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Research Article

A Network Learning Model for College Information Education Using Scientific Computing

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The development of network technology has further promoted the informatization of colleges and universities; the network teaching resources have been continuously enriched; the network teaching management has been constantly standardized; and the development of scientific computing technology also occurred. Network learning has become a major learning method and is accepted by more and more people. In order to build an intelligent network learning model, this paper starts from data mining, index data processing, and evaluation system design from the construction of index data as the main line. Based on the analysis of the existing network learning model index system, this paper proposes a boundary change network learning index system and uses data mining technology to mine the student status and student learning activity information recorded in the web page and the background database. In this way, the key factors which can evaluate students' online learning effect are extracted and quantified. Then, based on the basic principles and algorithms of fuzzy logic, artificial neural network, and fuzzy neural system, artificial neural network and adaptive fuzzy neural system are used for network learning modeling, respectively, and the experimental simulation and performance analysis of the two models are carried out. The experimental results show that the test accuracy rates of the two models based on BP neural network and adaptive fuzzy neural network are 68.6% and 91.4%, respectively. The model based on the adaptive fuzzy neural network is better in the field of network learning, is feasible in theory, and has reliable results in practice, and can be used as an intelligent computing model for developing network learning systems. It has a good promotion value and realizes the intelligence and automation of online learning, thereby further improving the online learning platform and promoting the construction and use of online courses.

1. Introduction

With the development of science and technology, online courses and online education have developed rapidly. Now online courses are not the patent of "remote education" students. Online courses have become an important part of college informatization education, and online learning has become an important learning method for college students. Especially in special times, students and teachers do not contact each other, and online teaching has become the most mainstream teaching method. As a learning method, online learning will be paid more attention. It will inevitably promote the reform of information-based education methods and methods in colleges and universities. Online learning will definitely have a greater impact on traditional teaching methods. At present, great achievements have been made in the construction of excellent courses and online courses, but the utilization of these teaching resources is far from satisfactory. The reasons for this situation are multifaceted. The lack of an effective and comprehensive network learning model that pays attention to process monitoring is one of the main reasons that hinder the low utilization rate of network courses. Since many college students are not very motivated to study, if there is no scientific and feasible guiding mechanism, students will develop the study habit of using network resources because students are accustomed to traditional study methods.

On the basis of studying the learning system at home and abroad, especially the network learning system, this paper establishes a network course learning model on the basis of a full investigation of many colleges and universities. In this paper, artificial neural networks (ANNs) and adaptive fuzzy neural networks (ANFIS) are used to establish computational models and conduct experimental simulations. Based on the analysis and comparison of the experimental data, a new network learning model is proposed, that is, the network learning model based on the adaptive nervous system.

In view of the actual demand of network learning, this paper is based on scientific computing theory. Compared with ordinary network teaching, this paper has the following innovations: (1) This paper proposes a new network learning method and a network learning model based on the adaptive fuzzy neural system. At present, ordinary online teaching mostly uses a linear model, that is, a linear combination of indicator weights and indicator scores. The literature search also shows that there is basically no research on the application of ANFIS to network learning at home and abroad. (2) The emergence of the online learning platform makes the teaching management of colleges and universities more and more information-based and manageable. The online teaching platform has a unique function of releasing messages and notifications. Teaching administrators can transmit important information to teachers and students in school in a timely manner, and teachers can also release course-related information in a timely manner. Compared with the traditional teaching mode, the information-based teaching management has obvious advantages in comprehensiveness, systematicness, and timeliness.

2. Related Work

With the development of network technology, more and more people have studied network learning. Among them, Kieslinger's research proposes a qualitative method for discovering microblogging practices and obtaining rich descriptions of a few cases, which can be used in the field of educational informatization [1]. Liu and Chen's research aims at the informatization of college teaching based on the network, which has become an inevitable choice to improve the teaching quality and learning efficiency of colleges and universities [2]. Luo's research pointed out that the combination of universities and network information platforms has enriched the teaching content and management methods of ideological and political education and created a good learning environment for students. Therefore, as a new attempt to promote individual learning and collaborative learning, he provides a highly feasible networked development model for ideological and political education in colleges and universities [3]. The study done by Sokolov points out the importance of information-based education [4]. Liga's research pointed out that the process of digital transformation will affect all areas of society [5]. Alanis introduced the results of using a recurrent neural network training algorithm based on the extended Kalman filter and its application in electricity price forecasting [6]. Safa's study used the ANN model for wheat production. The final ANN model can be well put into use in the wheat production industry [7]. Fei proposed the ANFIS model to improve the stability of the network by adjusting parameters [8]. Shan proposed the multilabel learning model, and integrated the AP clustering algorithm, multilabel backpropagation neural network and regularization in this model, which is an algorithm with fast training speed and strong generalization ability [9].

Inspired by other researchers, ordinary college education methods have been unable to adapt well to this era of developed networks. There is a clear gap between general education and information-based education. For example, statistical education information is too slow and prone to errors. It is impossible to mine teachers or students through data and thus cannot recommend hobbies to users. The general education method relies too much on the instruction link between students and teachers, while the information-based education method realizes the automation of online learning. Although the online learning of college informatization education based on scientific computing has been praised in many neighborhoods, it still has shortcomings. The network learning model of college information education uses data mining to determine users' preferences and recommends and guides users to learn independently. However, there is a problem that users can only use electronic devices to learn, which is tantamount to reducing the social ability of colleges and universities. There are still many college students who like to communicate and discuss with teachers offline, so the organic combination of online learning and offline education is a more reasonable way of college education.

3. Network Learning Model Method of College Information Education Based on Scientific Computing

3.1. Data Mining (DM) Technology. With the vigorous development of computer Internet technology and the automation of enterprise operation processes, a large amount of data is generated, and these data are all terabyte-level big data. These data and the related chain information are very important, and it records various data of the operation of the group enterprise. Faced with such a large amount of data, new data processing tools are needed to explore the operating laws of enterprises and provide valuable information. DM helps to dig out the development trend of the business. The data show the known facts and can also predict the unknown results. In this sense, DM has many benefits and can provide network learning data very well.

