Study on arts online education of knowledge comprehensive evaluation model based on BPNN

Yuting Han

Nanjing University of information science Technology College of media and art, Jiangsu 210044, China

Corresponding author's e-mail: hanyuting@163.com

Abstract

Connecting with the actual factures of our college and the demands for teaching quality, this topic introduces the artificial neural net theory into the assessment of teaching quality in colleges, establishing relative math model, integrating the complex index and giving measurement in order to provide more accurate and scientific assessment methods for teaching quality assessment. Through MATLAB software programmer, shaping BP neural net model and reaching reason results.

1 Introduction

How to improve the teaching quality in higher education has become the current focus of the work of higher education. However in universities, classroom teaching is the main channel for the implementation of education. Its quality at a large extent reflects and determines the quality of education in colleges and universities. The evaluation is the key to improve teaching quality. So how to set up a scientific justice evaluation university classroom teaching quality system is a very important problem [1].

Teaching is a synthesis of dynamic process of teaching and learning, there are many factors affecting it, and they affect it in different degree, the result of evaluation is hardly to use the equal math's analytic expression to show, it belongs to complicated non-linear sort problem, it has brought the very major difficulty for the quality synthetic evaluation. In the past, many the evaluation systems are direct evaluated by setting up a mathematical model, such as the weighted average method [2], hierarchical analysis process, fuzzy comprehensive evaluation method and so on. The above methods in the assessment process require influencing factors (evaluation index) with a linear relationship. Thus, it is difficult to rule out a variety of stochastic and subjective evaluation results which are easily bring about many distortion and bias.

Artificial neural network as a new technique, it is widely used in all kinds of evaluation problems, due to its ability of inherent non-linear processing, adaptive learning and high fault-tolerance. The Back Propagation Neural Network is the one of many types; it is one style of Artificial Neural Networks, which is a multilayer feed forward network, having strong nonlinear mapping ability. Considering the complexity and nonlinear to evaluate the university class teaching quality.

With the popularization of higher education, all society is increasingly concerned with the quality of education. Meanwhile, college get rapid development. They have trained lots of talented people in ethnic areas and prepared more power for the development of ethnic areas. But the focus of improving educational quality is to improve teaching quality, the effective way of which is teaching assessment [3]. As to colleges, the first problem to be solved is how to establish effective, scientific and reasonable assessment system of teaching quality.

Because many factors influence teaching quality and the factors differ in degrees, it's hard to apply the math analysis formula to indicate the assessment results, which belong to complex problem of non-lineal category. The traditional categorization is difficult to solve these problems, instead, artificial neural net as a new technology strikes out a way for non-lineal categorization and model-reorganization research [4].

With the coming of knowledge economy, the country has become the consensus of the whole country, the governments and universities have stepped up to the investment of science and technology. Therefore, how to evaluate outcomes of research fund investment, and how to evaluate the completion of personnel scientific research, also become a question that university research management department must be carefully consider. At present, the performance evaluation of university social science research is relatively rare. BP neural network evaluation methods have just started, there are many aspects need to be further refined and improved. The statistical results are shown in Table 1. We can see that that BP network can improve the quality of arts online education.

TABLE 1 The statistical results [5]

No.	Value
1	0.002
2	0.0305
3	0.019
4	0.0415
5	0.013
6	0.056
7	0.032
8	0.025
9	0.021
10	0.017

2 Related works

Today, higher education's popularity goes deeper and deeper, our society pay close attention to the quality of higher education. It is necessary to improve teaching quality in order to improve educational quality; the evaluation is the key to improve teaching quality. But how to set up a scientific justice evaluation teaching quality system is a complex problem.

In the teaching quality evaluation process，as there are many factor safety it，and they affect it in different degree，the result of evaluation is hardly to use the equal maths analytic expression to show, it belongs to complicated non-linear sort problem, and traditional sort method can't solve these problems thoroughly.

