Development of a Virtual Reality-based Implementation System for Vocational Education Orientation Training Mode using BP Neural Network in the Production and Teaching Combination

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Abstract. Improving the quality of higher education has been the focus of higher education. In universities, classroom teaching is still the main teaching method, and the quality of teaching reflects and determines the quality of university teaching to a certain extent. Professor Since evaluation is a key measure to improve the quality of education and learning, it is especially important to establish a scientific and reasonable model of vocational education guidance.This paper applies the BP Neural Network(BPNN) theory to the evaluation of innovation and entrepreneurship education in colleges and universities. In order to evaluate students' innovation and entrepreneurship ability, the scores corresponding to students' evaluation indexes were taken as input vectors, the number of hidden layer neurons was determined ,and the experimental evaluation results were taken as output vectors.The experimental results show that the BPNN is reasonable and feasible when it is used in the course evaluation of vocational education. The proposed algorithm has a certain accuracy, which is 14.96% higher than the traditional genetic algorithm. This paperintroducesthemodel,configuration, characteristics, training process, algorithm enhancement and limitations of neural network, and introduces genetic algorithm o n this basis. Through the analysis of the principle, basic operation and common ope rators of genetic algorithm, it lays a theoretical foundation for the following content .Keywords: BPNN; Education; Directional cultivation; to integrate the resources of enterprises with vocational schools and universities.

Keywords: BP Neural Network;genetic algorithm;Virtual Reality; vocational education
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1 INTRODUCTION

The aptitude training mode integrating industry and education is a new aptitude training mode combining teaching and industry[3]. When implementing the aptitude training mode of combination of industry and education, we should actively introduce the industrial resources of relevant enterprises based on the advantages and characteristics of each specialty of vocational education, so that the educational resources and industrial resources can be integrated and promoted mutually. In the process of curriculum assessment of vocational education, all elements that may affect students' curriculum effectiveness should be considered[13]. However, there are many elements related to students' curriculum effectiveness, and the degree of influence between each element and the elements is different. Therefore, the results of curriculum assessment are usually difficult to interpret with an accurate and appropriate mathematical analysis, and the traditional classification method is also difficult to accurately deal with this problem. This study proposes the use of VR technology and the BPNN algorithm to create an immersive and dynamic training environment, offering a solution to the complexities associated with curriculum assessment and nonlinear analysis.BPNN, with its nonlinear mapping, self-learning, self-organization and self-adaptive ability, has a good effect on solving the complex and difficult internal mechanism, and can provide a new method for solving the problems of nonlinear classification, pattern recognition, signal processing and so on[18].

In "Internet +"'s opinion, this paper uses Internet to reform the existing gift training model of the Combination of production and Teaching. The neural network is applied to the construction of the vocational education orientation training mode system, using the self-learning and adaptive functions of the neural network, through the supervised learning of the existing historical data, and using the neural network to simulate complex nonlinear changes, thereby Get more accurate prediction results. It can effectively promote industrial transformation and upgrading, enable enterprises to continuously innovate technology. Realize the "combination of learning and training" in aptitude training; coordinate professional construction and production practice, and speed up the enhancement of the quality of aptitude training; optimize aptitude training standards based on enterprise needs, and promote exchanges and cooperation between school-running entities. From the aspects of school-enterprise cooperation to build industrial colleges, strengthening school-enterprise cooperation in personnel training responsibilities, building a school-enterprise cooperation aptitude training community, and establishing a school-enterprise cooperation aptitude training adjustment mechanism, reasonable suggestions for optimizing the school-enterprise cooperation aptitude training model are put forward. Update of course content construction, interest appeals and distribution of interests among various subjects, etc., and put forward relevant solutions according to problems. In the existing literature, most of the research on the combination model of Production and Teaching in the transformation of higher vocational schools and applied undergraduate colleges is carried out. The research on a single element lacks systematic research on the aptitude training model of the combination of Production and Teaching in secondary vocational education[17].