DM finds out the relationship that is not easy to see and has a potential value in a large amount of random data and establishes the model of decision support and the process of predicting decision support. In other words, it is the process of mining potential information through algorithms in a large amount of data. Figure 1 shows an overview of DM. According to the DM model, the accuracy rate can be compared [10], and the relationship between the model and the data can be found in a large amount of data using

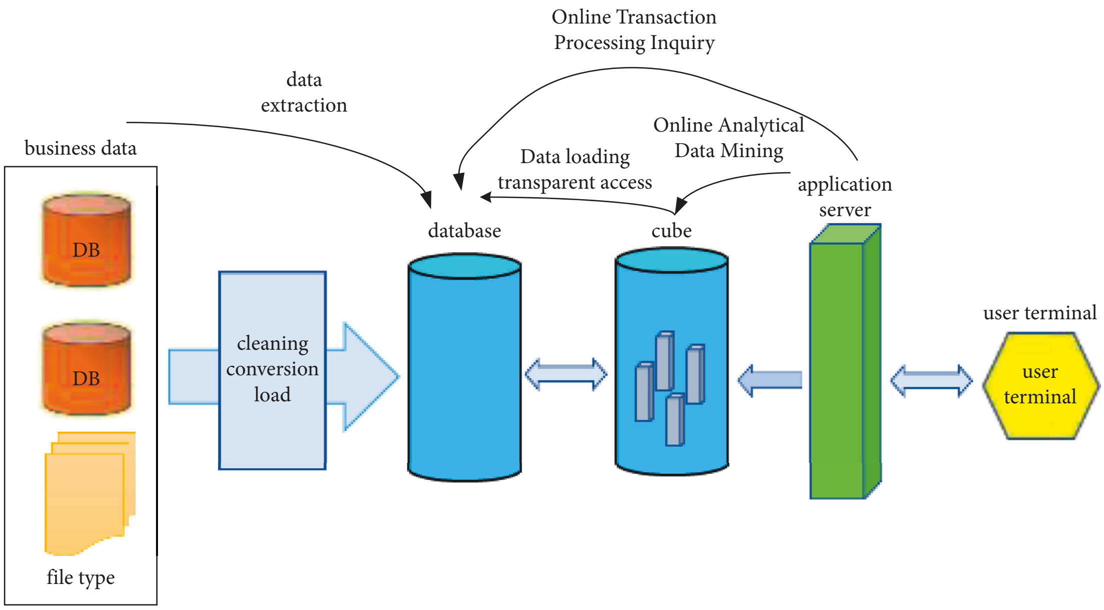

Figure 1: DM overview diagram.

analysis tools, and these relationships can be used to analyze risks and predict unknown results. The application of DM to the network learning of college information education can comprehensively analyze the hidden internal connection between network learning and various factors. For example, through the analysis of the database system related to the online course, it can reveal which factors have an impact on the decision of online learning, which is not possible with the traditional teaching method. In addition, through network mining technology, the resource information accumulated (such as registration information, login information, use of teaching resources, access logs, interactive information, homework completion, hobbies, and learning progress) in the process of users accessing the network can be fully utilized to carry out network teaching. Figure 2 shows the network learning information processing model based on DM.

The network learning information processing process of DM is divided into three parts: data source, data processing, and data result set.

(1) Data source: To carry out the entire network learning process, the source data of network learning must be obtained first, and two parts of network learning data need to be mined. One is the WEB log, which is based on statistical DM. The WEB log records all traces of users' online learning, such as registration information, learning methods, login duration, interactive information, learning duration, and resource click-through rate. Students' learning is closely related to these data, but it cannot directly reflect students' learning situation. Therefore, it is necessary to perform statistical analysis on WEB logs and analyze useful data. There are three types of WEB-based DM methods, namely, WEB structure DM, WEB content DM, and WEB usage DM.In addition to mining the WEB log, it is also necessary to mine the database. The network learning background database records a lot of information. By mining this information of the students, the data in the relevant indicator system can be obtained. The mining method is to mine the DM function in the database management software. Common database management software includes DB2, SqlServer, and Oracle.

(2) Data processing: First, it is necessary to sort out the data in the database, and then select the required and effective data according to the indicator library so as to submit the efficiency of DM. Then solve the ambiguity of the data and clear some dirty data, and then convert the different values in the database into the data code form. For example, for the convenience of processing, the grades "poor," "pass," "moderate," "good," and "excellent" can be converted to 1, 2, 3, 4, and 5, respectively. Finally, through DM methods and technologies, such as neural network and rough set, the data are analyzed and processed to obtain valuable information.

(3) Data result set: Extract useful information, preprocess the information, and finally feed the results back to the relevant personnel.

3.2. ANN Technology. For decades, the subject of neural networks has merged psychology, neurophysiology, mathematics, and computer and information science. A large number of network mechanisms, network models, and algorithm characteristics have been widely used in various fields [11].

3.2.1. Definition of ANN. ANN is improved on the basis of biological neural network. It mainly builds the ANN model by combining the principles of biological neural network

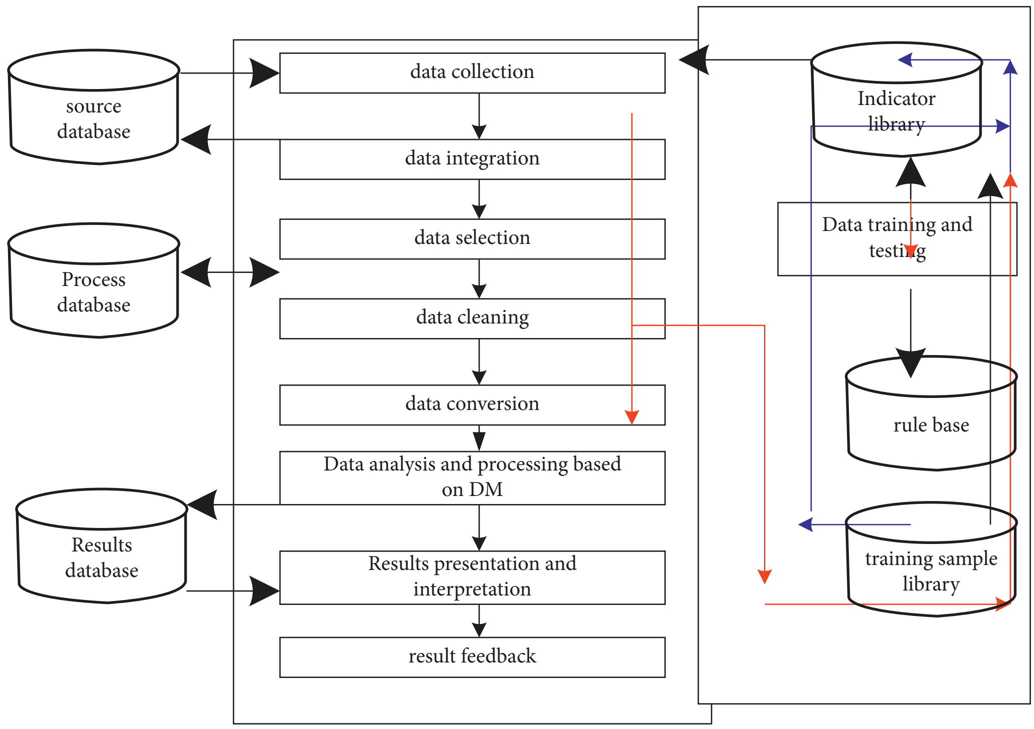

FIGURE 2: Diagram of the network learning information processing model based on DM.

with the needs of practical applications and solves practical problems by designing different neural network learning algorithms, simulating certain behaviors of the human brain and finally implementing them enables handling network learning problems well. Therefore, the biological neural network studies the intelligent mechanism, and the ANN studies how to realize the intelligent mechanism, and the two complement each other.

