

Retraction

Retracted: Development and Utilization of English Online Course Resources Based on Fuzzy Neural Network

Journal of Sensors

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] D. Liao, "Development and Utilization of English Online Course Resources Based on Fuzzy Neural Network," *Journal of Sensors*, vol. 2022, Article ID 1795446, 11 pages, 2022.

Research Article

Development and Utilization of English Online Course Resources Based on Fuzzy Neural Network

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Since the reform and development, after decades of changes in the times, China's basic education reform has been promoted several times, and the degree of information technology in the campus will become one of the important factors for parents to choose this school or not. From digital projectors since 2003 to multimedia-assisted English teaching nowadays, it is evident that online English teaching has become an important part of today's English online resources, but most of the English online resources nowadays are developed by professional research institutions, which leads to a situation where online English curriculum resources are not closely connected to the actual English teaching mode, and more importantly, there is a lack of online English course resources and they are outdated. In the new curriculum reform requirements, the development and utilization of English online resources are clearly pointed out, which shows the importance of developing and utilizing English online course resources and the need to develop in the direction of innovation and modernity, and the need to consider combining the development and utilization of English online course resources with modern technological progress, not only at the theoretical level but also at the practical level. English is a comprehensive and practical language that needs to be used and reinforced by users in order for them to be able to communicate and express their thoughts in English. In this paper, we adopt a fuzzy neural network approach and a gradient descent algorithm to address the shortcomings of current English online course resource development and utilization, and adopt an averaging process for weight updates, and then realize the control of the number of fuzzy rules by adding pooling operations. The experimental results show that this paper can effectively develop English online resources.

1. Introduction

With the rapid change of technology and the continuous development and progress of education, the subject teaching of English has become more and more important, for reasons undoubtedly linked to the general context of economic globalization [1].

However, with the recurrence of the epidemic, people have to implement the new teaching mode of online teaching on a large scale in order to prevent and control the new coronavirus. Such teaching mode makes the communicator across the cold screen not notice or blindly judge the expressions or some subtle body movements expressed by the other party without considering the cultural background and then may misunderstand the meaning expressed by the

other party [2]. Is the reason for these problems only because of online education or online communication? The answer is no, because ultimately, there is a bias in educational resources, and teachers do not develop and use them well enough to teach students the relevant content. For example, in our country, the nod of the head is a sign of agreement [3], and teachers usually tell students directly that if they say "agree," it means "agree" in our country. However, if students go to India or Arabia, they will find that nodding means "disagree." The root cause of this cognitive bias is that teachers have not explored the essence of English curriculum resources and have not taken into account the fact that the same body movement or even the same word can have very different meanings in different country contexts. Therefore, with the repeated outbreaks of the

epidemic, online teaching methods have become a routine for most students, and the development and utilization of online curriculum resources for English are imminent [4].

Nowadays, the role of English online course resources in teaching has become more and more important [5]. In addition, a search for the keywords “development and utilization of English online course resources” on the Internet resulted in only one paper, which analyzed the development and utilization of English online course resources in junior high school from a theoretical perspective, but the authors did not apply them to the actual teaching process. The authors did not apply them to actual teaching sessions or only proposed some strategies [6]. However, these strategies have some reference significance for this paper.

In order to develop and utilize English online course resources more fully, this paper will discuss and analyze from the perspective of algorithm theory and then design a fuzzy neural network model that can reasonably develop and utilize English online resources and provide some reference significance for the subsequent development and utilization of English online resources using fuzzy neural networks [7].

2. Research Background

Since the reform and development, after decades of changing times, China’s basic education reform has been promoted several times, and the degree of informatization in the campus will become one of the important factors for parents to choose this school or not [8]. The reason for this is that the level of informatization in a school is linked to whether the resources in the campus are reasonably developed as well as utilized. And it is on the premise of the rapidly changing technology and data-based background that whether teachers have rich English online course resources and whether they have appropriate multimedia to assist the development of English online teaching activities become an important software factor that restricts the modernization of English education [8].

However, as of now, most of the English online course resources in China are developed by professional organizations [9], which leads to a disconnect between the practical application and the connection of the development of the resources actually. With the advent of the data era, China has also begun to pay attention to data mining of massive amounts of data and to summarize and utilize the mined data in a reasonable way, which can also be considered as a basic step in the development of English course resources by professional institutions. However, such a development approach can have some problems, as described below [10].

- (1) The disconnect between the research and development team related to English online course resources and the actual teachers and students [11]

With the development of technology, the thinking of the research and development team may have the problem that the developed resources cannot keep up with the trend of the times because of the lack of integration with the reality

and the solidification of thinking, which in turn leads to the development of English online course resources that are also disconnected from the teaching and learning process of teachers and students. The new era of English curriculum reform requires that English teaching in the new era should be not only basic but also open, flexible, and with certain ideas. As far as teaching materials are concerned, the importance of teaching materials as an important teaching resource for students and teachers is self-evident. The problems of the elementary school mathematics textbook of the Humanities Education Edition show that the textbook should be fully equipped with ideological elements in the first place, but the team of the research and development institution is often disconnected from the real teaching process, which in turn leads to a disconnection between ideology and actual education, and this educational philosophy is obviously not in line with modern times. Therefore, as the era of technology as the cornerstone and great intelligence, it is essential to link the development and use of English online course resources with the development of today’s technology [12].