In the process of aptitude training mode innovation, we must grasp its key points, and on this basis, explore the innovative path of vocational education aptitude training mode, that is, deepen the combination of Production and Teaching, enhance the education system, and realize the two-way connection between aptitude training objectives and the requirements of industry and enterprises[6]. Taking the guarantee system of school-enterprise combination as the foundation, taking the teaching staff, curriculum system, practice and training, school group activities and school-enterprise cultural atmosphere as the five major supports, multi-dimensional directional matrix can enhance the professional psychological quality of college students. Arousing the enthusiasm of Chinese enterprises to participate in vocational education is a necessary condition for the curriculum of integrated vocational education, and cultivating the curriculum culture system of integrated vocational education is the guarantee for its sustainable development. When implementing the aptitude training mode of integrating production with education, we should actively introduce the

industrial resources of related enterprises on the basis of the advantages and characteristics of each major of vocational education, so that educational resources and industrial resources can be mutually integrated and promoted. Its innovation lies in:

(1) This paper selects the historical data of vocational education for training and forecasting, and predicts the scale of vocational education by constructing linear network, adaptive network and BP network.

(2) This paper explores the cultural nature and reveals the logic of vocational education curriculum transformation, and explores the general path of contemporary vocational education curriculum transformation-the concrete feasible path under the combination of Production and Teaching.

This paper studies training mode based on BPNN under the combination of Production and Teaching.The configuration is as follows:

The first chapter is the introduction part. This part mainly elaborates the research background and research importance of the implementation system construction of vocational education orientation training mode based on BPNN under the combination of Production and Teaching, and puts forward the research purpose, method and innovation of this paper. The second chapter mainly summarizes the relevant literature, summarizes the advantages and disadvantages, and puts forward the research ideas of this paper. The third chapter is the method part, which focuses on the optimization design method of the orientation training mode combining vocational education and neural network. The fourth chapter is the experimental analysis part. This part is experimentally verified on the dataset to analyze the performance of the model. Chapter five, conclusion and outlook. This part mainly reviews the main content and results of this research, summarizes the research conclusions and points out the direction of further research.

2 RELATED WORK

In terms of the essential properties of the pattern, it is an abstract concept. Through the understanding of real things, people extract the essence from them, and find out the regular way of the operation of things, so as to guide people's future practical activities. Patterns are used in all aspects of daily life, and the field of education is one aspect of pattern application.

Based on biological and psychological evidence, Grossberg proposed several nonlinear dynamical system configurations with novel properties[7]. The network dynamics of the system are modeled by first-order differential equations, and the network configuration is a self-organizing neural implementation of a mode aggregation algorithm. Based on the idea that neurons organize themselves to adjust to various patterns, Cohoun developed his work on self-organizing mapping[5]. Huang Yani believes that according to the degree of enterprise participation in school-enterprise cooperation, it can be divided into the following modes, from shallow to deep: enterprise cooperation mode, school-enterprise joint training mode, school-enterprise entity cooperation mode; at the same time, she pointed out the school-enterprise cooperation mode[10]. a series of problems. Liu Yourong, Xiang Gui'e, and Wang Jiancheng took application-oriented undergraduate universities as an example, and on the basis of analyzing their production-education combination model and its influencing factors, combined with existing research on production-education combination models and industry-university-research cooperation, they concluded four There are various modes, namely the R&D mode of industry-education combination, the co-construction mode of industry-education combination, the project traction mode, and the aptitude training and exchange mode[14]. Chen Minwei understands the combination of Production and Teaching as an organic whole formed by the combination of the education system and the industrial system[3]. Luo Ruzhen believes that the combination of Production and Teaching is a special organizational form different from pure education

and industry[15]. Allan Klingstrom believes that the aptitude training mode of combination of Production and Teaching is a way of educating people, which closely integrates enterprise production and teaching content[2]. JonWhittle and others believe that the rapid and stable development of vocational colleges should meet the following two conditions: one is to comply with the laws and logic of their own development; the other is to comply with the laws of market economic development[12]. Harald Knudsen believes that the quality of the aptitude training model of the combination of Production and Teaching in vocational colleges depends largely on the existence of inseparable connections between relevant stakeholders[8].

On the issue of the relationship between "production" and "education", in the order of aptitude transmission, the relationship between the two is the relationship between import and export, industry is the import unit of technical and technical aptitudes, and vocational education institutions (colleges) are the export units of technical and technical aptitudes, which cooperate and promote each other; The combination of Production and Teaching aims at cultivating technical and technical aptitudes.

