Model Construction of Higher Education Quality Assurance System Based on Fuzzy Neural Network

Lu Mei
Henan Vocational College of Information Statistics; Zhengzhoun Henan, 450000, China
E-mail: lmzqy63662908@163.com

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This paper uses the principles and advantages such as fuzzy law and neural network, integrates them organically, and designs a model of higher education quality assurance system based on the fuzzy neural network using MATLAB software. For the problems that the law quantifies the fuzzy information and does not have adaptive learning ability, this paper proposes a heterogeneous wireless network access selection algorithm based on DA-FNN. The algorithm combines fuzzy logic theory and neural network, which enables the algorithm to process fuzzy network attribute information while adaptively adjusting parameters, and uses the dragonfly algorithm to optimize the parameters of the affiliation function of the fuzzy neural network to make the network evaluation results more accurate and thus improve the system performance. To realize the separation of front and back ends and effectively improve the user experience, the MVVM (Model-View-View Model) model is used for the design. The system development process is standardized to facilitate system management with requirements analysis, conceptual design, detailed design, coding, and testing. The system is validated in the simulation software MATLAB, and the functions of sample maintenance, fuzzy neural network training, and fuzzy neural network evaluation are implemented in the student evaluation subsystem as an example. The fuzzy evaluation algorithm of higher education quality based on fuzzy neural network architecture proposed in this paper can effectively integrate the positive propagation mechanism, multi-level feedback mechanism, and fuzzy quality evaluation mechanism in the talent training system and provide a theoretical basis for rational analysis of the weak points of student ability development in the talent training process.

Povzetek: Predstavljeni model kakovosti visokošolskega izobraževanja temelji na mehki nevronski mreži, uporablja algoritem kačjega pastirja za optimizacijo in zagotavlja natančnejše ocene in izboljšano uporabniško izkušnjo.

1 Introduction

The 21st century is the century of quality. Quality has become the life and soul of higher education development. Quantitative growth without quality assurance will only lead to poor quality of higher education products and waste of resources. The basis of higher education development is scale, but the core is quality. Quality has become the life and soul of higher education development. The optimal allocation of domestic educational resources and the international competition for educational resources require us to establish a quality assurance system that is compatible with the internationalization and popularization of higher education. To enhance their competitiveness, colleges and universities should devote themselves to strengthening the innovation of the college management system and management mode, forming a stable, long-term, and reasonable operation mechanism, continuously improving the quality of education and teaching, and promoting their rapid development [1]. At present, there is little research on the teaching quality of college teachers and little research on how to regulate their teaching management, so there is no theoretical framework to guide the establishment of teaching quality assurance and feedback mechanisms in colleges and universities. However, just like the concern of the people in Western developed countries, the real purpose of higher education expansion cannot be achieved if the quantity of higher education is greatly expanded without guaranteeing and improving quality. Course quality improvement cannot be achieved without the construction of a course, a quality assurance system, and a perfect course quality assurance system that can provide long-term supervision for course quality assurance [2]. Although many colleges and universities in China have established teaching quality assurance systems, there is an obvious lack of quality assurance carried out for the curriculum. In China's higher education research, there are abundant research results on higher education teaching quality assurance systems. There are also many studies on curriculum construction and curriculum evaluation. However, there are still few studies on forming a systematic system for higher education curriculum quality assurance. China's higher education curriculum quality assurance system is urgently seeking further improvement.

With the advent of the electronic and digital era of data, a large amount of complex information is widely stored in various electronic systems, and a large amount of knowledge is stored in this complex information [3]. A fuzzy Neural Network (FNN) is the product of combining a fuzzy system and neural network, which is a good synthesis of the advantages of both and has good autonomous learning ability and explanation. Artificial intelligence is an important branch in the field of computer science, which has developed into a science with great potential and value after decades of development since it was proposed in 1956. Artificial intelligence is the study of human intelligence to produce machines or technologies designed to respond in imitation of human intelligence, which is widely used in various fields and brings great convenience to human life. An artificial neural network is a model built by simulating the neural network in the human brain. Artificial neural networks consist of many interconnected neurons, and the system simulates the human brain for information processing by adjusting the relationship between the interconnections of internal nodes. Natural language is mostly a vague, qualitative expression of the qualities of certain things, which is how the human brain reflects most phenomena in nature [4]. The human brain makes decisions and judgments based on information that is incomplete and imprecise. Fuzzy systems mimic this reasoning process by taking deterministic numerical type signal inputs, transforming them into fuzzy concepts, and subsequently imitating the human brain to make decisions according to specific fuzzy rules [5]. In human natural language, many concepts are fuzzy and not clearly defined, but also rarely cause ambiguity in a particular language environment.

The rapid development of information technology makes it gradually penetrate the education field, making education informatization a necessary way for countries to promote continuous development and change in education. The first round of the testing process was mainly conducted online, with the help of platforms such as Pinning and Study Talk, to carry out the film and television choreography and production course. The teacher carries out teaching through the online platform, and the main contents include general knowledge, case explanation, task assignment, and other operations. In this round of testing, the author and the instructor jointly completed the instructional design. Since the main practical devices for online students are students' smartphones and tablets, which exclude interference in offline courses, students can be in a teaching environment that they are familiar with and can conduct independent learning, which can improve learning efficiency. To improve the informatization of quality assessment in higher education, which is a multi-level and complex, and diverse field of specialization, Sayed G I have tried to analyze and mine the data from the collection of network data generated by the educational process as the research object and use information technology as a tool to provide a reference basis for the improvement of teaching quality [6].

2 Related jobs

L.A. Zadeh, an American automatic control expert, proposed the concept of a fuzzy subset in 1965 and published a paper: "Fuzzy Set Theory" (Fuzzy Set), which proposed fuzzy mathematics as the core idea to transform definite quantitative input into fuzzy input and imitate human brain thinking to process complex things [7]. L.A. Zadeh also proposed fuzzy logic theory in 1973, which further advanced the refinement of fuzzy theory. Fuzzy systems capture the characteristics of human fuzzy thinking and use fuzzy reasoning to solve problems that are difficult to solve in conventional ways by fuzzifying the input vectors separately and using the corresponding fuzzy rules in the fuzzy rule base to obtain the corresponding fuzzy results or exact numerical results. Fuzzy systems and artificial neural networks, two models that are originally independent of each other, start to combine, and their advantages are much higher than in one single study. Fuzzy neural networks make up for the interpretability of neural networks by using fuzzy logic to explain them, which expresses more clearly and concisely the logic that humans are used to, is suitable for abstracting certain knowledge that humans have not yet been able to understand explicitly, and can adjust the corresponding fuzzy logic as the knowledge changes in real-time, enabling self-adaptation through learning [8]. Fuzzy neural networks have become one of the most promising and important fields of artificial intelligence. Meraihi Y proposed an effective method to build multilayer neural networks on unsupervised data, which overcame the disadvantage of the original network of easily falling into local minima and made the number of layers of the network deeper, which once again set off a boom in neural network research [9].