3.2.2. Artificial Neuron Structure. The ANN actually imitates the physiological structure of the human brain. The artificial neuron is the most basic unit, and the neuron is the most basic unit of processing information [12]. The discovery of neurons has greatly promoted the development of neuroscience. Figure 3 shows the model of artificial neurons. It consists of four parts: the first part is m input data such as $x_1, x_2, \cdots, x_m$; the second part is the weighted sum of the input information, namely, $\sum_{i=1}^{m} \omega_i x_i$; the third part is the activation function $f(\sum_{i=1}^{m} \omega_i x_i - \theta)$; and the fourth part is an output $y = f(\sum_{i=1}^{m} \omega_i x_i - \theta)$. The function $f(x)$ is also called the transfer function; θ is called the bias, and its role is to adjust the network input of the transfer function.

There are three common activation functions:

(1) Binary function (also called step function): The analytical formula of the function is

$$f(x) = \begin{cases} 1, & x \geq x_0, \\ 0, & x < x_0. \end{cases} \tag{1}$$

(2) S function: The analytical formula of the function is

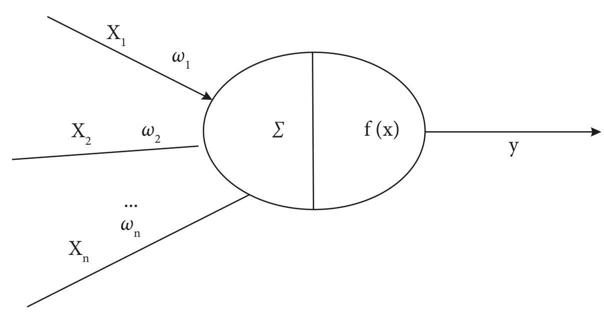

FIGURE 3: Model of the artificial neuron.

$$f(x) = \frac{1}{1 + e^{-x}}. \tag{2}$$

Among them, e represents the natural base.

(3) Hyperbolic function: The analytical formula of the function is

$$f(x) = \frac{1 - e^{-x}}{1 + e^{-x}}. \tag{3}$$

3.2.3. Learning of ANNs. The learning of ANN (also known as neural network training) continuously learns from the environment to acquire new knowledge and improve the performance of the neural network itself through the learned knowledge so that the ANN can meet the target requirements. This is the most important feature of the neural network. Generally, the improvement of the neural network is mainly by adjusting the parameters of the network itself, such as changing the weights and thresholds. [13].

There are three types of neural network training methods:

(1) Supervised learning: This learning method requires a standard limit output from the outside world; that is, there is a set of correct input and output samples. This set of samples is called training samples. The neural network continuously adjusts the parameters to change the error between the actual output and the known output until the error reaches an acceptable range.

(2) Unsupervised learning: This learning method does not have the role of a "supervisor," and the learning system adjusts its own parameters according to the statistical rules of the input data.

(3) Reinforcement learning: This is the combination of the above two methods, and there is no standard answer to the system output externally, but it will give good and bad evaluations, and the learning system is constantly strengthening the actions of the good part to improve its own parameters.

The neural network learning algorithm refers to the adjustment of neural network parameters. Therefore, the learning algorithm determines the computation of the neuron's threshold adjustment. Therefore, different algorithms need to be selected according to the structure of the neural network and the form of the connection between the neural network and the external environment. Different algorithms are aimed at different problems. Common neural network learning algorithms are as follows:

(1) Learning algorithm for error correction: The error correction learning algorithm belongs to the category of supervised learning, and its working principle is to adjust the connection strength of neurons according to whether the output error of the neural network reaches an acceptable range. It has a wide range of applicable scenarios and can be used in the learning process of nonlinear neurons.

Let $y_k(m)$ be the actual output of neuron k at time m when $x_k(m)$ is input and $g_k(m)$ be the known output given by the training sample, then the output error expression formula is

$$e_k(m) = g_k(m) - y_k(m). \tag{4}$$

The purpose of the error correction learning algorithm is to minimize the objective function based on $e_k(n)$ so that the actual output of each output unit in the network structure can be infinitely close to the known output. Therefore, the problem is transformed into the problem of finding the minimum value.

The error function is represented by the mean squared error, which defines the mean of the sum of squared errors as follows:

$$E_m = \frac{1}{2}\sum_k e_k^2(m). \tag{5}$$

When the connection weight of neuron j to i is ij, then the weight adjustment is as follows.

In formula $\Delta\omega_{\mathrm{ij}} = \eta\delta_j v_i$, the learning rate is denoted by η, the partial derivative of the error function with respect to the input of neuron j is denoted by δ, and the output of the ith neuron is denoted by v_i.

(2) Hebb learning algorithm: Scientists attribute it to unsupervised learning according to the conditioned reflex mechanism in biology. The algorithm is basically that when two neurons are activated at the same time, the strength of the connection is increased, and vice versa. The mathematical method is described as follows:

$$\Delta\omega_{kj} = f\left(x_j(m)\right. \tag{6}$$

Among them, $x_j(m)$ and $y_k(m)$ are the states of neurons connected to ω_{kj}, respectively, and η represents the learning rate, and f is the activation function. The function is as follows:

$$\Delta\omega_{kj} = \eta x_j(m)\cdot y_k(m). \tag{7}$$

(3) Stochastic learning algorithm: The error learning algorithm adopts the means of gradient descent, and the disadvantage is that it is easy to achieve the local optimum but the overall deviation while the random learning algorithm can achieve the overall optimization is by introducing unstable factors.

(4) Competitive learning algorithm: The outputs of the neural network compete with each other, and the strongest output will be activated. The mathematical representation of the rules for competitive learning is as follows:

$$\Delta\omega_{ji} = \begin{cases} \eta\left(x_i - \omega_{ji}\right), & j \longrightarrow \text{win}, \\ 0, & j \longrightarrow \text{de feat}. \end{cases} \tag{8}$$

The specific implementation steps of the BP network learning algorithm are as follows.

Network initialization: According to the input and output sequence of the system, it is known that the number of nodes in the input layer of the network is n, the number of nodes in the hidden layer is n_x, the number of nodes in the output layer is m, and specify a random number in the (−1, 1) interval for each v_{ij}, ω_{jk}, b_j, and b_k. Let the error function be $E_p = 1/2(y-)^2 = 1/2\sum_{k=1}^{m}(g_k - yo_k)^2$, in which the learning rate is denoted by η, and the calculation accuracy value is denoted by ε, and the maximum number of learning times is denoted by m.

When the pth input sample is extracted, and its corresponding expected output formula is expressed as follows:

$$g(p) = (g_1(p). \tag{9}$$

Among them, $g_m(p)$ represents the expected value of the p-th sample during the m-th learning.

Calculating the input and output of the hidden layer: Use $di_j\ (p)$ to represent the input of all neurons in the hidden layer, and then it can use $di_j\ (p)$ and the activation function to calculate the output of all neurons in the hidden layer do_j (p), and the formulas are as follows:

$$di_j(p) = \sum_{i=1}^{n} v_{ij}x_i(p) - b_j, \tag{10}$$

$$do_j = f\left(hi_j(p)\right). \tag{11}$$

Among them, $j = 1, 2, \cdots, n_x$.

