Construction and Application of Automatic Scoring Index System for College English Multimedia Teaching Based on Neural Network

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***Abstract*—With the continuous development of interactive multimedia, multimedia is increasingly integrated into college English teaching, providing advanced teaching equipment and resources. While enriching the teaching environment, it also brings new challenges to teaching ideas and strategies. Although the proportion of independent and selective learning of college students has increased, classroom teaching still constitutes the most essential unit of educational activities. Classroom evaluation is an important means and institutionalized element to improve the quality of university teaching. This paper analyzes the elements of multimedia classroom teaching and constructs an evaluation index system for English multimedia teaching. The improved model is used to achieve automatic teaching grading, acquire knowledge through environmental learning and improve its own performance, and evaluate the mathematical model of the English multimedia teaching evaluation system established by neural network theory accurately and effectively. In this paper, the results of automatic scoring of multimedia English teaching in colleges and universities are compared. Simulation software is used to verify the established neural network evaluation system. The simulation results show that the model is more suitable for the test data of English classroom teaching than the traditional methods, and the prediction effect is better. All 15 English teachers had a predicted error rate of less than 2%, and all 10 English teachers had a predicted error rate of less than 1%.**

***Keywords*—Cognition of multimedia teaching in universities; scoring index; neural network; teaching system**

I. INTRODUCTION

With the information in hypermedia structure to achieve human-computer interaction, multimedia college English classroom has become the driving force of classroom teaching mode reform, which has brought new challenges and development opportunities to teaching. In order to realize the hardware environment of multimedia classrooms, colleges and universities are committed to improving the level of multimedia teaching. How to scientifically apply multimedia technology to complete education is studied. The application has greatly changed the classroom teaching mode, such as promoting students' leading position and changing teaching strategies and methods. Modern educational teaching evaluation model guides and evaluates multimedia classroom teaching under the new situation [1]. The characteristics of multimedia teaching and the thought of modern educational technology are fully reflected in multimedia classroom teaching. Multimedia classroom teaching effectively promotes and determines the level of talent training and affects the quality. Multimedia instruction needs new evaluation indicators to guide and promote education. The establishment of a multimedia classroom teaching index system is the guidance [2] Any evaluation system to develop scoring standards is the basis of the construction of the quality evaluation system of the discipline. By constructing the teaching quality evaluation system to form a closed-loop feedback mechanism, the regular operation and perfect development of each fundamental element of the system can be guaranteed to achieve the expected goal. Therefore, the evaluation system is the comprehensive embodiment of all levels and elements of the system, and the evaluation system is the system and operation mechanism. Consequently, it is of great significance to improve the evaluation of college classroom teaching, expand the management theory of college teachers and improve the quality of classroom teaching.

Neural network theory is the information science of human brain learning. A network is a multi-layer feedforward network in many types of neural networks. The neural network is widely used in decision analysis of nonlinear, complex and comprehensive problems [3]. Neural networks can be used as a qualitative and quantitative combination of practical tools to comprehensively evaluate the object system beyond the sample mode. The theory of artificial neural networks is a frontier field that learns from the human brain. The correct can be used as a qualitative and quantitative effective tool to make a comprehensive evaluation of the object system outside the sample mode. In the face of the number of thousands of learners, it is necessary to establish a clear standard assessment. Relying on machine learning automatic detection can accomplish this work while reducing teachers' workload. The algorithm is used in comprehensive universities. Establishing an evaluation system that adapts to the new teaching mode and conforms to the latest teaching concept has become an important topic.

Automated Essay Scoring (AES) was the first to start in the field of automated essay scoring. The Project Essay Grade (PEG) system can extract statistical information about the essay, such as the length of the text, the number of sentences, and the proportion of adjective prepositions. Then these statistical features are taken as multivariate independent variables, and the previously evaluated composition scores are taken as dependent variables. Logistic regression algorithm is used to find the representation function between these statistical features and the scores of English multimedia

teaching, and automatic scoring is achieved by finding out a multivariate function that can describe the relationship between these statistical information and the scores of English multimedia teaching. PEG system can achieve a high accuracy in composition grading, but because it cannot deeply understand English multimedia teaching, its grading results are difficult to be accepted later.

We can use natural language processing technology to develop areas of automatic grading of subjective questions to help teachers teach and students learn. Moreover, online teaching has become an important mode of current teaching. If AI-related technologies can be applied to English multimedia teaching, the model can be trained by using the students' homework that has been corrected online as training samples. Then, with the increase of training samples, the performance of the automatic scoring system will continue to improve, and the system will be closer to the level of teachers' manual scoring.

The rest of this article is organized as follows. Section II discusses the related work. Section III constructs an automatic scoring index system for multimedia English teaching. Section IV analyzes the application results of automatic scoring in college English multimedia teaching. Section V summarizes the full text.

