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Computer-Aided Design AND APPLICATIONS

Fuzzy Instructional Assessment Model and Algorithm Based on Back Propagation Neural Network

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Abstract. The diversity of teaching is an important factor affecting teaching evaluation. Different teachers have different teaching methods and styles, and their evaluation standards and methods for students may also differ. This makes teaching evaluation complex and difficult to evaluate the teaching quality of all teachers using a unified standard. Therefore, this article designs a BPNN (Back Propagation Neural Network) assessment model of CAI (Computer-Assisted Instruction) quality assessment system by using the ANN (Artificial neural network) method which has developed rapidly in recent years, and completes the assessment of instructional level through training network. The model quantifies the concept of instructional assessment index into certain data as its input and instructional effect as its output, which is realized by MATLAB system. Moreover, this article applies the multi-level fuzzy assessment method to the comprehensive assessment of instructional level, and divides the assessment system into several indexes according to the needs, and establishes factor set, assessment set, membership function and weight set; According to the weight of assessment index, the comprehensive assessment of instructional level can be realized. The results show that, compared with the traditional NN (Neural network) instructional level assessment algorithm, the accuracy of this assessment algorithm is improved by about 18.16%, and the time consumption is shortened by about 3s. The proposed method can guide the implementation of CAI assessment, improve the instructional effect and promote the further deepening and improvement of computer-aided education.

Keywords: Back Propagation Neural Network; Computer-Assisted Instruction; Fuzzy Theory; Instructional Level; Evaluate
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1 INTRODUCTION

One of the key features of intelligent CAI is that it is suitable for individualized teaching, that is, it can choose appropriate instructional content according to the actual needs of learners and adopt appropriate teaching strategies to implement teaching. Computer assisted teaching and field visits are two different teaching methods that have certain applications [1] empirically compare the effectiveness of these two teaching methods, providing reference for relevant educators. It adopts an experimental group and a control group design, selecting 90 students from a high school in Nigeria as the research subjects, while the control group used on-site observation teaching methods. After the experiment, compare the grades of the two groups of students. The experimental group students use computer-aided teaching software for learning, which includes various forms such as videos, animations, and interactive exercises, covering the main content of basic science and technology courses. The control group of students participated in on-site inspection activities organized by teachers, including visits to laboratories, science and technology museums, and other places to understand the application and development of relevant science and technology. After the experiment, the scores of the two groups of students were counted and analyzed. The assessment of CAI is the measurement, analysis and assessment of the educational value and stage of CAI. With the growth of sci & tech, computers are widely used as a powerful tool. This requires computing to further simulate the thinking and methods of the human brain to deal with complex and changeable events. Gowda and Jayasree [2] analyzed energy aware routing based on convergence points using hybrid neural networks for mobile sinks. This is a complex and multidisciplinary topic, including wireless sensor networks (WSN), neural networks, machine learning, and energy aware routing protocols. In a brief scope, I try to provide some basic understanding. Firstly, wireless sensor networks are composed of a group of micro devices that can autonomously or collaboratively monitor and perceive physical phenomena in the environment. These devices typically have wireless communication capabilities, so they can form a network for data exchange. In WSN, energy aware routing is an important research field. This routing protocol considers the energy status of nodes when selecting data transmission paths, thereby maximizing the lifespan of the entire network. Hybrid neural network is a method that combines traditional neural networks with more complex neural networks. This method typically improves the performance of neural networks, enabling them to better handle complex tasks. CAI has refreshed, supplemented and strengthened the objectives, contents, methods and forms of general classroom teaching, and enriched and expanded the connotation of modern education. Han [3] analyzed the networks in the evaluation of physical education teaching in universities. It collects relevant data on physical education teaching in universities, including student performance, teacher evaluation, curriculum design, teaching resources, and other aspects. Ensuring sufficient representativeness of data can provide effective basis for teaching evaluation. Clean, standardize, or normalize the collected data to ensure consistency and accuracy. For missing data, mean filling or interpolation can be used for processing. Build an RBF neural network model using MATLAB or other neural network tools. The output layer corresponds to the results of teaching evaluation. Optimize the RBF neural network model using genetic algorithm (GA). By iteratively searching through GA, the optimal parameters such as center, width, and deviation of the radial basis function (RBF) are found. Input the preprocessed data into the optimized RBF neural network model for training. Through multiple iterations, the model will continuously adjust the weights and thresholds based on expected output, in order to further optimize the performance of the model. The assessment of classroom instructional level is to judge the activities and effects of teaching and learning in classroom teaching according to the purpose of higher education and instructional assessment standards, and it is a stage of finding problems in classroom teaching, improving teaching and providing decision-making services. He et al. [4] collected relevant data on the intelligent teaching ability of university talents, including student grades, teacher evaluations, teaching resources, and the use of intelligent teaching platforms. Ensuring sufficient representativeness of data can provide effective basis for research. Clean, standardize, or normalize the collected data to ensure consistency and accuracy. For missing data,