Electronic information is the trend of the times, and so is educational information, which has transformed traditional paper documents into electronic mode. Such information includes school scheduling information, teachers' teaching information, students' course selection information, grade information, etc. [10]. Moreover, with the development of online distance education, non-traditional educational information has further increased. How to dig out useful information for education from the huge amount of data and improve the quality of education teaching has become the reason that prompted the emergence of education data mining [11]. To take advantage of educational data analysis in quality assessment, it is crucial to design educational quality assessment algorithms to enhance and improve learning processes and competencies [12]. In recent years, there has been an increasing interest in combining technologies from the field of artificial intelligence with educational quality. For example, AI technologies are used to analyze classroom behaviour in a data-driven manner to improve the quality of classroom teaching and learning [13]. The existing education quality assessment algorithms can improve and enhance the quality of education and teaching in universities to a certain extent. Still, there are many factors affecting the quality assessment, which makes it difficult to quantify the quality assessment of higher engineering education. Therefore, when designing quality assessment algorithms, the logical relationships among the basic elements of higher education should be clearly described from a quantitative perspective, considering the actuality of higher education, the characteristics of higher education, and the implementation process of higher education assessment

[14]. The research entities of this paper are finally defined as training objectives, graduation requirements, subdivision points of graduation requirements, and curriculum system, and all the research carried out in the later stage is based on them. To identify the weak links between the entities of the model, the model is combined with a neural network-like architecture to propose a higher education quality assessment algorithm based on a fuzzy neural network architecture to evaluate the "attainment" of the entities.

3 Fuzzy neural network design and research

3.1 Fuzzy neural network model

The human understanding of the world is fuzzy, and there are many fuzzy concepts, such as young, big, warm, evening, etc. The properties of the objects described by these concepts cannot be answered simply by "yes" or "no". The Mamdani model is a fuzzy system consisting of a fuzzy rule base and a fuzzy inference machine. It works as follows: x is assumed to be an input variable, y is the output, and the whole system is a fuzzy logic controller.

$$y_i = f(\mu) + f(\sum_{i=1} w_i x_i) \quad (1)$$

The output usually can be expressed as: $\lambda_{B_i}(y) = \mu\lambda_{B_i}(y)$, while the overall fuzzy set is obtained as$B_i = UB$. Different methods can be used to clarify the fuzzy set B: the common methods are a weighted tie-breaker method, centre of gravity method, etc. The corresponding results are obtained at y.

$$y_i = f(w_i) \times f(x_i) \quad (2)$$

In the case of double scoring, the average is taken. Multiple scoring is selected according to the corresponding ratio so that the final score information corresponding to the response text may not be an integer and needs to be appropriately traded off according to the full score value of the current question type and the standard scoring information [15].

For visual phrases, the relationship between human actions and objects is represented by a hybrid model. In traditional methods, the templates of people and their corresponding objects do not reflect the constraint relationship between them but are represented separately. For example, when a person is moving things, although parts such as the person's arm may be covered by a box, the position of the human arm can be obtained according to the relationship between the person and the box [16]. Pose Fragments, what this method does is a blended fragment of parametric vision, not the entire object. Relational models divide the mixed model of the overall character into local fragments. The Skeleton model, this kind of model is a frequently used model in pose estimation. The pose estimation of the concert body used in this article is also established by using the skeleton model. Humans have many joint points physiologically, and the use of computer vision is the key to the human body. All these joint human points are not considered during point detection, but key points are selected for learning. This method will not only increase the operating efficiency of the network but also reduce redundancy. Therefore, 18 points are selected as bone key points in this paper.

3.2 Dragonfly algorithm to optimize fuzzy neural networks

The fuzzy logic can quantify the uncertainty in the access selection algorithm based on dragonfly optimization fuzzy neural network to better adapt to the changing network environment and network selection. The neural network can adjust the parameters of the affiliation function adaptively to break the restriction and inaccuracy of human tuning, and the dragonfly algorithm can make the fuzzy neural network under the condition that the initial parameters of the affiliation function are optimal [17]. The Dragonfly algorithm enables the fuzzy neural network to be trained with the optimal initial parameters of the affiliation function, and the combination of these three makes the network scoring more accurate, thus achieving the effect of optimizing each performance index.

Since each parameter in the input layer corresponds to three fuzzy sets, $3^{2\times M}$ fuzzy rules are fuzzily inferred.