- (2) Fragmented English online course resources

The recurrence of the epidemic has led many students to learn only through online teaching and learning, and the Internet has provided an extremely broad arena for the richness of English curriculum resources at all grade levels, but some teachers’ ability to integrate and filter English online resources still needs to be improved, which in turn has led to the disadvantages of disorganization, fragmentation, and fragmentation of today’s English online resources. Likewise, because of the disorganized English teaching resources on the Internet, teachers spend a lot of effort to collect various teaching resources and teaching materials, but the online English curriculum resource base is superficially rich in content, but in reality, it is superficial. A more serious problem is that the current English online resources are not serialized enough, and the logical framework of the online curriculum resources is ambiguous, lacking in innovation and personalization, which in turn makes it difficult to provide teachers and students with more effective independent learning resources [13].

- (3) Underutilization of course resources

As mentioned above, English online resources on the Internet today are actually quite colorful, but a big problem is that they are only “diverse” and do not form a “series” [14], i.e., the wide range of English online. The lack of categorization of online teaching resources on the Internet makes it impossible for teachers to find what they want when they use them to design corresponding teaching contents. Teachers are exhausted after spending a lot of manpower and resources on collecting teaching resources, so a phenomenon has emerged that many university teachers copy the PPT or other teaching resources from the Internet. This kind of teaching design not only is unhelpful to students’ learning but also highlights the shortcomings of insufficient utilization of English course resources and the

difficulty for both teachers and students to find effective independent learning resources on relevant resource platforms.

3. Materials and Methods

3.1. Overview of Data Mining. Data mining, called DATA Mining, abbreviated as DM, represents the process of extracting knowledge and information with value factors, or with certain laws and unknowns, from a large amount of unordered, incomplete, fuzzy, and random data containing noise and other disturbing signals [15]. The emergence of data mining technology is the inevitable choice of history, because today, a large number of decision analysis requires the support of data analysis and the objectivity of data mining has a significant role in decision analysis. In this paper, firstly, data mining provides technical support for the development and utilization of English online course resources, and secondly, the vast amount of English online course resources presents a cluttered nature that is ideal for data analysis to uncover valuable and meaningful potential online English resources that teachers and students need, so that users can get the resources they want and reduce the amount of irrelevant content. Appearance is the original purpose and meaning of this paper's implementation.

Data mining is a multidisciplinary aggregation in which data mining techniques include or all include the implementation of database systems, machine learning, statistics, and a variety of algorithms and data visualization. The basic process of data mining can be shown in Figure 1 [16].

As can be seen from Figure 1, the basic process of data mining can be composed of five steps, which include specifying the objectives, data collection or determining the database to be used, data preprocessing, constructing a model, and evaluating the model or predicting the relevant results. Among them, building a model is the core of the whole data mining analysis process, mainly through the data mining algorithm or optimization of the algorithm to obtain the relevant training model, so as to use visual means to output the accuracy or prediction results.

The first is to clarify the goal, as the name implies, to clarify the goal is to carry out data mining people in the implementation of the act of data mining to know clearly what kind of results they want to get, that is, through data mining technology to solve what kind of problems. In this paper, the clear goal is to find the English online course resources with potential value or direct meaning for different users, i.e., to achieve personalized recommendations for different users and then to achieve the effective development and utilization of English online course resources. It is clear from this that the problem to be solved in this paper is how to achieve effective use and development of English online resources.

The next step is data collection. After the previous step, the paper has got a clear objective and the problem that needs to be solved, and the next step is the indispensable step of data collection. Data collection is a very important process, and the result of data collection is likely to have a direct impact on the output, which determines the smoothness of the subsequent work of the thesis. One of the

techniques regarding data collection is often implemented using crawler technology, and the results of data collection will be presented in this paper in Section 4, experimental simulation.

The third step is data preprocessing. Data preprocessing can also be understood as data cleaning; in this process, the main "cleaning" is the data outliers, missing values, etc. The purpose of the preprocessing is to ensure that the relevant data must meet the input requirements and "clean." If the data is not preprocessed, it will greatly affect the accuracy of the final output or prediction results. The quality of data preprocessing also affects the accuracy of the final results. The cleanliness of the data preprocessing or data cleaning can usually be influenced by the following aspects.

- (1) Outliers: outliers generally refer to observations that are far from normal samples. For example, in the k -neighborhood algorithm, after the initial k -value and the correlation distance threshold are determined, some points will be far beyond the set threshold, and such data sample points are supposed to be eliminated. If these data samples are not rejected, the existence of outliers will directly affect the accuracy of model evaluation
- (2) Missing values: missing values are usually generated during the data collection process, usually due to technical aspects or personal privacy factors that prevent certain data samples from being observed or collected, thus resulting in missing data samples. The presence of missing values may lead to errors in model evaluation
- (3) Different magnitudes: nowadays, most research data are generally collected in two ways: one is to download relevant datasets directly from the Internet, and the other is to use crawling techniques. The raw data collected by crawling techniques have more or less different outlines before they are processed. Therefore, it is necessary to unify the collected raw data by the method of data standardization to unify the data with dimensional differences, such as the CTC alignment method to unify the speech text information in the research of speech recognition projects, and then get the uniform dimensional language text input
- (4) Complexity of dimensionality: for large-sample datasets, the collected data often contain thousands of data vectors, and if the neural network is used to train the data samples directly, the high-dimensional data vectors will cause the model training to be slow or even nonconvergent, which not only affects the model running efficiency but also greatly increases the complexity of the model. This not only affects the efficiency of the model but also greatly increases the complexity of the model. For example, in convolutional neural networks, researchers put the high-dimensional feature vectors obtained from the convolutional layer into the pooling layer for dimensionality reduction and then use the softmax layer to output the model training results or test results

