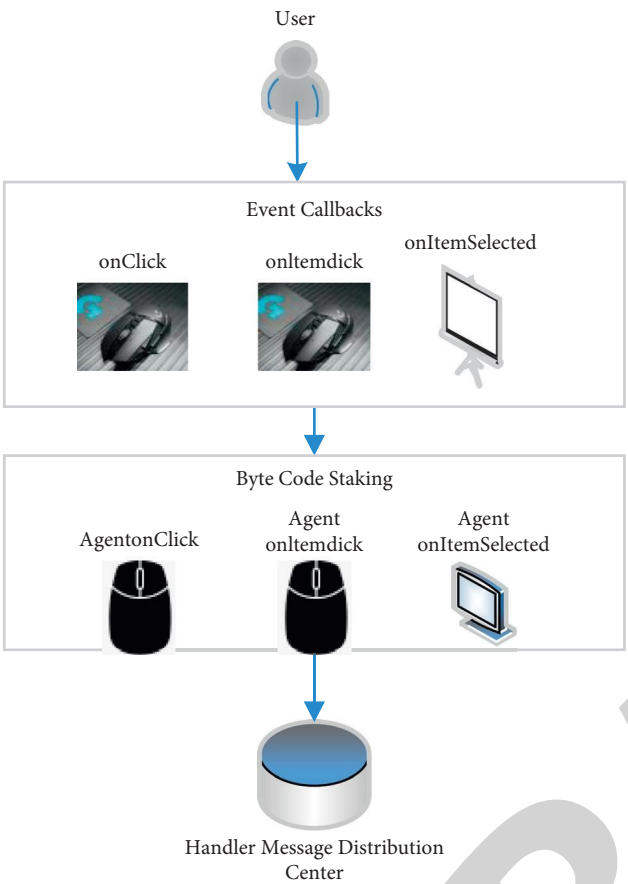

Figure 4: Data acquisition technology architecture diagram.

package through a custom multichannel packaging tool, so that the data collection SDK can obtain the channel information when the application is running. The model class design of channel statistics is given in Table 2.

4.5.3. User Equipment. User device statistics system version number, screen resolution, remaining memory, networking mode, IP address, and other device information, such as ACTIVITY_SERVICE, CONNECTIVITY_SERVICE, and WIFI_SERVICE, etc. By obtaining the object corresponding to the system service, the corresponding device information can be obtained. The model class design of the user equipment is given in Table 3.

4.5.4. PV Statistics. PV statistics are responsible for counting the number of clicks each person has on each page every day. The statistical information includes the name of the current page and the corresponding PV times. These data are of great significance for the statistics of users' preferences for APP usage. The model class definition of PV statistics is given in Table 4.

The statistical method of PV time mainly updates the PV times of the page in the corresponding data table by implanting the database update operation in the onCreate method of activity or fragment. It takes an event page as an example. If users open a certain event page frequently, it means that the current activities in the online environment are very attractive to users, which has great guiding significance for future event organization and strategy formulation.

4.6. Data Storage Service. This paper uses Kafka as the message system for server-side data storage. Since Kafka is distributed, it can meet the requirements of high concurrency and high throughput brought by real-time data reporting by data collection tools. The processing flow of the data storage service data flow is shown in Figure 6.

As a message middleware, the Kafka cluster is not only responsible for processing the data reported from the client, storing the data in MySql in turn, but also processing the data query from the data statistics analysis service and the PC front-end, and extracting the data from MySql. As the amount of business data increases, the number of Kafka can be increased to horizontally expand Kafka and improve the throughput of the Kafka cluster. The specific storage of MySql data is similar to the client's SQLite storage [20].

This section is the key chapter of this paper and is the realization part of the whole data acquisition tool. In this chapter, the design and implementation of general data collection module, custom data collection module, user behavior data collection module, byte code instrumentation module, data reporting module, and server-side data storage module of game application data collection tools are introduced in detail in combination with the artificial intelligence algorithm analysis and outline design in the Methods section. Through the detailed introduction in this chapter, all requirements of the game application data acquisition system have been completed.

5. Game Data Acquisition System Test and Results

This section tests and analyzes the mobile game data collection tool to verify whether the design and implementation of the tool meet the design requirements of the tool.

5.1. Test Environment. Based on the support vector machine algorithm in the artificial intelligence algorithm, combined with its characteristics in data analysis, the latest data on the distribution of Android platform versions released on the official website of Google Android developers show that Android 5.1, Android 6.0, Android 7.0, and Android 8.0 versions occupy 19.2%, 28.1%, 22.3%, and 21.7% of the market share, respectively, which occupies the top four in market share. Therefore, this article selects an Android mobile phone with the above four Android versions as the test mobile phone in this chapter. The selected mobile phone parameters are given in Table 5.

5.2. Test Plan. The testing part of this paper will start from two aspects, namely, functional testing and performance testing. The goal of functional testing is to verify whether each module of the data acquisition tool meets the basic data

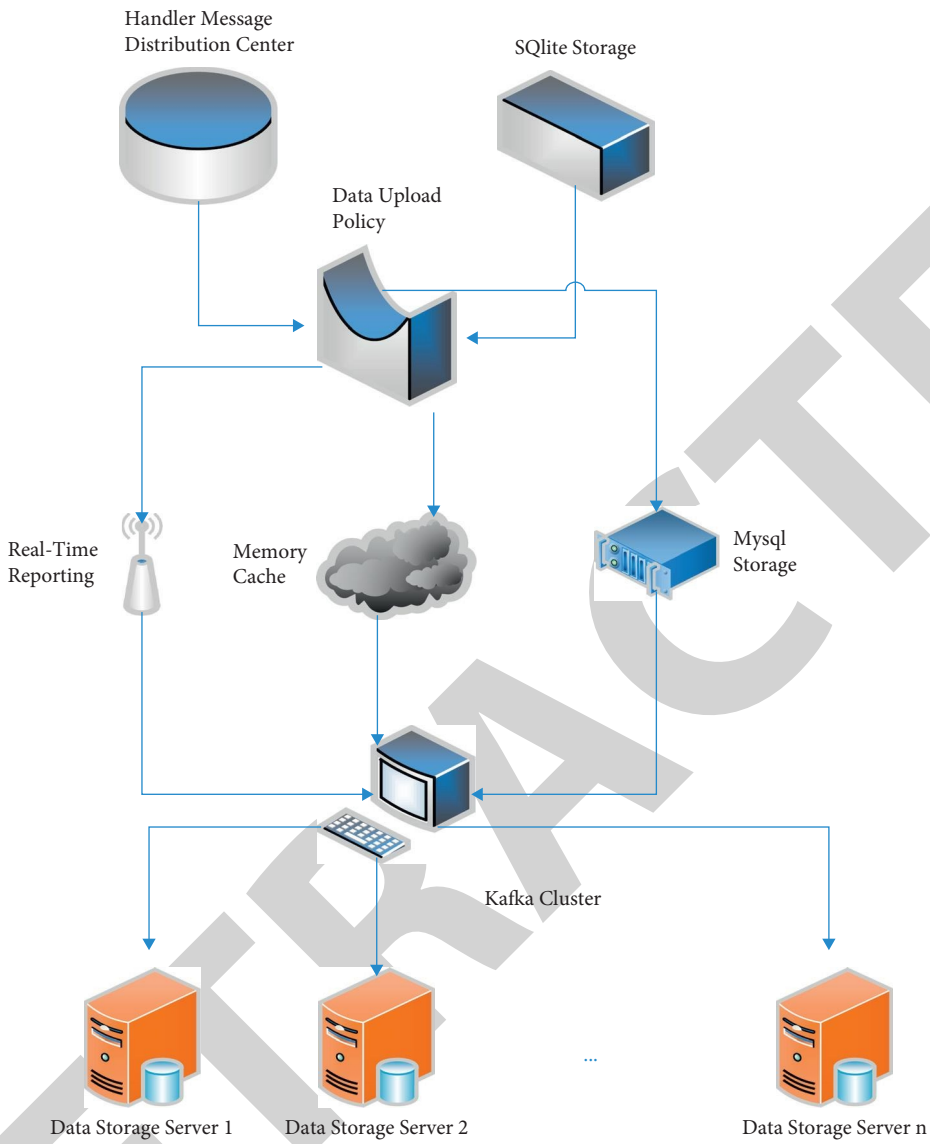

Figure 5: Overview of data reporting technology.

Table 1: Application overview model class.

Model type	Field name	Meaning
Application Data Block	appVersion	Application version
	crashInfo	Application crash information
	deviceTag	Device identification
	usedTime	Length of use
	launchCount	Number of starts

Table 2: Channel statistics model class.

Model type	Field name	Meaning
Channel Data Block	channelName	Channel name
	deviceName	Device name
	userPosition	User location

Table 3: User device model class.

Model type	Field name	Meaning
Device Data Block	deviceModel	Device model
	systemVersion	System version number
	Screen	Screen resolution
	iResolution	Remaining memory
	Memory remain	Networking method
	netMode	Network operator
	netOperator	IP address
	ipAdress	User location

Table 4: PV statistics model class.

Model type	Field name	Meaning
PVD Data Block	pageName	Page name
	deviceTag	User device ID
	pagePVCount	Page PV count.

Table 5: Test phone parameter information.

Device model	System version	Screen size (inch)	Screen resolution
OPPO R9	Android 5.1	5.5	1920 ∗ 1080
Meizu MX6	Android 6.0	5.5	1920 ∗ 1080
Huawei nova2 Plus	Android 7.0	5.5	1920 ∗ 1080
Redmi K50 Pro	Android 8.0	6.7	1920 ∗ 1080

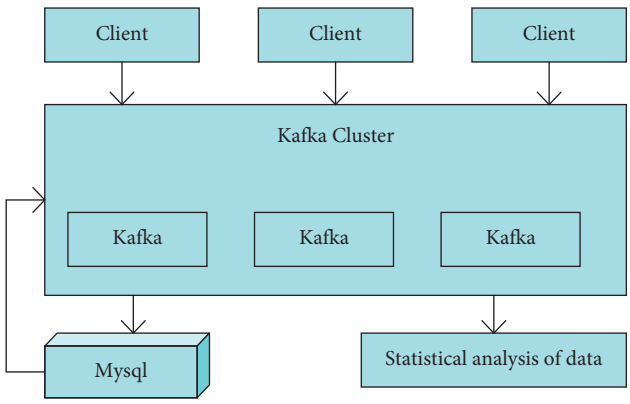

Figure 6: Processing flow of data storage service data flow.

acquisition functional requirements, including the general data acquisition module and the custom data acquisition module, to ensure the integrity of the tool function [21]. Since this article collects data from Android mobile games, this article takes the practice project chess and card game as an example and tests the functional requirements and performance requirements of the data collection tool according to the requirements put forward by the above evaluation in this article.

5.3. Functional Test of the General Data Acquisition Module. The function test of the general data acquisition module will start from the four functions of application overview information, channel statistics information, user equipment information, and PV statistics information to test whether the data collected by each function is correct. The test details of the general data acquisition module are as follows:

5.3.1. Test Content. Collect all information including application profile information, channel statistics, user device information, and PV statistics, such as app version number, crash information, app download channel number, phone screen resolution, page clicks, etc.

5.3.2. Test Steps. Through the channel packaging tool, the information of three different channels, Test1, Test2, and Test3, is written to the generated Release APK file. Then it opens the game, collects the application overview, channel statistics, and user device information, and clicks the button to switch pages to collect PV statistics on different pages. Finally, by inserting the code that accesses the data out-of-bounds in the code, the crash information is counted when this code is executed.

5.3.3. Expected Results

(1) During the running of the game, there is no game lag phenomenon

(2) When the array out-of-bounds code is executed, the application flashes back, and the collected Crash information is also caused by the out-of-bounds array

(3) The application profile data, channel statistics, user equipment data, and PV statistics are all the correct data collected

Test results are shown in Figure 7.