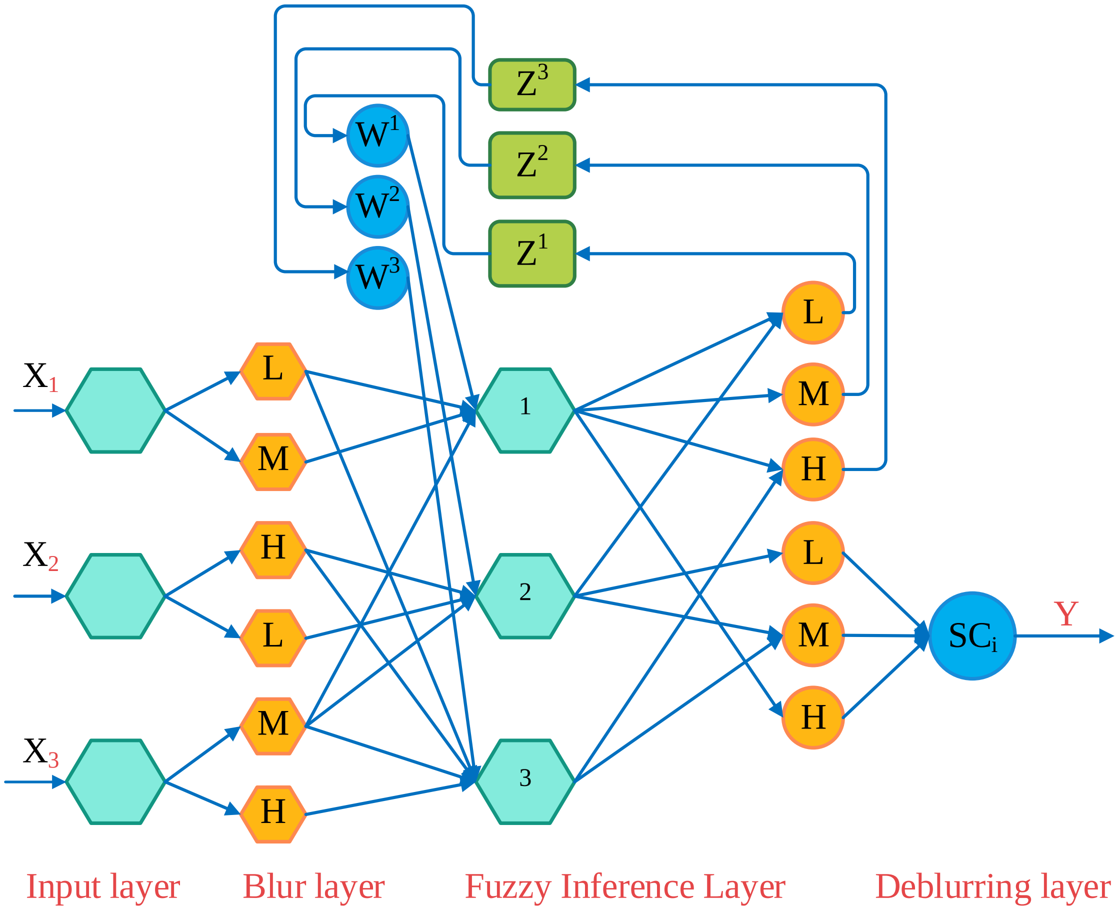

Figure 1: Fuzzy neural network model

To be able to choose the most suitable network access for different users, this chapter adopts a new swarm intelligence optimization algorithm, the dragonfly algorithm, to optimize the parameters of the Gaussian affiliation function, and the optimization process of the dragonfly algorithm is mainly realized through its swarm behaviour [18]. The dragonfly swarm will gradually move closer to food and away from enemies. In this process, the swarm will produce five behavioural modes: collision avoidance, pairing, gathering, foraging, and enemy avoidance.

$$E = \sum_{i=1}^{N} (h_i) - \frac{1}{2} \sum_{i=1} SC_i \tag{3}$$

$$S_i = \sum_{j=1}^{n} X - \sum_{j=1} X_j \tag{4}$$

The five behavioural patterns of the dragonfly population can be updated by separation, alignment, cohesion, food attraction, and natural enemy repulsion, and then the step vector of dragonfly individuals can be calculated, and then the position vector of dragonfly individuals at the next iteration can be obtained, and then we have

$$X_{t+1} = X_{t0} + \Delta X_{t+1} \tag{5}$$

The position vectors of dragonfly individuals with the smallest and the largest fitness are sorted according to their fitness values, i.e., X^+, X^-,. Then the dragonfly population's separation, alignment, cohesion, food attractiveness, and natural enemy repulsion are updated. Finally, the five behavioural weights, the step vector of dragonfly individuals, and the current position vector of dragonfly individuals are updated. If the number of iterations is $t > T$, the position vector of dragonfly individuals with the smallest fitness at this time is saved if the number of iterations is X^+.

4 Fuzzy neural network-based higher education quality assurance algorithm design

The flow chart of the algorithm in the higher education quality assessment model based on the fuzzy neural network architecture is shown in Figure 2. The fuzzy comprehensive evaluation matrixB_s indicates the final evaluation result of the graduation requirement subdivision, whichb_i indicates the evaluation result of the graduation requirement subdivision corresponding to the achievement level of i. By determining the image of the affiliation function and the intercept value ofλ, we can get the development trend and achievement situation of the corresponding graduation requirement sub-segments in successive years and provide feedback according to the results by conducting a fuzzy quality assessment on the graduation requirement sub-segments with qualified achievement degree. We can further analyze the specific achievement situation of the sub-segments to improve further and rationalize the talent cultivation system. The results of the fuzzy quality assessment can be used to analyze the achievement of the graduation requirements further.