Calculating the input and output of the output layer: The input of each neuron in the output layer must be calculated, and the output of each neuron in the output layer is calculated using the input of the nerve and the activation function. The mathematical expression is as follows:

$$\begin{aligned} yi_k(p) &= \sum_{i=1}^{n} w_{ik}x_i(p) - b_k, \\ yo_k(p) &= f\left(yi_k(p)\right). \end{aligned} \tag{12}$$

Among them, $k = 1, 2, \cdots, m$.

Calculating the partial derivative of each neuron: Knowing the expected output value and the actual output value of the neural network, the partial derivative of each neuron in the output layer can be calculated. The formula is as follows:

$$\delta_k = (p) = \left(d_k(p) - yo_k(p)\right) \cdot yo_k(p)\left(1 - yo_k(p)\right). \tag{13}$$

Among them, $k = 1, 2, \cdots, m$.

Finding the partial derivative of each neuron in the hidden layer: Knowing the weight of the connection from the hidden layer to each connection, the output layer $\delta_k(p)$ and the output $do_j(p)$ of the hidden layer, and the partial derivative $\delta_j(p)$ of the error function to the neurons in the hidden layer can be obtained. The formula is as follows:

$$\delta_j(p) = \left(\sum_{k=1}^{m} \delta_k(p) w_{jk}\right)\left(do_j(p)\right). \tag{14}$$

Among them, $j = 1, 2, \cdots, m$.

To find the error E, the formula is as follows:

$$E = \frac{1}{2m} \sum_{p=1}^{l} \sum_{k=1}^{m} \left(g_k(p - yo_k(p)^2\right. \tag{15}$$

Among them, l is the total number of samples.

Whether to continue training: When $E < \varepsilon$ or the set maximum number of times m is less than the number of learning times, the training ends. Otherwise, another learning sample will be randomly selected, and process of Equation (9) to Equation (15) will be looped to enter the next round of training.

3.3. Fuzzy Neural Network(FNN) Technology. FNN is a neural network algorithm based on neural network and is characterized by fuzzy theory. It brings together the advantages of neural network and fuzzy theory, and integrates recognition, learning, association, and information processing [14]. Fuzzy reasoning constitutes fuzzy rules according to a set of pre-established fuzzy conditions and uses fuzzy mathematical theory to reason. The fuzzy system uses numerical methods to estimate the nonlinear relationship between the input and the output, stores knowledge with rules, and finally uses the super learning ability of neural network to adjust the parameters in the network. Therefore, the FNN has been widely used. The following is the structure diagram of the FNN, as shown in Figure 4.

At present, the FNN mostly adopts the fuzzy inference model based on Mamdani and the fuzzy inference model based on T-S [15]. This paper uses the ANFIS FNN based on the T-S model, so only the T-S model is introduced below.

Let the input be $X = [x_1, x_2, \cdots, x_n]^T$; among them, x_1, x_2, and x_n are fuzzy linguistic variables. Let the range of the a-th linguistic variable be $\{F_a^1, F_a^2, \cdots, F_a^{ma}\}$, and let the a-th linguistic variable have m_a values. Let $F_a^{s_a}$ be the value of the s_a-th linguistic variable of x_a, which is a fuzzy set of x_a, and its membership is as follows:

$$\mu_{F_a^{s_a}}(x_a).\,(a = 1, 2, \cdots, n; s_a = 1, 2, \cdots, m_a). \tag{16}$$

The fuzzy rule of the T-S model is a linear combination of multiple input factors, so if the output vector is set as $Y = [y_1, y_2, \cdots, y_r]^T$, then the mathematical expression of the fuzzy rule of the T-S model is

$$\begin{cases} y_{1l} = p_{l0}^1 + p_{l1}^1 x_1 + p_{\ln}^1 x_n, \\ \vdots \\ y_{rl} = p_{l0}^r + p_{l1}^r x_1 + p_{\ln}^r x_n. \end{cases} \tag{17}$$

Among them, $l = 1, 2, \cdots, m$ and $m \leq \prod_{a=1}^{n} m_a$.

If the fuzzification of a fuzzy set of values is used when the input vector is used, then for a given input T, the fitness of each rule is the product of each node, and the formula is as follows:

$$\partial_1 = \mu_{F_1^{s_{1l}}}(x_1)\mu_{F_2^{s_{2l}}}(x_2)\cdots\mu_{F_{n1}^{s_{nl}}}(x_n). \tag{18}$$

Among them, $l = 1, 2, \cdots, m$.

The output of the fuzzy system can be calculated by calculating formula (10) as the weighted average of the output of each rule:

$$y_k = \sum_{i=1}^{m} \partial_l y_{kl} \div \sum_{j=1}^{m} \partial_l = \sum_{i=1}^{m} \overline{\partial_1} y_{kll} \quad k = 1, 2, \cdots, r. \tag{19}$$

Among them, $\overline{\partial_1} = \partial_1 \div \sum_{i=1}^{m} \partial_1$.

In the FNN of the T-S model, the system parameters are usually the central value C_{asa} of the membership function of each node in the antecedent network, the width δ_{as_a} $(a = 1, 2, \cdots, n; s_a = 1, 2, \cdots, m_a)$ and the connection weight $p_{lj}^k\,(l = 1, 2, \cdots, m; j = 1, 2, \cdots, n; k = 1, 2, \cdots, r)$ of the consequent network.

The learning algorithms of FNN usually include the least squares method, gradient descent method, and hybrid learning algorithm. Among them, the least

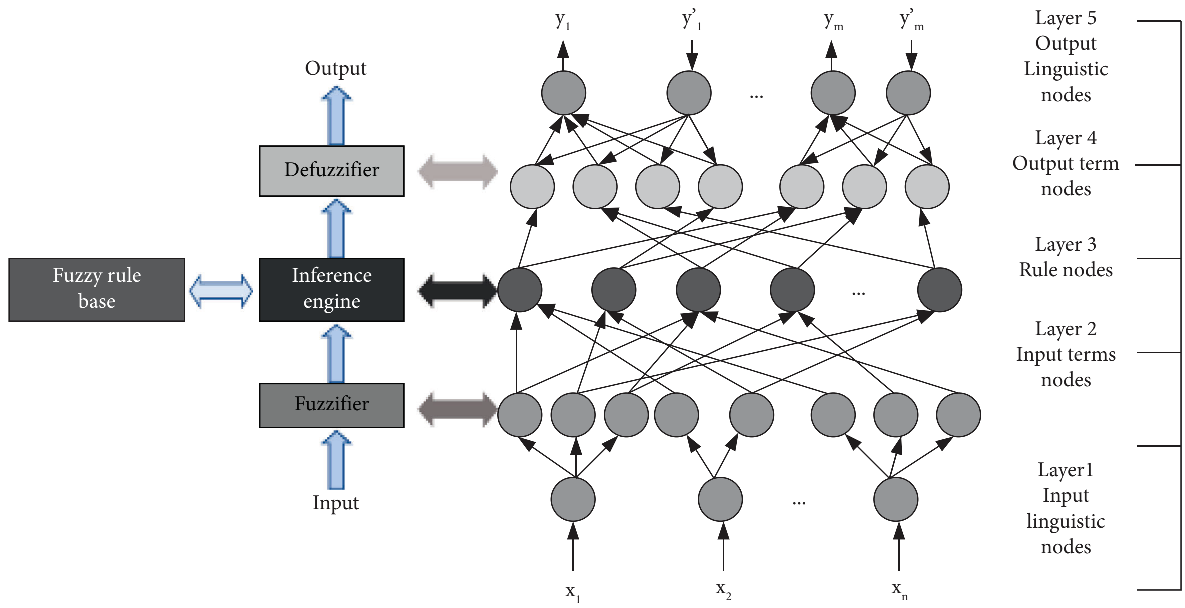

Figure 4: FNN structure diagram.

squares method has a better effect in dealing with nonstatistical errors in the evaluation process [16]. The neural network learning algorithm is very similar to the least squares method in the evaluation process, but the parameters for adjusting the internal structure are different. The main difference is that the FNN adjusts the membership parameter of the antecedent network and the connection weight of the consequent network, but the neural network adjusts the connection weight and bias.