mean filling or interpolation can be used for processing. Build a BP neural network model using MATLAB or other neural network tools. The input layer corresponds to various indicators of the intelligent teaching ability of university talents, and the output layer corresponds to the evaluation results of the intelligent teaching ability. Input the preprocessed data into the BP neural network model for training. Through multiple iterations, the model will continuously adjust the weights and thresholds. Constructing a scientific, systematic and effective assessment system of classroom instructional level is important for improving the assessment of classroom teaching in universities, expanding the management theory of educators in universities. The assessment of CAI can be compared with the general classroom teaching, and the function and effect of CAI can be fully realized, so that CAI can accelerate its development. In order to realize the further progress of CAI, we should also pay attention to the research on the assessment of CAI. BPNN has the ability of self-learning and self-adaptation, and its most remarkable feature is its self-learning ability, and it can get satisfactory processing results when the data contains noise, missing items or does not have complete cognition. In view of the successful experience of NN technology in other fields, it will be a useful attempt to apply NN theory to the assessment of instructional level.

The difficulty of instructional level assessment lies in the design of assessment index and the treatment of quantification process, especially the quantification problem. Fuzzy mathematics is a relatively new subject. Its formation and development is not to give up the strictness and accuracy of mathematics, but to enable some fuzzy things and phenomena that exist objectively to be studied and dealt with by mathematical methods. Comprehensive assessment of all the assessment objects, according to the given conditions, give each object a non-negative real number-assessment index, and then rank the best according to this. In the comprehensive assessment of college educators' instructional level, a large quantity of assessment indexes are involved and there are a lot of fuzzy phenomena and concepts in the assessment. Therefore, the method of fuzzy assessment is often used for quantitative treatment, so as to assess the instructional level of educators. In this article, the multi-level fuzzy assessment method is applied to the comprehensive assessment of instructional level to realize the comprehensive assessment of instructional level. The main innovations and contributions are as follows:

(1) Using the adaptive and self-learning principles of BPNN to assess the instructional level, a instructional level assessment model structure based on NN and an improved BPNN learning algorithm are proposed, which are realized by MATLAB system.

(2) The multi-level fuzzy assessment method is applied to the study of comprehensive assessment of instructional level, and the assessment system is divided into several indicators according to the needs, and a factor set, an assessment set, a membership function and a weight set are established; According to the weight of assessment index, the comprehensive assessment of instructional level can be realized.

(3) Using BPNN, this article solves the nonlinear problem of assessment, effectively overcomes the defects of traditional assessment methods.

Firstly, this article gives the background and research significance of the topic, and introduces the principle and basic characteristics of BPNN and fuzzy assessment method. Then, combined with the characteristics of BPNN, the instructional assessment method based on BPNN is discussed, and then the fuzzy assessment model of instructional level is constructed. Finally, a simulation is carried out to verify the feasibility of the algorithm model.

2 RELATED WORK

Kong et al. [5] constructed a human-machine interaction sets and BP neural networks. The human-machine interaction sets and BP neural network is a teaching model that utilizes fuzzy logic and neural network technology to design human-machine interaction. This model has the ability to handle uncertainty and ambiguity, and can better simulate human teaching processes. Firstly, it is necessary to collect a large amount of teaching data, including students' learning situation, learning behavior, learning feedback, etc. Fuzzify the collected data and convert clear numerical

values into fuzzy outputs. This process can be processed using fuzzy logic methods. Input the fuzzified data into the BP neural network for training. BP neural network is a backpropagation neural network that can learn and predict data patterns. Through training, neural networks can learn the inherent laws and patterns of teaching data. By combining the trained neural network with the actual human-computer interaction interface, the machine can provide intelligent teaching guidance based on students' learning behavior and feedback. Based on students' learning situation and feedback, continuously adjust and optimize the parameters and structure, so that the model can better adapt to different teaching environments and students' learning needs. Kumar et al. [6] conducted a quality evaluation of agricultural vocational practical teaching based on BP neural network. It collects relevant data from the practical teaching process, including student ratings, teacher evaluations, teaching materials, practical achievements, and other aspects. Ensuring sufficient representativeness of data can provide effective basis for evaluation. Clean, standardize, or normalize the collected data to ensure consistency and accuracy. For missing data, mean filling or interpolation can be used for processing. Build a BP neural network model using MATLAB or other neural network tools. The structure of the model can include input layer, the evaluation indicators of practical teaching quality, and the output layer corresponds to the evaluation results of practical teaching quality. Train by inputting the preprocessed data into the BP neural network model. Through multiple iterations, the model will continuously adjust the weights and thresholds. Computer assisted teaching is a very effective tool that can help students learn English and improve their listening, speaking, reading, and writing skills. These platforms typically provide interactive courses, including speech recognition technology, that can correct students' pronunciation. Some applications allow students to pair with native English speakers so that they can practice English in real contexts. Leidy [7] conducted computer-aided teaching in ESL language courses. Video conferencing tools such as Skype or Zoom can be used for remote ESL courses or for real-time communication between students and teachers on their own devices. These chat rooms can provide students with an environment for communicating in English, while also recording their conversations for teacher evaluation. Many online storybooks and games are equipped with sound and interactive elements, which can help students better understand the story while improving their listening and reading skills. Online vocabulary and grammar checkers: These tools can help students check their spelling and grammar errors, and help them improve their writing skills.