3 METHODOLOGY

3.1 Construction of Collaborative Mode of Aptitudes Training For Industry-Education Combination Engineering

The idea of collaborative mode construction is as follows: based on internal appeal and external promotion, the collaborative subject has the idea of collaboration, and then interacts for many times to determine the collaborative goal, and finally achieves the collaborative goal through a series of collaborative measures. The application of the collaborative mode in the industry-education combination project is to clearly show the level of collaborative elements, such as the internal motivation of both sides of industry and education, the external motivation of the third party organization with the government as the core, the formation and implementation process of the project and the final performance feedback, to the relevant subjects, and integrate all the collaborative elements. Therefore, the collaborative mode construction process is to first extract collaborative elements, then sort out the levels between elements, and finally integrate the platform[1]. Based on the synergy theory, specific analysis is made on each stage of the industry-education combination training of engineering aptitudes, so as to form the industry-education combination cooperation mode for engineering aptitudes training, as shown in Figure 1.

The collaborative mode of aptitude training of industry education combination engineering can be divided into four levels: (1) the motivation level composed of dynamic mechanism and incentive mechanism; (2) The action layer composed of formation mechanism and realization mechanism; (3) The constraint layer formed by the constraint mechanism; (4) The feedback mechanism constitutes the result layer. Connect the four levels together to get the overall picture of the operation of the whole collaborative mode. First of all, for the purposes of overlapping but not completely overlapping, universities and enterprises have generated the power to carry out collaborative cooperation. The third-party subject with the government as the core uses policy guidance, financial support, implementation guidance and other means to encourage the Production and Teaching sides and promote the start of the project. Subsequently, based on the preliminary cooperation intention, the two sides jointly agreed on the objectives of the industry education combination project in this cycle, and began to make preparations for the formal implementation of the project; After the two sides basically reach a consensus on the details of collaboration, they officially enter the stage of collaborative education, that is, under the premise of sharing resources and building a platform, they

jointly participate in the design of students' training system, textbook construction, course teaching, practice guidance and daily teaching evaluation[15].

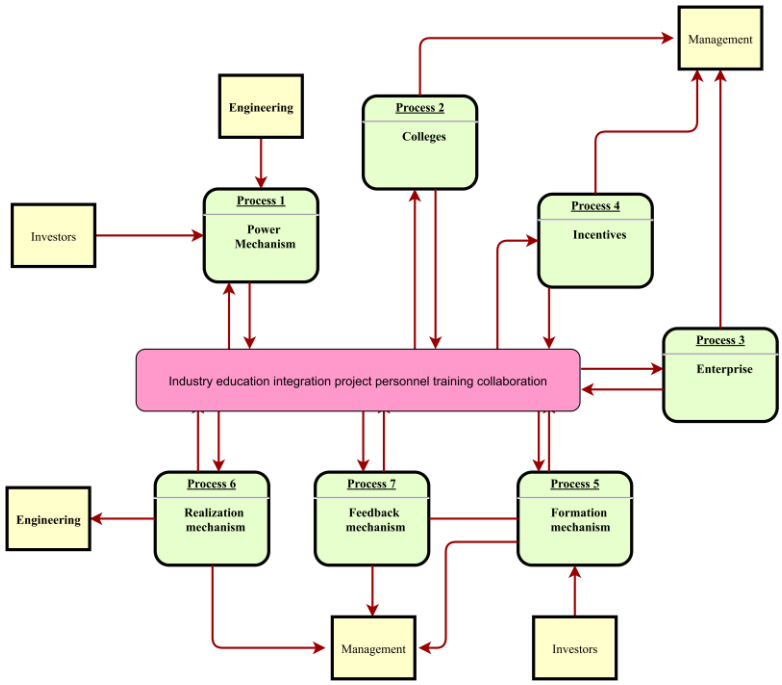

Figure 1: Collaborative mode of aptitude training for Industry Education combination Project.

Finally, the Production and Teaching combination project will produce direct and indirect results in the operation process. The direct results are the engineering aptitudes jointly cultivated by the Production and Teaching sides, while the indirect results include patents, papers and commercial products produced in the project. These results need to be evaluated to form feedback results, which will affect universities, enterprises, governments and other subjects, It will have an impact on the power and incentive mechanism of the industry education combination project in the next cycle, so as to promote the continuous optimization of the collaboration mode, and finally achieve an orderly configuration. The industry education combination has also achieved the best effect in cultivating engineering aptitudes[16].