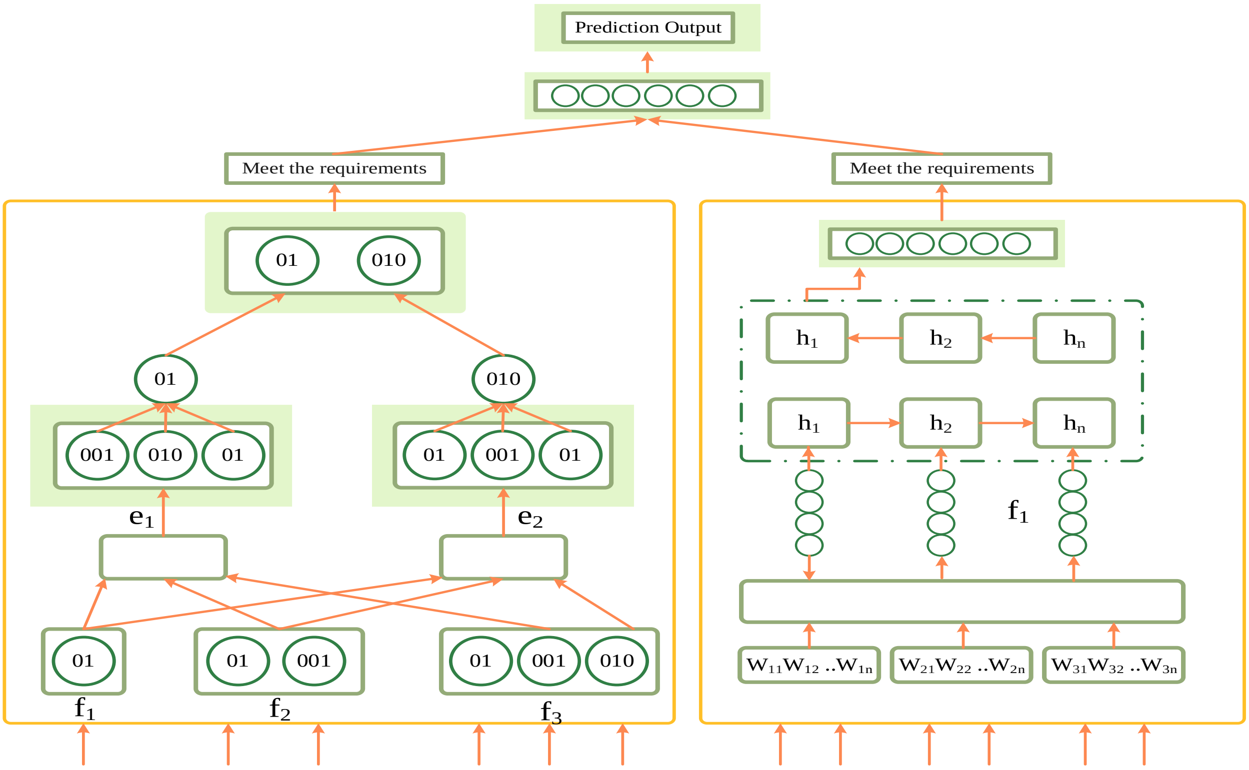

Figure 2: Flow chart of the algorithm in the higher education quality assessment model based on fuzzy neural network architecture

In order to comprehensively evaluate our proposed model, we have selected several existing higher education quality evaluation models or systems as comparison objects. These models or systems include traditional evaluation methods, models based on other machine learning algorithms, and other models based on fuzzy logic.

Firstly, we used a standardized dataset to test our model and compared its results with those obtained using traditional evaluation methods such as expert scoring and questionnaire surveys. Through comparative analysis, we found that models based on fuzzy neural networks have more advantages in handling uncertainty and fuzziness, and can more accurately reflect the actual situation of educational quality. Secondly, we compared the performance of our model with models based on other machine learning algorithms (such as support vector machines, decision trees, etc.) in evaluating the quality of higher education. By comparing the accuracy, recall, F1 value and other indicators of various algorithms, we found that models based on fuzzy neural networks perform better in comprehensive performance and can better adapt to the needs of education quality evaluation in different scenarios. In addition, we also compared the ability of the model based on fuzzy logic with our model in handling fuzzy information. Through comparative analysis, we found that our model is more innovative in combining the advantages of fuzzy logic and neural networks, and can maintain high evaluation accuracy while processing fuzzy information.

5 Design and implementation of higher education quality assurance system based on fuzzy neural network architecture

The degree of achievement of the graduation requirement subdivision directly corresponds to the degree of achievement of the teaching link at the bottom of the talent training system [19]. In the design of the fuzzy quality assessment mechanism, the degree of achievement of the graduation requirement subdivision and the weight of association between the graduation requirement subdivision and course entity are used as evaluation indexes. The reasonableness of the correspondence between teaching links and graduation requirement subdivision points directly determines the rationality of the talent cultivation system. Accordingly, the analysis of the achievement degree of graduation requirement subdivision points should be paid attention to when improving the rationality of the talent cultivation system, as shown in Figure 3.

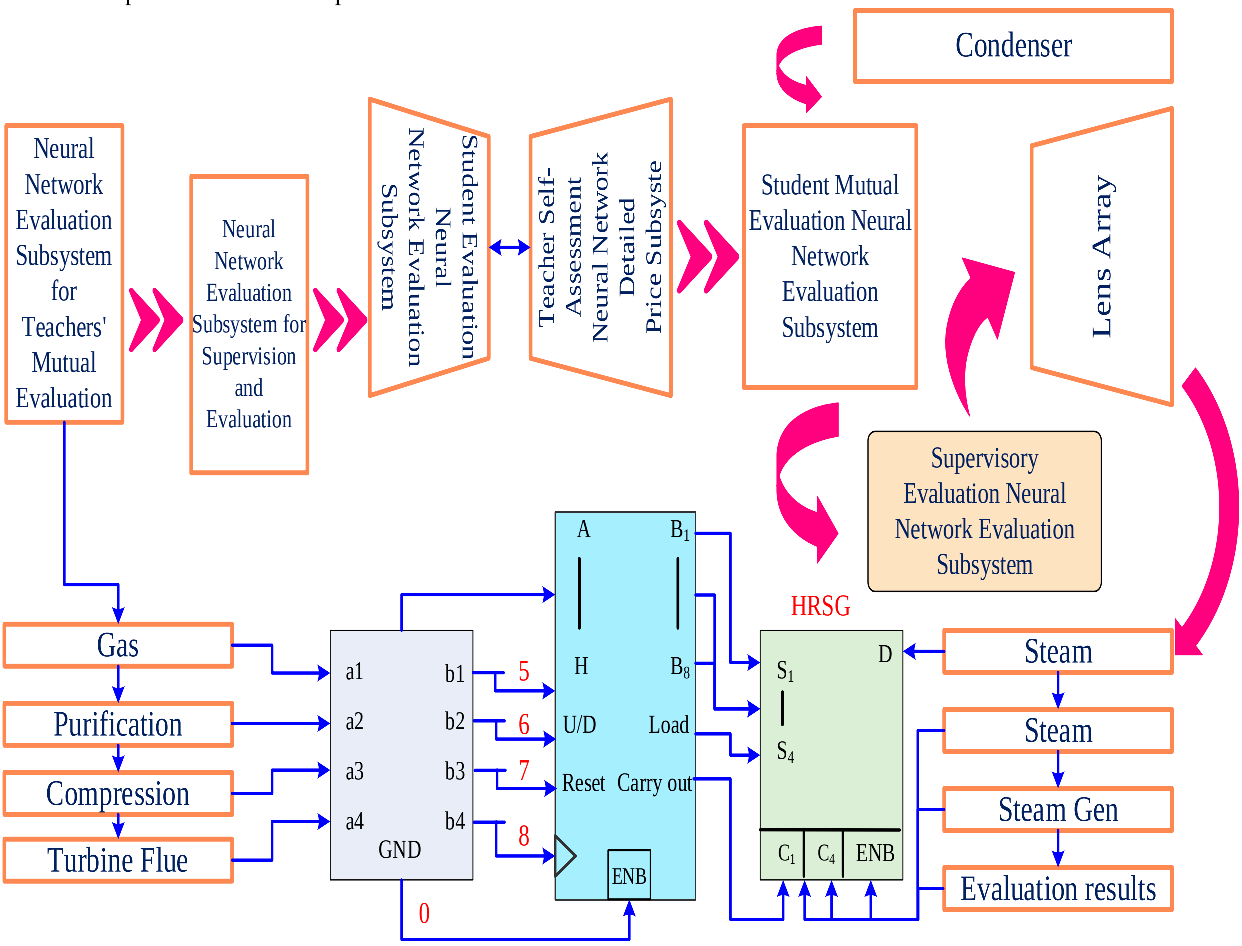

Figure 3: Structural framework of higher education quality assurance system based on fuzzy neural network

