

Retraction

Retracted: Design and Research of Artificial Intelligence in Multimedia Intelligent Question-Answering System and Self-Test System

Advances in Multimedia

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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] X. Yao, "Design and Research of Artificial Intelligence in Multimedia Intelligent Question-Answering System and Self-Test System," *Advances in Multimedia*, vol. 2022, Article ID 2156111, 8 pages, 2022.

Research Article

Design and Research of Artificial Intelligence in Multimedia Intelligent Question-Answering System and Self-Test System

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With the development of computer science and technology, online education is gradually accepted by more and more users, and has become one of the main teaching methods in schools under the influence of the epidemic in recent years. In addition, online vocational education or higher education has also captured the psychology of national learning, and online tutoring has gradually entered into nonstudent groups such as office workers. Although online education has the advantages of low cost and no limitation of time and space, it also has some problems, such as low classroom satisfaction, delayed feedback from students, and poor teaching effect. Therefore, this paper aims at this problem by combining the development background of foreign intelligent answer system and self-test system, and introducing it into our computer application, using artificial intelligence for natural language processing, aiming at online teaching students cannot get timely answer, and self-test questions intelligent system design. The final experimental results show that the system effectively alleviates the problems of students' delay in answering questions and poor self-test effect, and increases the satisfaction of online classroom by 13%.

1. Introduction

Online education is a new way of education produced under the development of modern information technology, which breaks the traditional way of offline face-to-face teaching and pays more attention to learners in the process of teaching. Through computer technology, multimedia technology, communication technology, and network technology, and other computer technology methods, pictures, text, animation, video, audio, and other multimedia intelligent means as teaching methods to realize teaching content teaching (Wang and Liu) [1]. At first, the content of online education only included the teaching of online live courses or recorded courses. Later, it gradually developed into seven support systems, courseware, and generation tool system to produce the content needed to be displayed in online teaching, which is equivalent to writing on the blackboard in traditional teaching. The online question-answering system is used to ask and answer students' questions and answers about what they do not understand after class, which is equivalent to the offline question-answering link in traditional teaching. How-

ever, due to the uncertainty of time between online students and teachers, the question-answering system can act as a 24-hour automatic answer teacher (Zhang) [2]. The web-based intelligent question-answering system, which integrates high and new technologies such as network communication and artificial intelligence, makes educational question-answering break through the time and space limitations of question-answering behavior, and widely expands the resource content, resource presentation form, and resource acquisition method of question answering, providing efficient and high-quality interaction between students and educational resources, which not only supports the smooth progress of network teaching but also becomes a useful supplement to traditional classroom teaching.

The homework publishing system is used to make and publish the homework after the course. Since the whole teaching process is carried out online, students cannot hand in the homework to the teacher offline, and the teacher will correct it and then send it back. Instead, it is distributed uniformly through the assignment publishing system, and students submit it back to the system for teacher correction

after completion (Bharat et al.) [3]. The same goes for the remote examination system and the remote communication and discussion system. In addition to the courseware and generating tools required by the teaching link, the remaining systems are collectively called learning management system, and the system involved in the teaching link is called multimedia streaming on demand/broadcast system. From the main system modules of online education, we can see that its birth is not only promoted by the epidemic but also closely related to the concept of open education in modern society. Open education is a kind of education mode opposite to closed education. Open education focuses on students and learning, and weakens the importance of teachers, schools, and classroom teaching (Ojokoh and Adebisi) [4]. Different from traditional cramming teaching, open teaching pays more attention to teaching methods and means. In the process of teaching, various teaching methods will be adopted to promote students' understanding and learning. Finally, the biggest difference between open teaching and closed teaching is that open teaching is not subject to the time, place, and age of learners, which is the problem of learning limitation and hindrance for closed teaching. At the same time, students have more flexibility and autonomy in choosing courses to study and learning to use media. In the process of learning, learning content can also be arranged according to their own progress and pace (Kumar and Valarmathie) [5].