The learning algorithm formula used in this model is

$$p_{lj}^{k}(t+1) = p_{lj}^{k}(t) + \beta\left(y_{dk} - y_{k}\right)x_{j}. \tag{20}$$

Among them, $(l = 1, 2, \cdots, m; j = 1, 2, \cdots, n; k = 1, 2, \cdots, r)$, and y_{dk} and y_k are the expected output and actual output, respectively, and β is the learning rate.

The learning algorithm formulas for C_{as_a} and width δ_{as_a} are

$$\begin{aligned} C_{asa}(k+1) &= C_{as_a}(k) - \beta\frac{\partial E}{\partial C_{as_a}}, \\ \partial_{as_a}(k+1) &= \partial_{as_a}(k) - \beta\frac{\partial E}{\partial C_{as_a}}. \end{aligned} \tag{21}$$

Among them, $l = 1, 2, \cdots, n; s_a = 1, 2, \cdots, m_a$.

4. Network Learning Experiment of College Information Education Based on Neural Network

This experiment is completed on the DM platform by calling the MATLAB algorithm interface for secondary development, and all experiments are completed through simulation experiments [17].

Introduction to MATLAB: MATLAB has a profound impact on scientific computing, image simulation, signal processing, and other fields through the comparative analysis of data. The MATLAB system always includes five parts: MATLAB math function library, development environment, MATLAB language, graphics function, and user program interface (API). The software also provides various toolboxes such as BP neural network toolbox and ANFIS toolbox. [18].

The program design of network learning is based on BP network, and its MATLAB program structure is shown in Figure 5.

The program design is based on the network learning of the adaptive fuzzy neural inference system, and its MATLAB program structure is shown in Figure 6.

4.1. Simulation Samples. The sample data comes from different places, and there must be no human factors in the sample collection; otherwise, the results will be considered as components. The sample collection also appropriately discards the values that are too remote. If the sample value is too biased, it will seriously affect the experimental results, which will make the results more or less high and low, which will weaken the information of the entire sample set [19]. Therefore, when selecting samples, we must discard the sample data with too much deviation. Figure 7 shows the process of constructing a valid sample set.

4.1.1. Acquisition of Samples. In ANNs and adaptive fuzzy neural systems, the selected samples are put into the network learning system for training, and the selection of samples will seriously affect the training results of the network model. Then, the sample selection must take representative and general data [20]. The sample used in this study comes from random 12 experienced basic computer application teachers,

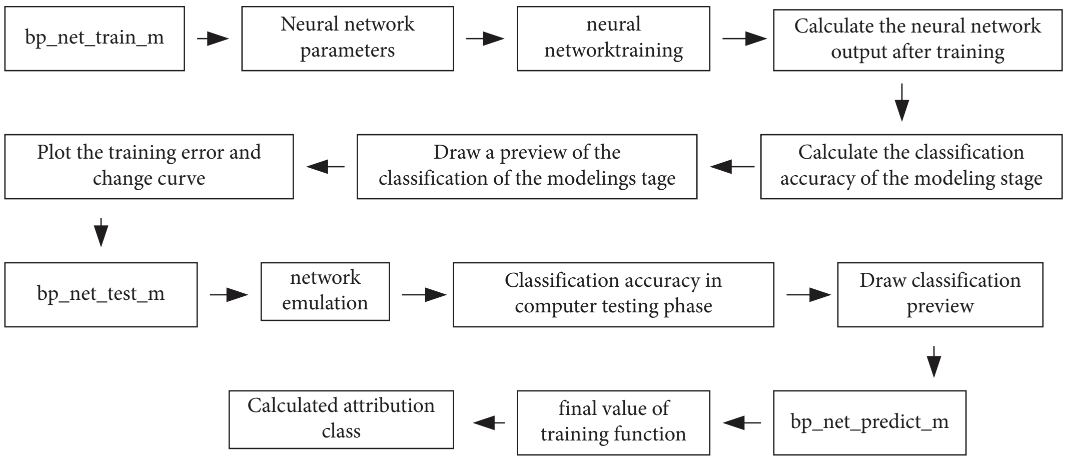

Figure 5: Program design diagram of network learning based on BP network.

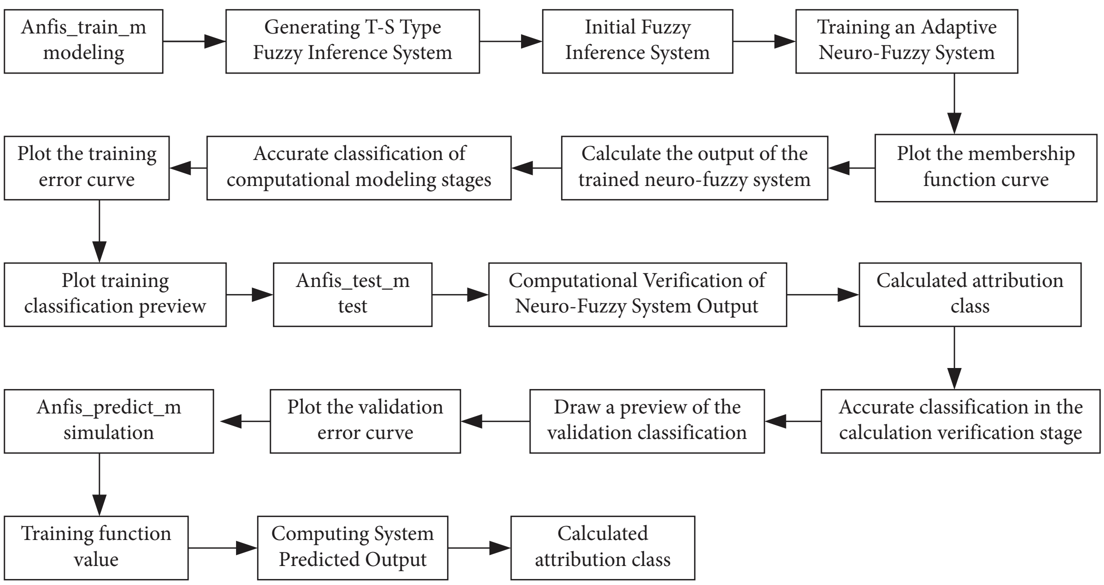

Figure 6: Program design diagram of network learning based on the adaptive fuzzy neural inference system.