Li [8] analyzed the application of artificial intelligence and machine learning in CAI. This has made the allocation of educational resources more equitable, and the learning efficiency of students has also significantly improved. Among them, the application of fuzzy assisted hierarchical neural network system in CAI provides new possibilities for English teaching. Such a system requires a method that can handle these complexities and uncertainties. One possible solution is to use a combination of fuzzy logic and neural networks. The system will use fuzzy logic to process input data, converting clear inputs into fuzzy outputs. This process can handle uncertainty and fuzziness, as fuzzy logic can handle uncertain or imprecise information. Then, input the fuzzy processed data into the neural network for training. Neural networks can learn and predict data patterns, which is particularly useful for processing large amounts of complex data. In this system, multiple levels can be designed to handle different levels of problems. Each layer can be processed using fuzzy logic and neural networks. This hierarchical design can better handle complexity and uncertainty. Finally, the system will optimize based on feedback and results. This may include adjusting the parameters of fuzzy logic, the weights of neural networks, or changing the hierarchical structure of the system. Such a system can not only be used for English teaching, but also for other fields that require processing a large amount of complex and uncertain data. However, the design and implementation of such systems require deep understanding and professional skills, including knowledge of fuzzy logic, neural networks, and computer programming. Li and Ji [9] conducted an analysis of English listening impairment based on computer-aided teaching. Computer assisted teaching has a wide range of applications in English listening, which can help improve students' listening skills by simulating real contexts, providing opportunities for repeated practice, and personalized feedback. Some students may not be able to

use computer-assisted listening learning due to device failures, network connectivity issues, or software compatibility issues. For beginners, computer-assisted listening materials may cause comprehension difficulties due to excessive language difficulty. In some computer-aided listening materials, background noise may exist, which may interfere with students' listening comprehension. If students do not master effective listening strategies such as predicting, inferring, and repeating key information, they may encounter difficulties in listening comprehension. At the same time, students should also improve their listening skills through active participation and repeated practice. In addition, teachers can also reduce students' confusion when using computer-assisted listening materials by adjusting the difficulty of listening materials, providing clear instructions and feedback, and other methods. Liu et al. [10] conducted undergraduate education evaluation testing. It collects relevant data on undergraduate education, including student performance, teacher evaluation, teaching resources, learning engagement, academic atmosphere, and other aspects. Ensuring sufficient representativeness of data can provide effective basis for evaluation. Clean, standardize, or normalize the collected data to ensure consistency and accuracy. For missing data, mean filling or interpolation can be used for processing. Build a BP neural network model using MATLAB or other neural network tools. Where the input layer corresponds to various indicators of undergraduate education, and the output layer corresponds to the evaluation results of undergraduate education quality. Input the preprocessed data into the BP neural network model for training. Through multiple iterations, the model will continuously adjust the weights and thresholds and expected output to optimize the performance of the model.

English interpretation teaching is an important link in foreign language education, and how to objectively and accurately evaluate its quality is the key. Traditional evaluation methods mainly rely on manual evaluation and quantitative indicators, but there are certain subjectivity and limitations. In recent years, neural networks have made significant progress in fields such as speech recognition and natural language processing, providing new ideas for evaluating the quality of interpretation teaching. Lu et al. [11] aim to use GA to optimize RBF neural networks and construct a model that can objectively and accurately evaluate the quality of English interpretation teaching. This model aims to address the shortcomings of traditional evaluation methods and improve the objectivity and accuracy of evaluation. Problem based computer-aided teaching of waste materials is an emerging educational method that combines the concepts of problem-solving learning and waste utilization. The development of this teaching method and its impact on students' problem-solving ability is the focus of this study. Problem based computer-aided teaching of waste materials has developed on the basis of problem-solving learning. Problem solving learning is a problem-oriented learning approach that emphasizes students' ability to improve problem-solving and innovation through self-directed learning, cooperative learning, and reflective learning in the process of solving practical problems. The computer-aided teaching of waste materials refers to the reuse of waste materials using computer technology, transforming them into valuable educational resources. Maspiroh and Subali [12] analyzed the development of computer-aided teaching of waste materials and its impact on students' problem-solving abilities. Research has shown that problem-based computer-aided teaching of waste materials can significantly improve students' problem-solving abilities.

Rosali [13] uses information technology to create videos that vividly demonstrate the process of directional movement of charges to form electric currents, which can reduce students' learning difficulty and improve their understanding. Secondly, By transforming indirect knowledge into intuitive images or animations, CAI can create more vivid and interesting learning experiences for students, stimulate their interest in learning, and thereby improve learning efficiency. However, for the application of CAI in middle school physics teaching, it is still necessary to consider the leading role of teachers and the subjectivity of students. When applying CAI, teachers should arrange teaching content and methods reasonably based on the actual teaching situation, and fully leverage the auxiliary role of CAI. At the same time, students should also actively participate in the learning process of CAI, exert their learning initiative, and use CAI as a tool to assist their learning, rather than relying solely on CAI for learning.