5.4. Function Test of the Custom Data Acquisition Module. The function of the custom data acquisition module is mainly based on the needs of the game project itself, configure the target data file to collect, and collect the corresponding data. This section will take chess and card games as an example to test the collection of the following information: time when entering/exiting the game; the time when the purchase room card option in the mall interface is clicked; the specific room card amount data of this option; the push message of the operation activity is clicked; entering the game selection page, the specific game is clicked event. The test details of the custom data acquisition module are as follows:

5.4.1. Test Content. Collect the time of entering the game and exiting the game; the specific amount data when the recharge amount option is clicked; the news push of the operation activity is clicked; the event of the subgame is selected.

5.4.2. Test Steps. First, it configures a custom data collection configuration file on the server and delivers it to the client. Next, it opens the chess and card game, receives the configuration file, collects the time of entering the game, then enters the mall interface, and selects room cards of different numbers in turn. After collecting the amount information of the selected room card, it enters the game selection interface. When Doudizhu or Mahjong is selected, it determines which game is selected to capture the event. When there is a news push of operational activities, it collects the page address to which the clicked news push jumps. Finally, when the user exits the game, the time of exiting the game is collected.

5.4.3. Expected Results

(1) During the running of the game, there is no game lag

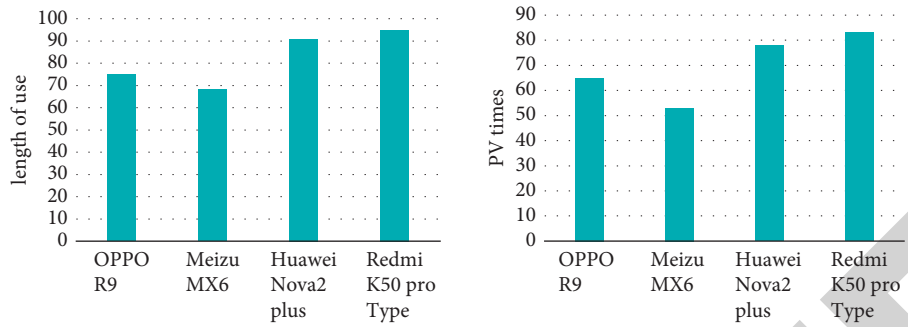

Figure 7: Test result graph.

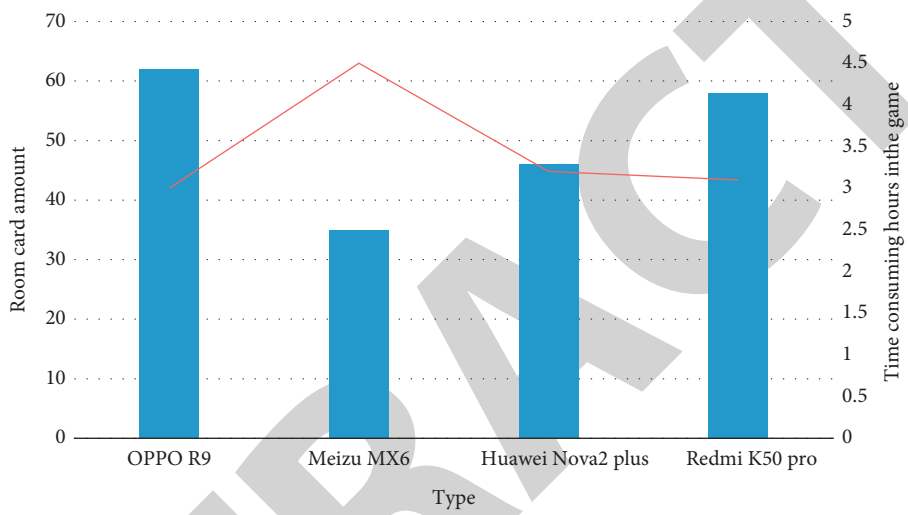

Figure 8: Functional test result graph.

(2) The collected time, amount, url, and other data will be displayed in the console in the form of logs

5.4.4. Test Results. The result is shown in Figure 8.

5.5. Data Collection Performance Test. The data collection performance test mainly tests the time-consuming situation of collecting data, and the result of the data collection performance test is an important basis for judging whether the data collection tool meets the basic requirements of mobile game collection data [22]. This article will generate a large amount of user behavior data by frequently operating the game within a certain period of time. It judges whether the performance of the data collection tool meets the actual use requirements according to whether there is a freeze or crash. The data acquisition performance test results are shown in Figure 9.

From the table that when the number of continuously collected data is less than 1000, the time consumption is within the acceptable range within 3 seconds, and there is no stuck phenomenon or crash phenomenon.

5.6. Data Read and Write Performance Test. The data read and write performance test mainly tests the time-consuming situation of reading and writing data in the SQLite database, to verify whether there is a serious performance problem when using the SQLite database to read and write data under the non-real-time reporting strategy. The test method is to modify the reporting policy to batch reporting and set the reporting threshold to 1000. It adds time-counting code to the methods of inserting data and reading data, respectively, and outputs time-consuming through the console.

5.7. Test Results. After the above functional tests of each module of the data acquisition tool, it shows the functions of each module, passing the test, and are in line with expectations. The functional test results show that the data acquisition tool can complete the functions of general data acquisition and custom data acquisition and has the function of local database storage. The evaluation of the data storage service based on the clustering algorithm is no different than the previous data storage service. Through functional testing, the mobile game data collection tool has met the expectations of functional design requirements and completed the basic functions of data collection and data reporting [23, 24]. The performance test of the system includes the data acquisition performance test and the data read and write performance test. If the test passes, it means that the test results of the system meet the expected values and perfectly fit the normal operation of the game application.

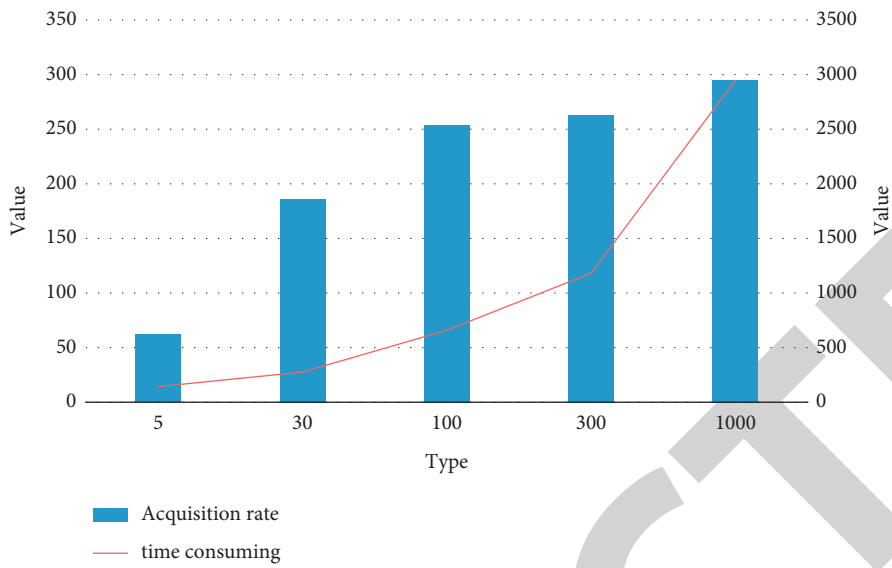

Figure 9: Relationship between time consumption, acquisition rate, and number of acquisitions.

6. Conclusions

This paper describes the design and research of a game data acquisition system based on artificial intelligence algorithms. The whole paper used artificial neural network algorithm in artificial intelligence algorithm and support vector machine algorithm to construct four modules of game data acquisition system: general data acquisition module, automatic data acquisition module, user behavior data acquisition module and data reporting module. This paper used the cluster analysis algorithm to conduct research and evaluation. It can be seen from the evaluation results that the mobile game application data collection tool functionally fulfills the functional requirements of general data collection, custom data collection, event data collection, data reporting, and back-end data storage. In addition, there is no stuttering phenomenon in the process of collecting data, which is in line with the performance requirements. It can be seen from the above that the game application data collection system provides basic data collection functions for individual developers and small and medium-sized enterprises, which helps users to collect data generated by users when operating games faster and more conveniently, to provide an important data basis for the subsequent improvement of product experience and optimization of product strategy. Mainly in the following aspects: only relying on client-side statistics cannot fully collect data, and some data still needs the cooperation of the server to complete. Taking the statistics of crash data as an example, the crash data obtained by the client-side statistics can only show the situation of crash occurring on this single mobile phone device and cannot obtain the total number of crash occurrences of the game application that day from a macro perspective. The ranking list of the total number of occurrences after aggregation of the same crash type, whether the number of crashes today has increased or decreased compared with the number of crashes yesterday, and so on. Therefore, after the client collects the data and reports it to the server, the server needs to classify, aggregate, and count the data to maximize the utilization of the collected data.

Data Availability

The data underlying the results presented in the study are included within the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Retraction

Retracted: High-Concurrency and High-Performance Application of Microservice Order System Based on Big Data

Security and Communication Networks

Received 8 January 2024; Accepted 8 January 2024; Published 9 January 2024

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) Manipulated or compromised peer review

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. Zhou, X. Wu, and Y. Chen, "High-Concurrency and High-Performance Application of Microservice Order System Based on Big Data," *Security and Communication Networks*, vol. 2022, Article ID 3424283, 11 pages, 2022.

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Research Article

High-Concurrency and High-Performance Application of Microservice Order System Based on Big Data

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The order system plays the role of the central nervous system in the integrated logistics operation. Theoretically speaking, the whole operation process of logistics service is to complete the order, the order information runs through all the links of the whole logistics, and the order processing efficiency affects the logistics process. This paper studies the high-concurrency and high-performance applications of the microservice order system based on big data, which prove that on the basis of big data technology, the performance of the microservice order system will be greatly improved. To this end, the analysis provides an overview of big data technologies and related content of microservices. It describes their application scenarios and then combines the development of the order system with a comprehensive analysis to prove its feasibility. At the same time, we compared multiple algorithms applied in microservices and found the most suitable algorithm for the order system and applied it, so that the order system can achieve high concurrency and high performance. The big data-based microservices control system proved to be useful for reasonable resource planning and for improving system performance in experiments. The final experiment found that in the microservice order system using big data, its transaction average response time was 0.01 s, and the success rate was 100%.

1. Introduction

The third-party logistics enterprises are changing from the traditional outsourcing type to the integrated logistics-type operation mode. It is precisely because of this change in mode that logistics enterprises have greatly improved in resource allocation and efficiency. Logistics enterprises will concentrate more resources and business capabilities (warehousing, transportation, distribution, information processing, and other logistics auxiliary functions). It actively expands the scope of logistics services, providing raw material supply, cargo storage, and management services to manufacturers. It can provide distribution and delivery services for dealers, and at the same time, complete the transfer of business flow, capital flow, information flow, and logistics. The application of the logistics information system is increasingly important for the operation of third-party logistics, and the control system will play a central role in managing the operation of integrated logistics. In the management of the integrated logistics operation mode, a high-performance order system is used to manage the operation, which can make the logistics information management easy, and at the same time, it can play the role of a bridge to connect the client and the client. In recent years, domestic large-scale, third-party integrated logistics enterprises have actively developed and implemented order systems, such as Baosu Logistics Comprehensive Order System and Guangdong Sinotrans Order System. The successful application of these order systems in third-party logistics companies has played a positive role in promoting the development of domestic logistics companies' order systems, and has shortened the gap with foreign-order systems. However, from the overall perspective of China's third-party logistics industry, the level of informatization of order management is still relatively low, and there is still a big gap between the popularity and application level of the order system and foreign countries. Foreign-order systems are fully functional, fully consider the application of

human–computer interaction, and have the advantages of high concurrency and high performance, and the application of the order system is more urgent for the third-party logistics enterprises that are transforming to the integrated logistics model. The order system can improve and optimize the operation management capability, internal resource allocation, logistics operation efficiency, and service quality of logistics enterprises. It has important application value and practical significance to meet the needs of enterprise users for specialized, integrated, and personalized high-level logistics services.