For nonlinear systems, the initial values of the connection weights and thresholds of the fuzzy neural network have a great deal to do with whether the network reaches a local minimum and converges during the network learning process. An important requirement is that the initial weights are expected to bring the state values of each neuron close to zero when the inputs are accumulated, which ensures that they do not fall on those flat areas at the beginning [20]. However, according to the specific research content of the experiment and the large amount of related data required for processing, the modelling analysis was carried out through the point-column body contour of each subject, and the human pelvis model was constructed by relying on Visuals. The marker points were attached to the pelvis. In terms of modelling, by observing the movement of the pelvic model, we can divide the Latin dance pelvic movement into the front and rear turning spans, left and right swing spans, and up and down spans with the spine as the vertical axis. And rely on software analysis to derive the required specific data of the pelvic movement process.

6 Experimental results and analysis

6.1 Fuzzy neural network model performance test

The model in this article can handle fuzzy and uncertain information, which is difficult for traditional evaluation methods to achieve. The combination of fuzzy logic and neural networks enables our model to learn and optimize its evaluation ability in uncertain environments. In contrast, existing methods for evaluating educational quality often rely on clear quantitative indicators, and their handling of ambiguous information is not accurate and comprehensive enough. Secondly, the model in this article introduces multi-attribute decision-making and comprehensively considers various influencing factors, making the evaluation results more reasonable and accurate. This is in stark contrast to many single evaluation methods in current SOTA, which often only focus on one aspect of indicators and overlook other potentially important factors.

In addition, our model also optimized the membership function parameters of the fuzzy neural network through the dragonfly algorithm, improving the accuracy of network evaluation. This optimization method is more scientific and efficient compared to traditional parameter selection methods, and can better adapt to evaluation needs in different scenarios. Observation of the prediction results reveals a pattern: when the target subject is a liberal arts subject, most prediction curves show a flat region in the first half and a positive correlation trend in the second half, and the true data points are closer to the prediction curve. The first half of the curve indicates that low scores in the leading course do not necessarily lead to low scores in the target subject [21]. Even if scores in the prior liberal arts class are low, scores in the subsequent liberal arts class are not necessarily low but are likely to improve in performance. The second half of the curve shows that when scores in the leading course are higher, scores in the target course are usually higher as well, showing a positive correlation. The tie prediction error was calculated to be about 4.5, and the prediction curve was obtained, as shown in Figure 4.

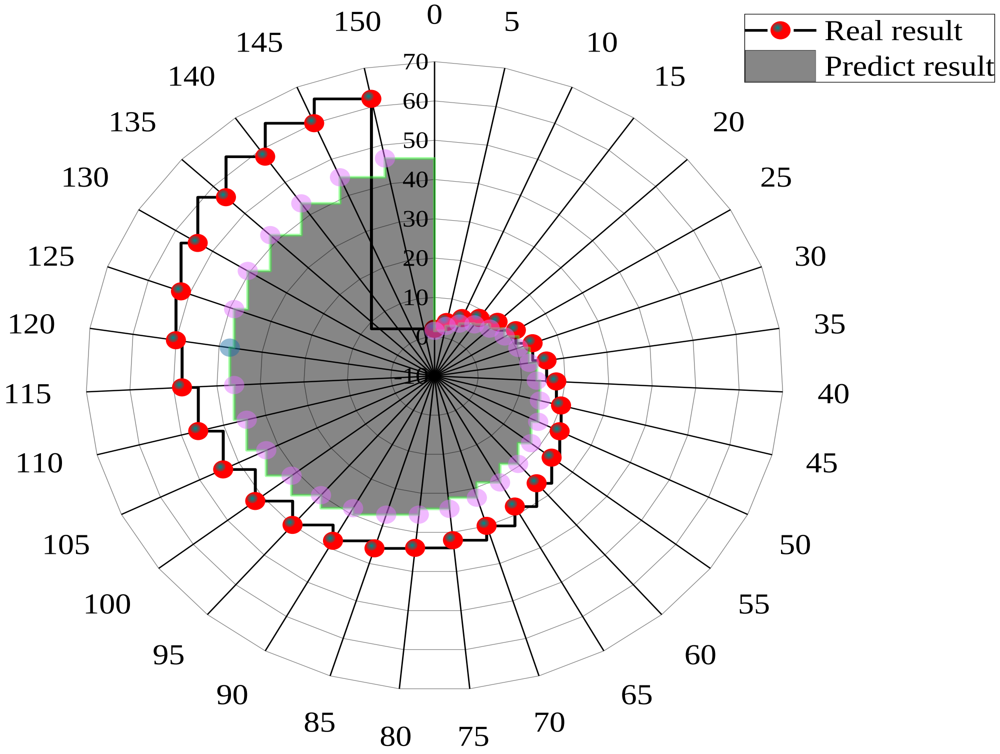

Figure 4: Comparison of fuzzy neural network prediction

As shown in Figure 5, the system throughput of the five algorithms, DA-FNN, PSO-FNN, FNN, SAW, and Fuzzy-Logic, is compared for the service arrival rate$\lambda = 1,2,\ldots,8$. The preferences of two types of users for each alternative network make more targeted network access selection for users and optimize the fuzzy neural network using the Dragonfly algorithm, which makes the network selection results more accurate and thus can guarantee more data transmission. When$\lambda = 8$, the system throughputs of the five algorithms, DA-FNN, PSO-FNN, FNN, SAW, and Fuzzy-Logic, are 263.9 Mbps, 252.9 Mbps, 251.2 Mbps, 230 Mbps, and 224.4 Mbps, respectively, and the algorithm DA-FNN proposed in this chapter is 4.35%, 5.06%, and 14.7% higher than the other four algorithms, respectively. 5.06%, 14.7%, and 17.6%, respectively, compared with the other four algorithms.