However, the development of online education in China is still relatively slow compared with that in western countries. Despite the rapid growth of online education demand under the impact of the COVID-19 pandemic, the actual hardware and software strength has not kept up with the current online education in primary and secondary schools actually faces severe challenges. Among them, teachers have low requirements for online teaching, and students and teachers only need a multimedia to complete the teaching and listening. Therefore, the main problem lies in the teaching result detection and Q&A after the course (Patel and Lyer [6]. A sample survey was conducted among students who received online teaching under the epidemic situation. According to the data survey, only about 25% of them believed that online teaching could meet their needs, and about 10% of them believed that current teaching resources and processes were insufficient to support complete online teaching. On the one hand, although students and teachers teach and interact through the same multimedia teaching system, multimedia has become the only communication link between them due to the form of online teaching. When offline students have doubts about the content of the lecture, they can go directly to the teacher's office to ask questions, and usually the teacher will answer the students' questions in the office. However, the online form may lead to a time difference between the two, and students will also feel depressed because they cannot find the teacher (Therasa and Mathivanan) [7]. In addition, one of the advantages of online education is that learning materials are abundant and can be downloaded and viewed through a special learning management system, but there is no effective test for students' actual mastery. According to the 24 domestic online

education platforms or education websites we investigated, this paper found that there are very few truly intelligent online Q&A systems in China. Some education websites do not have Q&A systems. Most education websites with Q&A systems use email, message boards, BBS, chat rooms, and other web-based interpersonal interaction methods to achieve Q&A. It can be seen that most domestic educators' understanding of online Q&A is still limited to the mode of interpersonal interaction in traditional teaching, while ignoring or avoiding the strong support provided by advanced technologies such as network technology and artificial intelligence for Q&A.

Therefore, the design and research of intelligent question-answering system and self-testing system of online education in multimedia environment is particularly important. Based on this background, this paper designs and constructs intelligent question-answering system and self-testing system with the help of artificial intelligence technology, which can provide instant feedback to the questions raised by students. It is of practical significance to integrate teaching resources to eliminate students' loneliness and reduce teachers' responsibility.

The research content of this paper is divided into three parts. Firstly, the system model is designed based on the existing research of intelligent question-answering system and related educational theories. Through the analysis and summary of the existing multimedia intelligent question-answering system and self-test system, we provide theoretical guidance for the system proposed in this paper and lay the foundation for the model design for the subsequent in-depth research. Secondly, we introduce a variety of technologies into the underlying logic of system design. The traditional learning management system is based on statistical theory to lock the most likely correct answer through probability. In this paper, the core algorithm of the system is designed by artificial intelligence theory on the deep learning framework Keras through PyCharm developer tool. Finally, we put the designed system into practical application. On the one hand, we pay attention to students' learning data and the effect of answering questions and self-testing of the system. On the other hand, we explore the influence of the system on distance teaching interaction through questionnaires, and further summarize the performance characteristics and shortcomings of the system.

2. Materials and Methods

Education is the eternal category of the development of every era and the means of the survival, continuation, and development of human society. Different societies have different forms of education. In the era when multimedia and computer networks were not popular, education was more in the offline form. In the middle of the 19th century, correspondence education, a form similar to distance education, first appeared in Britain between offline and online education. After students sign up for study, teachers will mail the relevant learning materials to the students, and the students will learn by self-study first, and then gather in a certain offline area for unified teaching within a period of

