

Analysis for Online Music Education Under Internet and Big Data Environment

Lanfang Zhang, Xi'an Academy of Fine Arts, China*

ABSTRACT

Online music teaching has brought great challenges to traditional music education. This paper investigates the paradigm of online music education and uses neural networks to evaluate its teaching quality based on the internet and big data. The main work is as follows: 1) The research progress of online music education at home and abroad is introduced. 2) This paper introduces the basic principle and algorithm steps of BPNN and establishes the evaluation index system of online music education quality. The experimental results show that the model proposed in this paper has high accuracy in evaluating online music teaching standards.

KEYWORDS

Big Data, Internet Technology, Neural Network, Online Music

INTRODUCTION

In the era of “Internet” and “big data,” all walks of life are inextricably connected with the Internet. Online education is the result of the combination of the education industry and the Internet. Online education has developed for many years and achieved remarkable results both abroad and at home. For example, the construction of the three major online platforms abroad, as well as the development of MOOCs (Massive Open Online Course) and microclasses, will contribute to the better development of online education in China (Sun & Chen, 2016). However, online music education is still in its infancy. Online music education is not limited by the time and space of traditional music education and can be taught and learned anytime and anywhere. This way strengthens the communication between students and teachers and helps students achieve the goal of autonomous learning. At the same time, online music education can also gamify the learning process and improve students' interest in learning. From the perspective of development trends, online music education is the direction of future development. The beneficiaries of online music education will gradually expand from students to all levels of society and truly realize the future vision of national independent music learning (Hebert, 2007).

Music class, as a special humanities discipline, focuses on cultivating students' ability to feel, appreciate, express, and create (Salavuo, 2008). In the traditional classroom, the single lecture-type teaching mode lacks the vividness of the classroom. The classroom needs to be taught according to the syllabus tasks. The classroom time is limited, and the students' knowledge is limited (Cremata & Powell, 2017). The research of network teaching mode needs to study the teaching environment

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*Corresponding Author

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built under the background of “Internet plus.” The teaching methods, such as “problem orientation, situation representation, collaboration, resource sharing” created in this context can be better combined with the offline teaching of music lessons (Ruippo, 2003).

From a theoretical point of view, this paper expounds and studies the directionality, scientificity, and diversity of music teaching. This modern teaching mode has gradually become an important part of basic education (Partti & Karlsen, 2010). From the perspective of teachers, online classroom teaching is different in teaching methods, teaching evaluations, teaching resources, teaching concepts. It not only enriches teachers’ teaching course content and teaching design methods but also strengthens teachers’ online teaching technology skills (Nart, 2016).

From the perspective of students, how can students well accept the new teaching mode under the guidance of teachers and improve their autonomous learning ability. Secondly, through data analysis, the important value of studying online teaching lies in promoting the transformation of teachers’ and students’ concepts, improving teachers’ comprehensive teaching quality, and promoting students’ personalized development (Crawford, 2017). In the information age, offline teaching and online teaching are gradually integrated and become equally important teaching models. The complementarity of online and offline teaching is the future development direction that educators need to study (Camlin & Lisboa, 2021).

The purpose of this study is to actively explore effective online teaching concepts under changing circumstances and find out whether online teaching can further promote the development of music teaching. This is of great significance for the further development of aesthetic education in music class, the integration of textbook knowledge and life in music class by using the online teaching mode, the combination of online and offline teaching in music class, and the future development and innovation of music class teaching (Digolo et al., 2011). Based on the Internet big data environment, this paper explores the model of online music education and uses the neural network to evaluate the quality of online music education.

RELATED WORK

With the influx of large-scale market investment and the development of Internet technology, the growth of online music education has developed rapidly. The increasing improvement of the Internet environment has led to the emergence of a large number of online music education institutions in China. China’s online music education products are rapidly integrated into people’s daily lives. Music lovers from all over the country have begun to accept the learning method of online music education and spend a lot of energy, time, and money applying it.