Many operational aspects of order fulfillment deal directly or indirectly with customers and affect customer satisfaction. Therefore, the order system is an important step in the successful construction of the logistics information system. The order system will play a positive role in the improvement of logistics enterprise operation and service quality: First of all, the order system will effectively integrate the internal warehousing and transportation resources of logistics enterprises and improve the efficiency of operation management and the level of collaborative management. It cooperates with suppliers, enterprises, distributors, customers, and logistics units to achieve information-sharing and resource optimization, all five of them can use the same order system for business operations at the same time, which can be well coordinated. It establishes the whole-process supervision and control of order execution, improves operation performance, reduces costs, and improves the operation and management level of logistics enterprises. Second, the order system can provide customers with real-time logistics information services through network information technology, which allows customers to grasp the execution status of orders in time and conduct logistics service supervision and complaints, The microservice order system based on big data involves the realization of these functions and improves customer satisfaction. It establishes monitoring and early warning of abnormal orders, and handles emergencies in a timely manner, improves the quality of logistics services, and enhances the customer service level of logistics enterprises.

At present, many scholars are studying the application of microservices under big data technology, and the research of many scholars is very valuable. The fast growth of machine learning and big information system stacks, according to Miao et al., encourages constant iterative upgrades of information scientific study or working methodologies. He produces data science and large data analytical cloud platform based on distributed system for schools or non-professional research disciplines, paying special attention to the goal of pleasant collaboration among existing data science teams. It is simple to alter the constituents of each component in a serverless system. The platform includes a personal software experiment atmosphere, JupyterHub depending on Diamond and HDFS for cross use, and a visual ways to construct based on data science engineering's modular architecture; however, his technique does not reach actual results [1]. So according Herman et al., big data techniques are used to develop a big data platform that combines micro and canisters for versatility and scalability in a unique way. He employs a hybrid architecture that incorporates polyglot persistence, data lake, and Lambda architectural characteristics. The system was built for an architectural services firm, and MongoDB was utilized as the major data store. Seven studies were produced as a consequence of the implementation, demonstrating the influence of big data on choice at all levels of an organization. However, his approach is not ideal for the approach of servers in the case of huge data [2]. To decrease system cost while ensuring system QoS and stability, Zhao et al. structured bucket web service activation as a random optimization problem. To address the outlined problem, he created a value elastic serverless deployment mechanism that balances the transfer between operating costs and QoS. However, the results demonstrate that this approach has a relatively low cost [3]. The fast growth in the number computing paradigms trying to leverage the cloud continuum, according to Taherizadeh et al., has had a serious influence on microservices adoption, notably in dynamic systems for which workload numbers wax and wane or Online world of Things (IoT) gadgets change their locales dynamically. A diverse range of complicated technologies must be deployed at the same time to fully realize the promise of cloud-persistent computing applications. In this modern computer context, this complicated mix of technologies is now causing data interoperability challenges. As a result, a conceptual model is required to formally explain the notions of distinct cloud application concepts. It is often difficult to put this statement into practice [4]. Big data, according to Gramigna, has altered the way the financial enterprise provides clients. When coupled with current data records, skill in use of the Program Administrator Data (PAD), which itself is part of the usual provision of services, allows the government to comprehend cost and practical paradigms and utilize this as a foundation for circular decision-making. It is ideal to utilize links to specific data records when records are connected with unique IDs. His study is not effectively integrated in microservices because using these connected datasets necessitates a robust legal and technological infrastructure for data exchange and data consumption [5]. Zahra et al.'s distributed software concept helps HPC applications to enhance processing capacity while lowering communication expenses. To ensure sustainability for Single Programs Multiple Data (SPMD) systems, templates create a valid virtual compute nodes (MsVPUs) collaborate utilizing an offline connectivity via the Sophisticated Network Control Protocol (AMQP) protocol. Fine-grained parallel algorithms for large data categorization are used to test and evaluate their proposed virtual machine. However, the processing unit's message passing paradigm has a substantial influence on HPC, and communication costs are large, which can degrade the speed of these models [6].

Virtualization technology can expand the capacity of hardware and simplify the process of software reconfiguration. The CPU virtualization technology can simulate multiple CPUs in parallel on a single CPU, allowing one platform to run multiple operating systems at the same time. The computer system's resource scheduling problem has

a significant impact on the order system's computing performance, efficiency, and service quality. However, when confronted with the diversity and dynamism of large-scale microservice servers' systems and resources, the user groups alter, as do the limits placed by users on activities. In a large data-based system, these jobs are planned. It has become a nice and warm and complex question in order to develop the system to efficaciously pace, reasonably allocate, and allocate funds in the serverless system, so that if the scheduling algorithms cost of a huge number of participants is low, the submission time is of the essence, the adequate testing is balanced, and the usage rate is high. It is a very innovative idea to apply big data technology and use microservices to design and develop the order system.

2. Overview of Big Data and Microservices and Model Building

2.1. Big Data. Various big data systems, machine learning based, open source tools or platforms, and big data data technologies have been created and may be utilized for distributed databases as a result of the rapid growth of big data technology and analytical technology [7, 8]. Big data processing and commercial services have pushed large-scale commercial needs and demands into people's daily lives, as seen by this. Today, big data-based application systems such as recommender system, predicting, analytical thinking, and analytical report tools are extensively employed. Business, science education, science and technology, school, biomedical, medicine and related fields, online networks and networks, smart cities and transit, and traffic, among other fields and applications, may all benefit from catastrophic big data processing and services. Big data-based applications, on the other hand, provide additional challenges and issues to quality assurance scientists owing to the massive volume of data created, the rapidity at which data comes, and the large range of heterogeneous data [9, 10]. There are still certain challenges and problems in the development of the microservice order system. Verifying the validity of analysis and prediction based on big data, for example, is challenging owing to the features of massive data volume and timeliness. Figure 1 shows an example of a large data application.

These quality parameters relate to different big data application scenarios, including parallelism and accuracy. Quality assurance scope and procedure for big data apps. It also includes the primary quality metrics as well as associated aspects. Statistical computation based around diversified massive datasets, system development machine learning algorithms and understanding, rational decision with uncertainty, semifunctions, and sophisticated visualization are some of the distinctive characteristics of big data applications. These distinct capabilities result in more intriguing QA and QoS needs, problems, and requirements [11]. According to recent feedback from engineers, how to ensure the quality of application systems based on big data has become an important concern.

Utilizing massive datasets and complicated intelligence algorithms, big data solutions deliver functions for prognosis, recommendation, and decision assistance. Big data program quality assurance, in general, refers to the study and implementation of different assurance procedures, methodologies, standards, guidelines, and systems in order to assure the quality of database systems based on a set of performance characteristics [12]. Figure 2 is an example of the extent of validation for a big data application's quality assurance.

2.2. Microservices. The design concept of microservices is to divide a huge business system into independent microservices, and each microservice contains a complete structure from data storage to business logic. This also means that they can function as a separate entity, but they are connected to each other. Each microservice is highly "autonomous," which is reflected in: each microservice can use different technologies to implement architecture and data storage technology as needed; each microservice can be deployed and maintained independently, with an independent life cycle and service boundary; there is no dependency between microservices from development, deployment to operation, and data exchange is only carried out through lightweight interface calls [13, 14]. Data transmission can be performed when calling through the lightweight interface, and at the same time, it can improve cohesion and reduce coupling. The microservice architecture realizes the high cohesion of a single service and the effect of low coupling between each service, which is more conducive to the local flexible change and deployment of the system.

The concept minibuses has lately gained a lot of traction in the context of distributed system software architecture. Microservices may be regarded of as a type of software architecture [15]. In a nutshell, microservices is a way of building a system out of a collection of tiny services: each service runs individually (processed zone), uses its own knowledge (database), and communicates with other services using a lightweight method (usually over HTTP or HTTPS). Each of their independent services has a complete structure and can perform corresponding operations independently. Services are designed on business skills in this manner, which fosters separation of concerns. Because big systems' design is often arranged in layers, team is usually made up of professionals that specialize in certain levels such as user experience, processing, and information [16]. The structure of this strategic priority will be comparable to the system's architecture. Even if the system is arranged in a variety of separate service modules on the middleware layer, updates or extra services may only be merged with a lot of work after it reaches a certain degree. The latter is due to the interconnectedness of layers inside them, as well as layers directly beneath them. Changing a single service frequently necessitates rebuilding and deploying the complete middleware layer [17]. Due to information systems dependencies, a modification, for example, is not confined to a single job. Microservices teams must be organized differently since they focus on a particular business feature and employed a large execution stack (containing user experience, storage, and external communication). The skills

Figure 1: Typical types of big data applications.

Figure 2: Example of validation scope for quality assurance for big data applications.

required to design uis, functionality, data warehouses, and product development are often found in cross-functional teams.

When necessary, companies can relocate their services. Of course, this comes at a cost, and most teams employ a completely automated deployment technique to make updates live. In addition, because modifications to one service may have an impact on another, each team must keep an eye on the overall health of the service. As a result, operations are delegated to teams (often called devops). Each vertical has all technological layers (temperature, functionality, and data services), and each vertical can contain numerous microdevices [18, 19]. An additional layer is required to handle communication between the many verticals, as well as to integrate the findings of the several verticals into a single page and provide it to the user. Figure 3 is a vertical decomposition instance of an e-commerce platform.

In the serverless workflow scheduling system, the user initially accesses the web service asset scheduling system over the web. It enters in to the software platform via various terminals, chooses cloud services that fit its requirements, and submits tasks, or cloud tasks. Microservices and cloud services are closely related, but there are many differences. Cloud service technology can be applied in the construction of microservice frameworks. Because most cloud computing uses the Map/Reduce methodology, the microservice platform separates user-submitted cloud jobs into several

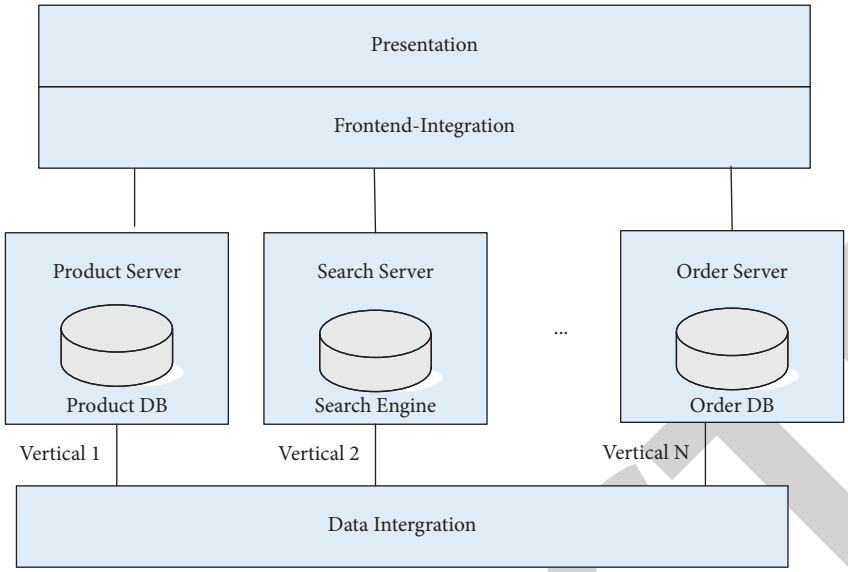

Figure 3: Decomposition based on organizational abilities and use situations.