II. Related Work

The importance of English teaching evaluation has gradually attracted the attention of domestic college teachers and educational management departments, and the theory and practice of teaching evaluation have significantly been developed [4]. At present, domestic universities actively learn from the research results of computer networks. It takes multimedia technology and combines modern teaching models such as flipped classrooms, Massive Open Online Courses (MOOC), micro class and mobile device-assisted learning with traditional college English teaching. English through innovative teaching mode, and realize the transformation trend of professionalization, mobile, socialization and data. The primary methods of evaluation index systems include the brainstorming method, target element decomposition method, structure decomposition method and target classification method, and there have been rich theoretical research results. Based on the Analytic Hierarchy Process (AHP), Fu J et al. constructed a three-in-one inquiry classroom teaching evaluation system of teachers' teaching, students' learning and supervision evaluation [5]. Yang Y et al. pointed out that the classroom teaching evaluation system should include vector, positioning, concept, condition, operation and output subsystems [6]. Qilin S et al. established the monitoring and evaluation system, of course, teaching quality, including four processes of course application evaluation, Q evaluation system, early feedback of course teaching and stage evaluation, which involved course content, student development, teacher-student interaction, classroom organization, teaching effect, reading and homework [7]. Pustokhina I V et al. pointed out that the main focus of the change in the evaluation method was: the purpose and function of the evaluation should be to improve the happy atmosphere of the learning classroom and cultivate the self-confidence of students in physical learning [8]. Wang X et al. pointed out that the evaluation of teachers should also involve students. Secondly, the evaluation should also pay attention to the combined evaluation of final results and usual performance, rather than one by one, and the evaluation process should also absorb students' participation [9]. Song R et al. pointed out online teaching, teaching quality, course content and other high-frequency words. It has been a hot issue in the field of online teaching evaluation recently. Evaluators often collect data on students' learning behaviours, preferences, motivations and other aspects through online teaching management systems, which provide important conditions and resource guarantees for learning analysis [10]. Kumar A et al. take the comprehensive evaluation problem of students' learning and examination scores as the evaluation object and use neural networks to establish a comprehensive evaluation model. Their research has achieved certain results and opened up a new path for teaching evaluation [11]. Based on the above considerations, the dynamic is the change in classroom teaching. The current classroom teaching evaluation still focuses on the static classroom teaching effect. Teaching quality includes teaching objectives, teaching attitude, teaching content, teaching process, teaching effect and so on, which cannot reflect the process and dynamic characteristics of classroom teaching. Media classroom teaching is a prerequisite for the creation of situations, the display of personality, the participation of learners and the development of learners' cognition. However, the current classroom teaching evaluation index is constantly improving and perfecting. The research on the assessment of English teaching needs to catch up. Educators need to construct a multivariate assessment model integrating the summative evaluation, diagnostic assessment and formative assessment, especially emphasizing the role of formative assessment. With the advantage of information technology, students' learning process is dynamically monitored, and the teaching quality is evaluated from the influencing factors.

III. Automatic Scoring Index System for Multimedia English Teaching

A. English Teaching Effect Rating System

Based on the effect of systematic teaching from a multidimensional perspective, this paper constructs an English teaching effect scoring system and comprehensively considers it through measurable evaluation indicators. The evaluation system of English multimedia teaching should fully consider guiding the quality [12]. The index system discovers that the teacher puts forward the improvement direction by analyzing the existing problems in teaching. English multimedia teaching quality is decomposed into evaluation units from three structural elements: teaching management department, teacher performance and student response. Starting from the teaching management department, the standardization of teaching content is mainly considered. From the teachers' perspective, the evaluation especially involves teaching art and teaching attitude. From the perspective of students and learners, it primarily aims at students' reaction in the teaching process and evaluates the degree of their integration into classroom teaching. According to the expert survey method and feedback teaching theory, a number of measurable system sub-indicators are designed in detail, and the system of English classroom teaching effect is constructed, as shown in Fig. 1.

Classroom teaching is a process of dynamic change, reflected in each dynamic link, and each dynamic link's effectiveness is reflected to a certain extent [13]. It generally divides the per-preparation of teaching content, teaching art, teaching attitude, and student feedback. Teaching content is the key part of the design. Teachers clear the goal, and teaching is conducive to the direction. In the multimedia environment, the richness of resources is reflected in text materials, pictures, objects, audio, video and other aspects. Teachers should consider the support of various teaching resources when designing teaching. Under the support of teaching resources, teachers will create a particular situation according to the specific teaching content, such as the life as mentioned earlier situation, problem situation, simulated real-world situation, virtual situation, and other teaching resources that should be designed in connection with life. The observation point analysis of the multimedia classroom teaching process should start from the essential link of classroom teaching and determine the evaluation standard according to the goal that the teaching link should achieve.