In China, online music education is a new construction model, which is a subject model derived from “Internet + education.” Therefore, the basic mode of online music education is also based on “Internet plus education,” that is, learners as the central subject, teachers, teaching platforms, and learning content as the auxiliary. The interaction of these four subjects forms an interactive mode (King et al., 2019). Online music education is the integration of Internet technology and music education, which is formed based on the characteristics of music art. Online music education is not simply subverting the traditional face-to-face music education model, nor can it completely replace the role of teachers in music education, but as a new teaching model based on the concept of personalized music education. Of course, the model of online music education is based on the model of “Internet + education,” which is formed by integrating the characteristics of music on the original model (Crawford, 2013). At present, there are four basic modes of online education platforms in China: business-to-customer (B2C), online-to-office (O2O), customer-to-customer (C2C), and intelligent hardware plus mode.

Online music education in Chinese colleges and universities started late, and its development is immature, but in the context of global development and the development of educational resources, Chinese colleges and universities are also actively participating in it. They plan to take advantage of

the development of Internet technology to release national high-quality courses on online education platforms for learners to learn for free. Based on the “Internet plus” mode, a teaching mode combining research-oriented MOOCs and online courses, Blake (2018) tried to design and implement a complete set of programs for self-study on the front line, teaching off the middle line and online consolidation after class. Albert (2015) mainly explained how to carry out online classes, which teaching software and teaching methods can be used, and uses the idea of network development to guide and help. Cayari (2021) concluded that the epidemic has accelerated the development of online education, and online teaching is conducive to cultivating students’ inquiry learning habits. However, online teaching cannot replace offline teaching. Online music teaching skills can assist offline teaching activities. Daubney and Fautley (2020) found that the Internet and music education are in line with the requirements of the times. Microclass, flipped class, smart class, and cloud class enable teachers to teach anytime and anywhere. They believe that this is the direction and focus of future school education research, promoting the development of students’ comprehensive abilities and realizations of their own life value.

Phillips (2008) concluded that offline fragmented learning has become the norm. The online learning process is conducive to internalizing students’ autonomous learning abilities and improving teachers’ and students’ information technology abilities. Therefore, the integration of offline learning and online teaching creates a personalized, independent, and exploratory learning space. Burnard (2007) mentioned that compared with traditional teaching, online teaching has its own advantages and feasibilities. Both live broadcasts and recorded broadcasts have strong flexibility and diversity. It is worthwhile for educators to innovate in the construction, reform, and development of different disciplines and explore and formulate more comprehensive teaching models.

Groupx and Hernly (2010) mentioned that the problems and difficulties faced by online teaching mainly include the uncontrollability of network technology, the content of teachers’ lectures, and live broadcast. The unique advantages of online teaching include the diversity of teaching, the new methods of teaching evaluation, and the resources of online teaching; however, how to solve problems and give full play to advantages are the problems that educators need to constantly think about. Bhattacharjee et al. (2006) believed that the new curriculum standards put forward new requirements for music teachers in primary and secondary schools. In the new era, music teachers should fully improve their own technology and teaching level, combine music education with information technology, and make contributions to the better development of music education. In order to promote the development of online music education, the United States government has made clear instructions on relevant school-running policies, requiring changes in learning, teaching, evaluation, and infrastructure to promote the development of the online music education system.

METHOD

Back Propagation Neural Networks

Introduction to the Algorithm

A neuron is the basic unit of a neural network, and its advantage lies in the parallelism of processing problems and information (Cao, 2021). This feature makes it process information fast, and it is because of this feature that a neural network is called the mainstream model of an intelligent algorithm. The information that needs to be transmitted and processed is distributed in the axons of neurons by means of parallel storage (Yuqing, 2021). The same information on the dendrites can be redundant with each other, and even partial failure will not cause a great impact, so it has a better processing ability for information with greater interference. It solves the problem of poor self-learning ability in traditional nonintelligent algorithms (Yang, 2022). The construction of a back propagation neural network (BPNN) includes hidden layers and input and output layers. The input layer mainly receives the incoming data, then transmits it to the hidden layer to complete the processing of the hidden layer, and passes it to the output layer to complete the final processing. If there is an error, the weights

are adjusted, and the network update is completed by feedback from the back to the front. Using a neural network for an education quality evaluation, that is, by using a large number of samples to train and adjust the parameters of the network, the weights of each connection tend to be stable and can be nonlinearly mapped to the desired results. At this point, the training is completed and the actual evaluation can be carried out. Then, input the new sample value and determine its corresponding evaluation level by calculating the new input value.