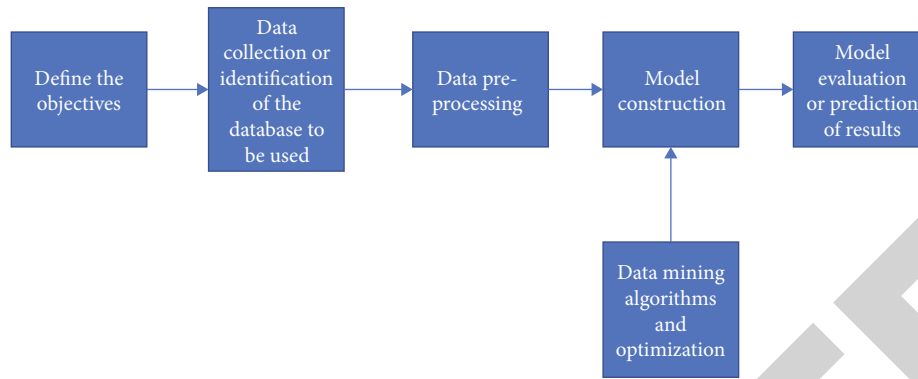


FIGURE 1: The basic process of data mining.

The fourth step is to build the model. Building the model is the most important and core part of the whole data mining. Before building the model, the first thing you need to consider as a researcher is what kind of model to use for building. In data mining model, modeling generally has traditional machine learning algorithms and neural network-based methods for modeling. Among the traditional machine learning algorithm-based modeling approaches are generally classification models and regression models, with classification models generally referring to logistic regression, k -nearest neighbor classification algorithms, decision trees, etc. and regression models generally referring to linear regression, ridge regression (essentially a modified least squares method), and support vector regression [17].

Meanwhile, the “dimensional complexity” mentioned above requires the establishment of corresponding feature engineering in classical machine learning algorithms, which is generally complex [18] and requires a lot of resources to build, but deep learning does not need to establish such an engineering but only needs to pass the processed input data. It is only necessary to pass the processed input data directly to the neural network, and then, the processed feature vector can be downscaled using operations such as pooling to output the obtained results using fully connected layers [19].

In summary, the research goal of this paper is to develop and utilize the massive, disordered, fuzzy, and random online English course resources, and data mining techniques can achieve this goal. The basic process of data mining can be divided into five steps, of which building a model and selecting a model are the most important part, and the selection and optimization of the algorithm in building the model occupy more than 80% of the whole data mining work. The final choice is to use deep learning algorithms to build a training model for English online course resources and fuzzify the resources by creating affiliation rules and other steps to achieve personalized recommendations for users and finally achieve the development and utilization of English online course resources.

3.2. Data Mining and Neural Network Relationship Identification. In the previous section, we discussed the development and utilization of English online resources using data mining technology and sorted out the 5 major

steps of data mining technology, so as to obtain the model construction scheme that will realize the effective utilization and development of English online course resources based on fuzzy neural network. The theoretical basis is provided.

From the definition of data mining, it can be said that data mining is a classification problem, and neural network can be considered as a form of data mining implementation. Neural network (NN) is known as artificial neural network, abbreviated as ANN in English, and the methodological view is that it is a mathematical computation and operation model that mimics the functions and results of biological neural network. And the modern neural network model or system is a nonlinear statistical tool for modeling datasets and is widely used for modeling complex input and output relationships, or essentially, an ANN is a model used to explore data [20].

In this paper, the huge amount of English online course resources is itself a very large dataset or sample set, which is stored in various places on the web, and in order to get the relevant dataset will be crawled and centralized using crawler techniques on the web. However, the goal of this paper is not to get these data, but to process and train these data and finally to mine the data that has potential value to students or teachers, and this process of “processing and training the data” is the basic process of data mining. “Training” can be considered as the process of invoking neural network algorithms, which is included in the data mining process, and the final output will be visualized through the training method of neural network model to output the corresponding accuracy and model prediction results, etc. These visualization results are the criteria for measuring the quality of the whole data mining process.

3.3. Fuzzy Neural Network. Since English online course resources are disordered and fuzzy, they need to be logically inferred through certain affiliation rules before they can be applied to the neural network and trained by the neural network model. This logical inference process can be understood as interest metrics in this paper and then the process of personalized recommendation for different users. In contrast, fuzzy neural networks are based on artificial neural networks and fuzzy control theory as the core. At first, they were only applied to the problem of poor accuracy in expert

systems and were finally formed by establishing fuzzy rules to achieve logical reasoning between fuzzy conclusions and conditional attributes and combining them with the adaptive learning approach of artificial neural networks. As the research progresses, fuzzy neural networks have gradually started to develop into the field of data mining from the initial problem of poor accuracy of expert systems.

Before describing fuzzy neural networks, it is important to understand fuzzy theory. Fuzzy theory is first of all “fuzzy,” “fuzzy” refers to a certain degree of cognitive fuzziness of a concept or definition, and to reason by fuzzy inference requires fuzzy sets. Fuzzy theory was proposed by American scholar L.A. Zadeh in 1965. Its theoretical meaning is that there is a fuzzy set, which is the actual data situation, and then, it is artificially divided into different sets, and then, the expression of the affiliation function is determined according to the research experience of experts, and finally, the affiliation function is used to calculate the affiliation degree of each data set, so as to achieve the purpose of classifying the data. Finally, the data with high similarity are grouped into one set according to the affiliation degree.

The more important concepts in fuzzy theory are affiliation function and degree of affiliation and fuzzy operations. Figure 2 shows the five steps of fuzzy inference.