B. *Construction of Neural Network Classroom Teaching Evaluation Model*

Neurons connect the different layers of the neural network, and neural networks can obtain a stable network system by repeated approximation learning [14]. The Back Propagation (BP) algorithm program updates the simple AHP classroom teaching evaluation index weight determination method. Model hierarchy is used to get the statistical sample data of the effect of classroom teaching evaluation, teacher evaluation sample validation set method divided into two parts of the training set and test set, enter a set of classroom teaching evaluation, the weighted average of the measure of a teacher's classroom teaching effect comprehensive score, as the training goals scored. The model calculates the neural network test score obtained by the investigated teachers, compares it with the target score of the sample data, and calculates the simulation prediction error of the neural network statistical data. The estimated weights of the model are repeatedly debugged until a stable neural network is obtained. Based on the backpropagation method, a term is added to each weight and min value change proportional to the previous weight and min value change.[15]. The algorithm is as follows:

$$available\Delta X_i = \frac{-[J^T(X_i)J(X_i)+\mu_i I]^{-1}}{J^T(X_i)V(X_i)} \quad (1)$$

J is the Jacobian matrix, I is the identity matrix, the error vector, and V is the parameter vector. All inputs are submitted to the network, and the corresponding network outputs and errors are calculated using the following equation.

$$e_q = t_q - a_q^m a^0 = p \quad (2)$$

$$a^m = f^m(w^m a^{m-1} + b^m), m = 1,2,\cdots M \quad (3)$$

Where 'p' is the input vector, 'w' is the weight vector of the MTH layer, 'f' is the vector of the transmission function of the MTH layer, 'a' is the output vector of the warp element generated in the MTH layer, and b is the bias value vector. For batch processing, the mean square error is the sum of the squared errors of all the targets in the training set [16].

$$the\ f(x) = \sum_{q=1}^{Q}\sum_{j=1}^{s}(e_j)^2 \quad (4)$$

The key in the algorithm is the calculation of the matrix. In order to compute the matrix, you need to replace the squared error's derivative with the error's derivative. The error vector is:

$$V^t = [e_{1,1}, e_{2,1}, \cdots e_{S^m,1}][e_{1,2} \cdots e_{S^m,2}][e_{1,Q} \cdots e_{S^m,Q}] \quad (5)$$

Where S^m is the total number of hidden layer nodes in the m layer.

$$N = QS^m, n = S_1(R+1) + S_2(R^1+1) + \cdots + S_m(R^m+1) \quad (6)$$

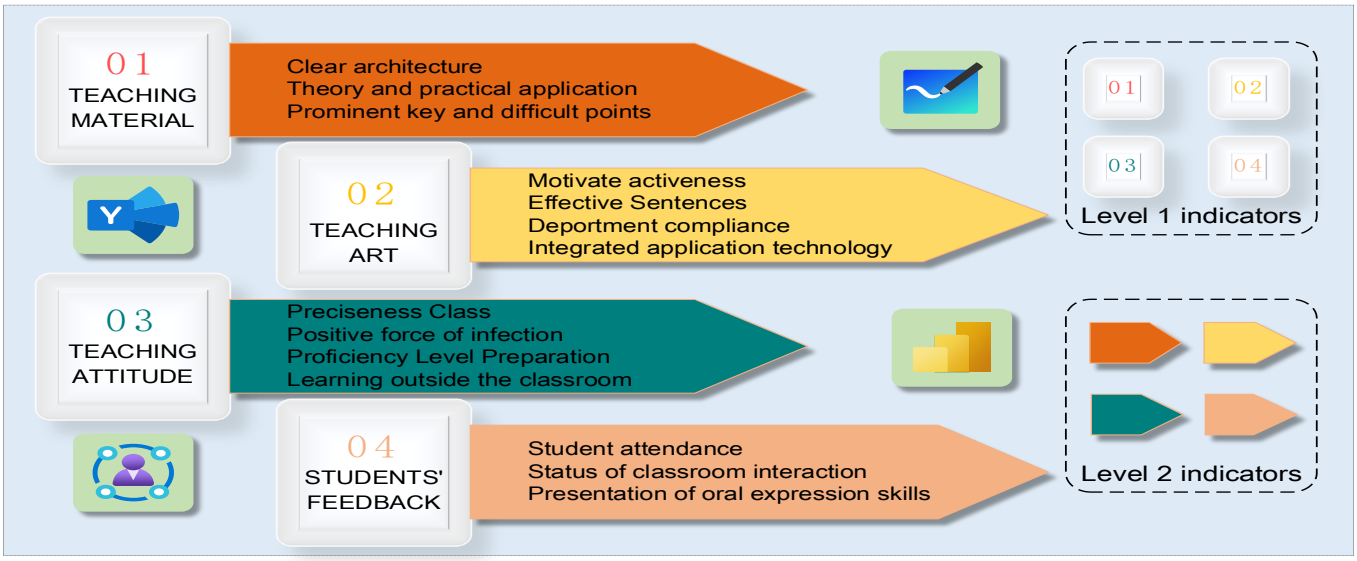

Fig. 1. Evaluation index system of English classroom teaching effect.

C. Improve the Learning Method of Neural Network

Neural networks acquire learning from the environment. The quality evaluation system of the teaching system starts from the main body and integrates the evaluation into any link. Only in this way can the evaluation system be formed to guide the whole system at a macro level. Each subsystem pays special attention to the combination of the teaching process and teaching results and the related factors affecting the teaching process and teaching results. Based on the above basic principles of the teaching system, this study proposes a roadmap of learning methods based on the quality evaluation system. In general, computational improvement is achieved gradually over time by adjusting its own parameters according to some predetermined measure [17]. The learning method provides information to supervise learning according to the environment, and the learning method is shown in Fig. 2.