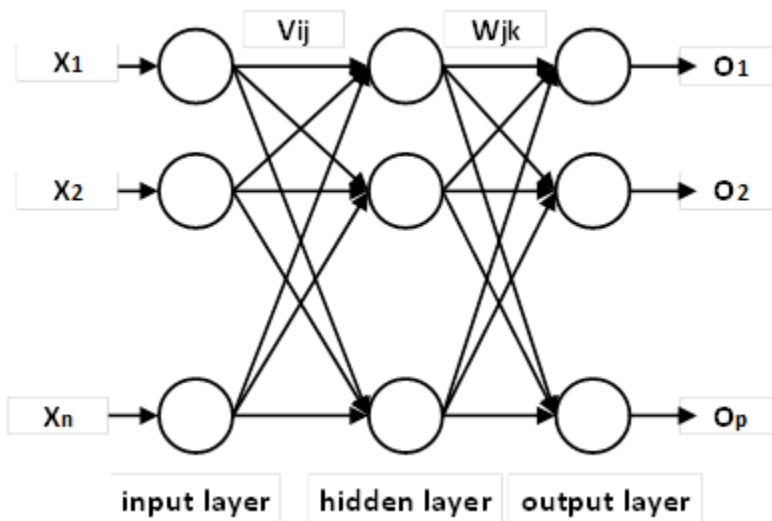
A BP neural network has unique advantages in dealing with various complex system problems, especially in dealing with nonlinear system problems. Some scholars have used a neural network to evaluate the teaching effect, simulating expert scoring, and received good application results. In this paper, a BP neural network is used to establish an online music education quality evaluation model, and the validity of the evaluation model is verified by test data.

Algorithm Flow

The principle of a BPNN is the forward propagation of the signal and the back propagation of the error. The initial feature input enters the BPNN through the input layer, is processed by neurons in the hidden layer, and finally outputs the result through the output layer. This process is called forward propagation (Chen, 2021). At this stage, the connection weight of the network has not changed, and its connection weight is related to the adjacent neurons. Then, if there is only forward propagation, the network accuracy and convergence cannot meet the requirements of target setting, so the error is still propagated backward. If there is an error between the output layer output and the known target, it is passed through the output layer to the next time of the network. The transmission process of the error is the adjustment process of the network to the neuron connection weights and thresholds, and its goal is to make the results more accurate. The model structure is shown in Figure 1.

- X_n : Denotes the output value of the n th neuron in the input layer. The input layer is the first layer of the neural network and is responsible for receiving external input data and passing it to the next layer for processing.
- V_{ij} : Denotes the connection weight value from the i th neuron to the j th neuron. In a neural network, each neuron is connected to all the neurons in the next layer, and these connection weight values

Figure 1. Basic structure of neural network



determine the strength and direction of the information transfer between different neurons, which is one of the key factors in the learning and classification process of the neural network.

1. **Forward propagation of information:** The input stage signal is conducted as indicated by the arrow in Figure 1. Initially, the information enters the entire network structure through the input layer, enters the hidden layer through the transfer matrix, and is then transmitted to the output layer after comprehensive processing. The output layer completes the final processing and output of the signal through the activation function. The j th input $net(j)$ and output o_j of the hidden layer, the k th input $net(k)$ and output y_k of the output layer are:

$$net(j) = \sum_{i=1}^n V_{ij} x_i + \alpha_j \quad (1)$$

$$o_j = \varphi \left(\sum_{i=1}^n V_{ij} + \alpha_j \right) \quad (2)$$

$$net(k) = \sum_{j=1}^m w_{jk} o_j + \beta_k = \sum_{j=1}^m w_{jk} \cdot \Phi \left(\sum_{i=1}^n V_{ij} + \alpha_j \right) + \beta_k \quad (3)$$

$$y_k = \psi \left(net(k) \right) = \psi \left(\sum_{i=1}^n w_{jk} \cdot \varphi \left(\sum_{i=1}^n V_{ij} + \alpha_j \right) + \beta_k \right) \quad (4)$$