Next, in the whole process of fuzzy reasoning, the first thing to understand is what is the basic idea of fuzzy control? Why fuzzy control theory is combined with neural networks in this paper and why it is decided to use fuzzy neural network model for English online course resource development and utilization?

In fuzzy control, the most important and core idea is to achieve human experience control through the use of computers, which can be understood as a higher level of mathematical operations; artificial neural networks are essentially a mathematical model applied to bionic research, which is mainly applied to the structure of neural prominence connections similar to the human brain to process information. For English online course resources, the presentation of many of them is fuzzy, uncertain, and difficult to measure with mathematical accuracy, but the personalized recommendation of the resource to the users or the demanders requires a certain degree of accuracy. At the same time, for the generalization of the content of the English online course resources and the accuracy of the recommended content, we can consider the expert experience to make artificial rules for the data source to interfere with the personalized recommendation results, and the fuzzy dataset can eventually be trained through the artificial neural network model to produce a more satisfactory result; of course, the accuracy of this result is inseparable from the design of the whole fuzzy neural network model. In order to better design this model, the next part of this paper will describe the basic types of fuzzy neural networks.

The basic types of fuzzy neural networks can be broadly classified into five types, which are distinguished by the combination of the two.

The first is the network type. “Network” means neural network, which means the introduction of neural network into the fuzzy inference system, and then, the learning and

control of fuzzy rules are realized by neural network, and finally, the model has the ability of adaptive learning.

The next is the tandem type. This model ensures that the advantages of both algorithms can be exploited simultaneously.

The third type is the parallel type. This model has a high accuracy rate in data processing.

The fourth type is the nondirectly connected type. This model indicates that each independent part is responsible for its own work, and the two parts are not substantially related. This model does not essentially integrate fuzzy control with neural networks, which ultimately leads to results that are more biased and less accurate.

The fifth type is the equivalence type. The equivalence type indicates that all neurons are equivalent to fuzzy neurons and all neuron nodes possess fuzziness, and this model is more widely used in the field of fault detection.

4. Results and Discussion

4.1. Process Analysis of Algorithm Implementation. Through the discussion in the above sections, it can be obtained that a fuzzy neural network is essentially a combination of a fuzzy inference system and a neural network, of which there are now five ways of combining the two in the study. In this paper, in order to better develop and utilize English online resources effectively, as well as to improve the accuracy of personalized recommendations to users and increase the user’s experience when using the English online course resource system, the basic model used is network-based; i.e., a neural network is incorporated into the fuzzy inference system, and the determination and control of fuzzy rules is achieved by using the adaptive learning ability of the neural network. In this process, the important features of the fuzzy inference system are retained while highlighting the powerful algorithmic capabilities of neural networks in data mining processing. The fuzzy neural network model is used to learn and train the obtained dataset while the corresponding affiliation function is determined and error adjusted using the relevant algorithms of neural networks. This network type of fuzzy neural network not only enables the overall network to have learning and adaptive capabilities but also ensures the learning efficiency and accuracy of the final output results of the neural network system while playing the inference advantages of the fuzzy inference system.

Among them, the basic network structure of the fuzzy neural network model system used in this research corresponds to the fuzzy inference system as follows, as shown in Figure 3.

In Figure 3, the first layer is the input layer, which corresponds to the one-to-one correspondence of the exact values of the samples. The third layer can also be called the “with” layer; the number of nodes in this layer is the number of fuzzy rules, such as the second layer of $\times 1$ m nodes and $\times 2$ n nodes of each node to take a node only with each node of the layer, together with the composition of $m * n$. This layer is mainly used to develop rules in the fuzzy neural network model; the fourth layer can also be called the “or layer,” in which the fuzziness of the output variable is divided,

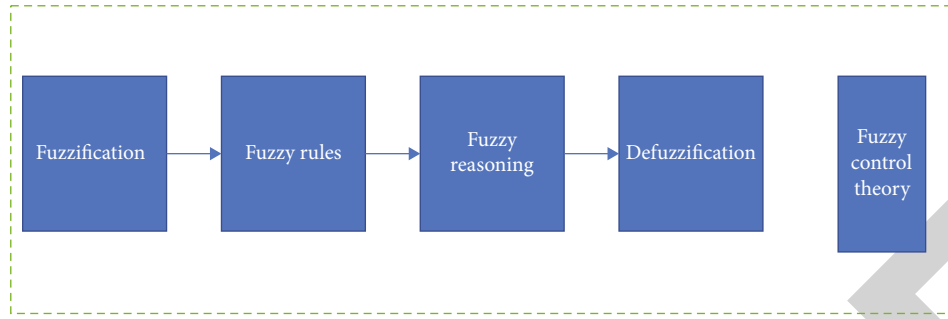


FIGURE 2: The basic process of fuzzy inference.

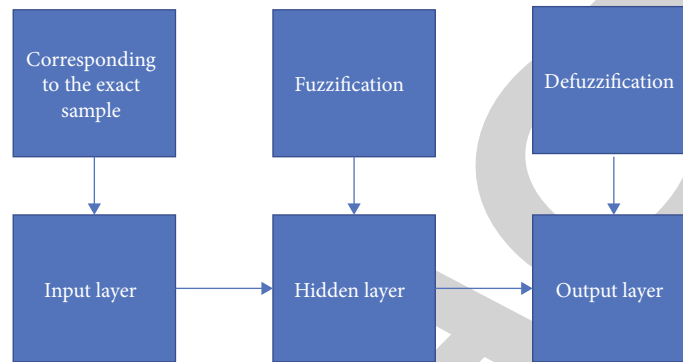


FIGURE 3: Correspondence between the basic network structure of the fuzzy neural network and the fuzzy inference system.

where the number of nodes in the layer is the number of output variable fuzziness q . The fifth layer is the defuzzification layer, in which the number of nodes indicates the number of output variables, and the physical meaning is to convert the fuzzified values to the exact values of the output variables. It is important to note that the third, fourth, and fifth layers are fully interconnected in the form of the affiliation function parameters in layer 2 and the weights in layers 3, 4, and 4 and 5 are adjusted with the training model.