3.2 Bpnn

Among them, the neurons in the front and rear layers are fully connected, and there is no connection between the same layers[11]. . When the network receives the reference output target, each neuron in the network generates connection weights according to the input response, and then reversely modifies the connection weights from the output layer to the input layer in the direction of reducing the network error, and repeats this process until the network error To meet the training requirements, that is, to complete the network training process. BPNN is currently the most widely used network model and the essence of artificial neural network system. It has the ability to deal with linear inseparability and can simulate nonlinear systems well[20]. In the use of neural network, about 80%~90% of the network uses BPNN or its modified form. Judging from the current situation, BPNN is the most popular among the current neural network technologies. a kind of. This technology

is a network system that completes the propagation process in a single-item way, and has multi-level features and nonlinear mapping features. It can summarize the data function relationship without a priori formula process. The configuration of BPNN is demonstrated in Figure2.

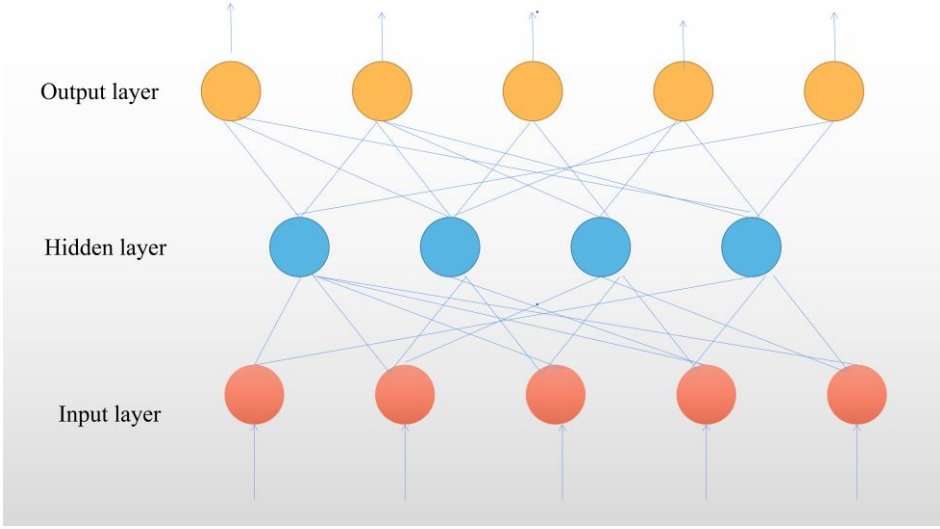

Figure 2: BPNN configuration.

u_i is the output after linear combination of input signals, v_i is the local sensing area of the neuron, x_i is the input signal of the neuron, and w_{ij} is the synaptic strength.

$$u_i = \sum_j w_{ij} x_j \tag{1}$$

After being processed by the output layer unit, an output response is generated. If the error between the output response and the expected output does not meet the requirements, the error will be transmitted back layer by layer along the connection path, and the connection weight and off value of each layer will be modified to reduce the error[9]. After modifying the connection weight and off value, the new connection weight and off value will be used to calculate and process the input mode to generate an output response, which will be compared with the expected output. The error will be calculated repeatedly until the error is less than the given value. In the network, the mathematical relationship between various parts plays a great role. First, the front-end part, also recognized as the input layer, acts on the front-end part through O_k and net_k.

$$O_k = f(net_k) \qquad k = 1,2,.....,m \tag{2}$$

$$net_k = \sum_{j=0}^{m} w_{jk} y_j \qquad k = 1,2,\ldots\ldots,m \tag{3}$$

The second is the middle part, also known as hidden layer, which affects the middle part through y_j and net_j.

$$y_j = f(net_j) \qquad k = 1,2,\ldots\ldots,m \tag{4}$$

$$net_j = \sum_{j=0}^{m} j v_{ij} x_i \qquad k = 1,2,\ldots\ldots,m \tag{5}$$

The unipolar sigmoid function is a category of functions, $f(x)$ can choose the unipolar sigmoid function.

$$f(x) = \frac{1}{1+e^{-x}} \tag{6}$$

Continuous functions generally have continuity and derivability, which makes the function application range wider. then $f(x)$ has this property.

$$f'(x) = f(x)[1 - f(x)] \tag{7}$$

Another category of functions is the bipolar sigmoid function, which also has its own characteristics and has a wide range of applications.

$$f(x) = \frac{1-e^{-x}}{1+e^{-x}} \tag{8}$$

3.3 Enhancement Of Bpnn

BPNN has advantages, but it also has disadvantages.