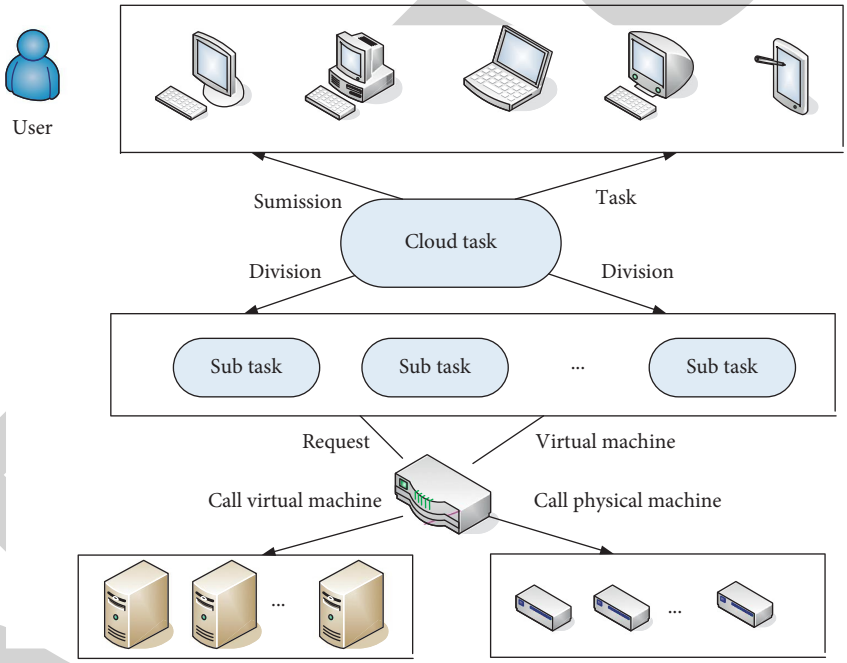

Figure 4: Microserver resource scheduling architecture diagram.

subtasks [20]. These subtasks are self-contained and can operate in parallel, after which virtual machine requests are initiated. Figure 4 depicts the web service resource scheduling structure.

The schedule center calls the relevant virtual machine after obtaining the virtualization request signal from each subtask by evaluating the information and resources for every vms and matching it with the related scheduling algorithm to execute the planned task resource. Power control, which incorporates virtual machine load balanced and physically host load balancing, should be considered throughout this planning. It not only makes high-performance hosts vulnerable to failure, but it also influences job completion times.

2.3. Scheduling Model of Microservices in the Order System. Because each demand response and container have a one-to-one relationship, the architecture of the matching container should be defined. To accommodate for variations in execution time, sufficient resource redundant should be introduced to the same kind of jobs in various workflows.

To do so, we first compile records on cpu workloads for various jobs, and then use that data to determine the most

cost-effective arrangement for each type of web service instance. We receive the carton setup scheme $CE = \{ce | j = 1, 2, \ldots, h\}$ when there are h forms of administrations, for which ce is a matrix indicating the set-up of the view that includes the j-th type of web service, including the number of processor cores. When an application wishes to scale up the amount of service instances for the j-th microservice, it must first construct a container with the appropriate configuration.

To handle multiworkflows, we combine workflows by adding tasks to a workflow's predecessor tasks, then all ingress tasks and subsequent tasks' tasks to exit all tasks (Line 1 Algorithm 1). Because there is no data transmission or additional jobs between computer workload and other activities, this technique can ensure that multiworkflow scheduling is fair. This strategy ensures that the initial state of each task is controlled at the same level, avoiding unfair situations. As the foundation for task ranking, we calculated the scheduler urgency u_i from each ready job in the combined workflow. An available task is one that has finished its previous task; therefore, an entrance assignment is also a ready job.

$$u_i = \frac{sd - \mathrm{XFT}(t_i)}{\mathrm{hop}(t_i)}, \tag{1}$$

where $\mathrm{hop}(t_i)$ is the percentage of unfilled tasks mostly on critical route from the exit task to the release task and $\mathrm{XFT}(t_i)$ is the estimated completion time, which is defined as follows:

$$\mathrm{XFT}(t_i) = \min_{ms \in \mathrm{MS}(t_i)} \{\mathrm{EFT}(t_i, ms, T)\}, \tag{2}$$

where $\mathrm{MS}(t_i)$ denotes the collection of instances capable of dealing with t_i. The frequency of the example necessary to determine the EFT is adjusted to the pace of instance ms because the specified instance is still undetermined.

Select the ready job with the simplest user interface for schedule based on the urgency. Task mapping must take into account how to take the most of existing capabilities as well as how to establish new eventually transfer and containers. In $\mathrm{MS}(t_i)$, laxity is calculated for all occurrences:

$$\begin{aligned} \mathrm{Laxity}\left(t_i ms_{j,k}\right) &= sd_i - \mathrm{EFT}(t_i, ms, T), \\ \mathrm{incr\,Cost}\left(t_i ms_{j,k}\right) &= \cos t' - \cos t, \\ \min \mathrm{Speed} &= \frac{w_i}{sd_i - \mathrm{IT}\left(c_{j,k}\right)}. \end{aligned} \tag{3}$$

If budget and costs represent the costs that was over, and the assignment is assigned. It is difficult to accomplish in time if minSpeed is larger than the largest speed of the allocated virtual machine. There are two plans in the EFT that we compute: the initial stage is to determine tasks to previously created instances. The second option is to construct a fast instance and then allocate tasks to it using the plan with the smallest EFT.

The divergence rate between the wealth of programs offered by the vessel and the quantity of required resources for computation is calculated using the following formula:

$$\begin{aligned} F_{\mathrm{ram}} &= \frac{s_{i,j,\mathrm{cpu}} - r_{i,j,\mathrm{cpu}}}{r_{i,j,\mathrm{cpu}}} \times 100\%, \\ F_{\mathrm{ram}} &= \frac{s_{i,j,\mathrm{ram}} - r_{i,j,\mathrm{ram}}}{r_{i,j,\mathrm{ram}}} \times 100\%, \\ F_{\mathrm{ram}} &= \frac{s_{i,j,\mathrm{ram}} - r_{i,j,\mathrm{ram}}}{r_{i,j,\mathrm{ram}}} \times 100\%. \end{aligned} \tag{4}$$

Here, F_{cpu} and F_{ram} can represent the supply and demand deviation rate of the container CPU resources and memory resources of the j-th basic service in the ith aggregate service. The delay sensitivity model expression is

$$\mathrm{t}_{i,j} = \frac{t_{ij}}{K_{\mathrm{cpu}}\left(1 + F_{\mathrm{cpu}}\right) + K_{\mathrm{ram}}\left(1 + F_{\mathrm{ram}}\right)}. \tag{5}$$

The model expression for the edge computing terminal to provide computing resources for aperiodic and nonassociative aggregated services is

$$\begin{aligned} A_{\mathrm{cpu}}(t) &= \sum_{j=1}^{n} s_{i,j,\mathrm{cpu}}\left(e\left(t - t_{i,j,imi}\right) - e\left(t - t_{i,j}^{*}\right)\right), \\ \mathrm{A}_{\mathrm{ram}}(t) &= \sum_{j=1}^{n} s_{i,j,\mathrm{ram}}\left(e\left(t - t_{i,j,imi}\right) - e\left(t - t_{i,j}^{*}\right)\right), \end{aligned} \tag{6}$$

where $A_{\mathrm{cpu}}(t)$ and $A_{\mathrm{ram}}(t)$ are the timing curves of the edge-computing terminal supplying CPU resources and memory resources for the ith aperiodic nonassociative aggregate service, respectively.

The model expression for counting the memory resources of microservices is

$$\begin{aligned} B_{\mathrm{cpu}}(t) &= \sum_{f=1}^{N} A_{l,f,\mathrm{cpu},B}\left(t - \sum_{y=1}^{f} T_{y-1}\right), \\ B_{\mathrm{ram}}(t) &= \sum_{f=1}^{N} A_{l,f,\mathrm{ram},B}\left(t - \sum_{y=1}^{f} T_{y-1}\right), \end{aligned} \tag{7}$$

where $\sum_{f=1}^{N} A_{l,f,\mathrm{cpu},B}(t - \sum_{y=1}^{f} T_{y-1})$ and $\sum_{f=1}^{N} A_{l,f,\mathrm{ram},B}(t - \sum_{y=1}^{f} T_{y-1})$, respectively, constitute the l-th aperiodic associative aggregate.

The timing curve of the CPU resources and memory resources of the f-th aperiodic nonassociative aggregate service of the service; $\sum_{y=1}^{f} T_{y-1}$ is the sum of all aggregation service delays before the f-th aggregation service in the association sequence.

The model expression for counting the external memory resources of microservices is

$$\begin{aligned} C_{\mathrm{cpu}}(t) &= \sum_{h=0}^{Q} A_{q,g,\mathrm{cpu},C}(t - hT - h\Delta t), \\ C_{\mathrm{ram}}(t) &= \sum_{h=0}^{Q} A_{q,g,\mathrm{ram},C}(t - hT - h\Delta t), \end{aligned} \tag{8}$$

where $C_{\mathrm{cpu}}(t)$ and $\mathrm{C}_{\mathrm{ram}}(t)$ are the timing curves of the microservice computing terminal supplying CPU resources

and memory resources for the qth cycle nonassociative aggregated service, respectively, and Q is the number of executions.

The investment cost of resource integration is represented by C_{inv}, C_{ope} represents the cost of container usage, and C_{pen} represents the penalty cost of aggregate service delay exceeding the limit. Their expressions are as follows:

$$\begin{aligned} \min C &= C_{\text{inv}} + C_{\text{ope}} + C_{\text{pen}}, \\ C_{\text{inv}} &= E_{\text{cpu}} c_{\text{cpu}} + E_{\text{ram}} c_{\text{ram}}, \\ C_{\text{ope}} &= E_{\text{ope}} c_{\text{cpu}} + E_{\text{ope}} c_{\text{ram}}, \\ C_{\text{ope,cpu}} &= \sum_{i=1}^{m} s_{i,j,\text{cpu}} i_{i,j}^{*} a, \\ C_{\text{ope,ram}} &= \sum_{i=1}^{m} s_{i,j,\text{ram}} i_{i,j}^{*} a, \\ C_{\text{ope}} &= M \sum_{\text{i}=1}^{N} \left[\max\left(0, T_{\text{AS},i} - T_{\text{AS},i}^{*}\right) \right]. \end{aligned} \tag{9}$$

Here, E_{cpu} and Eram are the configuration amounts of CPU resources and memory resources of edge computing terminals, respectively; C_{cpu} and C_{ram} are the configuration costs of unit CPU resources and memory resources, respectively. The microservice running logs can be collected and stored through the real-time data collection engine Logstash and the log framework Log4j. The search server Elastic search and the visual analysis platform Kibana are used to query and analyze logs, which greatly facilitate the operation and maintenance personnel to analyze and quickly locate the failure of microservice calls.

3. Experiment and Result Analysis of the Microservice Order System

3.1. Experimental Process. Although many order solutions provide web-based modeling editors, the majority of order systems are client-server oriented. The degree of application logic embedded on the client side of the user can be separated between large and small client architectures. On the server side, a monolithic design with a database (large user) and business logic is typically used (small client). Individual aspects in business logic frequently use the same technological stack and interface via method calls, resulting in tight coupling between them. Figure 5 shows the architecture of the order system business process management tool.

Two functional scenarios are selected to test the running performance of the platform: The test environment is two 8-core, 16G virtual machines, one deploys the microservice Docker, and the other deploys the MySQL database. They are connected with 100 M network bandwidth and use Load Runner-software. The test environment and equipment of this test are shown in Figure 6.