time (Manmadhan and Kovoor) [8]. With the establishment of the Open University in Britain in the 1970s, this kind of teaching form is regarded as the official birth of modern distance education and also a milestone in the history of modern distance education. Amadou Mahtar Mbo, Director-General of UNESCO, said: “The success of the Open University has convinced many countries in the world that the distance education system based on the application of new technologies can make an effective contribution to the increase in the quantity and quality of higher education in the vast field of lifelong education” (Qin et al.) [9]. With the development of computer network, the British government began to invest heavily in and develop online education. So far, almost all primary and secondary schools in Britain have set up their own online schools. At the same time, an ATI Corporation has been specially established in the UK to provide online education for universities, as well as provide models for online education and design prototypes for the training of the second generation of online education. In addition to Britain, the United States is also one of the countries with the early development of online education. In September 1998, Stanford University held the Master of Engineering program online and opened about 30 courses. In the same year, USDLA, the American Distance Education Committee, was established, which has been committed to and helped the development of distance education (Yusuf et al.) [10]. In addition, the United States government has also developed the famous Internet2 plan, which aims to establish a complete online education network on the Internet, so that no matter the government departments, research institutions, and schools at all levels can connect through this online education network, so as to promote the development of online education, making online education accessible to all Americans in a new teaching environment. Australia is also a leader in the field of online education because it started the network earlier than the United States. They established the “Lifelong Learning Network” to realize various new ideas, technologies, and teaching plans of online education (El-Komy et al.) [11].

China’s education development fully absorbed the experience and lessons learned from the development of western countries. China’s educational mode has also mainly experienced two eras, offline education and distance education. Further, distance education is divided into three stages: correspondence education, radio and television education, and online education. However, western countries did not experience the link of radio and television education because computer science and technology were not popularized in China at that time. Therefore, online education was not called the education method accepted by the public, but adopted the broadcasting method which was more acceptable at that time (Guo) [12]. It was not until the end of 1994 that China’s first public computer network using TCP/IP protocol, the China Education and Research Computer Network (CERNET) Demonstration Project was established under the auspices of the Education Commission of China and 10 universities including Tsinghua University, that China’s online education was born. Later, under the leadership of Wang Dazhong of Tsinghua University, Tsinghua

University took the lead in launching online postgraduate refresher courses. In the same year, Hunan University also cooperated with China Telecom to establish online University (Mozafari et al.) [13]. In September 1998, the Ministry of Education officially approved Tsinghua University, Beijing University of Posts and Telecommunications, Zhejiang University, and Hunan University as the first batch of national modern distance education pilot colleges. Formulated after the Ministry of Education “about supporting the construction of a number of high school network education institute to conduct modern distance education pilot work of several opinions” clearly 31 pilot colleges and universities is highly autonomy, such as can be combined with their own situation work out standards for admission and enrolment numbers, can be combined with their own professional colleges and universities set up professional advantage of directory, and have the right to issue state-recognized academic qualifications and diplomas (Chen et al.) [14]. On July 31, 2000, 31 pilot schools established the “Modern Distance Education Collaboration Group of Higher Education Institutions” in Beijing to strengthen exchanges and cooperation among pilot universities and promote the construction and sharing of educational resources (Yusuf et al.) [15].

With the advent of the Internet era, China’s education model has also undergone great changes. From the perspective of education methods, online education has emerged as a new force, which has a great impact on classroom education. From the perspective of education mode, the traditional exam-oriented education has also been gradually found not suitable for the current environment, so China’s education has gradually shifted from exam-oriented education to quality education. As an education mode introduced from the United States, STEM education is also integrating with quality education, becoming the most respected education mode on the current education track.

3. Results and Discussion

The rapid popularization of computer networks has provided a solid hardware and software foundation for the development of online education, and the epidemic situation in recent years has provided a good opportunity for the development of online education. Therefore, in today’s educational environment, learners can learn courses anytime and anywhere. The online education system represented by computer network is leading to the profound change of online education system [16–18]. In the new generation of online education, we should not only stick to the form of online teaching, but also start with after-class and after-class learning management systems to ensure the efficiency and results of online learning. The flow of the question answering self-test system based on artificial intelligence in this paper is shown in Figure 1. The system model is divided into two parts: the browser side and the server side. The browser side is divided into students, teachers, and administrators. The server side connects to the knowledge base, including thesaurus, question answer base, and rule base. The thesaurus is composed of keywords, the question answer database is composed of multiple documents of