A program design education can construct a neural network model through deep learning algorithms. Saito and Watanobe [14] utilize a large amount of learning path and user behavior data to predict users' learning paths and interests, thereby recommending suitable learning resources for users. It uses deep learning algorithms to construct a neural network model for predicting users' learning paths and interests. Evaluate the model using test set data, calculate indicators such as accuracy, recall, F1 score, etc. to facilitate adjusting model parameters and optimizing model structure. Based on the trained neural network model, design a recommendation system to recommend suitable learning resources for users based on their behavioral data and interests. Common recommendation algorithms can be used, such as collaborative filtering, content filtering, hybrid recommendation, etc. Test and optimize the recommendation system to improve its recommendation accuracy and user experience. The recommendation strategy and algorithm of the system can be continuously adjusted and optimized based on user feedback and evaluation. Fuzzy mathematics is a branch of mathematics that deals with uncertain things through fuzzy sets and fuzzy logic. In the evaluation of educational quality, fuzzy mathematics can be used to construct a fuzzy comprehensive evaluation model, which can consider multiple factors of the evaluation object and express the fuzzy relationships between various factors. For example, when evaluating the teaching quality of teachers, fuzzy mathematics can be used to evaluate their teaching effectiveness, which can include multiple aspects such as teaching attitude, teaching content, teaching methods, and teaching effectiveness [15]. Yang et al. [16] constructed an optimized BP neural model for network teaching management. By collecting a large amount of relevant data on teaching management, including but not limited to student grades, teacher evaluations, course arrangements, teaching resources, etc. Ensure that the data covers various situations, so that the model can better adapt to various scenarios during training. Clean, standardize, or normalize the collected data to ensure consistency and accuracy. For missing data, mean filling or interpolation can be used for processing. Build a BP neural network model using MATLAB or other neural network tools. And predict the evaluation results based on the input teaching management indicators. Zhao [17] collects a large amount of English ICAI MOOC course data, including course videos, course documents, exercise questions, and answers. It uses programming languages such as Python to implement a BP neural network model. The input layer should contain features related to the English ICAI MOOC course, such as video duration, number of video barrages, difficulty of exercise questions, etc. The output layer should include the difficulty level of the course, such as easy, average, and difficult. Train the BP neural network model using the prepared dataset.

According to the previous research results, this article puts forward a new instructional assessment algorithm based on BPNN, and gives the construction stage of fuzzy assessment model of instructional level, in order to open up a brand-new method for reasonable assessment of instructional level.

3 TEACHING ASSESSMENT ALGORITHM BASED ON BPNN

The factors that affect the instructional level are complex and diverse, mainly involving three aspects: educators, learners and managers, and all the influencing factors are interrelated and interact with each other. This article constructs a instructional assessment model based on BPNN algorithm. Combined with the actual teaching situation of educators, this article determines the influencing factors of instructional assessment; Moreover, according to the characteristics of professional teaching and the guideline of combining qualitative and quantitative, a instructional level monitoring system is constructed from the aspects of professional teaching, curriculum teaching, educator teaching and learner learning quality monitoring. The appearance of BPNN algorithm has ended the history that there is no training algorithm in multi-level network, and it is considered as the training method of multi-level network system. The topology diagram of BPNN is shown in Figure 1.

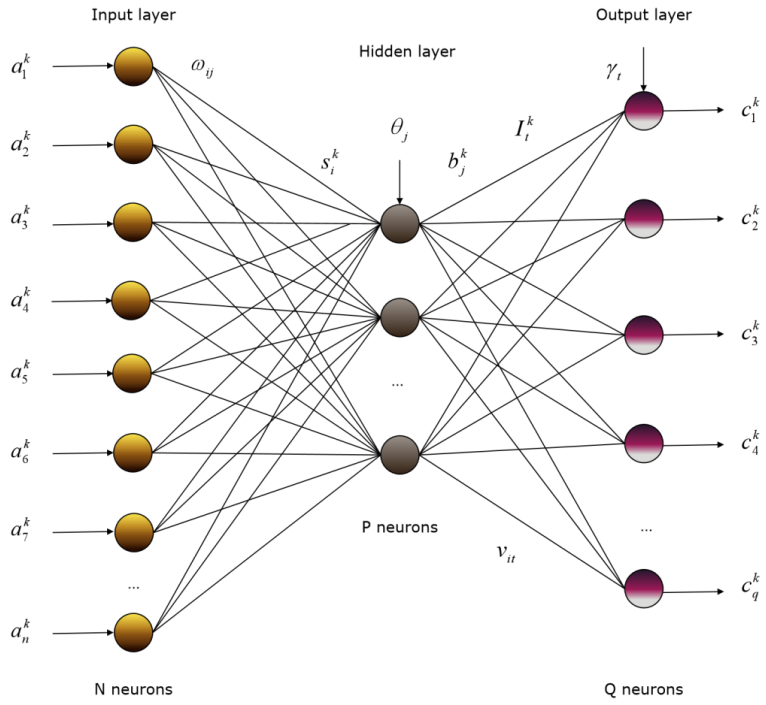

Figure 1: BPNN topology diagram.