A task's computational effort is defined as the time it takes to complete it on a typical compute service (in seconds). A workflows application is employed as a server application in this case, with each job corresponding to a microservice and each microservice handling only one type

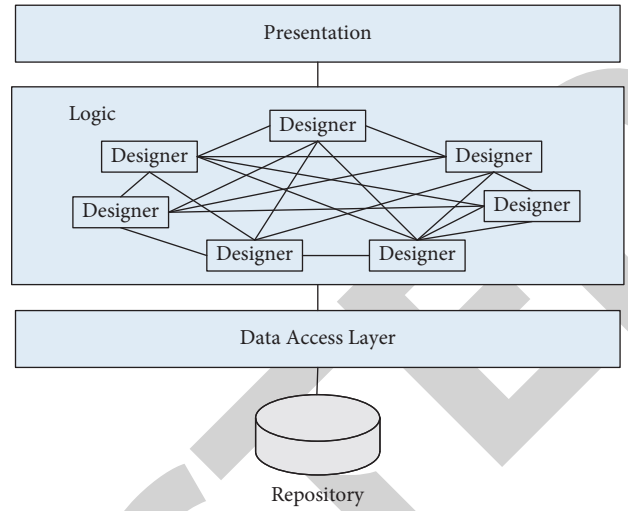

Figure 5: Architecture of business process management tools.

of task. Each task's cost of execution and other details are recorded. The ECU of Linux environment has been used to represent the virtual machine's computational capacity and resources, and the discontinuous unit is considered to be 0.5 ECU. In addition, the VM and container starting times are chosen based on relevant tests. Four distinct types of virtual machines (VMs) were employed in the studies, as indicated in Table 1.

3.2. Experimental Results. A number of methods may be employed in the building of a big data-based microservice order system to make it operate with diverse workflows, workload patterns, and workloads. We ran many sets of trials to evaluate each method's performance, then chose a steady workload pattern and ran the algorithm in a variety of workflow applications. The number of jobs in each workflow is fixed at around 50 (Because of its unusual structure, SIPHT is around 30 square feet in size).

We observed that, with the exception of SCS, the success rate gradually increased with increasing factors. The results show that ESMS outperforms the others. According to the data given in Table 2, ESMS can produce more appropriate solution than other methods.

If the order system wants to get the advantage of high performance, it needs to ensure its success rate and also control the cost. ESMS uses minimal machines while keeping costs to a minimum. Reduced operational costs complexity can also be achieved by using fewer equipment. ProLiS has the most machines in Montage. As previously discussed, its arbitrary deadline allocation causes greater and greater instances to be created, faster and faster, requiring more VMs. In obviously, the cost is determined not only by the number of virtual machines (VMs) but also by their configuration. When costs are near, however, fewer VMs are preferable, as shown in Table 3, which illustrates the VM used by various workflows.

The success rate of ESMS in the LIGO experiment was 18.31%, 36.39%, and 6.02% greater than ProLiS, SCS, and IC-PCPD2, respectively. SCS's success rate varies greatly because

Figure 6: Experiment apparatus.

Table 1: Virtual server layouts and costs.

Version	ECU	vCPU	Memory (GB)	Cost
m4.large	5.4	3	9	0.23
m5d.large	6	4	5	0.24
m4.xlarge	12	2	13	0.31
m5d.xlarge	18	3	13	0.321

Table 2: The number of reasonable choices for various workflows.

	Series of pictures	LIGO	Chromosome	SIPHT
ProLiS	7	2	8	9
SCS	1	0	1	0
IC-PCPD2	0	2	15	4
ESMS	9	9	12	9

Table 3: The number of virtual machines (VMs) employed in certain workflows.

	Series of pictures	LIGO	Chromosome	SIPHT
ProLiS	7598	2154	3684	758
SCS	654	2015	2357	421
IC-PCPD2	357	1567	2458	363
ESMS	125	1587	1029	245

there is no practical answer. SCS determines number of cases based on the network vector before using the EDF scheduling method. However, the load vector's expected outcomes diverge somewhat from the EDF scheduling algorithm's requirements, forcing some activities to queue. The ensuing delay builds up during workflow execution, eventually leading it to time out. Additionally, as the factor rises, the VM's cost-efficiency varies and the configuration steadily reduces. As a result, so if the limit is loosened, the success rate remains unchanged. The success rate is higher because the other three mechanisms are all dependent on scheduling problem, and resource requirements may be established through the task-scheduling problem. The findings further show the value of scheduling tasks and autoscaling integration. IC-performance PCPD2's is likewise inconsistent: it can obtain a viable solution in the genome with high success rate, low cost, and quantity close to ESMS, but could not get any working solution in Montage. Figure 7 shows the success rates for different workflows and stable workloads.

The mean hit rate of Circuit is similar to that of ESMS for SIPHT; however, IC-PCPD2 has just three possible schemes. This is due to the fact that the hit rate of Circuit is usually between 99% and 100%, as shown in Figure 8.

In terms of value for money, all possible solutions from trials with various factor values are gathered, their costs are standardized, and the overall price is computed. ESMS costs 79.08% less than ProLiS, 6.80% less than ProLiS, 15.37% less than ProLiS, and 18.29% less than ProLiS. Except for IC-PCPD2, which has no realistic option at Montage, and cost of ESMS in other three processes is 4.57%, 0.58%, and 11.39% cheaper than IC-PCPD2. Their typical expenses are shown in Figure 9.

The improvements in success rate and cost for four workflow applications (referred to as M, L, G, and S) and three workload modes (referred to as S, D, and I) for five

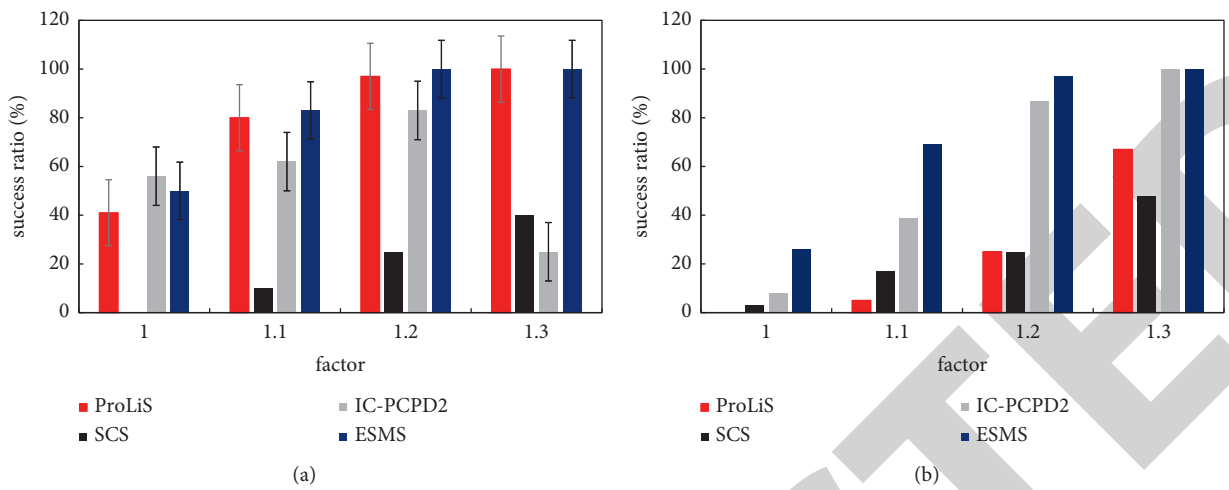

Figure 7: With a variety of workflows and consistent workloads, the success rate is high. (a) Montage. (b) LIGO.

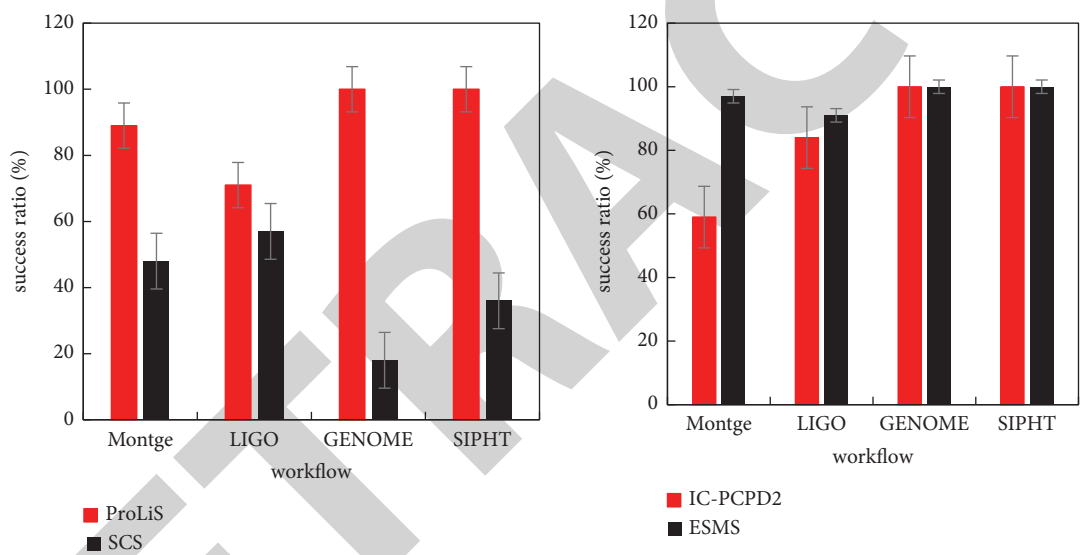

Figure 8: The success ratio.

groups are presented in Table 4. Compared with IC-PCPD2, ESMS has a performance improvement of 0.58–14.64% in cost. Overall, ESMS has a success rate of 0.00–7.40% greater than IC-PCPD2, and in Montage, it may reach 72.97%.

In the algorithm comparison experiment of the microservice framework based on big data technology, it can be seen that the performance of the ESMS algorithm is excellent in all aspects. Applying it in the development order system can make the system meet the requirements of high concurrency and high performance and can well meet the needs of order system development. The graphic simply does not matter when in the longer processes, the stores are utilized, it always fails, its response time basically does not change much, and the effect of real-time response can be achieved. The order system can perform up to six tasks at the same time, with good concurrency. The figure shows the trend of the response time over time when the big data-based microservice order system is used and also describes how many tasks the system can perform at the same time in different states. Figure 10 shows its response time and number of parallel tasks.

4. Discussion

It can be seen from the above experiments that the algorithms for selecting microservices based on big data have their own advantages. When compared to ProLiS, the ESMS algorithm offers an overall success rate improvement of 0.16%–1.30%. The improvement of LIGO, in example, is as high as 18.31%. In terms of money, the improvement ranges from 6.80 to 22.66%, with a Montage of 85.84%. Except in two rare circumstances, when the success rate is 82.01% and 99.8%, the gain in accuracy rate is generally between 27.50% and 67.62% when compared to SCS. SCS can also be compared in terms of the cost since it is unable to find a feasible solution. In GE-NOME, IC-PCPD2 can reach performance comparable to ESMS, as previously stated. In the platform performance test, multiple virtual uses, and