The fundamental difference between neural networks and fuzzy neural networks is that each layer of fuzzy neural networks has a certain physical meaning and is a combination of logical reasoning, expert experience and knowledge, linguistic computation, and linear dynamics with the ability to learn, reason, identify, associate, adapt, etc. More importantly, the key to the fuzzy neural network model is the optimization of the weight coefficients. The optimization of weight coefficients is linked to the learning algorithm of the neural network, and the following learning algorithms are available in the fuzzy neural network model, as shown in Table 1.

In this paper, the basic idea of building an English online course resource development and utilization system is to obtain relevant English online resources by using crawler technology, thus forming a dataset of about 1500 items, extracting 1200 items from this dataset as a training set and 300 items as a test set of data samples, and training and calibrating the processed training and test sets by designing a fuzzy neural network model. Therefore, in order to achieve better data mining results and maximize the

development and utilization of English online course resources, the corresponding learning objective of this paper is obviously the structured learning approach of Figure 1, and through comprehensive consideration, this paper finally chooses to use the gradient descent algorithm to achieve the training and data mining of the fuzzy neural network model.

In this paper, the algorithm flow for the development and utilization of English online course resources based on fuzzy neural network model is as follows, as shown in Figure 4.

In Figure 4, it can be seen that the key of this model lies in the learning algorithm, and the gradient descent algorithm used in this paper mines the data rules of the dataset to realize the personalized recommendation function for users. Among them, the idea of gradient descent method is mainly related to the differential in mathematics, the gradient is the slope of the function in the meaning of mathematics, and the gradient descent corresponds to the movement of the left and right direction of the established differential derivative.

In the gradient descent algorithm, the formula for updating the weights used in this paper is as follows:

$$w_{i+1} = w_i - \alpha * \frac{dL}{dw_i}. \quad (1)$$

In formula (1), w_i is the starting value of the weights, w_{i+1} is the updated value of the weights, α is the learning rate of the algorithm; in this paper, the α starting value is set equal to 0.001 and then adjusted according to the degree of

TABLE 1: Several learning algorithms for fuzzy neural systems.

Learning objective	Specific algorithm	Characteristic
Structure learning	Mainly using clustering methods, extraction of rules from sample data	Subtractive clustering, entropy clustering, self-organizing clustering, incremental learning algorithms (LMS), genetic algorithms, and gradient descent methods
Parameter learning	Learning of parameters, which is essentially an optimization process	BP algorithms, genetic algorithms, rough set theory, particle swarm theory, and chaos theory
Hybrid learning	Parameter learning and structure learning are performed dynamically during the learning process	OLS methods based on fuzzy basis functions, augmented learning methods, hybrid algorithms (e.g., a combination of least squares and BP algorithms)

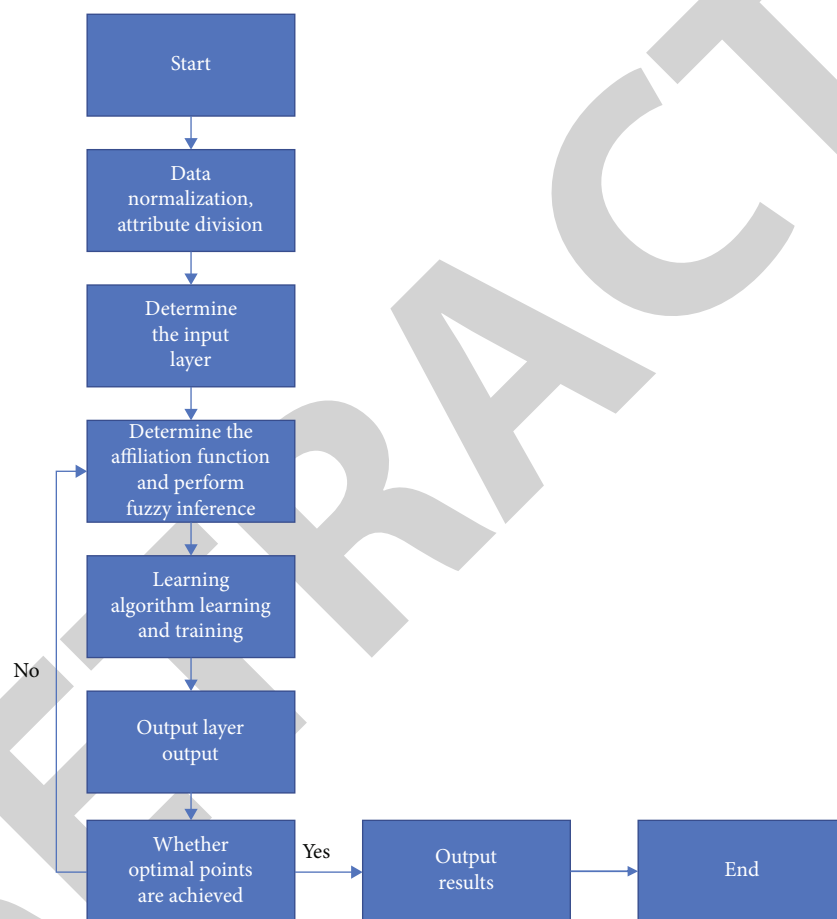


FIGURE 4: Algorithm flow for the development and utilization of English online course resources based on fuzzy neural network model.

convergence of the output loss curve of the system, so as to achieve the purpose of adjusting the direction of gradient descent and then make the whole model to the direction of the global optimum.