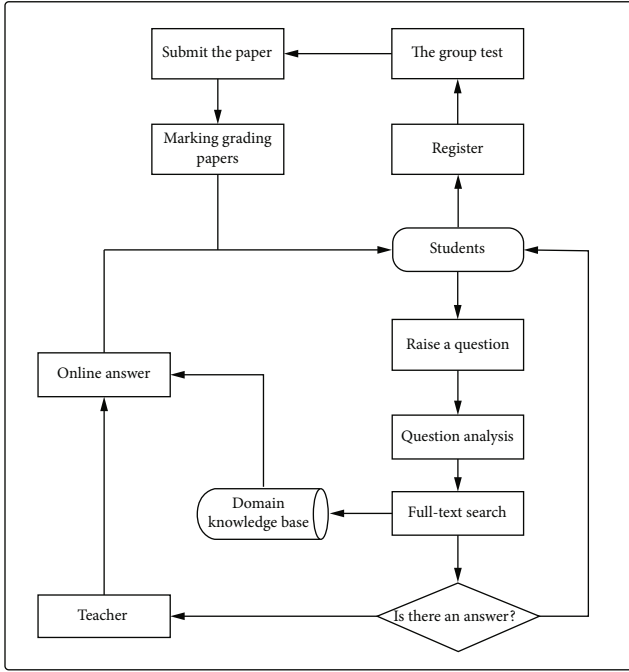


FIGURE 1: Flow chart of question-answering self-test system based on artificial intelligence.

question answers, and the rule inventory contains some inference rules.

As shown in Figure 1, after the students ask questions in natural language on the browser side, the server side uses the search technology of combining spatial vector model and Boolean model to match and search the results of word segmentation and semantic analysis with the question answer library. Finally, documents whose relevance reaches a certain threshold are searched out and presented to learners in descending order of relevance. If there are no search results or the students are not satisfied with the results, they will turn to no answer questions, which will be answered manually.

Traditional intelligent answering questions and self-test system are mostly based on Web under the function of computer assisted instruction system. As an adaptive knowledge base, the advantage is that can be divided into two parts, artificial answering questions and automatic question-answering, allowing learners through a Web browser any node in the network flexible online question answering questions automatically, greatly liberated the human. At the same time, compared with the more original online teaching, the working principle of Web-based learning management system is mainly divided into two parts. When there is a manual answering online, the students' answering page automatically jumps to the manual. When the user is not online, the questions required by students will be sent to the corresponding teacher by email, and the teacher will automatically return to the student's email after answering the questions. At the same time, the system will display the question on the square in the form of a bulletin board. If someone answers the question, it will also return to the students' mailbox in the form of email. Either way, the system

collects the questions and adds them to the domain knowledge base, so that the next time someone asks a similar question, the answer can be given directly, reducing the response time. This involves the matching inference process of the system, and the traditional matching method is usually fuzzy inference. Fuzzy inference refers to the selection of the best answer through the synthesis of fuzzy relations, such as judging the inference pattern according to the corresponding matching rules, and finally translating the conclusion into natural language form. The specific expression is shown in the following:

$$R = IFx \text{ is } \tilde{A} \text{ Then } y \text{ is } \tilde{B},$$

$$\tilde{B} = \tilde{A} \circ \tilde{R} = (b_{ij})_{n \times m}, \quad (1)$$

$$b_{ij} = \bigvee_{l=1}^k a_{il} \wedge r_{lj} \quad (i = 1, 2, \dots, n; j = 1, 2, \dots, m).$$