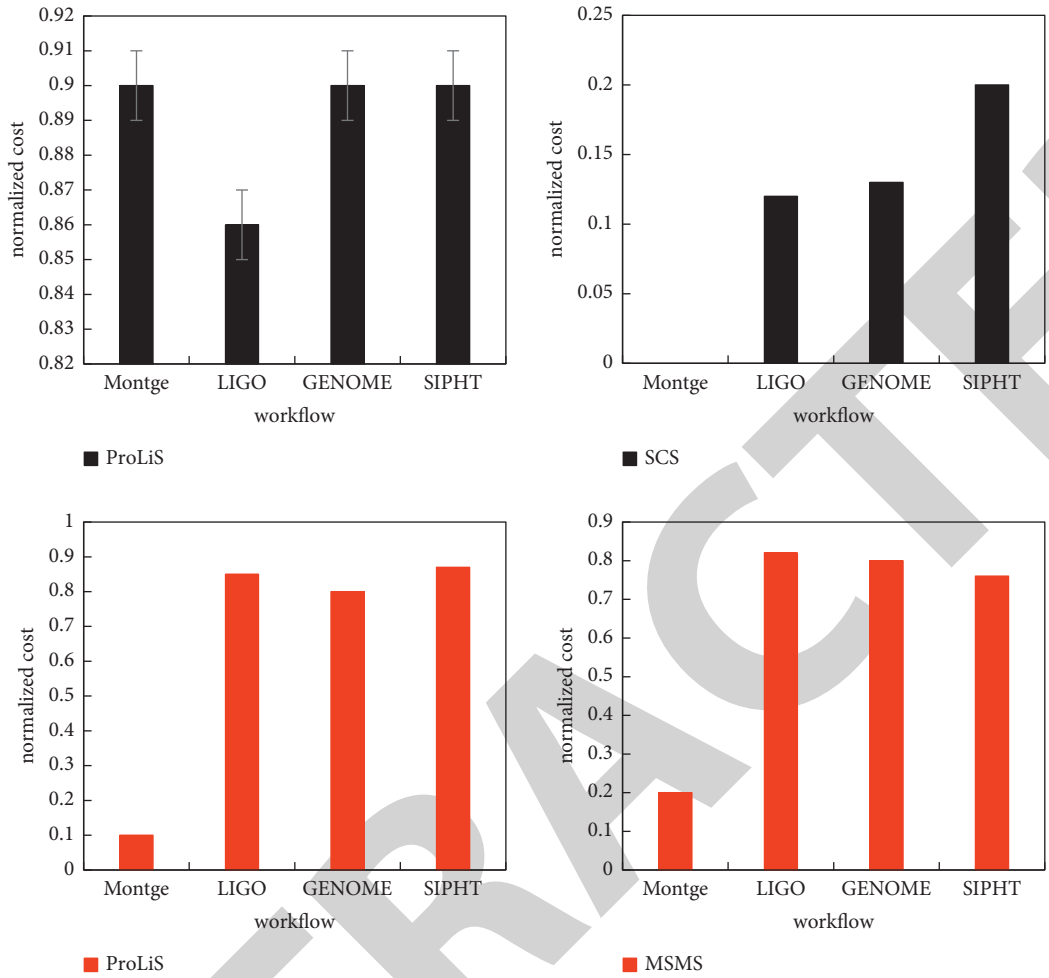

Figure 9: The normalized cost.

Table 4: The percentage improvement of ESMS above other algorithms.

Group	ProLiS (%)	IC-PCPD2 (%)	SCS (%)
1	1.30	35.54	47.68
2	0.69	70.51	48.09
3	1.17	72.97	62.00
4	18.31	6.02	36.39
5	12.30	7.20	40.25

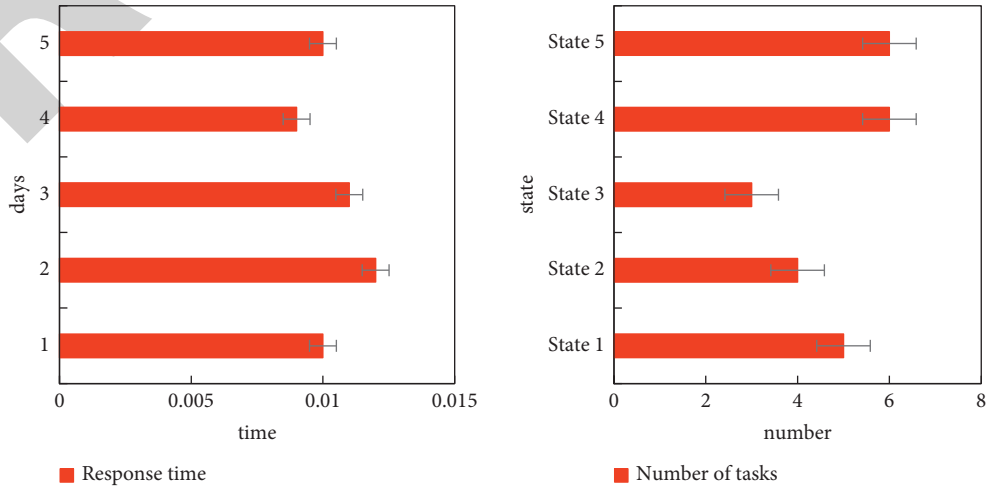

Figure 10: System response time and number of parallel tasks.

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Retraction

Retracted: Comprehensive Treatment of Urban Landscape Water Environment Based on Aquatic Plants Purification and Restoration

Security and Communication Networks

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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) Manipulated or compromised peer review

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] K. Li, "Comprehensive Treatment of Urban Landscape Water Environment Based on Aquatic Plants Purification and Restoration," *Security and Communication Networks*, vol. 2022, Article ID 8771933, 9 pages, 2022.

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Research Article

Comprehensive Treatment of Urban Landscape Water Environment Based on Aquatic Plants Purification and Restoration

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Water is the source of life and the foundation for the growth of all things. Water is also an important part of the urban ecological structure. A healthy water environment is the basis for human survival and development, and it is also one of the important conditions for the harmonious development of cities. With the rapid development of the economy and the improvement of the level of urbanization, the water environment pollution in the urban landscape has become more and more serious, such as serious water eutrophication and rapid algae reproduction in the water environment. As plants that can survive in water, aquatic plants have always been an important main body of the water ecological environment. It plays an unparalleled role in water environment purification and comprehensive treatment of water pollution. This paper aims to study the comprehensive management of urban landscape water environment based on the purification and restoration of aquatic plants. It combines the purification and restoration ability of aquatic plants and genetic algorithm to carry out the comprehensive management experiment of urban landscape water environment. The conclusion shows that after the purification and restoration of aquatic plants and comprehensive pollution control, the comprehensive eutrophic substance content of the urban landscape pond water body decreased by 21.7 mg, and the water body transparency increased by 20 cm.

1. Introduction

Water is the basis for all things to survive and develop. The protection of water resources and the control of water pollution are the basic conditions for the harmonious coexistence between man and nature. With the development of urbanization, various landscape water bodies such as artificial lakes, fountains and moats have appeared in the city. Urban landscape water bodies refer to water bodies, lakes, rivers, and other water bodies that can regulate the microclimate of the water environment and beautify the environment to form landscapes. It is one of the basic elements of garden landscape and an important part of urban landscape. Urban landscape water bodies are also vulnerable to serious pollution. Urban landscape water pollution is mainly reflected in the following aspects: The first is the problem of replenishment water. When the replenishment water of the urban landscape water body is insufficient, the content of nitrogen, phosphorus, and other nutrients in the water is too high, which will cause the urban landscape water body to be seriously polluted. The second is that the fluidity of the water body is poor, and the water quality cannot be exchanged. This leads to the problem of weak self-purification ability of urban landscape water and serious eutrophication of water. The third is the issue of water pollution discharge in urban life and industry. A large number of sewage generated by urban residents' living and industrial production are poured into urban landscape water bodies, which aggravates the pollution degree of urban landscape water bodies. Therefore, urban landscape water environment governance is of great significance to ensure the coordination of urban water environment with urban production and life and is also an

important measure to improve urban water pollution. Aquatic plants refer to plants that can survive in water bodies and have certain ecological purification functions. Aquatic plants have important functions such as absorbing heavy metals, removing pollutants, and purifying and repairing water bodies. Therefore, aquatic plants play an important role in the management of urban landscape water pollution.

The innovations of this paper are as follows: (1) It studies the comprehensive management method of urban landscape water environment based on the purification and restoration of aquatic plants. (2) This paper combines the ability of aquatic plants to purify and restore and genetic algorithm to carry out the comprehensive management experiment of urban landscape water environment and draw effective conclusions. It draws valid conclusions in two aspects: the change of eutrophic substances in water body and the change of water body transparency.

2. Related Work

There are many studies related to the purification and restoration of aquatic plants in academia. Among them, Li et al. studied the ability of an aquatic plant called *Nepenthes* to absorb uranium pollution in the aquatic environment. He also proved through experiments that *Nepenthes* has a good absorption capacity for uranium and can play a certain role in the purification and restoration of water environment [1]. Baunthiyal and Sharma mainly studied the ability of aquatic plants to remove fluorinated pollutants from the water environment. Their research shows that aquatic plants have a good effect on the removal of fluorinated pollutants in the water environment [2]. Lu et al. mainly studied the absorption capacity of eight aquatic plants including water hyacinth and spruce to heavy metals in the water environment. They found that aquatic plants in different places have different adsorption capacities for heavy metals. However, the uptake capacity of copper by root and stem tissues of all aquatic plants is consistent [3]. Haghnazar et al. studied the absorption capacity of aquatic plants to various pollutants in the urban water environment. Their research found that aquatic plants have better ability to absorb and purify toxic pollutants in urban water environment [4]. Saleh et al.'s research focuses on the ability of aquatic plants in the Egyptian environment to purify and remediate wastewater from human activities and urban development. They found that the purification ability of aquatic plants will be restricted by the different activity content of radionuclides in the water environment, the multiplying mass of plants, and the illumination and other factors [5]. Auchterlonie et al. mainly studied the ability of water hyacinth, an aquatic plant, to purify and restore the water environment in South Africa. They found that water hyacinth has a better treatment effect on water eutrophication in South Africa [6]. Although these studies are related to the purification and restoration of aquatic plants, the process of these studies is complex and requires a lot of time and effort. And its practicability for the comprehensive management of urban landscape water environment research is not strong enough.

3. Urban Landscape Water Environment Management Methods

3.1. Aquatic Plant Purification and Restoration. Aquatic plant purification and restoration is one of the ecological restoration methods. It specifically refers to the use of tissues such as roots and stems of aquatic plants to precipitate organic matter and nutrient salts in the water environment and absorb them by aquatic plants. At the same time, it has various functions such as precipitation, filtration, adsorption, adsorption, and decomposition of nutrients such as nitrogen and phosphorus. This thus achieves a phytoremediation technique for water purification [7]. Aquatic plant purification and restoration is one of the important methods to comprehensively control water pollution. Its advantages are low cost, wide adaptability, and no secondary pollutants. However, there are also some shortcomings. It takes a long time for aquatic plants to purify and restore the water environment, and it is difficult to restore deep pollution [8, 9]. Commonly used aquatic plants are floating plants, emergent plants, and submerged plants. The water quality range of water treatment for aquatic plants is shown in Table 1 [10].

The mechanism of the removal of nutrients in water by aquatic plants is shown in Figure 1 [11].

3.2. Genetic Algorithms. Genetic algorithm is a method of global search and optimization. It does not make any demands on the problem domain. Its essence is an efficient, parallel processing, global search method [12]. The operation of genetic algorithm follows the principle of survival of the fittest and successively generates an approximate optimal solution among many solutions [13]. Genetic algorithms are widely used in biology, computer science, engineering, economics, and other fields [14–17]. Genetic evolution starts with a population of completely random individuals and then occurs from generation to generation. In each generation, the fitness of the entire population will be reevaluated. It randomly selects multiple individuals (based on their fitness) from the current population and generates a new population of life through the theory of natural selection and mutation. This population becomes the current population in the next iteration of the algorithm [18]. The basic flow of the genetic algorithm is shown in Figure 2.

It assumes that there are n sample input data in total, and there are relative m sample output data. The one-to-one correspondence between the input and output data is called the interpolation condition, and the following formula can be established:

$$m = f(x_n). \tag{1}$$

Before applying the genetic algorithm, some parameters of the hidden nodes in the network need to be clarified, such as the number, size, expansion constant, and weight of the data center. If all sample data are selected as input data, then the number of data centers is the number of samples, and all basis functions have the same expansion constant [19]. The

Table 1: Scope of water quality for water treatment of aquatic plants.