Artificial neural network as a new technique, it is widely used in all kinds of evaluation problems, due to its ability of inherent non-linear processing, adaptive learning and high fault-tolerance. Artificial neural network has its particular advantages in solving teaching quality evaluation problems, so bring the artificial neural network theory into the higher quality evaluation. [6]

Based on the research of teaching quality evaluation actuality and characteristic，combining characteristics of neural network technologies, teaching quality evaluation model based on BP network is proposed in this paper, and then the evaluation model was improved and validated in the article. The model proposed in this paper provides a feasible scheme for teaching quality evaluation.
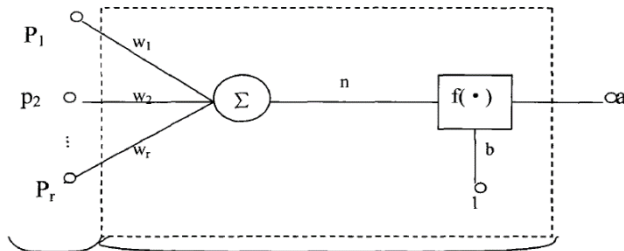

FIGURE 1 BP neuron

BP neuron is shown in Figure 1. In this paper, with combination of theoretical studies and empirical research, qualitative analysis and quantitative analysis of the combination of research methods, does in-depth discussion and research on the college social science research and performance evaluation. First introduced the thesis background and purpose; Secondly, on the basis of the summary and synthesis of the university research and a comprehensive concise, objective and comparable, operability setting principles to build a college social science research evaluation index system, introduce the BP neural network method. Finally, through empirical research, including the required data collection and procession, and sample learning and simulation results at the end of this study were summarized, and prospects for the future of college social science research and performance evaluation.

This paper applies the Levenberg-Marquardt algorithm on the network to improve the evaluation model, and combines with the MATLAB software evaluation process. Expect of the methods and conclusions of this study provide the basis for the evaluation of university social science research performance. The artificial neuron model is shown
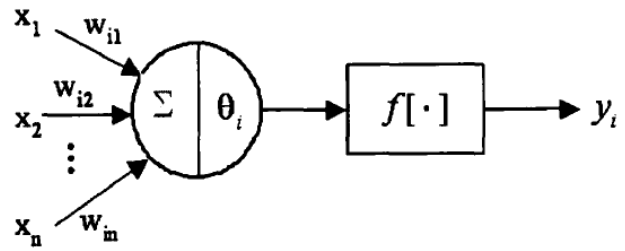
in Figure 2.

FIGURE 2 The artificial neuron model

Three aspects, as shown in Equation (1) are independent.

$$U_i = \sum_{j=1}^{n} X_j \cdot w_{ij} - \theta_i , \qquad (1)$$

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

Where U_i is the indexing, w_j is the weight, respectively, of the sample, as shown in Equation (2).

$$\begin{cases} W_{ij}^{(l)} = W_{ij}^{(l-1)} + \Delta W_{ij}^{(l-1)} \\ \Delta W_{ij}^{(l-1)} = -\eta \dfrac{\partial E_{ij}^{(l)}}{\partial E_{ij}^{(l-1)}} \end{cases} \qquad (3)$$

Where η is the weight in $W_{ij}^{(l)}$, as shown in Equation (3).

3 Model

$$\Delta w_{ij}^{(l-1)} = -\eta \delta_{jk}^{(l)} O_{ij}^{(l-1)} + \beta \Delta w w_{ij}^{(l-1)} , \qquad (4)$$

When we calculate the Equation (4), we can obtain the Equation (5)

$$\Delta w_{jk} = -\eta \frac{\partial E}{\partial w_{jk}} = -\eta \frac{\partial E}{\partial net_k} \cdot \frac{\partial net_k}{\partial w_{jk}} =$$

$$\eta(d_k - o_k)o_k(1 - o_k)y_j$$

$$\tag{5}$$

$$\Delta v_{jk} = -\eta \frac{\partial E}{\partial v_{jk}} = \eta \frac{\partial E}{\partial net_j} \cdot \frac{\partial net_j}{\partial v_{jk}} =$$

$$\eta \delta_j^y x_i = \eta \left(\sum_{k=1}^{l} \delta_k^o w_{jk} \right) y_j(1 - y_j)x_i$$
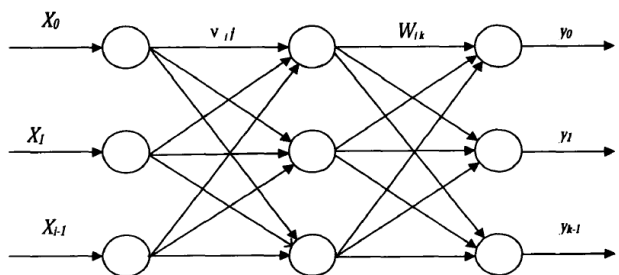