$$x = x_1, x_2, x_3, \cdots, x_{12} \tag{1}$$

The hidden layer output is:

$$O_j = f\left(\sum_{i=1}^{n+1} v_{ij} x_i\right) x_n = 1, v_{i,n+1} = -\theta_j \tag{2}$$

The output of the output layer is:

$$y = f\left(\sum_{j=1}^{n+1} \omega_{jk} x_j\right) x_{n+1} = 1, \omega_{j,n+1} = -\theta_k \tag{3}$$

The output layer error is:

$$d_{jk} = y(1-y)(y-Y) \tag{4}$$

The hidden layer error is:

$$d_{ij} = O_j(1-O_j)\sum_{k=1}^{m} d_{ij}\omega_{jk} \tag{5}$$

The transformation function of nodes usually selects Sigmoid function. In reality, due to various subjective factors, the assessment lacks theoretical basis. Therefore, according to the characteristics of BPNN, this article intends to establish a model of instructional level assessment system by using BPNN theory. After training the network, the instructional level can be assessd. The maximum characteristic root of pairwise comparison weight is calculated and the consistency test is carried out. Finally, the index combination weight vector that passed the combination consistency test is obtained. The monitoring and assessment of instructional level based on BPNN

can make learners clear their learning goals and the degree they should achieve after learning, and use effective learning time to achieve the best learning effect.

The effective construction of instructional level assessment index system reflect important significance in the assessment of instructional level in universities. By establishing instructional assessment system, formulating assessment standards and carrying out quantitative management, educators can better improve the guidance level of internship teaching and practice, and also directly promote the requirements of learners to master knowledge and improve their comprehensive quality. The vector model of multilayer BPNN is shown in Figure 2.

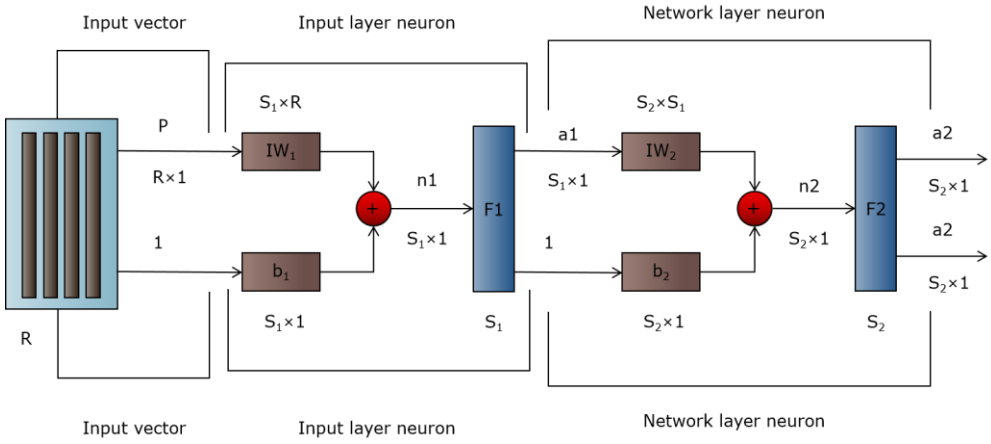

Figure 2: Vector model of multilayer BPNN.

The model assessment results reproduce the expert's experience knowledge and avoid the subjectivity of expert assessment, which ensures the objectivity of instructional level assessment. Firstly, the model trains the sub-network part from the secondary index input to its corresponding primary index output, and takes the trained parameters as the pre-training parameters of the sub-network; Then the first-level training index is output to the final output fully connected network, and this parameter is used as the pre-training parameter of the output fully connected network; Finally, the pre-training parameters are imported into the whole network and combined training is carried out.

4 CONSTRUCTION OF FUZZY ASSESSMENT MODEL OF INSTRUCTIONAL LEVEL

Scientific and effective assessment of classroom instructional level is an important means to realize instructional level monitoring and total quality management, and reflect important significance in promoting the improvement of instructional level. The most widely used assessment method of classroom instructional level in universities is fuzzy assessment method. In order to describe fuzzy things quantitatively by fuzzy definition, the choice of fuzziness is the key to deal with the problem here. It can assess educators' instructional level from all aspects in a three-dimensional way, and improve the quality of running universities in an objective, fair, scientific and effective way. However, in the comprehensive assessment of college educators' instructional level, the determination of weight has certain subjective factors.