(1) There is a contradiction between the local minimum value and the global optimal value, so it is difficult to get the global optimal value.

(2) If the training times of neural network are large, the disadvantages are slow convergence speed and low efficiency.

(3) Only on the basis of theoretical guidance can we ensure the scientific accuracy of the prediction results of neural network, especially the determination of the number of hidden layer nodes needs theoretical guidance.

(4) There is a contradiction between learning new samples and forgetting old ones, while neural networks tend to forget old ones.

The BPNN with single hidden layer can basically fit all nonlinear functional relationships. The training error trend of BPNN is shown in Figure

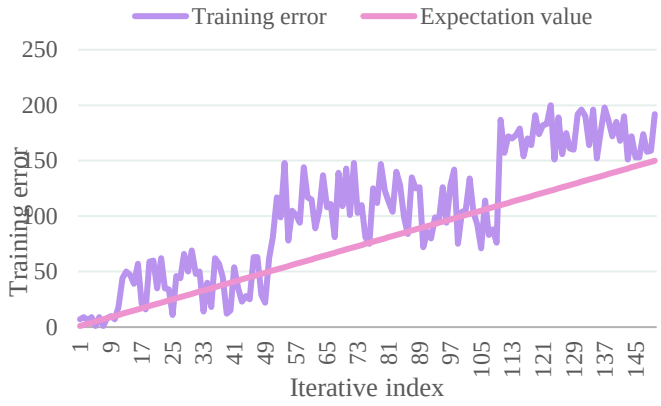

Figure 3: Training error trend of BPNN.

The following enhancement methods are proposed:

Add momentum. The learning rate η is closely related to BPNN algorithm. The larger the η value, the faster the network convergence, but it will cause instability; η value is too small to avoid instability, but the convergence is too slow. So the momentum term is introduced, where α is the momentum term. The momentum term is added to BPNN, which becomes a new BP algorithm.

$$\Delta w_{ij}(n) = \alpha \Delta w_{ij}(n-1) + \eta \delta_j(n) v_i(n) \tag{9}$$

Consider (9) as t time series with a as a variable, t from 0 to η, then

$$\Delta w_{ij}(n) = \eta \sum_{t=0}^{n} a^{n-1} \delta_j(t) v_i(t) \tag{10}$$

(2)Adjust the learning rate. Setting learning rate η, the overall error decreases after changing the weight value, while $\eta = \theta\eta(\theta \le 0)$ changes the learning rate and the weight value in different degrees, which leads to the downward adjustment of the total error, thus indicating that the adjustment of learning rate plays a role.

3.4 Expert System Based on Neural Network

From knowledge representation, reasoning mechanism to control mode, the neural model is essentially different from the logic-based psychological model in the current expert system.

Knowledge is changed from explicit representation to implicit representation[19]. This kind of knowledge is not converted into rules by human processing, but automatically acquired by learning algorithm. The reasoning mechanism changes from the process of retrieval and verification to the competition of hidden patterns on the network for input. This competition is parallel and specific to specific characteristics,. Fig. 4 shows the basic configuration of a neural network expert system. Among them, the automatic acquisition module inputs, organizes and stores learning examples provided by experts, selects the configuration of neural network, and calls the learning algorithm of neural network to achieve knowledge acquisition for the knowledge base. When a new learning example is input, the knowledge acquisition module automatically obtains a new network weight distribution by learning the new example, thus updating the knowledge base[21].

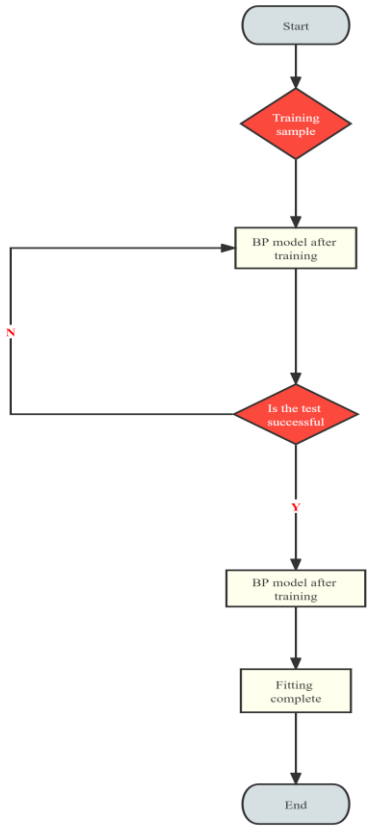

Figure 4: Basic configuration of neural network expert system.