FIGURE 3 The three layer neural figure

The three layer neural figure is shown in Figure 3, and

Error curved surface two spaces is shown in Figure 4. The performance evaluation of the digitalizing of basic education, the education administrative departments have a correct understanding of the technology development level and change the trend of the future, so as to provide scientific basis for the basic education digitalizing decision, in order to reduce the decision-making process of the subjectivity and blindness. The performance evaluation of the establishment of a fair and objective of basic education digitalizing evaluation system is particularly important.
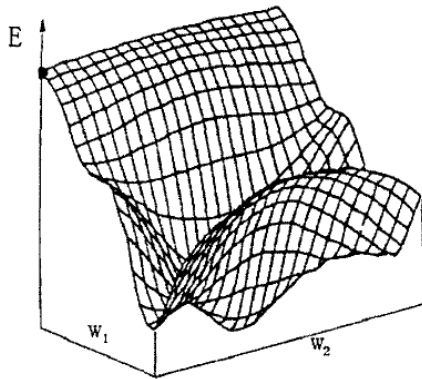

FIGURE 4 Error curved surface two spaces

This paper focuses on the discussion and implementation of education digitalizing performance evaluation BP neural network tool MATLAB based modeling. Completed the BP network modeling and performance evaluation of basic education digitalizing, process of BP network algorithm for performance evaluation is given; simulation of the performance evaluation of the improved BP algorithm based on the basic education digitalizing. Finally, the model is trained and tested using survey data, are within 5％error test results, the evaluation result has very high reference value, it proved high stability that MATLAB BP artificial neural network on the basis of the Education Digitalizing Performance Evaluation. There are some codes as below:

```
P=load('a.txt');
T=load('aa.txt');
net}ewff(threshold, {'tansig','logsig' }, 'traingd' );
>> net.trainParam.epochs=2000;
net.trainParam.goal=0.0001;
net=train(net,P,T);
A=sim(net,P)
E=T-A;
plot(E)
res=norm(E)
```

BP neuron error curve is shown in Figure 5. With the mature technology of Internet and multimedia, Research emphasis of network education is turning on evaluate effect of network learning and learners from platform development and resource design. The key to evaluation is to establish the evaluation model s, among which the most familiar one is linear, the comprehensive evaluation model of weighted average of the evaluation targets. Being simple in calculation and convenient in its building，this model is widely adopted in the present teaching evaluation.
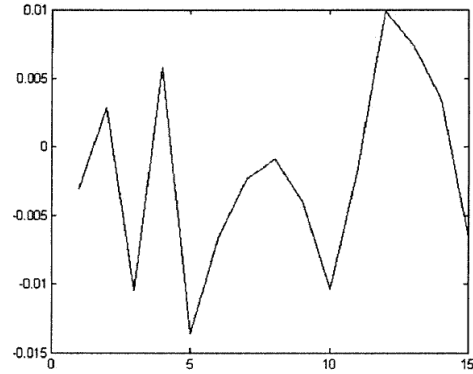

FIGURE 5 Error curve

In fact, its evaluation results are poor in reliability. The evaluation in network learning is a problem of Multi-index comprehensive which need value judgment to statistical index of different sides in describing students' learning process and effect and synthesize evaluation value to get students' entireness evaluation of network learning. Humanistic principle should be insisted in evaluating, that students should be regarded as the people of comprehensive development. It not only evaluates students' quantity and level of knowledge mastering, but also emphasizes the comprehensive quality of emotional experience, inquiry ability and cooperation spirit, while these index indicate the different characters of the objects and these characters are some degree fuzzy, i.e. none-linear, and hence the more feasible and reliable is the comprehensive evaluation by the means of fuzzy theories. On the basis of this thought，in the first this paper introduces the related evaluation theories of based-network learning and evaluation index system. Then based on this, a feasible evaluation index system is brought forward according to our college' network teaching platform of assembly language, and construct a applied fuzzy comprehensive evaluation model of based-network learning. According to quantitative index and qualitative index, corresponding membership function is built，which achieves unified treatment of the quantitative data and qualitative analysis, changing previous single and unilateral evaluation method. We can see Equation (6) and its process of proof is Equation (7).