Figure 2 shows the stability of the traditional question answering self-test system under different test states, where the red color represents the changing trend of the intelligent question-answering system. Blue represents the changing trend of the self-test system. It can be seen that the stability of the traditional question-answering system is better than that of the self-test system. Through the research data, we analyze that the traditional system has the advantages of naturalness and modularity. To adopt the fixed mode and the format to represent knowledge, at the same time in the whole process of answering questions with artificial participation, also exist in the process of database in modularity, flexibility call answer contact, and mutual influence between each rule, so efficient and accurate for knowledge the answer to add, delete, modify, or expanded. But on the contrary, the self-test system only carries on the fuzzy match to the student test knowledge point, and integrates the related test content. The randomness of the whole process is large, and the correlation between the contents is low, so the stability is poor. The specific expression is shown in the following:

$$S_N(A, B) = \max_{1 \leq j} \sqrt{\frac{1}{t} \sum_{i=1}^t N(a_i, b_j)^2},$$

$$A = \{u_1/a_1, u_2/a_2, \dots, u_s/a_s\}, \quad (2)$$

$$B = \{v_1/b_1, v_2/b_2, \dots, v_s/b_s\},$$

$$N\alpha(a, b) = \begin{cases} N_r(a, b), & N_r(a, b) \geq \alpha, \\ 0, & N_r(a, b) < \alpha. \end{cases}$$

Traditional learning systems are mainly based on statistical principles for analysis and evaluation, but with the development of the Internet, people enter the era of information explosion. The emergence of large-scale corpora makes language processing based on statistics insufficient to support the further exploration of the internal laws of language. For example, in the past, when network information did not grow as rapidly as it does today, the analysis of corpus by question-answering system and self-testing system was mainly calculated based on Salton's vector space model.

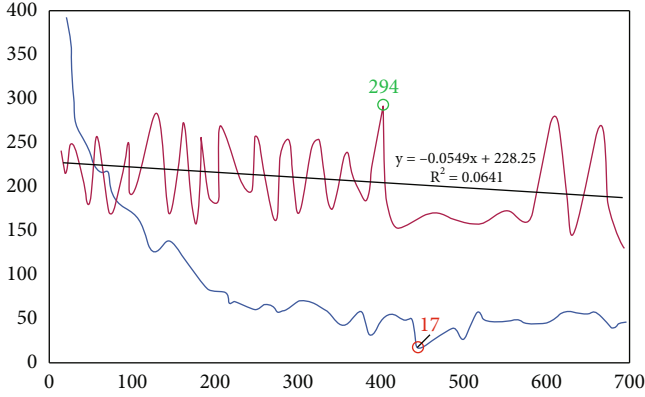


FIGURE 2: Comparison of stability between traditional and intelligent question answering systems under different test conditions.

The system uses weighted vectors to represent the documents and questions to be queried. According to the complementarity of vectors, the similarity of sentences is measured from word frequency (TF) and word frequency (IDF). The word frequency here refers to the frequency of a keyword in the full text, which is mainly affected by the total number of words. Word segmentation is the first step of intelligent question answering, and the design of thesaurus is directly related to the quality of word segmentation and thus affects the search results. Because in the question answering system, students' questions are generally professional, mostly for a certain course, and the questions are concise and short. In automatic word segmentation, the natural language is first preprocessed to remove irrelevant punctuation marks, and Chinese and English characters are separated into several strings. Therefore, in the practical application of this model, all word frequencies will be normalized and mood particles or content particles, such as "de," "de," and "ah," will be removed. There are three common Chinese word segmentation methods: string matching (or dictionary) based word segmentation, statistics-based word segmentation, and understanding based word segmentation. This system adopts the word segmentation method based on string matching (or dictionary); while Chinese string word segmentation adopts the positive maximum matching method according to the thesaurus. The specific expression is shown in Equations (3)–(6). See Figure 3 for its specific ability to analyze documents.

$$\vec{d}_j = (w_{1j}, w_{2j}, \dots, w_{ij}), \quad (3)$$

$$g_i = \log(N/n_i), \quad (4)$$

$$\vec{q} = (w_{1q}, w_{2q}, \dots, w_{tq}), \quad (5)$$

$$w_{tq} = \left(0.5 + \frac{0.5 \text{freq}_{iq}}{\max \text{tf}_q}\right) \times \log \frac{N}{n_i}. \quad (6)$$

The maximum matching algorithm mainly includes forward maximum matching algorithm, reverse maximum