Comparison of the success rate of user access to the desired network for the five algorithms DA-FNN, PSO-FNN, FNN, SAW, and Fuzzy-Logic at the service arrival rate$\lambda = 1,2,\ldots,8$. The success rate of user access to the desired network is the ratio of the number of times a user can access the desired network to the total number of times the network is successfully accessed [22]. The user-desired networks in this chapter are determined based on the preference of real-time and non-real-time users for the three networks. When real-time users are located only in the overlapping region of LTE and WLAN1 or in the overlapping region of LTE, WLAN1, and WLAN2, the desired networks are all LTE. When the non-real-time service users are located only in the overlapping area of LTE and WLAN1 or in the overlapping area of LTE, WLAN1, and WLAN2, the desired network is LTE and WLAN1.

In terms of quantitative analysis, we used multiple performance indicators to evaluate the performance of the fuzzy neural network model. Firstly, we calculated the tie prediction error, which can reflect the degree of deviation between the model's predicted results and the actual data. In the prediction of humanities subjects, we obtained a tie prediction error of about 4.5, indicating that the model has a certain accuracy in predicting humanities grades. Secondly, we also compared the performance of different algorithms in terms of system throughput. Through simulation experiments, we obtained data on system throughput for five algorithms: DA-FNN, PSO-FNN, FNN, SAW, and fuzzy logic. The experimental results indicate that when the service arrival rate λ= At 8 o'clock, the system throughput of the DA-FNN algorithm was 263.9 Mbps, which increased by 4.35%, 5.06%, 14.7%, and 17.6% compared to the other four algorithms, respectively. This fully demonstrates the advantages of the DA-FNN algorithm in terms of system throughput.

In addition, we also conducted a quantitative analysis of the success rate of user access to the required network. The success rate of user access to the required network is an important indicator reflecting the performance of network access selection algorithms. By comparing the performance of five algorithms, namely DA-FNN, PSO-FNN, FNN, SAW, and fuzzy logic, in terms of user access success rate, we found that DA-FNN algorithm also shows significant advantages in user access success rate.

6.2 Higher education system testing

System testing is an indispensable part of the software development cycle, testing the system in terms of functionality and performance to ensure that it can correctly handle problems during operation. For this higher education quality assessment system, we will focus on the functional testing of the system. Functional testing is mainly based on the black-box testing method, which requires the system developer to provide test data from the system interface [23]. The data captured during the acquisition process was opened by TQM software for processing. From the outline of the human body presented by the Marker points before, delete the noise points and drop points in the first step, then repair the missing points, and finally connect the determined Marker points to construct a point initially. Finally, according to the point-and-column data we have processed, the Excel table data can be exported, and the specific values and movement changes of each frame of action can be seen in the form of specific values and used as experimental data. The main functions of this system are the login function, course goal achievement calculation function, course achievement calculation function, graduation requirement breakdown point achievement calculation function, graduation requirement achievement calculation function, training goal achievement calculation function, administrator release information function, administrator add general user information function, timeout without operating on the system automatic exit system function, professional course and teacher information using EXCEL input function for professional courses and teachers' information, etc.

Take Graduation Requirement Subdivision 4-4 (GRSP4-4) as an example. The content of GRSP4-4 is "be able to collect, organize and analyze experimental data, and draw reasonable and valid conclusions through information synthesis". According to the content of the syllabus, the graduation requirement subdivision points 4.4 corresponds to the courses of compilation principles, data structure course design, operating system course design, and thesis part of the graduation design. The results are shown in Figure 6, which is a line graph of the affiliation function of GRSP4-4.