$$\frac{\partial E_{ij}^{(l)}}{\partial E_{ij}^{(l-1)}} = \frac{\partial E_{ij}^{(l)}}{\partial O_{ij}^{(l)}}\frac{\partial O_{ij}^{(l)}}{\partial I_{ij}^{(l)}}\frac{\partial E_{ij}^{(l)}}{\partial W_{ij}^{(l-1)}} = \delta_{ij}^{(l)}\frac{\partial E_{ij}^{(l)}}{\partial O_{ij}^{(l)}} = \delta_{ij}^{(l)}O_{ij}^{(l-1)}, \quad (6)$$

$$J(x) = \begin{pmatrix} \dfrac{\partial e_{1,1}}{\partial w_{1,1}^1} & \dfrac{\partial e_{1,1}}{\partial w_{1,2}^1} & \cdots & \dfrac{\partial e_{1,1}}{\partial w_{S^1,R}^1} & \dfrac{\partial e_{1,1}}{\partial b_1^1} & \cdots & \dfrac{\partial e_{1,1}}{\partial b_{S^1}^1} & \dfrac{\partial e_{1,1}}{\partial w_{1,1}^2} & \cdots & \dfrac{\partial e_{1,1}}{\partial w_{S^M,S^{M-1}}^M} & \dfrac{\partial e_{1,1}}{\partial b_{S^M}^M} \\[8pt] \dfrac{\partial e_{2,1}}{\partial w_{1,1}^1} & \dfrac{\partial e_{2,1}}{\partial w_{1,2}^1} & \cdots & \dfrac{\partial e_{2,1}}{\partial w_{S^1,R}^1} & \dfrac{\partial e_{2,1}}{\partial b_1^1} & \cdots & \dfrac{\partial e_{2,1}}{\partial b_{S^1}^1} & \dfrac{\partial e_{2,1}}{\partial w_{1,1}^2} & \cdots & \dfrac{\partial e_{2,1}}{\partial w_{S^M,S^{M-1}}^M} & \dfrac{\partial e_{2,1}}{\partial b_{S^M}^M} \\[4pt] & & & & \vdots & & & & & & \\[4pt] \dfrac{\partial e_{S^M,1}}{\partial w_{1,1}^1} & \dfrac{\partial e_{S^M,1}}{\partial w_{1,2}^1} & \cdots & \dfrac{\partial e_{S^M,1}}{\partial w_{S^1,R}^1} & \dfrac{\partial e_{S^M,1}}{\partial b_1^1} & \cdots & \dfrac{\partial e_{S^M,1}}{\partial b_{S^1}^1} & \dfrac{\partial e_{S^M,1}}{\partial w_{1,1}^2} & \cdots & \dfrac{\partial e_{S^M,1}}{\partial w_{S^M,S^{M-1}}^M} & \dfrac{\partial e_{1,1}}{\partial b_{S^M}^M} \\[8pt] \dfrac{\partial e_{1,2}}{\partial w_{1,1}^1} & \dfrac{\partial e_{1,2}}{\partial w_{1,2}^1} & \cdots & \dfrac{\partial e_{1,2}}{\partial w_{S^1,R}^1} & \dfrac{\partial e_{1,2}}{\partial b_1^1} & \cdots & \dfrac{\partial e_{1,2}}{\partial b_{S^1}^1} & \dfrac{\partial e_{1,2}}{\partial w_{1,1}^2} & \cdots & \dfrac{\partial e_{1,2}}{\partial w_{S^M,S^{M-1}}^M} & \dfrac{\partial e_{1,2}}{\partial b_{S^M}^M} \end{pmatrix} \quad (7)$$

With the further development involving the Internet in field of education, more and more experts and scholars are going to establish the digital resources which result in the

huge enrichment of network educational resource and make the learners more rely on the network. Meanwhile, learners in one sort of teaching environment may encounter the huge discrepancy of culture, knowledge, capacity. Thus the preconceived ideas in doing research would provide with the personalized learning. Therefore, in order to accustom this environment, teaching network system, based on different learning needs in different background of culture, could efficiently provide with the teaching activities to meet personalized needs. Based on the learners' behavior, this paper gives an explicit analysis on learner's knowledge mode and the current situation of learning needs. Also based on the cognitive teaching theory, Chinese e-learning technology standards (CELTS), Java, XML, Web data mining, network snuffer, and artificial intelligence, automatic construction of knowledge model and web services, this paper put forward a kind of intelligent mining method of personalized learning needs. Therefore this method, viewed as a service of design and implementation of the algorithm, can be widely spread in every field of activities of teaching knowledge, culture through building the platform of personalized teaching system which contributes to examine the effectiveness and reliability of the findings of research. Only in this way, network teaching can deliver the excellent value. Finally, we get the neuron model as shown in Figure 6.
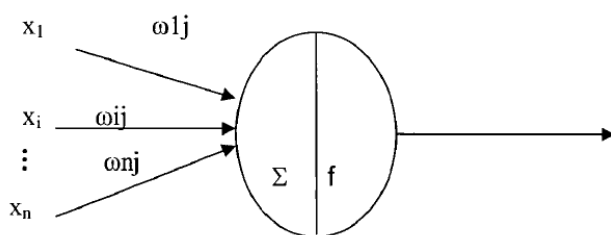