2. **Backpropagation of BPNN:** In the training phase, the output is compared with the measured value to obtain the network error. If the error is acceptable, the training is complete. When the output does not reach the preset threshold, backpropagation is performed to correct the parameters of the neural network. If the number of samples is g , the ideal sample value of the output is assumed to be $t_k^g = [t_1^g, t_2^g, \dots, t_p^g]$ to deduce its propagation process. The neural network value after one training is compared with the preset ideal value, and the MSE(Mean Squared Error) is used as the calculation unit. The quadratic expression and the global error are as follows:

$$E_g = \frac{1}{2} \sum_{k=1}^p (t_k^g - y_k^g) \quad (5)$$

$$E = \frac{1}{2} \sum_{g=1}^g \sum_{k=1}^p (t_k^g - y_k^g)^2 \quad (6)$$

In the error correction link, the gradient descent method is used for processing. Choose the learning rate η in $(0, 1)$. The function of an activation function is to add some nonlinear factors to the

neural network model so that it can better solve more complex nonlinear problems. The commonly used activation function of a BPNN is Sigmoid. The conventional neural network algorithm learning process is shown in Figure 2.

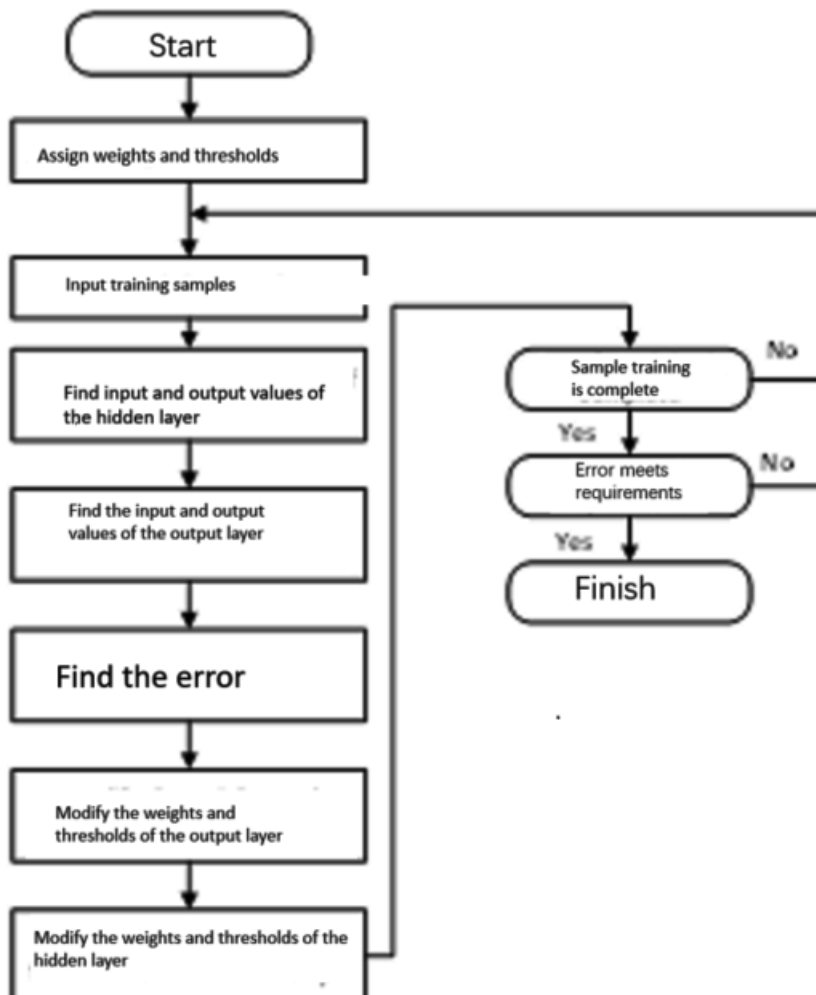
The modeling of a BP neural network in this paper was carried out in Matrix Laboratory (MATLAB) 2016b. Due to the rapid development of neural network technology in recent years, many new algorithms and functions related to the neural network have been updated and included in the neural network toolbox of MATLAB, and the work of establishing a neural network model has been greatly simplified.