Type	Applicable places	Processing scope	Contaminant removal mechanisms	Common types	Application
Floating plant	Strong oxidation pond	Urban sewage, industrial wastewater, storm runoff, polluted natural water	Plant uptake, microbial metabolism	Water hyacinth, float ping, algae, big peanuts Jiang Hong	Easy design, but industrial optimization less research
Emergent plants	Artificial or natural wetlands	Urban secondary sewage, industrial wastewater, storm runoff	Plant uptake, microbial metabolism	Reed, incense Po, wick grass, mushroom	Research application vs. many, process design meter is mature
Submerged plants	Natural body of water	Submerged vegetation restoration, polluted water restoration	For nitrogen and phosphorus short-term storage, control eutrophication form of expression	Original type of water	Difficult to operate degree, research and application, few

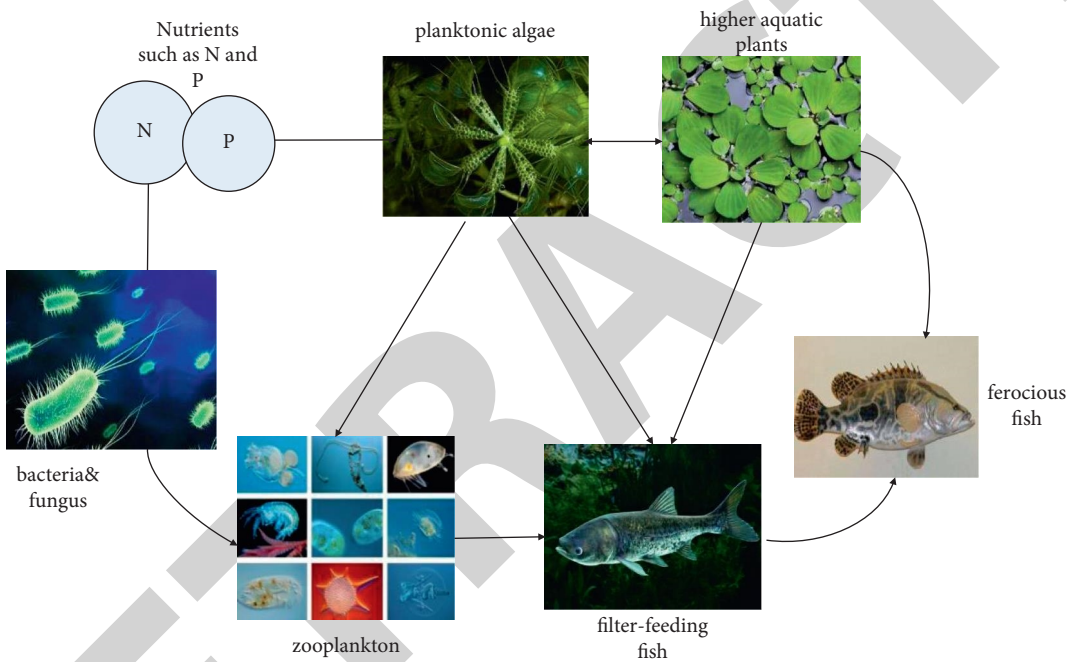

Figure 1: Removal mechanism and process of nutrients in water by aquatic plants.

size of the weights in the network can be calculated from the values of all the sample data. Therefore, the formula for passing the kth node in the hidden layer to the next layer is

$$h_k = \varnothing \mathrm{kz} \left\| x_n - h_k \right\|. \tag{2}$$

If $H = h_k$ is the output of the hidden layer of the genetic network, then the output of the network can be obtained as

$$f(x_n) = \sum_{k=1}^{n} h_k. \tag{3}$$

For the input vector X, if the matrix H is invertible, the weight can be obtained at this time:

$$L = H^{-1} X. \tag{4}$$

This method is a complete interpolation method, that is, the output data obtained by the network is the output of all samples. Although this method can achieve zero error, in practical applications, full interpolation is unattainable [20]. In addition, when there are too many sample data, the H matrix of the hidden layer will change, which will cause instability during the inversion. For instability, a regularized network can be used to solve it.

Assuming that the function F needs to be approximated by another function, the approximation function can usually be found by solving the method of minimizing the objective function; that is, the standard error term can be found:

$$E(F) = \frac{1}{2} \sum_{k=1}^{n} (X - F(X)). \tag{5}$$

At this time, $E(F)$ is the required standard error term value. In order to solve the instability of the H matrix generated in the interpolation process of the genetic neural network, a regularization term can be added on the basis of the above formula. On the one hand, it reduces the complexity of the approximation function, and on the other

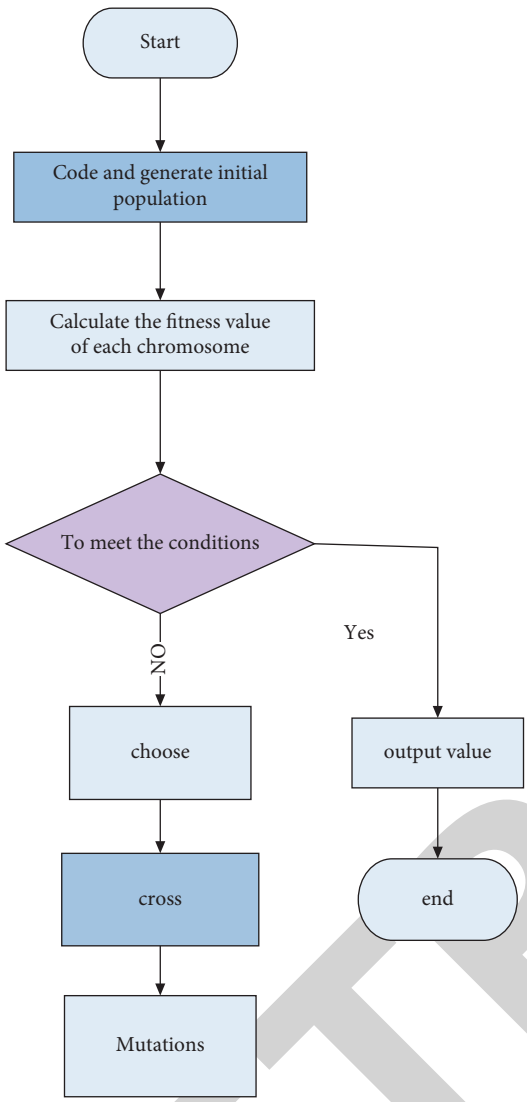

Figure 2: Genetic algorithm flowchart.

hand, it reflects the "geometric" characteristics of the approximation function [21–23]. The added regularization term is

$$E(F) = \frac{1}{2}\|\mathrm{DF}\|^2. \tag{6}$$

In the above formula, D is a linear differential operator. At this time, the total network error term [24]

$$E(F) = \gamma E_k(F). \tag{7}$$

In the formula, γ takes a positive value and is the coefficient of the regularization term. Then the Lagrange formula is

$$\mathrm{DF}_\gamma = \frac{1}{\gamma}\sum_{k=1}^{n} X\delta(F - X). \tag{8}$$

The solution of the above formula is

$$F_\gamma(x) = \frac{1}{\gamma}\sum_{k=1}^{n} G(X_n). \tag{9}$$

The regularization can be obtained by performing linear operations on n basis functions G under different weights [25]:

$$F(x) = \sum_{k=1}^{n} G(x, x_n). \tag{10}$$

Next, the predicted output data $y(n)$ can be calculated from the input data $x(n)$:

$$y(n) = \sum_{k=1}^{m} w_k \varnothing x(n). \tag{11}$$

It replaces the parameters in the original network:

$$W(n+1) = W(n) + \mu_w e(n) \varnothing F. \tag{12}$$

If the input information is x and $j = 1, 2, 3$, the output of the ith hidden node is

$$h_i = \varnothing_i \left\| x_j - c_i(k) \right\|. \tag{13}$$

Among them, $\varnothing_i$ is the activation function of the hidden node, that is, the Gaussian function. Finally, the final output weight of the genetic network can be obtained [26]:

$$\theta = \left\| y - y_n \right\|, \tag{14}$$

which is

$$\theta = \| y - \widehat{H} w \|. \tag{15}$$

4. Experiment of Comprehensive Treatment of Urban Landscape Water Environment

4.1. Experimental Materials and Methods. This experiment of comprehensive treatment of urban landscape water environment is mainly based on the purification and restoration ability of aquatic plants and genetic algorithm. The experiment selected a landscape pond A in Xi'an as the experimental object. The area of the pond is 200 m, the depth of the pond near the bank is about 1 m, and the water depth in the center of the pond is 1.8 m. The pond is surrounded by a landscaped garden with lush trees. Before the start of this experiment, the pond had not been dredged, and the lake bottom was heavily silted up. Moreover, the silt layer is relatively thick and is semifluid, which is easily affected by hydraulic pressure to form sediment floating. Before the ecological purification and restoration of aquatic plants, the hydraulic fluidity of the pond was poor, and the eutrophication of the water body was very serious. The details of the water quality of the pond are shown in Table 2.

It can be seen from Table 2 that the content of eutrophic substances contained in the water body of the pond before the comprehensive treatment of the water environment is significantly higher.

Table 2: Water quality of pond A.

	COD	TN	Ammonia nitrogen	TP	Phosphate
Background concentration	38	3.56	0.95	0.35	0.20
Reclaimed water quality	1.12	11.2	7.55	0.26	0.19
Turbidity	26	18	20	17	22

The aquatic plants selected in this experiment were iris, canna, and celandine, as shown in Figure 3.

The purification and restoration functions of these three aquatic plants on the water environment are as follows: Iris can effectively improve water quality. This makes it more conducive to plant growth, thus keeping the ecosystem in a virtuous cycle. Canna has strong adaptability and high removal efficiency of phosphorus. Celandine can effectively remove all kinds of nutrients in the promotion [27]. These three aquatic plants not only have beautiful landscape effects, but also have better water purification and restoration effects when combined together. Therefore, the cultivation of these three plants in pond A is in line with the experimental purpose.

This experiment combines the water purification and restoration capabilities of the above three aquatic plants and the optimal arrangement function of the genetic algorithm to purify and restore the water body of pond A. After the restoration is completed, the changes in the content of eutrophic substances in the water body and the changes in the transparency of the water body are observed. This then judges the effect of aquatic plants on the purification, restoration, and pollution control of the pond landscape water body. It judges the purification, restoration, and pollution control effects of aquatic plants on the pond landscape water body by analyzing the changes of eutrophic substances in the water body and the changes of water body transparency.

4.2. Changes in the Content of Eutrophic Substances in Water. TN, TP, nitrogen, phosphate, COD, ammonia nitrogen, nitrate nitrogen, and phosphorus are important indicators of water eutrophication. Therefore, the removal of eutrophic substances such as TN, TP, nitrogen, phosphate, COD, ammonia nitrogen, nitrate nitrogen, and phosphorus in the water body is an important measure to control the serious problems of water eutrophication and pollution. It grows three aquatic plants, iris, canna, and celandine, and combines the optimization function of genetic algorithm for water pollution control. The changes of eutrophic substances in the water body of pond A are shown in Figure 4 and Figure 5.

It can be seen from Figures 4 and 5 that 8 eutrophic substances are TN, TP, nitrogen, phosphate, COD, ammonia nitrogen, nitrate nitrogen, and phosphorus. Its content from 20 days before to 60 days after water purification and pollution treatment continued to decline as a whole. The average magnitude of its decrease is 2.1 mg/L. The smallest decrease was the change in TP content. It decreased from 2.8 mg/L before 20 days to 0.6 mg/L after 60 days, with a decreasing range of 2.2 mg/L. The biggest drop was in phosphorus changes. It decreased from 4.1 mg/L 20 days ago to 0.8 mg/L after 60 days, a decrease of 3.3 mg/L. This shows that aquatic plants have better adsorption and removal effects on eutrophic substances in the water body of pond A, and the adsorption and removal effects of phosphorus are the best.

4.3. Changes in Water Transparency. Finally, it is necessary to observe the change of the water transparency of the water body. It is combined with the results of changes in the content of eutrophic substances in the water body analyzed in the previous step to judge the effect of comprehensive treatment of urban landscape water bodies. As far as urban landscape water is concerned, water transparency is a very important evaluation index. The human senses can intuitively feel the quality of the water body through the transparency of the water body. Therefore, to a certain extent, the transparency index of the urban landscape water body directly affects the public's acceptance of the landscape water body. Water transparency reflects the clarity and turbidity of water. Highly polluted waters have higher turbidity, whereas less polluted or unpolluted waters have higher clarity. The transparency of water body reflects the light scattering intensity of particles in the water body and the higher transparency of water body. It shows that the less particulate matter contained in the water body, the less eutrophic substances contained in the water body at this time, and the water body is less polluted. The turbidity of the water body directly reflects the content of impurities in the water body. The higher the turbidity, the higher the impurity content in the water body, that is, the more the pollutants in the water body. Figures 6 and 7 show the changes in the transparency of the water body in the pond after purification and restoration by aquatic plants.