In unsupervised learning, there is no external support in the supervision process. The learning system adjusts the training parameters uniformly according to the statistical law of the data provided by the external environment, and the structure is external fixed input. Supervised learning requires a model data set provided by the outside world. The input results correspond to the output results one by one, and this set of known data is set as the training sample set. The relearning system adjusts the system parameters according to the difference known. The external environment of relearning only gives evaluation information to the system output, but not the correct answer. Learning systems improve their performance by reinforcing actions. The quality evaluation system focuses on the formation of index content. In the thinking dimension of index content formation, the core subject of the system is sorted out, and the index content is clustered to form a particular general index type. The weight coefficient tests the evaluation system through teaching practice so as to create a perfect automatic scoring system in the repeated practice data.

D. Design of an Automatic Scoring System for Teaching Based on Improved Neural Network

Through continuous learning and training, artificial neural networks can discover their rules from complex data with unknown patterns, mainly can deal with arbitrary types of data. Therefore, this design will improve the theory of neural network applied to the teaching evaluation system, solve the problem's evaluation index system, and overcome the traditional evaluation of the mathematical model and mathematical, analytical expression. Evaluate the accurate application of neural network theory to establish the mathematical model of the system [18]. If an error threshold exceeds the specified error range, adjust the connection weights among all layers and the threshold value of nodes. Therefore, the neural network is used in the comprehensive evaluation of the quality of teaching. The basic idea is to use each evaluation index of the neural network input vector with a value that is expert of the evaluation results of the neural network output vector. According to the comprehensive index system in the above section [19], the model is the required classroom model. The system design comprises various subsystems for guiding the ideology of network-based teaching within the respiratory field. These include the neural network evaluation subsystem for guiding teaching in the network, the multimedia resources neural network evaluation subsystem, the teaching conditions neural network evaluation subsystem, the teaching building neural network evaluation subsystem, the teaching management neural network study, the neural network evaluation subsystem for practice-based teaching in the building, and the English training neural network evaluation subsystem. The outputs of the eight subsystems constitute the integrated network's input system structure block diagram, as shown in Fig. 3.

Each subsystem model adopts a three-layer BP neural network, and neurons in each layer are only connected with neurons in neighbouring layers [19]. The conversion function of each node adopts the Sigmoid function.

$$S = \sqrt{0.43nm + 0.11m^2 + 2.55n + 0.77m} + 0.35 \quad (7)$$

The index weights are obtained for each subsystem, and organizational education experts score the training samples according to the above index system. After training the model with a large number of samples, the subsystem is established, and the value is finally obtained. The model's structure of the system entails that the comprehensive output value of each subsystem is considered. The output is the teaching evaluation results divided into four grades: excellent, good, pass and fail. The value is shown in Fig. 4.

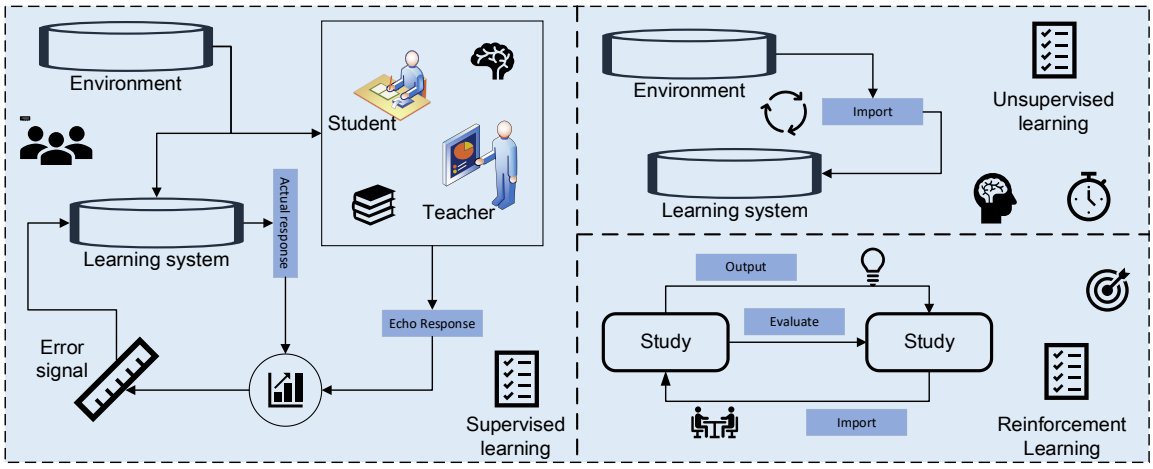

Fig. 2. Information content supervised learning.