Therefore, several independent expert systems in the same knowledge domain can be combined into a larger neural network expert system. The nodes with the connection relationship can be connected. The combined neural network expert system can provide more learning examples, and can obtain a more reliable and richer knowledge base after learning and training. On the contrary, if several rule-based expert systems are combined into a larger expert system, since the rules in each knowledge base are determined individually, the redundancy and inconsistency of the rules in the combined knowledge base are large; That is, the more rules of each subsystem, the less reliable the combined large system knowledge base. Especially in classification, diagnosis and optimization, expert systems based on neural network and traditional expert systems can show their superior

performance. Development and utilization of broader fields, which are reflected in the following aspects:

(1) At present, the neural network expert system is still stuck in solving some relatively small problems.

(2) The performance of neural network expert system is greatly affected by the training sample set. If the orthogonality and completeness of sample data are not good, the performance of expert system will be reduced.

(3) The present neural network expert system has no explanatory ability. The process and results of the expert system are not transparent to users, which affects users' trust in the expert system.

(4) The present neural network expert system has no inquiry mechanism. When insufficient information is encountered in the calculation process, it does not ask the user for relevant evidence. Some evidence is known to the user, but the user does not know whether they are useful for the expert system to solve, so the quality of the solution result is bound to be affected.

(5) The knowledge representation, input and output of the neural network expert system should be digitized, and the inference should be numerical calculation. It is difficult to digitize some knowledge, evidence and results, which undoubtedly limits the application of expert system based on neural network.

4 RESULT ANALYSIS AND DISCUSSION

4.1 Matrix Laboratory

Matrix Laboratory (MATLAB) has its own neural network toolbox, which mainly aims at the analysis and design of neural network system, and provides a large number of functions, graphical user interfaces and Simulink simulation tools that can be called directly, which can greatly facilitate weight training, reduce the workload of training programs and effectively enhance work efficiency. It is one of the excellent softwares for analysis and design of neural network system, so compared with programs using C language or Fortran language for numerical calculation, MATLAB can save a lot of programming time.

The design process of this experiment is as follows: the quantitative evaluation index scale of classroom teaching quality in colleges and universities is obtained, the sample data is obtained through students' online evaluation, and then the sample data is input and normalized to establish a neural network model. The training of neural network is started and stopped when the error obtained meets the requirements or the training times reach the maximum.The experimental results are shown in Figures 5 and 6. In this chapter, in order to verify the effectiveness of this algorithm, four model performance evaluation indexes are selected for evaluation. They are MSE(Mean squared error) and RMSE(Root mean square error).

Figures 5 and 6 show that the convergence speed of the neural network evaluation model in this paper is effectively enhanced, and the model training time is reduced; the mean square error of the neural network evaluation model in this paper is lower than that of the ordinary BPNN evaluation model, indicating that the neural network evaluation model in this paper The accuracy is higher than that of the common BPNN evaluation model.

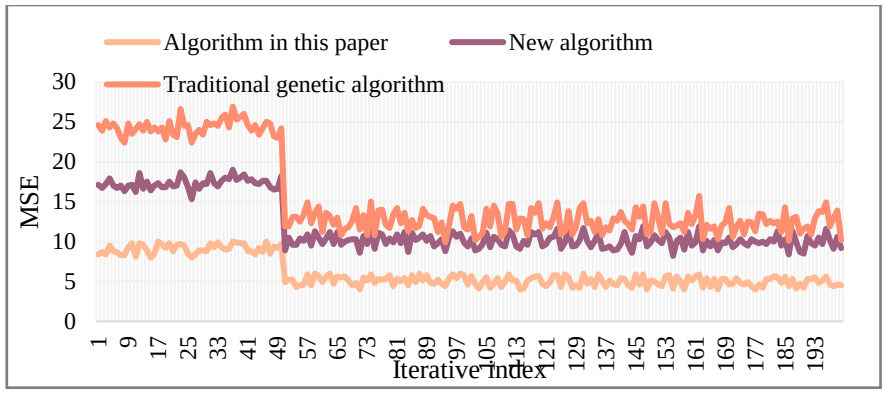

Figure 5: Mean square error experimental results.