Characteristics and Principles of an Online Music Teaching Evaluation

Characteristics of an Online Music Teaching Evaluation

1. **Emphasize students' individuality:** In terms of purpose, the content of music online teaching is more flexible, and students who receive online music teaching have a stronger sense of experience with the learning content itself. Therefore, the evaluation of music online teaching

Figure 2. BP neural network flow chart



is mainly to enable teachers and students to make progress in the process of online classrooms. The evaluation of music online teaching should be student-centered. Therefore, the current music online teaching evaluation should focus on students' self-realization and self-transcendence and abandon the constraints of traditional music teaching classrooms on teachers' teaching and students' acceptance process. Let students choose their favorite music teaching content and music teaching speed and construct the music teaching content when they are interested. This is also more conducive to students' diverse understanding of music.

2. **Emphasis on co-construction:** From the main body, the biggest difference between online music teaching and traditional offline music teaching is that online music teaching has infinite possibilities. In the process of online music teaching, music teachers can mobilize unlimited online music teaching resources as their own teaching library and select the teaching resources that they think are more beneficial to their own teaching. In addition, students can also participate in the selection process, allowing teachers and students to constantly collide with their thinking while choosing teaching resources, and finally, build the teaching mode and teaching content of online music teaching. For the evaluation of online music teaching, the most important thing is to evaluate the effect of students' learning. Only in this way can we truly evaluate the quality of teachers' teaching content completely and objectively.

Basic Principles of Music Online Teaching Evaluations

1. **Diversification of evaluation indicators and evaluation subjects:** The links and contents included in the music online teaching process are rich and diverse. Therefore, in the process of an online music teaching evaluation, it is not limited to the evaluation of teaching results. When constructing an evaluation system for online music teaching, it is necessary to combine the differences between online music teaching and offline traditional music teaching. According to different indicators, such as teachers and students, the evaluation indicators are quantified to ensure the comprehensiveness and reliability of the evaluation system. In the selection of evaluation subjects, in addition to teachers and students, corresponding experts should also be selected, and their professional evaluation opinions should be listened to ensure that the evaluation system can be improved.
2. **The evaluation content is comprehensive:** Online music teaching not only refers to the teaching in the classroom but also has extremely high requirements for the preparation before the class, the professor in the class, and the evaluation feedback after the class. Therefore, in the process of an online music teaching evaluation, these different processes must be incorporated into the teaching evaluation system. Teachers and students' respective evaluations of teaching quality are combined to make the evaluation content complete and more specific. In the process of evaluating the teaching quality of online music, corresponding adjustments can be made according to the teaching content and teaching mode of different teachers to ensure that the final result of a teaching evaluation is comprehensive and accurate. The evaluation system of online music teaching needs to add the evaluation guidance for the teaching process so as to ensure that the final evaluation system can play a certain role in promoting the improvement of teachers' classroom teaching quality.

Construction of an Online Teaching Evaluation System for Music Education

Combined with the content and characteristics of online music teaching, combined with the comprehensiveness and flexibility of a music teaching evaluation, this paper mainly categorizes online music teaching evaluations into three types of evaluation: basic, process, and result. On this basis, 15 indicators were constructed, respectively, and combined with different evaluation subjects, and an evaluation system for online music teaching was formed. The specific indicators are shown in Table 1.