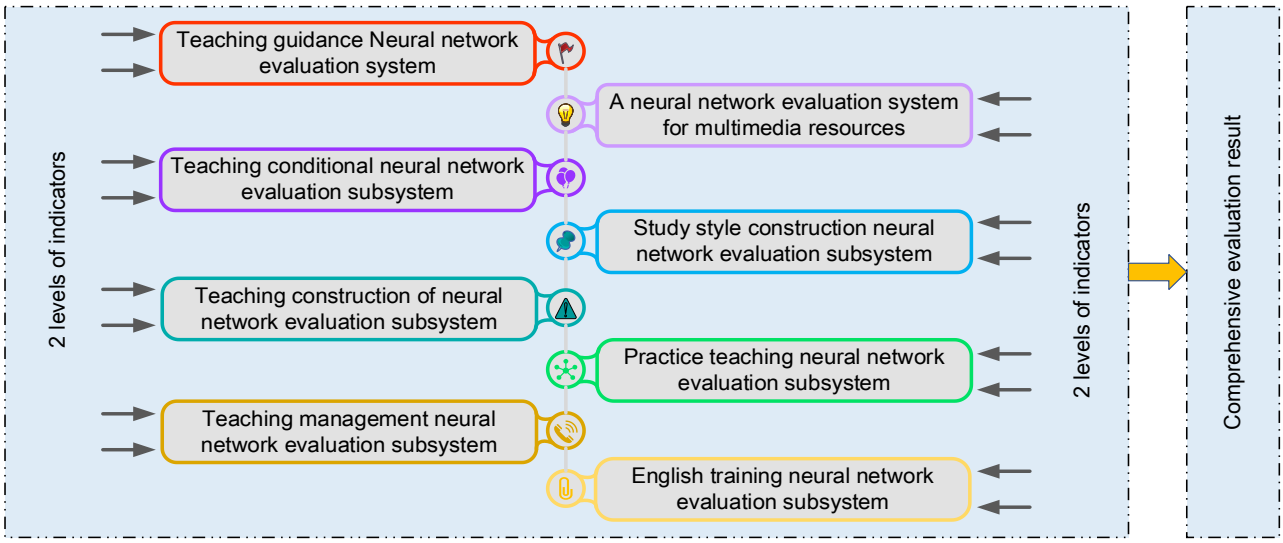

Fig. 3. Application flow chart of social security fund cloud audit platform.

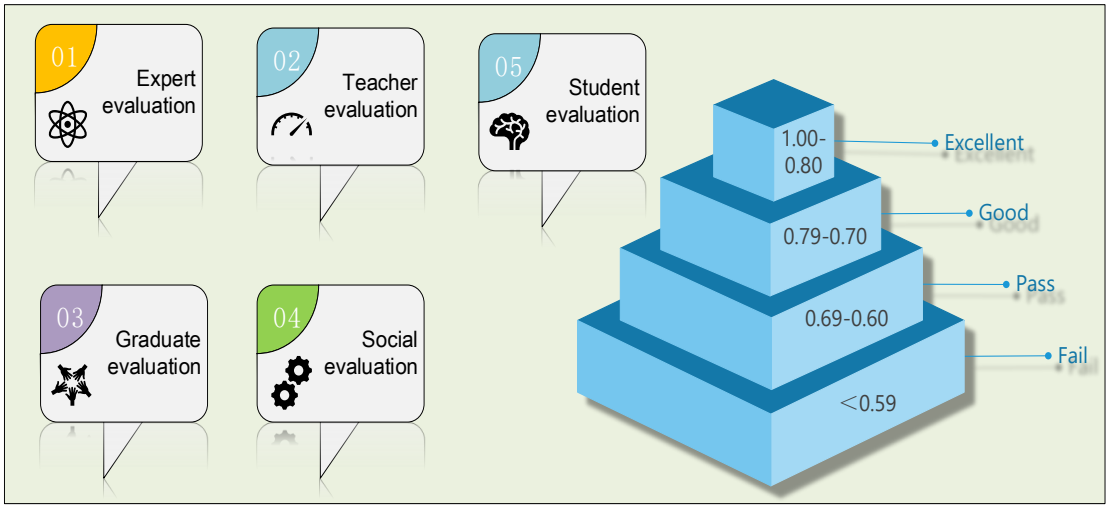

Fig. 4. Range of output values for each level.

The selection of neural network training samples is the key to this system and the evaluation results of the system. The system uses the evaluation of experts of the Ministry of Education, the evaluation of college teachers, the evaluation of students in school, the evaluation of graduates, social evaluation and other ways to obtain information using information cards and the Internet. The teaching evaluation score is between 1.00 and 0.80, which means the teaching activity is excellent. The teaching evaluation score is between 0.79 and 0.70, meaning the teaching activity is good. The teaching evaluation score is between 0.69 and 0.60, which means that the teaching activity is passed; A score of <0.59 in the teaching evaluation indicates that the teaching activity is failing.

IV. Application of Automatic Grading in College English Multimedia Teaching

A. Index Weight of the Automated Scoring System

In this study, the AHP is used to calculate the weight of indicators. AHP is an evaluation method that combines quantitative analysis and qualitative analysis to simplify complex problems and simplify simple issues [20]. The process can effectively ensure the rationality and scientificity of index weight. The scoring matrices of 10 experts on the first-level indicators are summarized in a judgment matrix and summarized by the arithmetic average method, which is to take the average value of the values and calculates the corresponding summary value by the arithmetic average of the scoring values of each expert, as shown in Fig. 5.

The first-level index scoring judgment matrix was input, and the consistency test data was obtained, as shown in Fig. 6. In the consistency test, C.R. denotes the consistency ratio, C.I. denotes the consistency index, and R.I. indicates that the average consistency indicator is a fixed value. When C.R. < 0.1, the judgment matrix is consistent; If C.R. > 0.1, the judgment matrix does not meet the consistency requirements. If the data does not meet the requirements, delete the data, fill in the data matrix again, and calculate the weight after the consistency check.