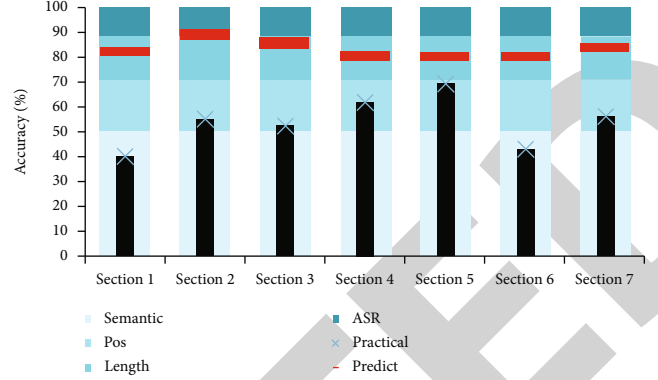


FIGURE 3: Maximum matching analysis of fitting effect of traditional vector space model.

matching algorithm, and bidirectional matching algorithm. The main principle is to segment a single character string, and then compare it with the thesaurus. If it is a word, record it. Otherwise, continue the comparison by adding or reducing a word. If there is still one word left, the comparison will be terminated. If the single character string cannot be segmented, it will be treated as not registered.

Therefore, we hope that by introducing artificial intelligence technology and the self-learning ability of neural network, on the one hand, we can dig and sort out information from daily audio and video, and on the other hand, we can make full use of sufficient learning materials on the Internet, so as to complement the archived information in the system to the greatest extent. This is also the biggest advantage of the intelligent question-answering system and self-test system proposed in this paper. Neural network model is one of the core algorithms of artificial intelligence technology, which is proposed to solve the problem of computer without logical machinery. The researchers hope that by mimicking how the human brain works when a computer performs a task, it can achieve complex results in the operation of each simple unit. The research results of neural networks show that the main characteristics of artificial neural networks are continuous-time nonlinear dynamics, global function of networks, massively parallel distributed processing, high robustness, and learning association ability. According to the characteristics of different tasks performed, neural networks will carry out abstract simulation of different processes according to the way the human brain processes. So far, there are more than 40 models. In the field of information processing and crawling recognition, the commonly used neural network model is BP back propagation neural network. It is time-cyclable and the connection mode between neurons is fully connected, which means that its processing complexity is high. Therefore, it is very beneficial for the analysis and precipitation of data in the question-answering and self-testing system. Therefore, this paper designs the core algorithms of multimedia intelligent question-answering system and self-testing system through the theory of artificial intelligence on the deep learning framework Keras by PyCharm developer tool. The principle is to calculate the error between each neuron by using the

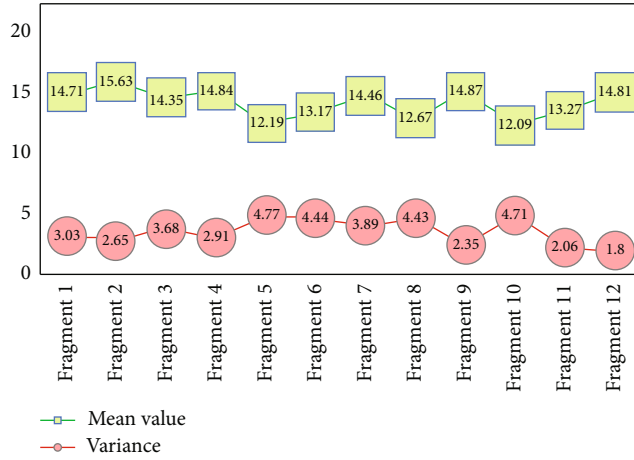


FIGURE 4: The recognition results of different text segments based on BP reverse neural network.