Table 1. Construction of online teaching evaluation systems for music education

Index	Label
Teaching goals are clear	D1
Reasonable teaching design	D2
Rich and diverse teaching resources	D3
Teaching resources are updated quickly	D4
Study time	D5
Frequent discussions among students	D6
Coverage rate of teacher's reply	D7
Effectiveness of teacher's reply	D8
Number of students asking or answering	D9
Collaboration among team members	D10
Team members have a clear division of tasks	D11
The quality of the student's question or answer	D12
Group task completion	D13
Professional skills test	D14
Student learning satisfaction	D15

EXPERIMENT AND ANALYSIS

Data Source and Data Preprocessing

In order to verify the validity of the model proposed in this paper, a total of 895 groups of relevant data were collected from the Academic Affairs Office of a university for training and testing. The online music education quality evaluation data consist of three parts, including supervision expert data, peer teacher data, and student data. Before using the data, preprocessing was required, and the formula used is as follows:

$$y_i = \frac{x_i - x_{min}}{x_{max} - x_{min}} \quad (7)$$

Parameter Selection of the Model

1. **Selection of activation function:** In this paper, two functions were selected for comparison, and the specific experimental results are shown in Figure 3. It can be seen that Sigmoid works better.
2. **For the number of neurons in the hidden layer:** This paper verified the performance of the algorithm by setting the number of neurons from 5 to 15 different. The MSE were calculated to get the optimal number of neurons. The experimental results are shown in Figure 4.

Performance Test of the Optimal Model

After selecting the optimal parameters of the BP model through the above experiments, 100 groups of samples were input into the traditional BPNN, and the MSE of the sample training was compared, as

Figure 3. The effect of different activation functions on model training (MSE: Mean Squared Error)

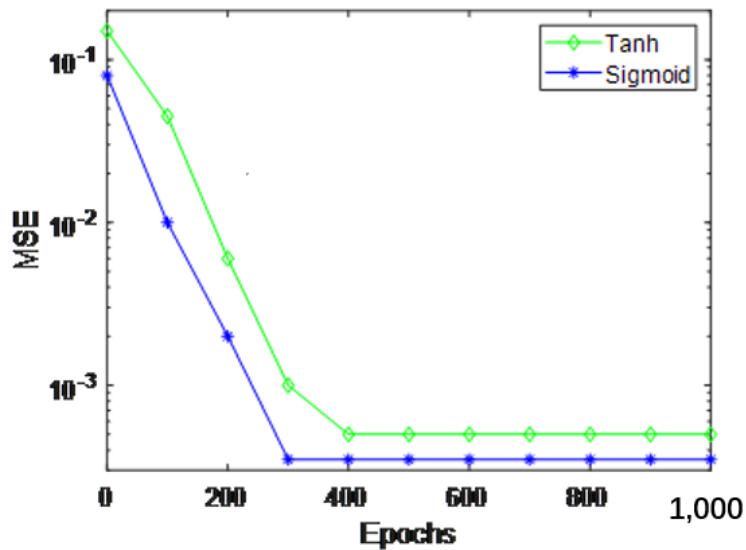
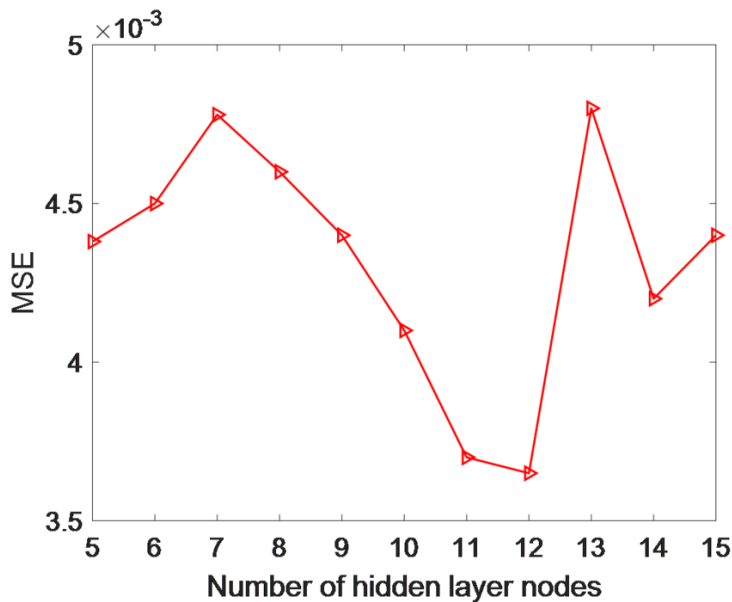