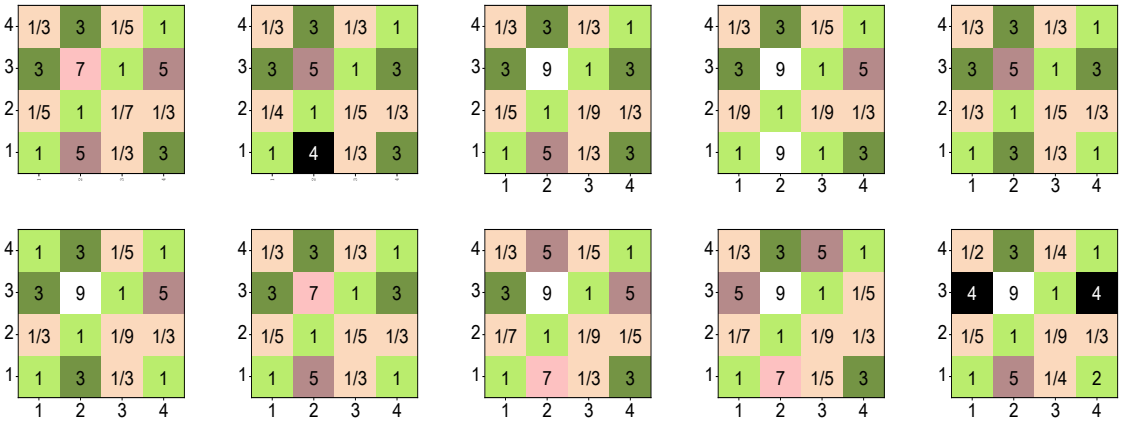

Fig. 5. Expert score arithmetic average summary numerical statistics chart.

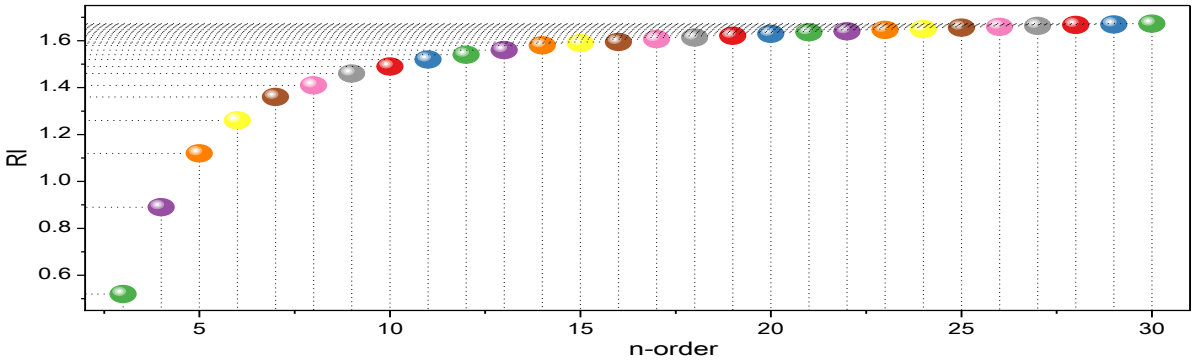

Fig. 6. Matrix consistency test data graph.

The C.R. value of the consistency test result is 0.044, indicating that the consistency test result meets the requirements and the calculated weight data. This process is effectively used to check the consistency of each expert's score. After passing the test, the arithmetic average method is used to carry out the weighted summary. The summarized values are re-entered into the table for the consistency test. After passing the consistency test, the weight value of each indicator is obtained. The formula is used for data entry, and the index weight is obtained. The single ranking of index weight hierarchy means that the subordinate second-level indicators of a first-level indicator carry out the separate weight calculation, and the total ranking of hierarchy means that the second-level indicators of all first-level indicators carry out the comprehensive weight calculation and ranking. The results of the expert survey were analyzed through hierarchical analysis. The weights of the second-level indicators were obtained by calculating the data, and the consequences of the indicators were summarized as shown in Fig. 7.

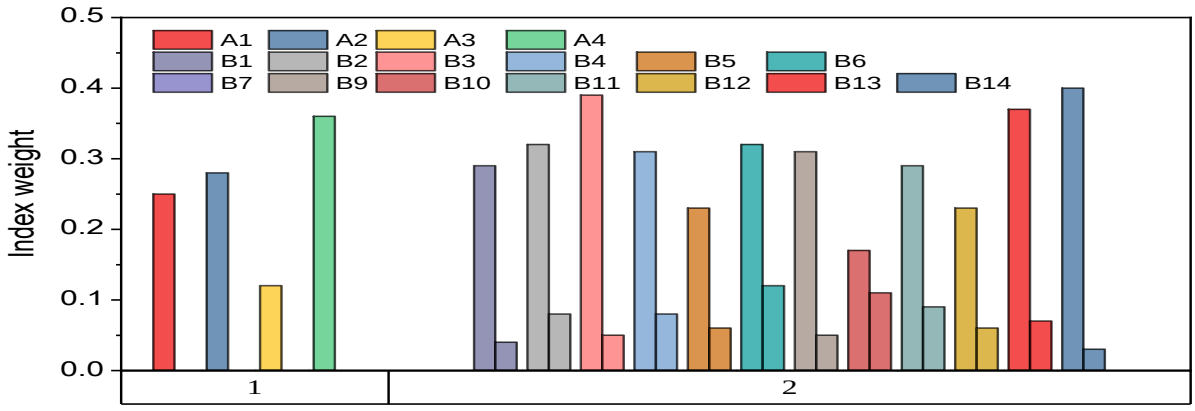

Fig. 7. Summary diagram of weights of system indicators.