In the fuzzy assessment model of instructional level, the selection of assessment elements, the design of assessment indexes, the organization of assessment process and the processing of assessment results should be objective, accurate and realistic. In the regulation of assessment conditions, we should not only take the norm, but also control the interference so that the assessment can point to the ultimate goal. The establishment of instructional level assessment

index system should follow the following principles: ⊖ the guideline of scientific orientation. ⊜ Consistency principle. ⊛ Integrity principle. ④ Principle of independence. ⑤ The guideline of traceability. ⑥ The guideline of operability. In this article, the assessment of instructional level is mainly considered from the following aspects: educators' quality, instructional content, teaching methods, teaching attitude and instructional effect. Taking these five aspects as the first-level assessment indexes and setting up 18 second-level assessment indexes under these first-level assessment indexes, the instructional level index system is formed. Qualitative indicators have great fuzziness, so it is needed to quantify these indicators and then determine the weight of each indicator. Fuzzy theory just does this, so it can be used to assess the instructional level. This will make the assessment more reasonable and accurate, which is an effective supplement to AHP. In the stage of evaluating the factors affecting the instructional level, experts are invited to analyze all the influencing factors, and all the influencing factors listed in the preliminary selection are selected by AHP.

In order to ensure the scientific nature and operability of the research stage, this study specially invites educational experts, university administrators and outstanding educators to assess, so as to get the weight of judgment indicators.

$$A=(a_1,a_2,a_3,\ldots,a_n) \tag{6}$$

Among them, a_i represents the weight of u_i, the factor of i. They must meet the normalization conditions:

$$\sum_{i=1}^{n} a_i = 1 \tag{7}$$

Moreover, in order to get a relatively fair weight distribution, the list method can be used to calculate. For the secondary index, AHP is used to solve it. Construct their own judgment matrices for the secondary indicators corresponding to each primary indicator. Fuzzy assessment can effectively combine qualitative analysis with quantitative analysis, and make comprehensive assessment at multiple levels and with multiple factors, which is scientific and reliable. Moreover, the improved AHP can solve the problem that the traditional scale is difficult to judge the matrix and needs consistency test. Then the fuzzy assessment method can be used to comprehensively assess the object system involving fuzzy factors, which solves the problems of fuzziness and uncertainty of judgment.

Using weighted average fuzzy synthesis operator:

$$b_i=\sum_{i=1}^{\rho}(a_i\cdot r_{ij})=\min\left(1,\sum_{i=1}^{\rho}a_i\cdot r_{ij}\right)\qquad j=1,2,3,\ldots,m \tag{8}$$

In the formula, b_i, the i assessment index belonging to the j grade. The acquisition of fuzzy assessment matrix: firstly, make a binary judgment, that is, analyze the grade of each factor of the assessed object; Then a judge gives the conclusion of belonging or not, and forms the result with a Boolean matrix. Secondly, the obtained Boolean matrices are accumulated to form a degree matrix F ; ; Then divide this degree matrix F by the quantity of judges, and get the fuzzy assessment matrix R expressed by membership degree:

$$R=\frac{F}{K} \tag{9}$$

Single-level comprehensive assessment: let the weight set of i -level sub-targets be:

$$A_i=(a_{i1},a_{i2},a_{i3},\ldots,a_{il}) \tag{10}$$

The comprehensive assessment result of this layer is:

$$B_i = A_i \circ R_i = (a_{i1}, a_{i2}, a_{i3}, \ldots, a_{il}) \circ \begin{bmatrix} b_{i11} & b_{i12} & b_{i13} & b_{i1m} \\ b_{i21} & b_{i22} & b_{i23} & b_{i2m} \\ \cdots & \cdots & \cdots & \cdots \\ b_{il1} & b_{il2} & b_{il3} & b_{ilm} \end{bmatrix} \quad (11)$$
$$= (b_{i,1}, b_{i,2}, b_{i,3}, \ldots, b_{i,m})$$

Comprehensive assessment of the overall goal. Judging from the bottom layer by layer, the comprehensive assessment result of the general objective can be obtained as follows:

$$B_i = (b_{0,1}, b_{0,2}, b_{0,3}, \ldots, b_{0,m}) \quad (12)$$

It is difficult or subjective to determine the weight vector in fuzzy assessment method, which may be unrealistic. Therefore, this article combines fuzzy assessment with AHP. AHP+ fuzzy assessment method can effectively determine the index set and weight value by layers, transform qualitative research into quantitative assessment, which is a combination of qualitative and quantitative, and comprehensively assess the instructional level of universities. In addition, when applying fuzzy assessment to assess teaching, because there are many assessment indexes, this article uses weighted average method to analyze and assess the results, and can compare and sort the indexes, which has achieved good results.

5 RESULT ANALYSIS AND DISCUSSION

Instructional level assessment index itself has a guiding role in teaching, that is, educators will pay attention to what indicators are assessed. Therefore, the establishment and selection of indicators is extremely important. In this article, according to the five first-level indicators and the eighteen second-level indicators in the instructional level assessment index system constructed above, a questionnaire was made, distributed. Secondly, the scoring data [0,100] is standardized to be between [0,1]. The data de-outlier processing is shown in Figure 3.