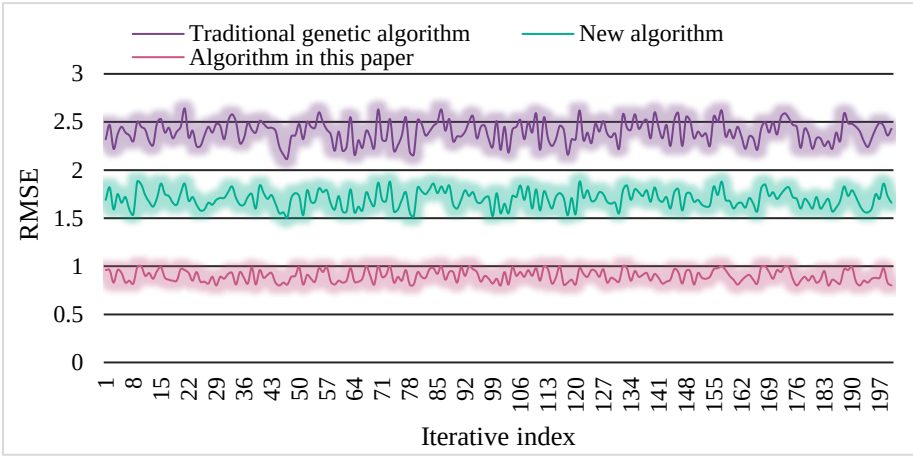

Figure 6: Root mean square error experimental results.

4.2 Curriculum Evaluation Design

The design steps of vocational education course evaluation system are as follows:

(1) Collect targeted sample data according to the vocational education course evaluation index system.

(2) Establish a suitable BPNN model. Including the number of network layers, the number of output layer and input layer.

(3) The normalized data is optimized by genetic algorithm for weight matrix and assigned to BP god .

(4) Set appropriate network training parameters. Including the period of showing intermediate results, network training times.

(5) Training network. Stop training when the training times reach the upper limit or the training accuracy meets the requirements.

(6) The network parameters to minimize the error of the direction of appropriate adjustment, so as to make vocational education curriculum evaluation system more reasonable.

As the collected sample data has different network input differences, the difference between the numbers may be large, resulting in slow network convergence time, long training time, and small data information may be submerged by large data information. Therefore, it is necessary to normalize the original data before network training. This paper adopts the premnMX function mainly used for processing the learning data set, which can effectively map the data. The normalized data can better retain the original meaning of the data, and will not cause the loss of information.

	1	*2*	*3*	*4*	*5*	*6*	*7*
Attendance	*1.00*	*0.65*	*0.15*	*0.23*	*0.58*	*0.89*	*0.75*
Classroom discipline	*0.50*	*0.78*	*0.47*	*0.55*	*0.13*	*0.25*	*0.15*
Operating specifications	*0.15*	*0.16*	*0.66*	*0.17*	*0.62*	*0.16*	*0.95*
Skill mastery	*0.30*	*0.42*	*0.32*	*0.61*	*0.73*	*0.74*	*0.36*
Comprehensive application	*0.69*	*0.12*	*0.19*	*0.88*	*0.58*	*0.32*	*0.14*

Table 1: Results after data normalization.

The simulation process includes: reading the training data and training target data according to the configuration of the neural network model proposed in Table 1, generating the corresponding network model, defining the learning rate, the number of learning times and the accuracy of the predictor, and training the pattern model. After training, the corresponding neural network model is generated, the test data is read, and the predicted value is output through the network calculation. In this paper, the first data of Table 1 is used as training data, and the last five data are used as test data.