Meanwhile, in order to make the performance of the algorithm optimal, the weights obtained from different data samples are averaged in this paper, and this average value will be used as the direction of the weight gradient of the sample as a whole, so the formula can be shown as follows:

$$\bar{w} = \frac{1}{n} \sum_{i=1}^n (w_1 + w_2 + \dots + w_n), \quad (2)$$

where \bar{w} will correspond to the weights in the next w_i iteration process. In order to make the gradient descent algorithm more nonlinear, the bias function is also indispensable in the gradient update of this paper, and the bias b_i function is calculated as follows:

$$b_{i+1} = b_i - \alpha * \frac{dL}{db_i} \quad (3)$$

In this paper, in order to get the best convergence performance, the learning algorithm will keep repeating the above formula in the iterative process until the loss

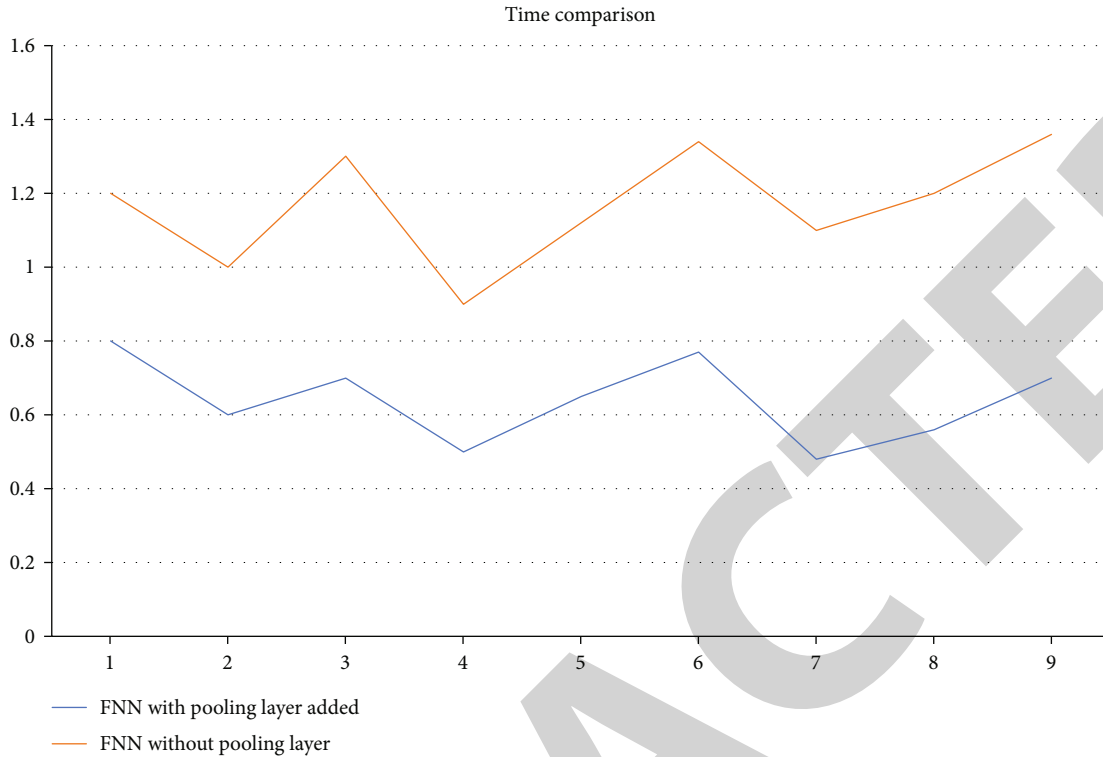


FIGURE 5: Comparison of FNN with a pooling layer and FNN without a pooling layer.

function no longer converges or convergence becomes abnormally slow; then, it means that the model has reached the optimal solution.

4.2. Simulation Results and Analysis. To achieve the goal of developing and utilizing English online course resources, this experiment is conducted using the above algorithm with the accuracy of user personalized recommendation as the evaluation index. The results show that as the dimensionality increases, the number of fuzzy rules in the fuzzy neural network model will also grow exponentially therefore, in order to overcome this shortcoming, this experiment will be implemented through the above process when the pooling layer is introduced to achieve control over the number of nodes and reduce the model training time, where the comparison of training efficiency after adding the pooling layer and without the pooling layer is shown in Figure 5.

It can be seen from Figure 5 that the time efficiency of the fuzzy neural system model in this paper is improved by about 10% during the training process by adding or not adding pooling layers to the model.

The fuzzy neural network constructed in this paper is ultimately a 5-layer structure, in which the first and last layers are the input and output layers, respectively; the fourth layer is the newly added pooling layer; the second layer is the fuzzification and affiliation function layer; the third layer is the fuzzy rule formulation layer; and the fourth pooling layer controls the number of fuzzy rules. The final accuracy comparison curves of the two models tested separately in this paper are shown in the following figure.