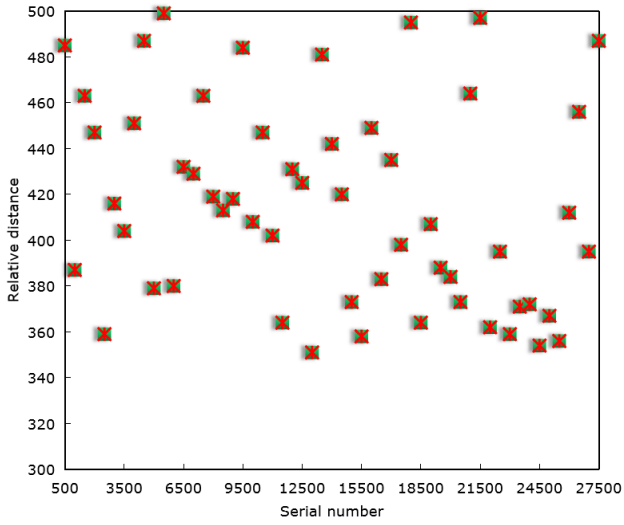

Figure 3: Data outlier removal processing.

Using the above data to train the designed instructional level assessment model, we can get better NN weight. The model quantifies the concept of instructional assessment index into certain data as

its input and instructional effect as its output, which is realized by MATLAB system. The function of NN toolbox in MATLAB is perfect. It contains all kinds of functions related to NN, such as initialization, learning and simulation, so it is convenient to simulate the system in the toolbox.

In the stage of designing NN, this article mainly focuses on tests and analyzes the results of training. According to the results of each test, the quantity of hidden layer nodes is continuously increased or decreased until the required performance is obtained. The learning times are 10000 times, and the error is 0.001. After constructing the forward NN, the network is trained. The obtained model is tested, and the convergence of the model is shown in Figure 4.

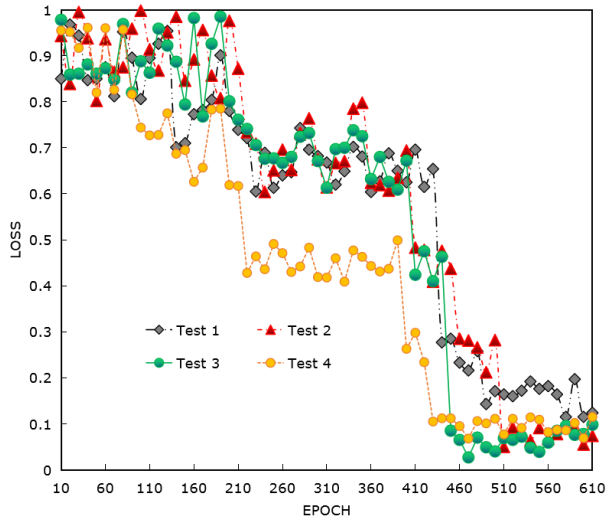

Figure 4: Model convergence.

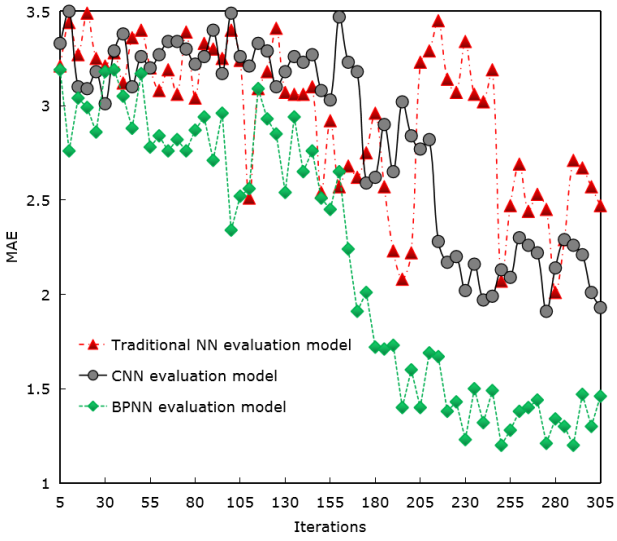

Figure 5: Algorithm error situation.

In order to avoid the network falling into local minimum during training, momentum factor is introduced to avoid this phenomenon. According to experience, the general value of momentum factor is about 0.86.

Applying BPNN to the assessment of instructional level does not need to establish a complex mathematical model, which solves the nonlinear problem of assessment and effectively overcomes the defects of traditional assessment methods. The errors of several algorithms are shown in Figure 5.

The model converges quickly. This method can comprehensively assess the object system involving fuzzy factors, which solves the problems of fuzziness and uncertainty in judgment, and is very suitable for comprehensive assessment of instructional level. In order to further verify the assessment effect of the fuzzy assessment model of instructional level, the pre-prepared test data are input into the trained BPNN model; Then the results are compared with the expert assessment results. Table 1 shows the assessment of some samples. The specific comparison between the model simulation output assessment results and the expert assessment results is shown in Figure 6.

Sample number	*Expert appraisal*	*Model output result*
50	83.417	79.328
55	83.965	76.241
60	80.459	84.516
65	76.786	79.719
70	70.492	66.682
75	63.125	65.447
80	66.6	63.193
85	67.669	66.328
90	70.169	64.732
95	65.171	70.678
100	65.249	66.54
105	80.784	81.16
110	82.903	81.632
115	80.058	76.287
120	82.829	84.218

Table 1: Sample assessment results.