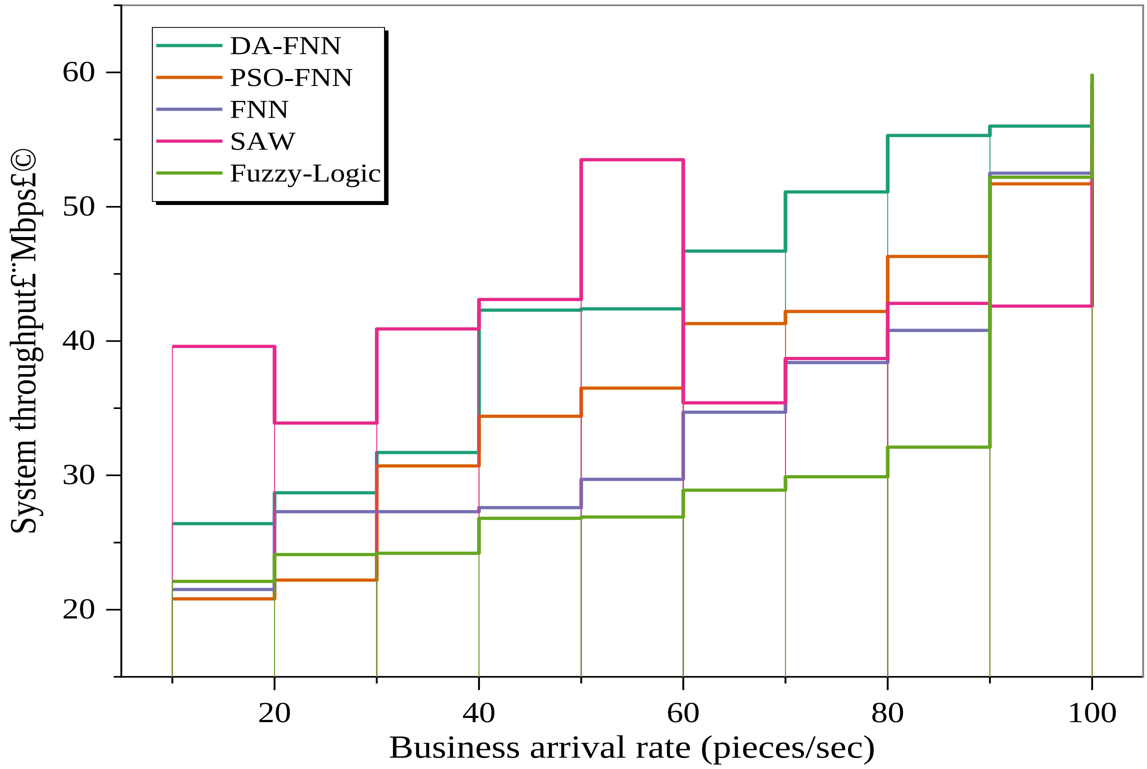

Figure 5: Uniform throughput comparison results

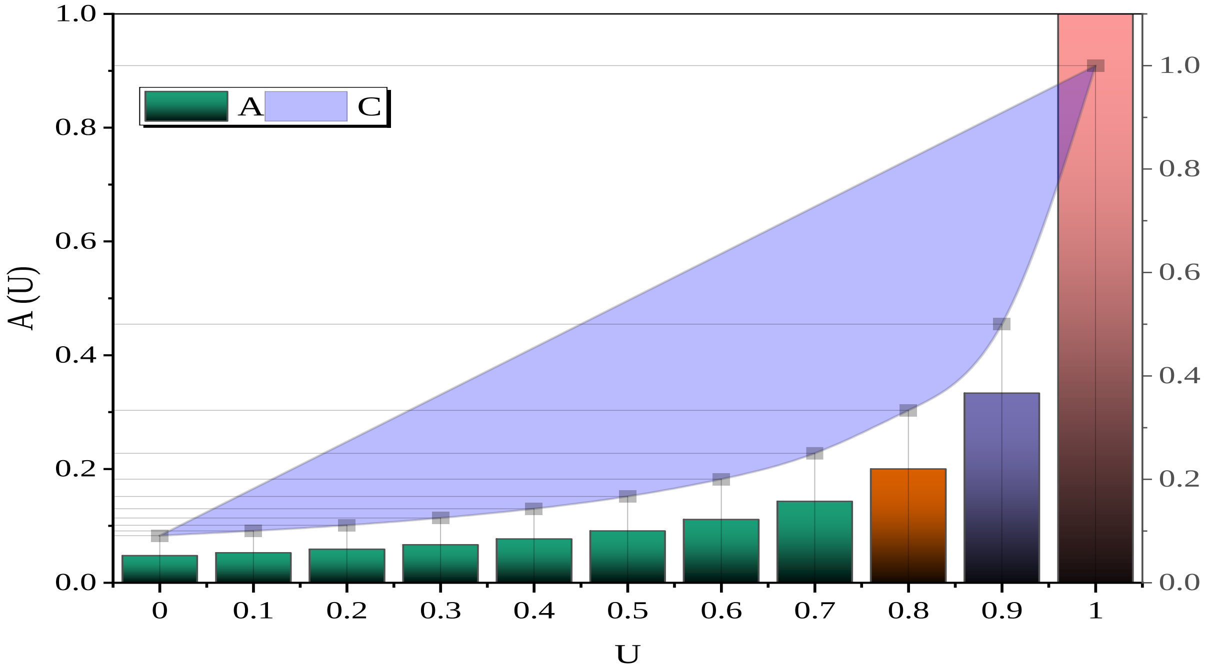

Figure 6: Cumulative proportional affiliation function curves of GRSP 4-4 reach

In terms of validity, the instant feedback from the review website effectively increases students' interest in writing, revising their essays repeatedly, thus improving their writing skills. However, due to the limitations of the technology of the web-criticism website, the feedback given to students at the vocabulary and grammar level is more precise because the scoring rules for vocabulary and grammar are relatively clear, in which vocabulary is mainly examined for richness and complexity. Grammar is mainly examined for the correctness and richness of grammatical structures. However, the grading website does not yet give students enough feedback on writing content, chapter structure, style rhetoric, content logic, and coherence, all of which are relatively subjective. Therefore, only two of these scores, vocabulary and grammar, are extracted in this paper, as shown in Figure 7. Therefore, in this paper, a trial is used to train the network, and then the trained network is simulated.

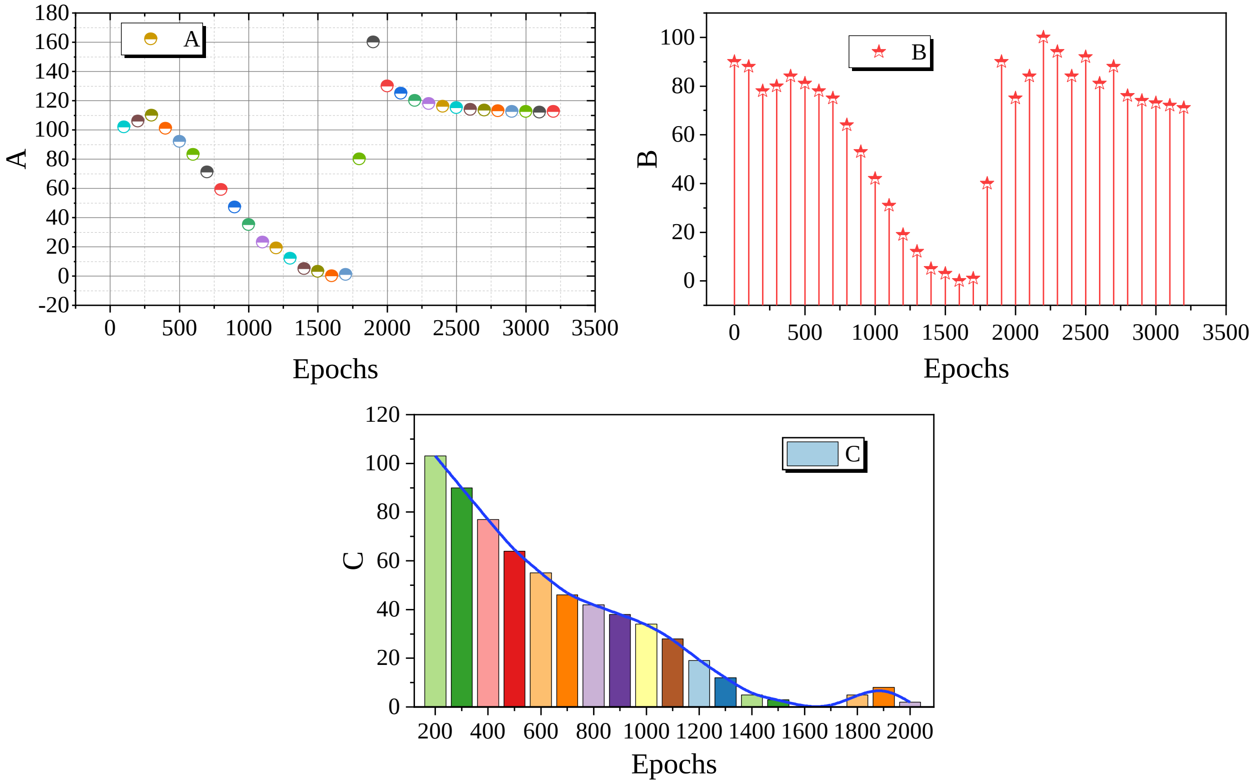

Figure 7: Model training results

Table 1: Related work summary.