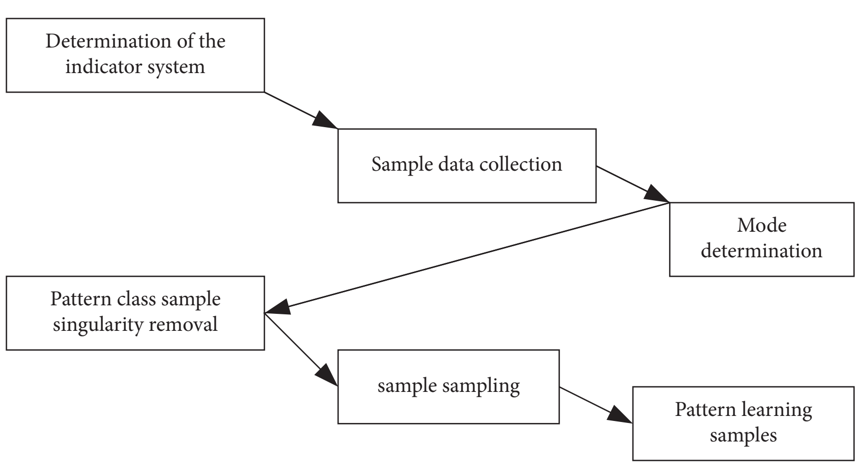

Figure 7: Process diagram for building a valid sample set.

and each group will be evaluated according to the raw data we provide for 300 students' computer application basic course online learning. The evaluation system adopts a five-level system: poor, pass, medium, good, and excellent. The system's processing rules for samples are as follows: the evaluation indicators are converted from poor, pass, medium, good, and excellent to 1, 2, 3, 4, and 5, respectively. The output poor, pass, medium, good, and excellent correspond to five intervals, namely, [0 3], [3 3.5], [3.5 4], [4 4.5], and [4.5 5].

The experiment compared and analyzed 300 experiments, extracted 275 student data as valid samples, and divided these 275 sets of data into two parts: test items and training items [21]. In order to neutralize the ratio between test items and training items, the experiment randomly selects 240 student data as training items, and the remaining 35 groups of student data as test items to test the neural network model generated by training.

4.1.2. Correlation Analysis of Samples. In the network learning index system of college informatization education, there must be some indicators that affect the evaluation results, while some indicators have little impact, or even negligible. In the experiment, those indicators that can be ignored can be appropriately discarded when the data is input so as to achieve the purpose of dimensionality reduction. The purpose of correlation analysis is to make the main feature clear when the main feature value is ambiguous so that the main feature information can also be easily identified by the system, which can greatly improve the identification efficiency of the system. In addition, due to the reduction of the dimension of the input vector, the number of nodes in the network structure will be correspondingly reduced, which will reduce the space complexity of the network and improve the learning efficiency of the network model in disguise. It solves the trouble caused by too many network dimensions [22].

Relevant studies have shown through experiments that the nearest neighbor algorithm can eliminate irrelevant attributes very well. Therefore, this paper uses the nearest neighbor algorithm to judge the degree of correlation between the online learning of college informatization education and the seven evaluation indicators such as online time, homework completion rate, homework average score, and self-assessment average score. The following data were obtained through systematic analysis, and the details are shown in Table 1 and Figure 8.

The data in Figure 8 show the degree of correlation between each evaluation index and the online learning of college informatization, and each index item has a high correlation to the evaluation results. Since this experiment uses two-dimensional output, the dimension is low, so the experiment can choose all the above indicators as the input of the neural network experiment for modeling.

4.1.3. Establishing the Validity Analysis of the Sample. In order to ensure the validity of the sample data used to build the model, it is necessary to use cross-validation to select sample data, especially when the total number of samples is not large enough.

K-fold cross-validation is to divide the data into k equal parts, and each time an experiment is performed, one part is selected as the detection item, and the rest are all training items. Repeating this process k times can just make every piece of data checked once. The accuracy of the experiment is the average of k validations.

This experiment adopts five-fold cross-validation, that is, 275 groups of sample data are divided into five equal parts, each with 55 groups of data, and 220 groups of data are used as training items and 55 groups of data are used as test items. The results of five-fold cross-validation based on BP network and ANFIS are as follows.

The results based on the BP network model are shown in Table 2.

The results based on the ANFIS model are shown in Table 3.

From the experimental data in Tables 2 and 3, the average correct classification rates of five-fold cross-validation based on BP network and ANFIS are 0.782% and 0.833%, respectively. The accuracy rates are relatively high, which proves that the filtered sample data can meet the modeling requirements.

4.2. Data Simulation Experiment of the Network Learning Model Based on BP Neural Network. The data simulation is carried out with the university informatization network learning model based on the BP neural network, and the sample data are uploaded to the test system for the experiment to obtain the following data. The details are shown in Table 4.

It can be seen from the experimental data that the data test accuracy rate of the network learning model based on BP network is only 68.6%.

4.3. Data Simulation Experiment Based on the ANFIS Learning Model. In the same way, the data simulation is carried out with the university informatization network learning model based on the ANFIS, and the sample data are uploaded to the test system for experimentation to obtain the following data, as shown in Figure 9.

It can be seen from the experimental data that the data test accuracy rate of the network learning model based on the ANFIS is 91.4%.

4.4. Comparison of Test Results. Figure 10 shows the comparison results by comparing the accuracy of cross-checking and model testing based on BP network and ANFIS. It can be known that the model based on ANFIS is significantly better than the model based on BP network.

5. Discussion

How to mobilize the enthusiasm of college students to use network resources, to improve the utilization rate of network teaching resources, and to give full play to the role of

Table 1: Sample correlation analysis table.

Number of indicator groups	Indicator name	Relevance
1	Average work time	0.2468
2	Online time	0.2357
3	Homework completion rate	0.2052
4	Self-assessment average	0.1781
5	The number of times the discussion asked the question	0.1041
6	Resource usage time	0.0932
7	Number of times to discuss and reply to questions	0.0789

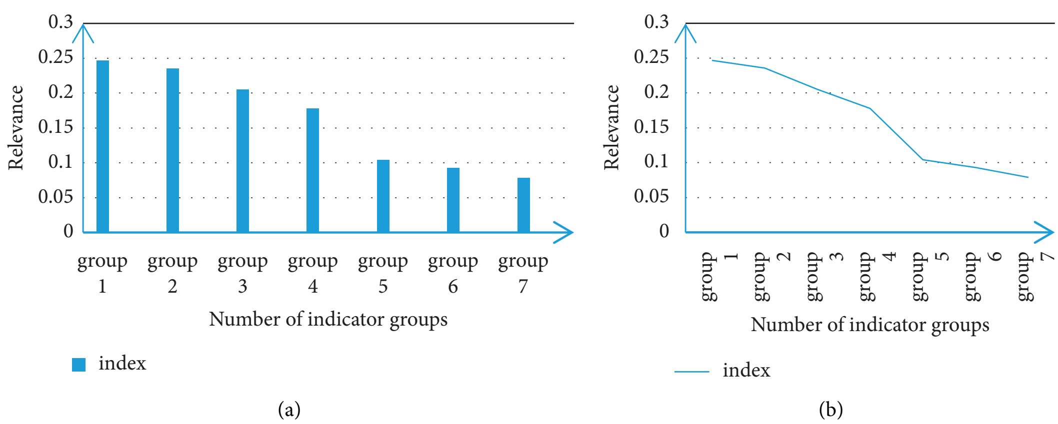

Figure 8: Sample correlation analysis plot.