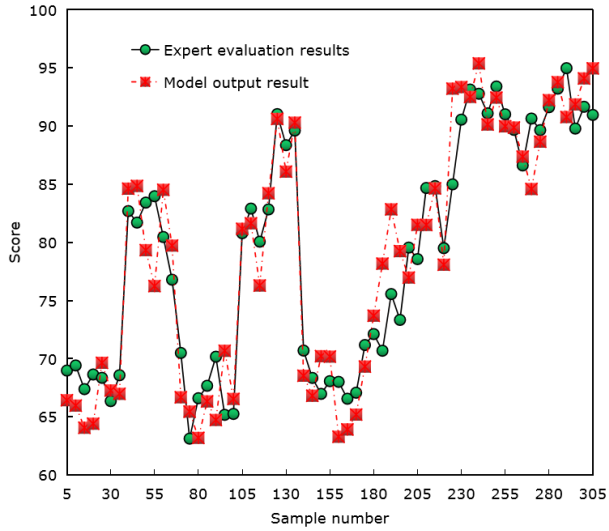

Figure 6: Comparison between expert assessment results and model output results.

From the results in Table 1 and Figure 6, it can be found that the training sample output results are close to the expert assessment results. Through instructional assessment, we can comprehensively assess and assess learners' mastery of professional basic knowledge and professional practical skills, and strengthen their comprehensive application ability. Therefore, the genetic algorithm is introduced into the selection of hyperparameters of BPNN, and the hyperparameters of NN are optimized, so as to adaptively find the super parameters that best match the currently modeled BPNN model. In addition, in order to reduce the complexity of the comprehensive assessment process, on the basis of determining the final comprehensive index weight, the known data samples can be used for BPNN training.

The traditional NN-based assessment model and the BPNN-based fuzzy assessment model are used to experiment the sample data. Set the learning times to 2000, the iteration times to 500, the initial step size to 0.8. Input the sample data and test data into MATLAB program for training, and get satisfactory training results. The comparison of the accuracy of the two models in evaluating the data processing of the test set is shown in Figure 7.

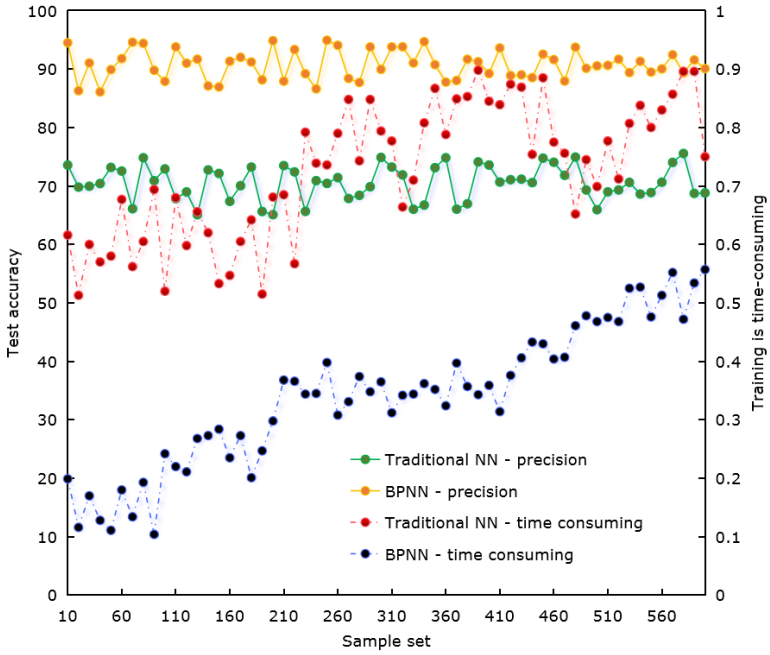

Figure 7: Comparison of model assessment performance.

On the whole, compared with the traditional NN assessment model, the fuzzy assessment model improves the accuracy by about 18.16% and shortens the time consumption by about 3s. The proposed method can guide the implementation of CAI assessment and improve the instructional effect; Moreover, it opens up a brand-new method for the reasonable assessment of instructional level, thus providing useful reference value for the research of instructional level assessment.

6 CONCLUSIONS

The instructional level of universities is related to the success of personnel training, and a scientific and reasonable instructional level assessment system is the key to ensure the instructional level. Carrying out the assessment of instructional level is an effective measure to ensure that universities greatly improve the instructional level, and will certainly reflect important significance in enhancing the comprehensive strength of universities. This article puts forward the application

of BPNN theory to the assessment of classroom instructional level. Using ANN method, the BPNN assessment model of CAI quality assessment system is designed, and the instructional level assessment is completed through training network. The research shows that, compared with the traditional NN instructional level assessment algorithm, the accuracy of this assessment algorithm is improved by about 18.16%, and the time consumption is shortened by about 3s. The model is scientific and practical. Applying BPNN theory to build a instructional level assessment model can not only overcome the inherent defects of traditional assessment methods, but also get the assessment results of instructional level quickly and accurately. This model avoids human subjectivity and randomness.

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