This system designs eight subsystem output index weights. The weights are given 16 input values through model training, and then the teaching effect system evaluation results can be obtained. The evaluation is realized through the design of the evaluation database. From the database will be evaluated all teacher indicators into the system for database operation, evaluation of the main program neural network evaluation results display interface. The system monitors teaching, and the evaluation results can be used as a reference for teachers to conduct subsequent teaching activities. Multimedia teaching tools combine with teaching time to implement autonomous learning and offline face-to-face teaching organically. At the same time, learning should be combined with professional requirements, and the improvement degree of ability and quality should be matched with the learning objectives to improve students' satisfaction with course teaching.

B. *Results of Neural Network Evaluation on the Quality of College English Multimedia Teaching*

Matlab simulation's system design and application include efficient numerical calculation, matrix operation, signal processing, graph generation, and other functions. In addition, the software also provides a variety of practical toolboxes. Neural Networks Toolbox is one of them. Matlab neural network toolbox users can be very convenient for simulation. The system simulation was carried out in the toolbox, and the sample data were realized. It automatically mobilizes the initialization function and threshold based on the default parameters. Target vector T of the sample. According to the simulation steps, the system conducts simulation training and experimental analysis in the toolbox, and the results are shown in Fig. 8. According to the evaluation results of 10 groups of data by experts, it can be seen that the evaluation results of the neural network are consistent with those of experts.

The error of the test sample is almost the same as that of the test sample in the acceptable range. The statistical situation of items 4-8 in the questionnaire shows that 20% of the teaching simulation evaluation is excellent; 30% of the teaching simulation evaluation is good; 40% of the teaching simulation evaluation is passed; 10% of the teaching simulation evaluation is failed. The error of the excellent evaluation test sample is 0.02, the good evaluation test sample is 0.01, and the error of passing the evaluation test sample is 0.01. The simulation error is within the controllable range. Using the automatic rating system to analyze the teaching quality, it is found that after the automatic rating system is enabled, the teaching performance only needs to input the corresponding index value and weight, and the evaluation subsystem can comprehensively evaluate the effect. Through teacher evaluation, students' learning effects can be objectively understood, and students' learning effects can reflect teachers' teaching effects. Therefore, the automatic evaluation model based on an improved neural network is a reasonable mechanical evaluation model. After the training evaluation is successful and the model is implemented, the repeated scoring process is separated from the experts by model learning. The application of the model not only saves capital investment but also ensures the scientificity of the model.

C. *Evaluation Results of Neural Network Application in English Multimedia Teaching*

The author obtains survey data and implements standardized preprocessing. This paper takes statistics teaching as the survey object, and the course is mainly offered for English majors. Utilizing the questionnaire survey, we obtain the classroom teaching data of some teachers in 10 universities, a total of 60 teachers. The sample data of all evaluation indicators were normalized, and the weight of scientific teaching content was the highest among all indicators. The weighted calculation obtained the classroom teaching quality score of all statistics teachers. The network structure takes 14 evaluation indicators as input neurons, the double hidden layer contains seven and three neurons, respectively, and the final output layer contains the unique prediction score of neurons. The error threshold of the model training was set as 10-5, and the times were set as 20000. The stable neural network was obtained by using the gradient descent algorithm. The neural network model predicts the classroom teaching scores of 15 teachers in the test set. The known classroom teaching scores are compared with the model, and the relative errors are calculated. The results are shown in Fig. 9.

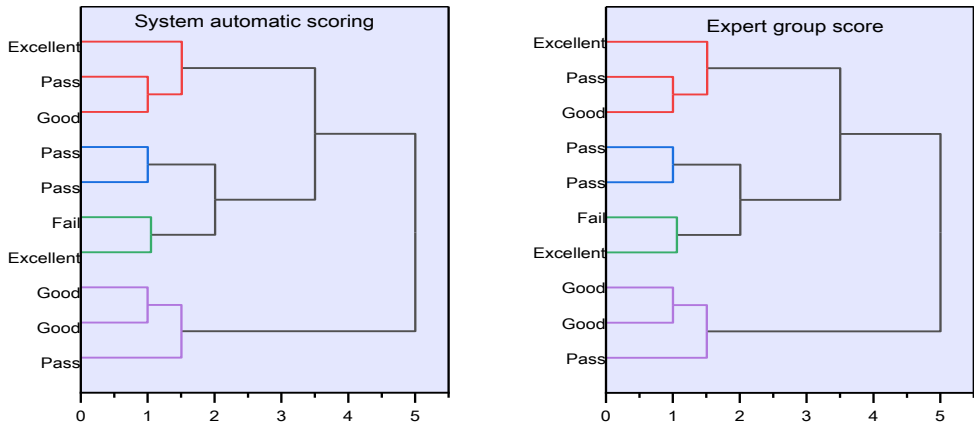

Fig. 8. Model simulation training results.