As can be seen from Figure 6, this paper compares the accuracy curve changes in two cases, one for the fuzzy neural network without the pooling operation and one for the fuzzy neural network with the pooling operation. In Figure 6, the paper uses the English abbreviation FNN for fuzzy neural network to facilitate the discussion. The accuracy of FNN with pooling operation is almost similar to that of FNN without pooling operation, but overall, the accuracy of FNN with pooling operation is higher than that of the network model without pooling operation, and the network is more robust, as shown in Figure 6.

In order to better test the fuzzy neural network model suitable for the development and utilization of English online course resources, this paper decided to use the FNN after adding the pooling layer operation after the curve comparison mentioned above. However, as can be seen from Section 4.1, this paper will take gradient descent algorithm as the learning algorithm of fuzzy neural network after analysis and discussion, and in the gradient algorithm, in order to better control the gradient descent direction of FNN, two comparisons are made in this paper: one is to adopt only the weight update formula and bias function update formula under formulas (1) and (3), named as method 1; the other is to adopt (1), (2), and (3) formulas of the weight update, weight average, and bias function update formulas, named Law 2, and the final error curves through the FNN model are as follows.

From Figure 7, it can be seen that the accuracy of method 1 is lower compared to that of method 2, and method 2 is much better than method 1 in terms of both the robustness of the network and the degree of accuracy,

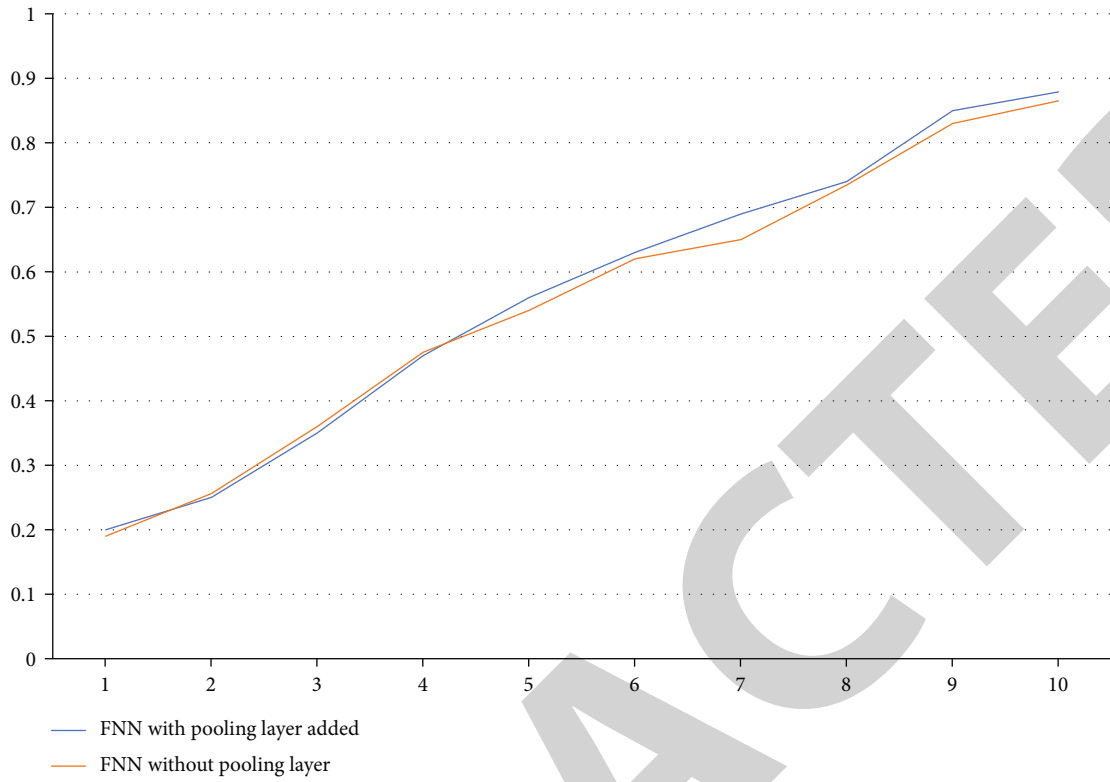


FIGURE 6: ACC curve of fuzzy neural network training.