Research contents	Existing methods	Main findings	Limitations	Related to this article
Fuzzy Subsets and Fuzzy Logic	L. A. Zadeh proposed fuzzy set theory	Transforming quantitative input into fuzzy input, imitating human brain thinking to process complex things	Initial theory lacking practical application	Provided a theoretical basis for fuzzy processing
Combining Fuzzy Systems with Neural Networks	Combining Fuzzy Logic with Neural Networks	Improved system adaptability and interpretability	Incomplete integration and lack of specific application scenarios	Inspired the application ideas of fuzzy neural networks in this article
Research on Multilayer Neural Networks	Meraihi Y proposes an effective construction method	Overcoming local minima and deeper network layers	Mainly targeting unsupervised data, may not be applicable for supervised learning	Provided ideas for neural network optimization
Educational data mining	Using data mining techniques to process educational information	Improving the quality of education and teaching	Data processing and analysis methods may not be advanced enough	Explained the importance of data mining in education quality assessment
Existing education quality evaluation algorithms	Combining data analysis with artificial intelligence technology	Improved the quality of higher education and teaching	Difficult to quantify the quality evaluation of higher engineering education	Pointed out the limitations of existing algorithms and the need for improvement
The Application of Fuzzy Neural Network in Education Quality Evaluation	Not yet thoroughly researched	-	Lack of relevant research, there is still a lot of room for exploration	The research topic of this article aims to fill this research gap

Multi-attribute decision-making considers multiple influencing factors, and the evaluation results of the network are more reasonable and accurate, which can meet the diversified service demands of users. However, the algorithm still has the problem of weight allocation. The access selection algorithm based on fuzzy logic can quantify the fuzzy information, but the calculation is more complicated. The access selection algorithm based on an artificial neural network can make full use of the neural network's learning ability but cannot handle fuzzy information. The combined access selection algorithm makes the output network evaluation more accurate by fuzzifying the network parameters and training the fuzzy neural network. Still, the convergence speed of the fuzzy neural network is slow, and the initial value of the affiliation function parameter selection has a large impact on the network evaluation results.

The model in this article can handle fuzzy and uncertain information, which is difficult for traditional evaluation methods to achieve. The combination of fuzzy logic and neural networks enables our model to learn and optimize its evaluation ability in uncertain environments. In contrast, existing methods for evaluating educational quality often rely on clear quantitative indicators, and their handling of ambiguous information is not accurate and comprehensive enough.

Secondly, the model in this article introduces multi-attribute decision-making and comprehensively considers various influencing factors, making the evaluation results more reasonable and accurate. This is in stark contrast to many single evaluation methods in current SOTA, which often only focus on one aspect of indicators and overlook other potentially important factors.

In addition, our model also optimized the membership function parameters of the fuzzy neural network through the dragonfly algorithm, improving the accuracy of network evaluation. This optimization method is more scientific and efficient compared to traditional parameter selection methods, and can better adapt to evaluation needs in different scenarios.

7 Conclusion

In this paper, a model of higher education quality assurance systems is constructed based on a fuzzy neural network. Based on the adaptive fuzzy neural inference system (ANFIS), an iterative adaptive fuzzy neural inference system (iterative ANFIS) is proposed, which can find several data with a strong correlation with the results in high-dimensional data, making the model more applicable to high latitude and low correlation data. As can be seen from the figure, the overall scores of students in the third and fourth stage tests showed a large increase compared to the first time, indicating that student's proficiency in theoretical knowledge has improved significantly, which indicates that the use of the instructional design automation tool helped the teacher to better organize the classroom and students' learning efficiency has improved. At the end of the course, a questionnaire was administered to some of the participating students through the online learning tool. The main questions of the survey included whether they were satisfied with the course content arrangement, the degree of student participation in the classroom, and the degree of application of the technology tools recommended by the instructor. The fuzzy assessment algorithm of higher education quality based on fuzzy neural network architecture proposed in the article can effectively analyze and discover the weaknesses of students' ability development in the process of talent training and provide data support for the realization of multi-level feedback mechanism in the continuous improvement of the talent training system. However, due to my limited management and ability, the functions of the higher engineering education quality assessment system in this paper still need further improvement. Although the system can manage and display entities and the relationships between entities, it does not provide analysis results that can be directly used by university users. In the later stage, the system needs to do a comprehensive analysis of the strengths and weaknesses of students' abilities in various aspects based on multiple data. In addition, it can be displayed in the form of radar charts and pie charts to truly improve the overall level of students year by year in practical applications.

Although this model has high scalability and real-world applicability, there are still some limitations and areas that need further improvement. For example, the performance of a model may be affected by the quality and quantity of data, so in some cases, data preprocessing and feature selection may be necessary. In addition, with the continuous development of the higher education quality assurance system, further research and development of new algorithms and technologies may be needed to better adapt to future needs.

In the future, we will continue to pay attention to the development trends and demand changes of the higher education quality assurance system, and continuously improve and optimize this model. We plan to introduce more advanced technologies and algorithms to improve the accuracy and efficiency of model evaluation. At the same time, strengthen cooperation and communication with other higher education institutions, and jointly promote the development and innovation of the quality assurance system of higher education.

Competing of interests

The authors declare no competing of interests.

Authorship Contribution Statement

Lu Mei: Writing-Original draft preparation, Conceptualization, Supervision, Project administration.

Data Availability

On Request

Declarations

Not applicable

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