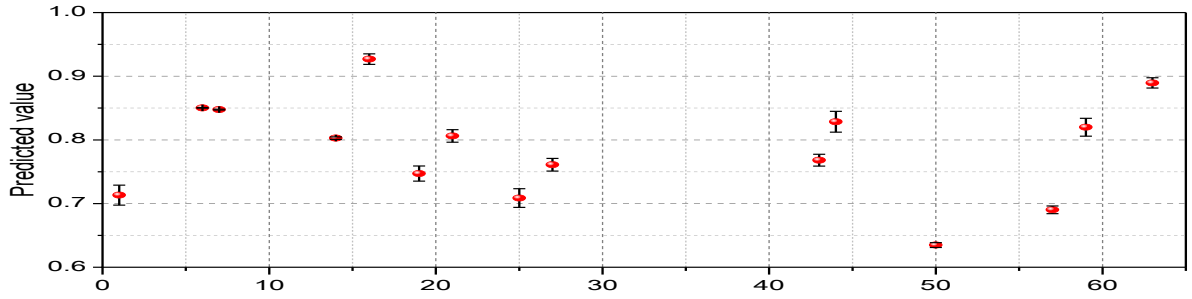

Fig. 9. Relative error between classroom teaching and neural network model prediction results.

The comparison of the above prediction results shows that the model is applied to the test data of English classroom teaching and obtains a better evaluation effect. The prediction error rate of the 15 teachers' classroom teaching quality score is controlled within 2%, and the error rate of 10 teachers is controlled within 1%. Therefore, the neural network teaching evaluation model can be put into the classroom teaching evaluation practice. Quantitative evaluation of teaching results and supervision of the process, and actively break through their own level in teaching. Evaluation promotes the formation of learning habits, according to learning needs to constantly adjust their learning state, always maintaining a serious and efficient learning state. Evaluations motivate teachers and students to strive for higher goals. A comprehensive review can effectively improve the teaching level to form good teacher supervision.

D. Discussion on Automatic Scoring of Multimedia English Teaching in Colleges and Universities

With the continuous increase of online teaching business and the rapid development of artificial intelligence technology, the current education model is developing in the direction of intelligence [21]. Online teaching will produce a lot of data, and the training of neural network model has a high demand for data [22]. Therefore, the application of neural network model to college English multimedia teaching is very innovative and practical value.

This paper studies the difficulties related to automatic online scoring of college English multimedia. The difficulty of automatic marking technology is mainly the correction of subjective questions, and the difficulty of subjective questions is the understanding of semantics. Subjective questions mainly rely on natural language processing, that is, text preprocessing, Chinese word segmentation, text vectorization, feature extraction and automatic scoring are carried out according to the processing order of natural language.

In this paper, by randomly combining the answers with the same score of the same question to form similar text pairs and positive sample pairs, the answers with large score differences or different questions are combined into negative sample pairs, so as to solve the problem of sample scarcity when using deep learning algorithms for automatic scoring.

At present, there are few researches on automatic scoring of Chinese subjective questions based on natural language processing, which has been the main research direction in the field of education [23]. In view of the importance of automatic scoring to promote the fairness of education and reduce the redundancy of teachers' work, automatic scoring has begun to adopt the method based on neural network [24]. However, due to the different application fields of subjective questions, the emphasis of subjective questions in different professional fields is also different, especially the data of subjective questions does not have a relatively open and accurate data set. The current studies are all based on small-scale data from the school where the researcher is located, so it is necessary to construct a public data set of subjective questions.

V. CONCLUSION

The purpose is to provide feedback and teaching information to observe and promote the effect and progress of teaching, emphasizing improving the quality of teaching. College English teaching assessment encourages students to achieve their learning goals at all stages, cultivates their comprehensive English application ability, and helps teachers become conscious researchers of teaching theories and practitioners of teaching methods. This paper constructs the statistical index system of classroom teaching quality evaluation from teaching art, teaching attitude, students' reaction to classroom teaching and teaching content. Taking college English classroom teaching data as an example, this paper obtains the initial weight of evaluation. It calculates the target score of sample data by using expert scoring and an analytic hierarchy process. The neural network model trains the classroom teaching sample data to approximate the expert score, put into the test and inspection and obtains a good evaluation effect. The neural network model based on the BP algorithm makes use of the learning ability to maximize the inner connection between the teacher's teaching input information and the quality output, and it is separated from the expert scoring in the subsequent promotion and use. The sample size of the classroom teaching evaluation data set collected in this paper is small, and the advantages of the neural network model in extensive data analysis are more obvious if the model can be developed in a broader range of teaching activities. It is helpful to promote the transformation of teaching assessment form from results and figures to process and description, promote the combination of formative assessment and teaching, and improve the feasibility and scientificity of the assessment scheme.

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