FIGURE 6 Neuron model

In recent years, due to the proliferation of computers and the Internet on a global scale with the rapid and sophisticated development, it provide a rich source of information for people to search and access to useful information, at the same time the rapid expansion of information in various fields of Society and led to the current mass of information on the Internet was exponential growth, the contradiction between the rich Data and poor knowledge became more and more prominent, users in different fields look forward to finding their desired knowledge from these mountains of data and information, and above increasingly serious conflicts also hindered the search, access and maintenance for knowledge.

At present, the world has entered the time of knowledge economy, the knowledge competitive capacity has been an important criterion to measure a country or a region's comprehensive competitiveness, consequently, only effective organization and management of knowledge could

effectively stimulate more knowledge of application and creativity, could meet the strong demand of the users in various fields to realize the knowledge sharing and reuse. And on the current situation of knowledge application, it is too far to meet people's expectations; a deep reason is the quality and standards of the knowledge models. The quality of knowledge models directly affects the performance of knowledge processing, for example high-quality knowledge models can provide to users a clear, interactive knowledge systems and to facilitate more efficient in their work and so on. But the highly non-uniform of construction standards result in the different description of same knowledge, influence on the understanding and sharing of knowledge. Although there has been a lot of theory and methods of knowledge models, but they are all derived from the different developers using different construction methods, development tools and platforms in different practical applications, so certainly there are kinds of defects, severely limit the reusing and sharing of knowledge. In the front of new environment and new problems, it is impossible to maximize the efficient use of the various existing knowledge models, this is a waste.

4 Conclusion

1). Analysis of the existing class teaching quality evaluation research, it concentrate on two point, one is on the study of content of quality evaluation system, another is on the Study of the way how to assess quality grade.

2). To introduce the knowledge of neural network, to make a system research on the constructing and training of BP network model. To introduce problems exist in BP learning algorithm and improvements in learning algorithm, Statement corrective method of BP，and has analyzed its characteristic.

3). This dissertation presents a novel classroom teaching evaluation system, which optimizes the quality of design. It includes a comprehensive assessment of teaching quality and in accordance with the main body of the characteristics of universities and disciplines, and it is very useful to optimize the tiered quality of teaching evaluation system.

4). Design for university class quality evaluation model. Including fix the network structure, learning parameters and learning algorithm.

5). The system carries on the confirmation in simulation software MATLAB, set student evaluation of teaching subsystem as example, realized the functions of style data maintenance, BPNN training and BPNN evaluation. Through the experiment data, it indicates using BPNN evaluate quality is feasible, and satisfy the request of precision, it really prompts a convenience tools for teaching quality evaluation. The paper finally summarized the research work of this article, and discussed some solution of question as well as the further research work prospect.

References

[1] Rumelhart D E, Hinton G E, Iliams R J 2006 Learning internal representations by error propagation in *Parallel Distributed Processing* Rumelhart D E and *McClelland J L Eds Cambridge MA MIT press* 318-62

[2] Lee H-M, Chen C-M, Huang T-C 2011 Learning efficiency improvement of back-propagation algorithm by error saturation prevention method *Neurocomputing* (41) 125-43

[3] Tack Mu K won, Hui Chen 2006 Contrast enhancement for back

propagation [J] *IEEE Transactions on Neural Networks* **11**(7) 515-24

[4] KSL. Research Themes [EB/OL] http: // www.ksl.Stanford.edu /researchthem.shtm1 2006-01-23

[5] Studer R, Benjamins V R, Fensel D 2008 Knowledge Engineering, Principles and Methods *Data and Knowledge Engineering* **25**(122)

161-97

[6] Bruijn J, Ehrig M, Feier C 2006 Ontology mediation, merging and aligning Davies J, Studer R, Warren P, eds *Semantic Web Technologies: Trends and Research in Ontology-based Systems Wiley UK*

Author

Yu-ting Han, 1978.8, Anhui huoqiu, P.R. China.

Current position, grades: associate professor of Nanjing University of information science Technology college of media and art.
University studies: art design.
Scientific interest: the study of art design and art design education.