Table 2: Cross-check result table of BP network.

Category	True positive rate	False positive rate	Accuracy	Feedback rate	ROC area
Difference	0.833	0.012	0.833	0.833	0.991
Middle	0.76	0.149	0.745	0.76	0.869
Pass	0.763	0.075	0.795	0.763	0.913
Good	0.774	0.061	0.787	0.774	0.946
Excellent	0.947	0.012	0.857	0.947	0.997
Average	0.782	0.09	0.782	0.782	0.915

Table 3: Cross-check result table of ANFIS.

Category	True positive rate	False positive rate	Accuracy	Feedback rate	ROC area
Difference	0.722	0.019	0.722	0.722	0.986
Middle	0.845	0.081	0.861	0.845	0.933
Pass	0.84	0.065	0.829	0.84	0.954
Good	0.817	0.047	0.831	0.817	0.965
Excellent	0.895	0.016	0.81	0.895	0.998
Average	0.833	0.061	0.833	0.833	0.954

Table 4: Data test table of network learning model based on BP neural network.

Category	True positive rate	False positive rate	Accuracy	Feedback rate	ROC area
Difference	1	0	1	1	1
Middle	0.8	0.24	0.571	0.8	0.828
Pass	0.7	0.08	0.778	0.7	0.88
Good	0.727	0.125	0.727	0.727	0.924
Excellent	0	0	0	0	1
Average	0.686	0.131	0.643	0.686	0.893

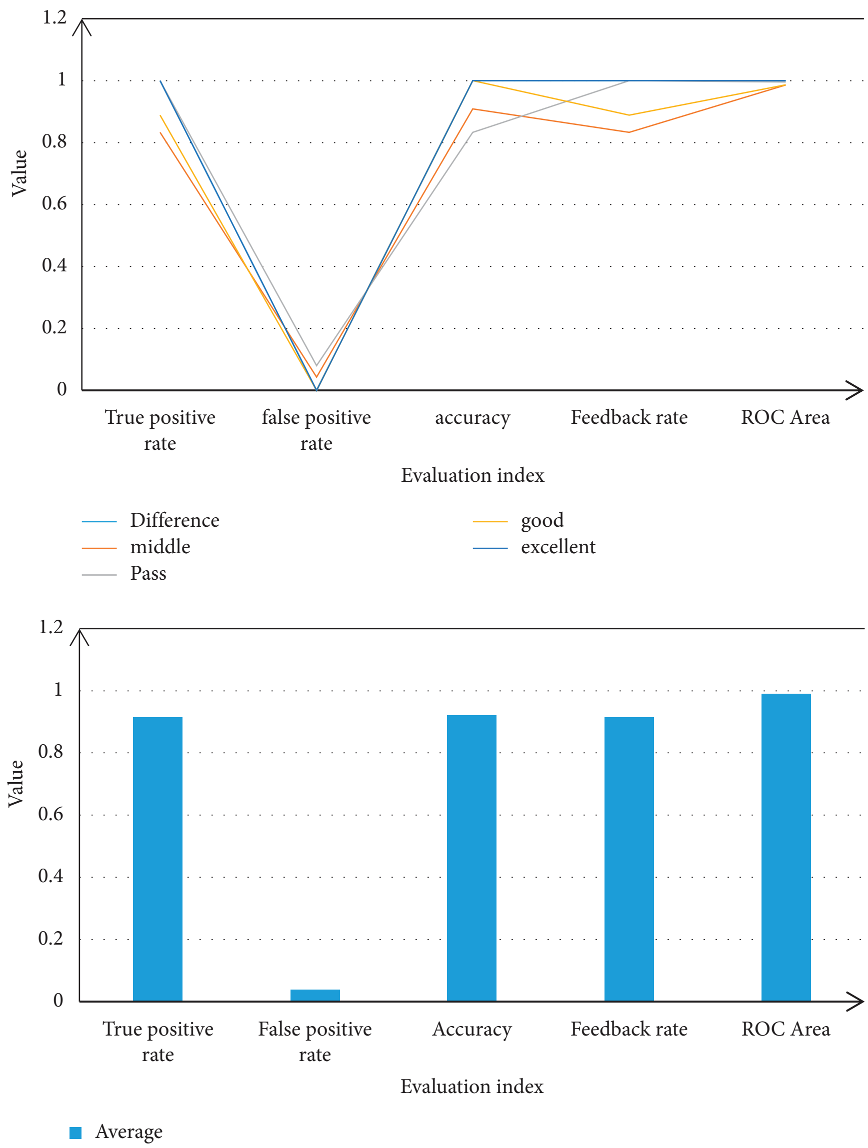

Figure 9: Data test diagram of network learning model based on ANFIS.

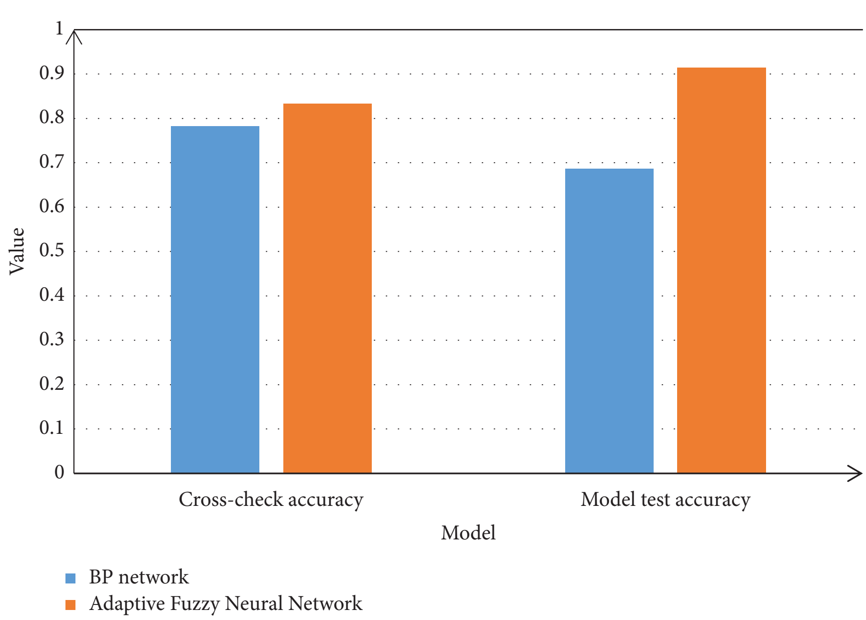

Figure 10: Comparison diagram of two network learning models.

network resources in teaching colleges and universities has become a hot topic in the construction of online courses in recent years. This paper is devoted to the research on the network learning model of college informatization education based on scientific computing. By modeling several algorithms and importing data for testing and use, in order to compare various indicators based on ANNs and ANFIS, it is to be determined which network model can be used to achieve the optimization of the system. In the era of artificial intelligence, people's lives are constantly being impacted by ANNs technology. On the basis of ANNs, it is just around the corner to fully realize the network learning of college informatization education.