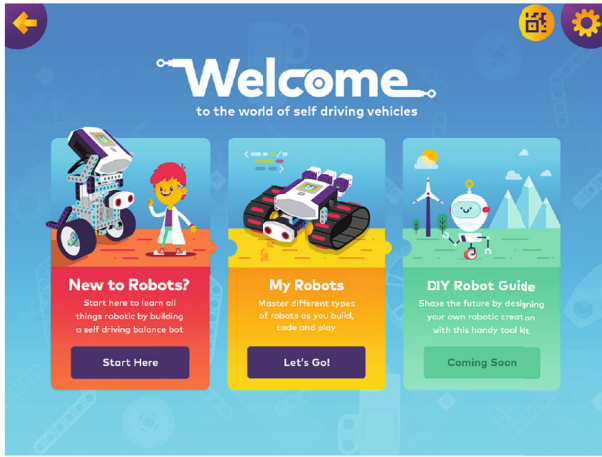


FIGURE 5: Multimedia intelligent question-answering and self-testing system UI interface.

fully connected characteristic in the neuron, and the answer with the smallest error will be the one with the highest matching degree. At the same time, the steepest descent method is used to iterate the full coefficients of neurons in each layer and finally output the results. The specific expression is shown in the following:

$$\begin{aligned}
 E_k &= \frac{1}{2} \sum_{j=1}^m (y'_{kj} - y_{kj})^2, \\
 W(k+1) &= W(k) - \mu \Delta E_k, \\
 \frac{\partial E_k}{\partial y_{kj}} &= -(y'_{kj} - y_{kj}), \\
 \text{net}_{kj} &= \sum_i w_{ij} x_{ij}.
 \end{aligned} \tag{7}$$

Figure 4 shows the recognition results of different text segments based on BP reverse neural network. It can be seen that among the 12 randomly selected test text results, the

average value is basically maintained at about 13, and the error is maintained at about 3. It can be seen that the stability and accuracy are higher than the traditional algorithm.

4. Result Analysis and Discussion

After programming the core algorithm of the system, we finally need to design the UI interface of the system. The final design result is similar to that shown in Figure 5. The main page is mainly divided into three sections: Q&A section, self-test section, and square section. Users can enter the corresponding functional area by clicking on different modules. If users have doubts about a certain knowledge point, they can click on the Q&A plate. The system will first search the database to see if there is any relevant answer, if there is, it will send the relevant answer to the user. If not, or the user still asks for someone after reading the relevant answer, it can enter the submission stage, and the two sides will discuss the problem through email. The self-test section mainly tests the teaching effect. Different from the traditional self-test, the database referenced by the self-test system proposed in this paper is not only its own database, but also crawling data on the Internet based on artificial intelligence neural network technology. Therefore, the content of the self-test question bank of the self-test version proposed in this paper will be richer. Finally, the main tasks of the square module are user retention and answering questions collected by the system and published in the public area. On the one hand, it can bring the boring learning platform with social attributes and increase students' interest in using the system. On the other hand, it provides a platform for the question answering subsystem to publicize the questions, which can reduce the labor cost and increase the resolution rate of the system to the greatest extent.

Finally, we applied the system in the actual classroom, and used data analysis, content analysis, and questionnaire to analyze the interactive quality of the system and user satisfaction. In order to ensure the objectivity and accuracy of the subjects, we carried out the experiment around the age of 23-26. Firstly, 120 college students aged 23-26 were randomly recruited nationwide. The reason for choosing subjects between 23 and 26 years old is to avoid that younger users' subjective attitude towards learning will affect their judgment results of the system. However, the 23-26-year-old student users are relatively mature, so we can obtain the maximum objective perspective of the system proposed in this paper. The specific results are shown in Figure 6. For the convenience of statistics, 120 subjects were randomly divided into 12 groups, and each of them scored the traditional learning management system and the intelligent question-answering and self-testing system proposed in this paper. The final results show that the satisfaction of the intelligent question-answering and self-testing system proposed in this paper is higher, which is about 13% higher than that of the traditional system, indicating that the system proposed in this paper has certain practicability.