It can be seen from Figures 6 and 7 that the water transparency of pond A after pollution control has increased from 20 cm 7 days ago to 40 cm after 63 days. In contrast, the turbidity of the water body decreased from 24 cm before 7 days of treatment to 2 cm after 63 days. This shows that after the purification and restoration of aquatic plants and pollution control, the water transparency of the landscape pond has increased significantly. It also means that the comprehensive treatment of water pollution has achieved good results.

In summary, after the purification and restoration of aquatic plants and comprehensive pollution control, the comprehensive eutrophic substance content of the landscape pond water body decreased by 21.7 mg, and the water body transparency increased by 20 cm. The effect of the landscape water body after pollution control is shown in Figure 8.

It can be seen that after the comprehensive pollution control based on the purification and restoration of aquatic plants and the optimal arrangement of genetic algorithm, the landscape water body has achieved a good landscape water body effect.

Figure 3: (From left to right) Iris, canna, celandine.

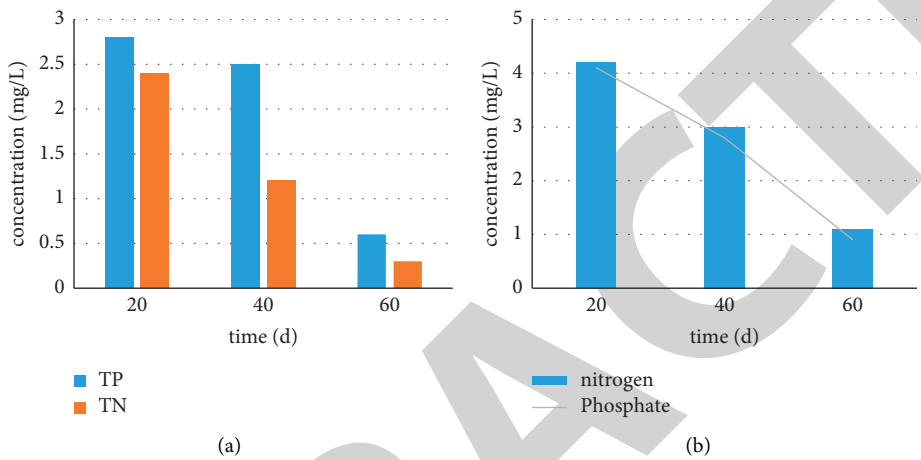

Figure 4: Changes in the content of TN, TP, nitrogen, and phosphate over time in water. (a) Changes in the content of TN and TP. (b) Changes in nitrogen and phosphate content.

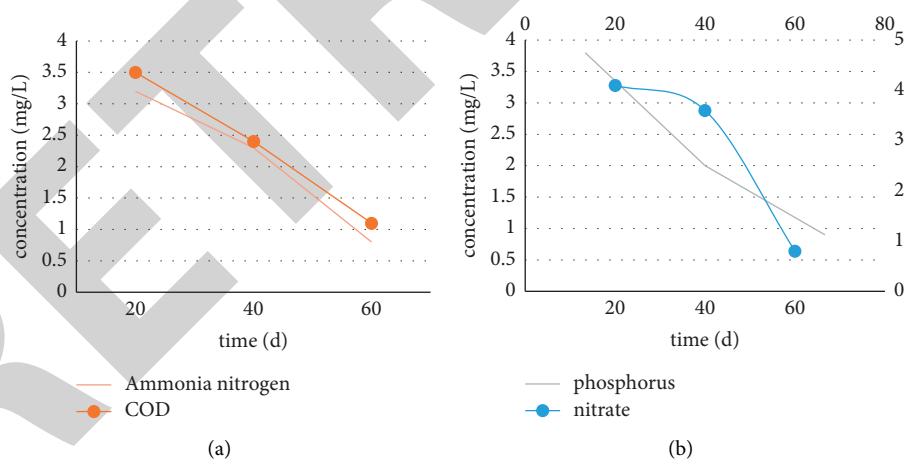

Figure 5: Changes in the content of COD, ammonia nitrogen, nitrate nitrogen, and phosphorus in water. (a) Changes in the content of COD and ammonia nitrogen. (b) Changes in the content of nitrate and phosphorus.

5. Discussion

Urban landscape water body is an important part of urban water environment. It not only has a certain ecological function, but also has a unique aesthetic function. Urban landscape water bodies have always played an important role in the urban water environment. The urban water environment has been polluted more and more, and the urban landscape water bodies have also been polluted and destroyed more and more. Therefore, the comprehensive treatment of urban water environment pollution and the treatment of urban landscape water pollution are of great significance for protecting the urban water environment and maintaining the harmonious development between the production and life of urban residents and nature [28].

As plants that can survive and reproduce in water, aquatic plants have certain ecological functions. It also has a certain purification and repair effect on water pollution. Therefore,

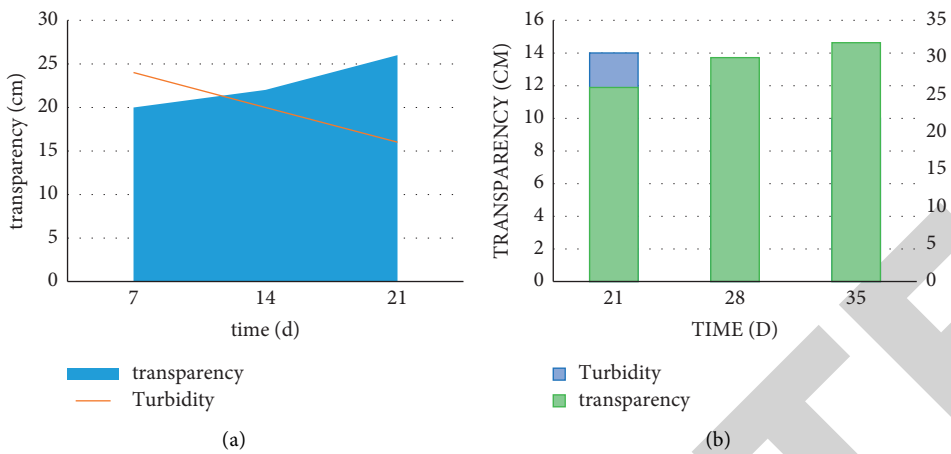

Figure 6: Changes in water transparency from day 7 to 35. (a) 7–21 days' water transparency changes. (b) 21–35 days' water transparency changes.

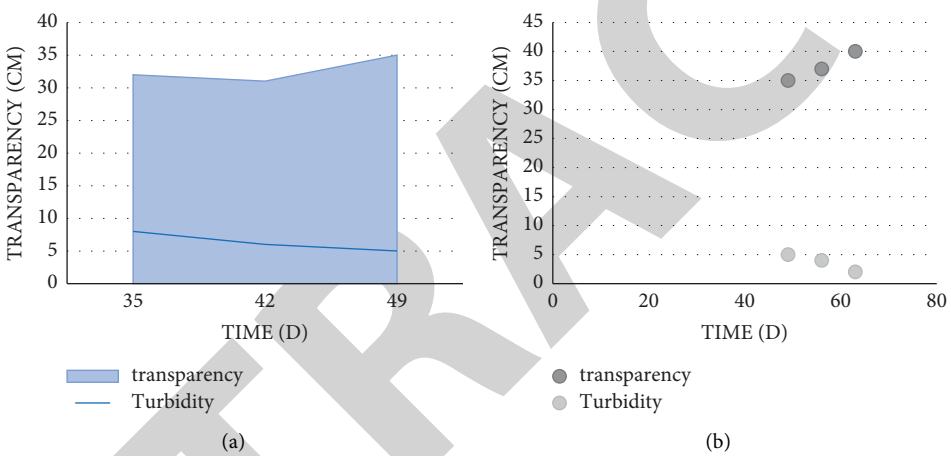

Figure 7: Changes in water clarity from 35 to 63 days. (a) Changes in water transparency in 35–49 days. (b) Changes in water transparency in 49–63 days.

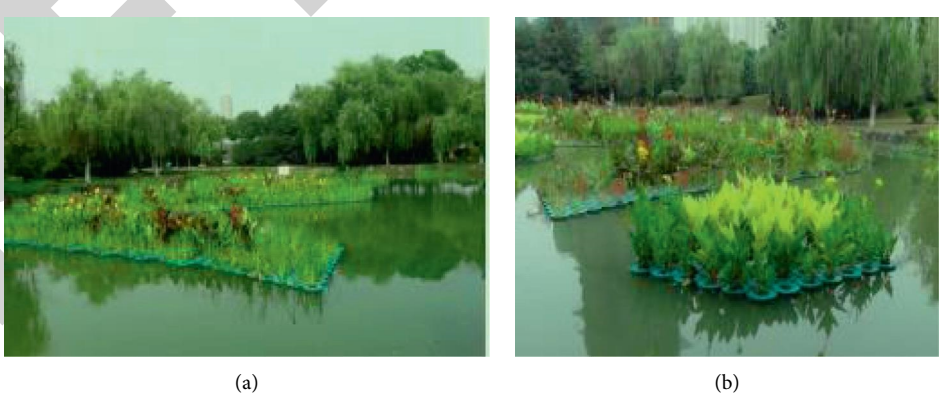

Figure 8: Pond A water body effect after pollution control. (a) 30 days after pollution control. (b) 60 days after pollution control.

aquatic plants are often used in the comprehensive management of water environment pollution. As a global search optimization algorithm, genetic algorithm plays a certain role in the construction of pollution control system. In this paper, the comprehensive management of urban landscape water environment is carried out based on the purification and restoration ability of aquatic plants and genetic algorithm.

The urban landscape water environment comprehensive treatment experiment designed in this paper first selected a landscape pond A in Xi'an as the experimental object and

conducted a basic investigation on its water quality. It then selected three aquatic plants, iris, canna, and celandine, as raw materials for the purification and restoration of aquatic plants and combined genetic algorithms to conduct experiments. It planted these three aquatic plants in the pond water body. The experiment judged the effect of the comprehensive urban water environment management experiment based on the purification and restoration ability of aquatic plants and genetic algorithm by observing the changes in the content of various eutrophic substances in the pond water within 60 days and the changes in water transparency within 7–63 days. After the experiment, it was found that the content of eutrophic substances in the landscape water body decreased significantly, and the water body transparency increased. This shows that the experiment has achieved a good effect of comprehensive treatment of urban water environment. After the experiment, it was found that the comprehensive eutrophic content of the landscape pond water after the purification and restoration of aquatic plants and comprehensive pollution control decreased by 21.7 mg, and the transparency of the water body increased by 20 cm. This shows that the content of eutrophic substances in the landscape water body has decreased significantly, and the transparency of the water body has increased. It also means that the experiment has achieved a good effect of comprehensive treatment of urban water environment.

6. Conclusion

In view of the economic significance of comprehensive management of urban landscape water bodies for protecting urban water environment, this paper mainly studies the comprehensive management of urban water environment based on aquatic plant purification and restoration and genetic algorithm. This paper mainly studies the comprehensive management of urban water environment based on aquatic plant purification and restoration and genetic algorithm. The experimental research in this paper shows that the comprehensive treatment of urban water environment based on the purification and restoration of aquatic plants and genetic algorithm can achieve good results. The conclusions drawn in this paper have certain significance for promoting the progress of comprehensive treatment technology of urban water environment. The research of this paper also has limitations, for example, the research angle is still a little narrow, and the research method is not innovative enough. It is believed that there will be more excellent researches related to the comprehensive management of urban water environment in the future.

Data Availability

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

Conflicts of Interest

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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