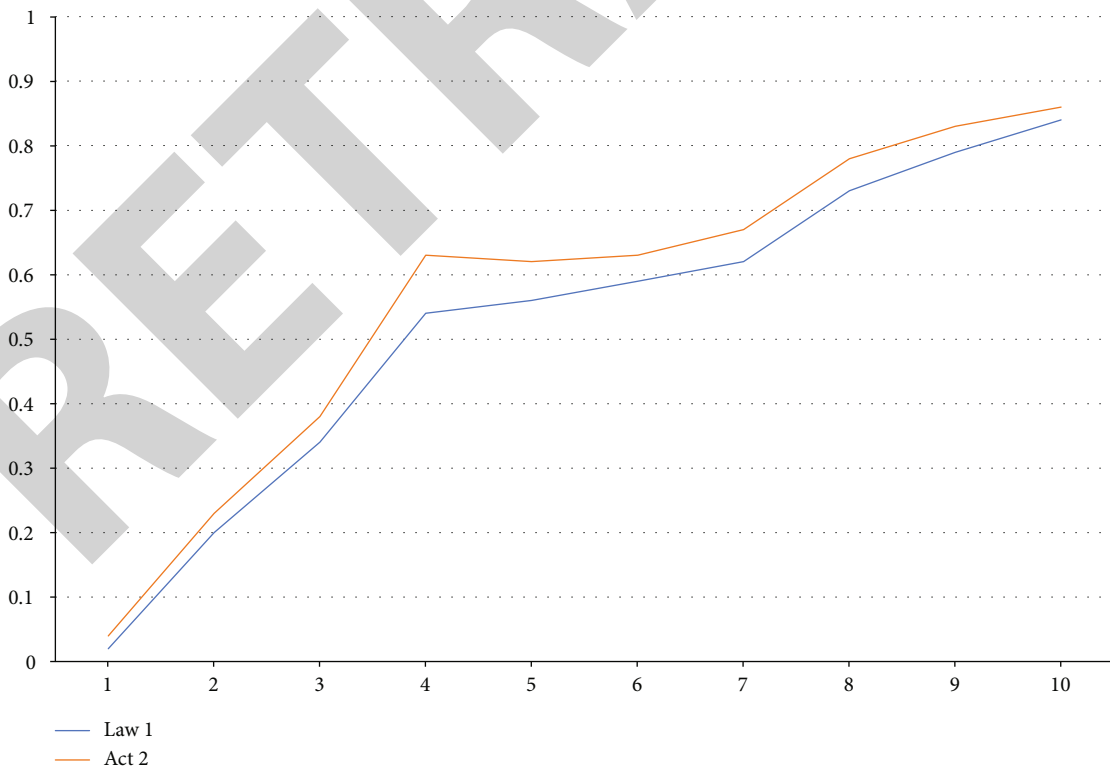


FIGURE 7: Comparison of accuracy curves under different weight calculation methods.

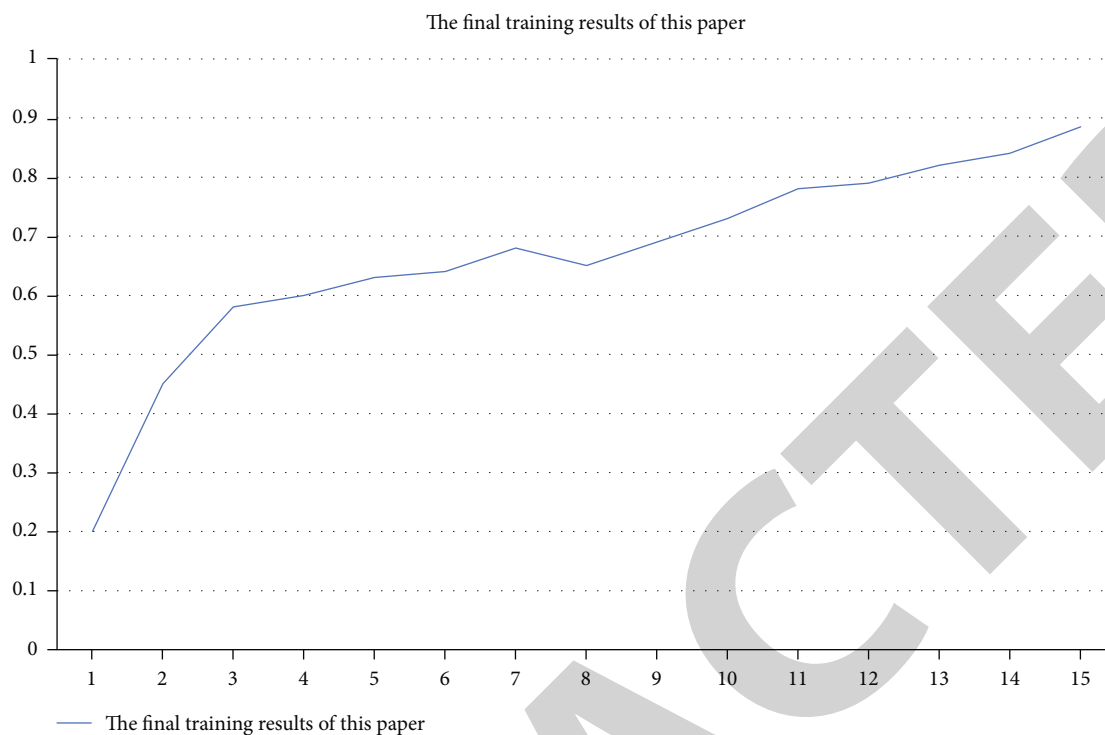


FIGURE 8: The change of ACC curve of FNN training in this paper after method 2 and adding pooling operation.

so this paper will adopt method 2 and introduce the pooling layer for model training. Figure 8 shows the final training results.

From Figure 8, it can be seen that the accuracy of the model in this paper has been improved to some extent after the operation of the above methods and pooling, by about 3%, and the final measured accuracy is around 89%, which shows that the model is effective when applied to the development and utilization of English online resources.

5. Conclusion

Compared with traditional machine learning algorithms, the neural network-based model uses a deep learning framework and model with higher accuracy and stronger performance, where more importantly, the neural network based on the deep learning framework can be more easily adapted to different domains and applications, and the learning method of migration that makes the pretrained deep network applicable to different applications in the same domain can also play a certain role. This migratory learning characteristic can easily extend its application scope; for example, in the development and utilization model of English online course resources to be studied in this paper, it can be transplanted to different disciplines, such as language and geography, based on the words of the deep learning framework, and the transplantation steps only need to change the corresponding dataset to complete.

This paper proposes to apply fuzzy neural networks to the development and utilization of English online course resources, analyzes them through experiments, and finally makes reasonable modifications to the weight formula and

introduces pooling operations, which finally improves the accuracy and robustness of the model training, and experiments prove that the accuracy rate of the development and utilization of English online course resources based on fuzzy neural networks proposed in this paper can reach 89%.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The author declares no conflicts of interest.

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