In order to further improve the satisfaction of users, we further analyzed the distribution of the satisfaction rate of the subjects, and found that most of the subjects were

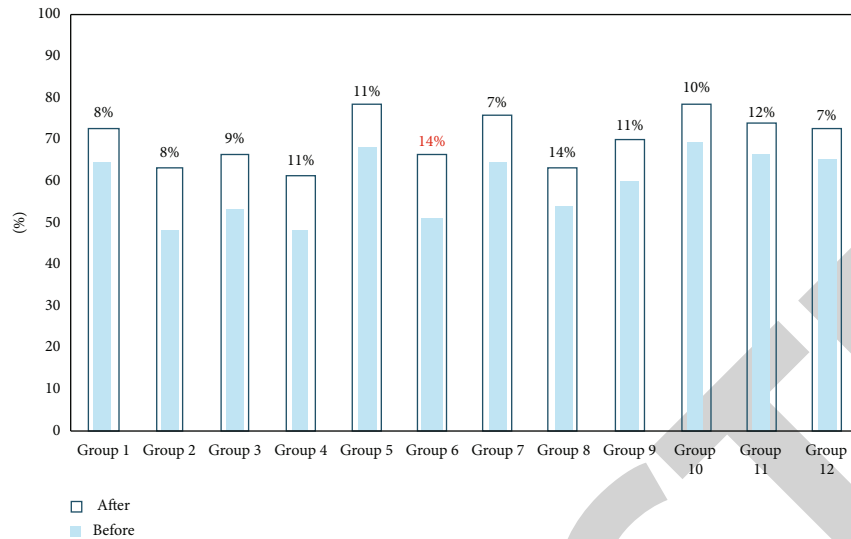


FIGURE 6: User satisfaction of intelligent question answering self-test system.

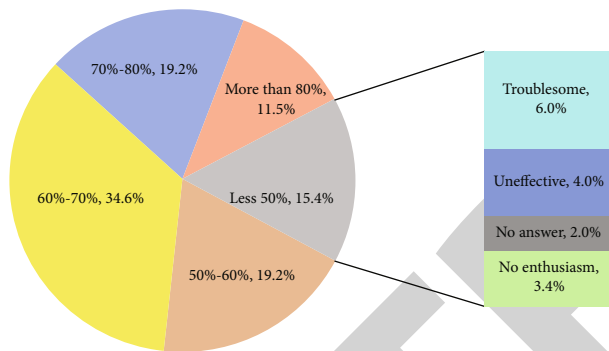


FIGURE 7: Problems of intelligent question answering self-test system.

relatively satisfied with the system proposed in this paper. If the evaluation of satisfaction lower than 50% was considered as unsatisfactory, about 15.4% disagreed with the system proposed in this paper. In order to better find system problems, we also conducted an investigation and analysis for the 15.4%, and the results are shown in Figure 7. It can be seen that the biggest reason for dissatisfaction is that the system proposed in this paper is troublesome to operate (6%), in addition to low efficiency (4%), no answer (2%), and no enthusiasm for learning (3.4%), so in the subsequent algorithm and system design optimization, attention should be paid to system simplicity and other issues.

5. Conclusion

Based on the analysis of the current situation of online education in the epidemic era, this paper finds that the epidemic has accelerated the development of online education, but the back-end learning management system does not match the rapid development of the industry, especially the multimedia intelligent question-answering system and self-test system. Therefore, the design and research of intelligent question-

answering system and self-test system in network education under multimedia environment is particularly important. Based on this background, this paper designs and constructs an intelligent question-answering system and a self-test system with the help of artificial intelligence technology, which can provide immediate feedback to the questions raised by students. At the same time, the algorithm proposed in this paper uses artificial intelligence technology to connect the system database with the Internet database, giving the system the ability to analyze and solve problems in today's information explosion era. Finally, in practical application, the satisfaction of the system designed in this paper is about 13% higher than that of the traditional system. It is of practical significance to integrate teaching resources, eliminate students' loneliness, and reduce teachers' responsibilities.

Data Availability

The figures used to support the findings of this study are included in the article.

Conflicts of Interest

The author declares that he has no conflicts of interest.

Acknowledgments

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