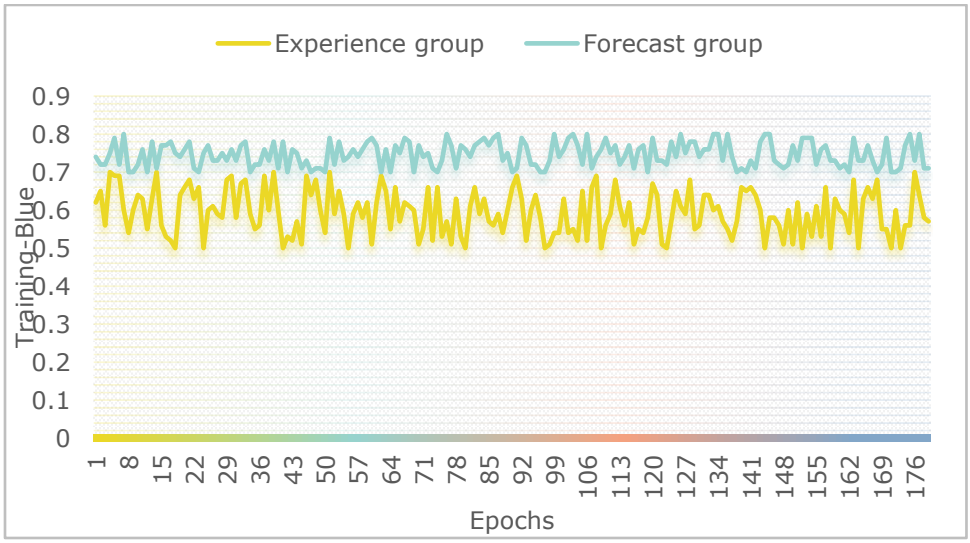

Figure 7: Training results of the momentum factor in the neural network.

It can be seen that the error target of the network has not been met after many training. The momentum factor plays an important role in the neural network, especially in the training process, it can effectively avoid the local minimum and local maximum of the network. According to the summary of the experimental trial and error method, the dynamic factor is generally taken as about 0.5. Therefore, when the momentum factor of the experimental trial and error method is taken as 0.6, The neural network model achieves the best experimental results. Figure 8 shows people's satisfaction with the optimized design of the algorithm.

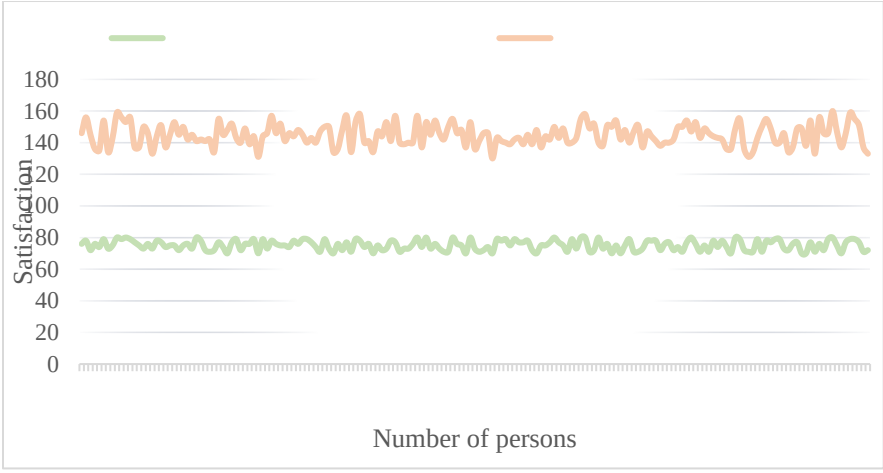

Figure 8: Satisfaction.

Analysis of the data shows that the method in this paper can effectively realize the construction and design of the implementation system of the vocational education orientation training mode based on BPNN, and the image recognition accuracy is high and the design effect is enhanced. The algorithm in this paper has a certain accuracy, which is 14.96% higher than the traditional genetic algorithm.

5 CONCLUSIONS

In this paper, a vocational education oriented training mode implementation system based on BPNN is proposed to construct and design landscape information fusion perception and block area template matching to realize education and training design. Finally, simulation test and analysis are carried out. This paper introduces the model, configuration, characteristics, training process, algorithm enhancement and limitations of neural network, and introduces genetic algorithm on this basis. Through the analysis of the principle, basic operation and common operators of genetic algorithm, it lays a theoretical foundation for the following content. By constructing the course evaluation model of vocational education based on BPNN, we can greatly reduce the impact of human factors on students' performance evaluation, and play a good auxiliary role in improving the quality of students' Education in vocational colleges. The experiment proves that the BPNN is reasonable and feasible when it is used in the course evaluation of vocational education. The result error is small and the training time is very fast. This algorithm has a certain accuracy, which is 14.96% higher than the traditional genetic algorithm. Due to the author's shallow experience in neural network research, there are still unstable factors in the evaluation effect of neural network. Better network training effect can be obtained through appropriate adjustment of network parameters.

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