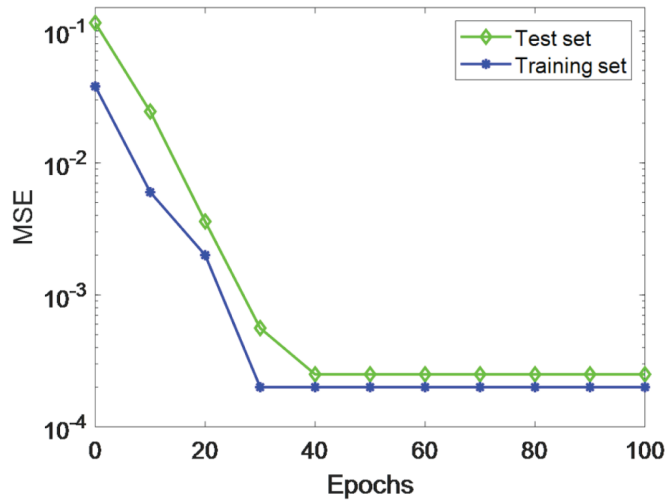
Figure 4. The effect of a different number of hidden layer nodes on model training



shown in Figure 5. It can be seen that the training set and the test set quickly reached the convergence and the convergence accuracy met the preset requirements.

In order to improve online music teaching evaluations, it is necessary to comprehensively consider online platform resources, online music teaching processes, and online learning to build online teaching quality evaluation systems. We need to accelerate the construction of a big data platform and use big data technology to fully explore the value of online teaching data, build a cloud teaching platform for

Figure 5. BP neural network training graph after optimal parameter selection



MSE(Mean Squared Error)
BP(Backpropagation Neural Network)

resource sharing, and provide strong data support for online teaching evaluations. Relevant evaluation of teaching quality is directly generated through big data, and these evaluations are stored for a long time. When teachers need to learn from and adjust the teaching model in the future, they can directly convert the previous teaching evaluation into the reference basis for establishing the teaching model. In addition, through the analysis of big data, online music teaching teachers can also organically combine the number of people attending the class, the course setting, the basic situation of teacher-student interaction, and the feedback of students to the class and share with other music teachers.

CONCLUSION

Online music education is a new education mode combining music education with the Internet. It is changing the traditional face-to-face learning mode and promoting the reform of music education and training. Based on the Internet big data environment, this paper explores the current situation of online music education and uses a neural network to evaluate the quality of online music education. Finally, the following work has been completed: 1) First, introduce the research progress of online music education at home and abroad and establish a theoretical basis for the follow-up methods. 2) Based on the basic principles and algorithm steps of BPNN, the evaluation index system of online music education quality is established. The online music education quality evaluation model established by BP neural networks is used for learning samples. The output value of the sample network tested was very close to the expert evaluation value. The model can accurately determine the teaching quality evaluation results according to each evaluation index.

AUTHOR NOTE

The figures and tables used to support the findings of this study are included in the article. The author declares that they have no conflicts of interest. This work was not supported by any funds. The author would like to show sincere thanks to those techniques who have contributed to this research.

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Lanfang Zhang received the B.S. degree in music education from Xi'an Conservatory of Music, Xi'an, China, in 2002, and the M.S. degree in fine arts from Xi'an University of Architecture and Technology, Xi'an, China, in 2012. She is an Associate Professor at Xi'an Academy of Fine Arts in Vocal Teaching and Singing, and a member of Vocal Music Association of China. The directed vocal work “In the bright sunshine” won the second prize of the First National College Students Art Exhibition. Won the second prize of the Bel Canto Professional Youth Group in the Shaanxi Vocal competition. Won the Excellence Award in the China Division of the 23rd Puccini International Vocal Competition in Italy.