6. Conclusions

Using fuzzy logic theory to simulate the logical reasoning process of the human brain and ANNs with the characteristics of learning ability, fuzzy logic theory and ANNs can be organically combined to establish a network learning model based on the adaptive fuzzy neural system. This model has both the advantages of fuzzy logic reasoning system and the advantages of the ANN system. Experiments show that the accuracy of the adaptive fuzzy neural system network learning model is as high as 91.4%, and it can be used as a network learning model for college information education. However, this study still has shortcomings: (1) When faced with a large amount of data input, although the learning model based on the adaptive fuzzy neural system network has a high accuracy, it has an obvious disadvantage; that is, its use accuracy cannot reach 100%. This means that a lot of data will be transmitted incorrectly, resulting in data confusion, which is difficult to accept in the field of university informatization network learning. (2) The contrasting neural network technology used in this paper is not comprehensive enough, and only two technologies, BP neural network and ANFIS, are not enough to be universal. Therefore, improving the accuracy of the system and using more neural network technology is the direction of future development.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest with any financial organizations regarding the material reported in this manuscript.

References

[1] B. Kieslinger, M. Ebner, and H. Wiesenhofer, "Microblogging practices of scientists in E-learning: a qualitative approach," *International Journal of Emerging Technologies in Learning*, vol. 6, no. 4, pp. 31–39, 2011.

[2] Y. Liu and M. Chen, "Research on the improvement of teaching informatization level in colleges and universities based on network," *Agro Food Industry Hi-Tech*, vol. 28, no. 1, pp. 1054–1058, 2017.

[3] P. Luo, "Researches on ASP.NET-based education website development for ideological and political management of colleges and universities," *Revista de la Facultad de Ingenieria*, vol. 32, no. 11, pp. 960–966, 2017.

[4] A. V. Sokolov and A. S. Turgaev, "Bibliologos and library and information education," *Scientific and Technical Libraries*, vol. 12, pp. 15–44, 2021.

[5] L. Marina B and S. Irina A, "A man in the era of digitalization of society," *Humanitarian Vector*, vol. 16, no. 2, pp. 29–38, 2021.

[6] A. Y. Alanis and Y. Alma, "Electricity prices forecasting using artificial neural networks," *IEEE Latin America Transactions*, vol. 16, no. 1, pp. 105–111, 2018.

[7] M. Safa, S. Samarasinghe, and M. Nejat, "Prediction of wheat production using artificial neural networks and investigating indirect factors affecting it: case study in canterbury province, New Zealand," *Journal of Agricultural Science and Technology A*, vol. 17, no. 4, pp. 791–803, 2018.

[8] J. Fei and Z. Feng, "Adaptive super-twisting sliding mode control for micro gyroscope based on double loop fuzzy neural network structure," *International Journal of Machine Learning and Cybernetics*, vol. 12, no. 3, pp. 611–624, 2021.

[9] D. Shan and X. Xu, "Multi-label learning model based on multi-label radial basis function neural network and regularized extreme learning machine," *Pattern Recognition and Artificial Intelligence*, vol. 30, no. 9, pp. 833–840, 2017.

[10] H. Huo, Y. Chang, and Y. Tang, "Analysis of treatment effect of acupuncture on cervical spondylosis and neck pain with the data mining technology under deep learning," *The Journal of Supercomputing*, vol. 78, no. 4, pp. 5547–5564, 2021.

[11] B. Kumi-Boateng and Y. Z. Yao, "Horizontal coordinate transformation using artificial neural network technology-A case study of Ghana geodetic reference network," *Journal of Geomatics*, vol. 11, no. 1, pp. 1–11, 2017.

[12] S. Ladrech, J. Wang, M. Mathieu, J. L. Puel, and M. Lenoir, "High mobility group box 1 (HMGB1): dual functions in the cochlear auditory neurons in response to stress?" *Histochemistry and Cell Biology*, vol. 147, no. 3, pp. 307–316, 2017.

[13] A. R. Khudhair Abbas, "Artificial neural networks in E-learning personalization: a review," *International Journal of Intelligent Information Systems*, vol. 5, no. 6, pp. 104–108, 2016.

[14] K. Waldemar, "The human world of fuzziness, human entropy and general fuzzy systems theory," *Journal of Japan Society for Fuzzy Theory & Systems*, vol. 4, no. 5, pp. 825–841, 2017.

[15] T. Duan and A. Wang, "Fuzzy neural network learning based on hierarchical agglomerative T-S fuzzy inference," *International Journal of Reasoning-based Intelligent Systems*, vol. 10, no. 2, pp. 83–89, 2018.

[16] X. Wang, S. Fang, and X. Zhu, "Weighted least-squares phase unwrapping algorithm based on a non-interfering image of an object," *Applied Optics*, vol. 56, no. 15, p. 4543, 2017.

[17] S. Jadlovská, L. Koska, and M. Kentoš, "MATLAB-Based tools for modelling and control of underactuated mechanical systems," *Transactions on Electrical Engineering*, vol. 6, no. 3, pp. 56–61, 2020.

[18] H. Shi, X. Meng, and Y. You, "Prediction and verification on heating load of ground source heat pump heating system based on BP neural network for plant factory," *Nongye Gongcheng Xuebao/Transactions of the Chinese Society of Agricultural Engineering*, vol. 35, no. 2, pp. 196–202, 2019.

[19] M. J. Cabañero-Martínez, S. García-Sanjuán, S. Escribano, M. Fernandez-Alcantara, J. R. Martinez-Riera, and R. Julia-Sanchis, "Mixed-method study on the satisfaction of a high-fidelity simulation program in a sample of nursing-degree students," *Nurse Education Today*, vol. 100, no. 6, Article ID 104858, 2021.

[20] X. L. Huang and S. H. Choi, "A simulation sample accumulation method for efficient simulation- based policy improvement in markov decision process," *Journal of Korea Multimedia Society*, vol. 23, no. 7, pp. 830–839, 2020.

[21] D. Zhao, "Injuries in college basketball sports based on machine learning from the perspective of the integration of sports and medicine," *Computational Intelligence and Neuroscience*, vol. 2022, pp. 1–11, Article ID 1429042, 2022.

[22] C. Jing, X. Zhao, H. Ren, X. Chen, and N. Gaowa, "An approach to oral English assessment based on intelligent computing model," *Scientific Programming*, vol. 2022, pp. 1–8, Article ID 4663574, 2022.