Retraction

Retracted: Design and Application of Machine Learning-Based Evaluation for University Music Teaching

Mathematical Problems in Engineering

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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

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

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

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

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

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

References

Research Article

Design and Application of Machine Learning-Based Evaluation for University Music Teaching

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Teaching evaluation (TE) is an operational means of music education and management, a value judgment on university-related music teaching activities, with the fundamental purpose of promoting and improving the overall development of the cultivated subjects. With the deepening of quality education, the types and contents of music teaching evaluation (MTE) are being updated and changed, and many universities are gradually introducing music classroom teaching quality evaluation systems. Teaching quality evaluation plays an important role in the development of music teaching and affects the quality of educational evaluation, and is an important guarantee for the continuous reform and development of university music teaching (UMT), as well as an important means for scientific and reasonable management of schools, which plays an irreplaceable role in the development of schools. The evaluation of the quality of university music classroom teaching is a systematic process of analyzing and evaluating the teaching programs, teaching effects, and teaching processes of the music classroom within the school, which is conducive to improving the quality of university music classroom teaching. This article will focus on the overview of university music classroom teaching quality evaluation, analyze its main problems and causes, develop effective improvement measures to solve them, and build a machine learning (ML)-based UMT quality evaluation system. The model quantifies the concept of MTE indexes into definite data as the input of the network, and the comprehensive evaluation results as the output. The method overcomes the subjective factors of the evaluation subject in the evaluation process, but also obtains satisfactory evaluation results with wide applicability.

1. Introduction

The content of university TE can be shown from the evaluation index system, which contains seven elements, such as the idea of running the university and leadership, teachers’ team, teaching conditions and practical application, professional and curriculum construction, quality management, academic style construction and student guidance, and teaching effect, etc. There are also corresponding secondary indicators and actual observation points under the primary indicators. Since the assessment of university teaching work in China has been carried out, many universities have accepted the teaching assessment according to their actual situation [1–3], and the teaching assessment of universities has been widely concerned by everyone and has attracted great attention from the relevant scholars in the society. Despite the existence of certain advantages of the university teaching assessment work, but still reveals some unavoidable problems, the reason for the existence of the problem is not only of the assessment subject, but also of the assessment object. In view of this, it is crucial and inevitable to think about the assessment of university teaching nowadays. Music is a form of artistic expression that contains a very rich emotion, and at this stage in China’s university teaching process, the relevant education departments are paying more attention to the teaching of the subject of musicology. In order to meet people’s growing spiritual needs, university music teachers should organize the teaching process, contact
with the reality of life, diversify classroom teaching according to students' interests, and fully mobilize students' learning enthusiasm. Establishing TE indexes and standardizing university MTE. In the process of organizing classroom teaching activities, university music teachers should improve the TE system and analysis of university music majors in order to improve the teaching quality of music majors, and establish a scientific and reasonable TE index to help in-service teachers carry out their music teaching work efficiently. In the process of guiding students to learn music knowledge, university music teachers should set a TE index that meets students' learning needs and standardize their teaching work according to the actual situation of students' learning [2–4]. A scientific evaluation index should not only combine the personal teaching level of in-service teachers, but also relate to the characteristics of music as a subject and avoid formal teaching. In the actual teaching work, teachers should master the mutual influence between students and their own teaching, understand the development mechanism in music education work, and improve the teaching quality of the subject of music through TE, and constantly enrich the music literacy of students. The trend of the search hotness of university music education in Google is shown in Figure 1, and it can be found that the hotness has increased in recent years, which proves that the society pays attention to UMT [5].

Focus on changing the role of evaluation, fully mobilize students’ learning enthusiasm. University music teachers in the process of using TE, pay attention to the object of TE to be clear, every student is the object of TE, if the teacher in the process of classroom teaching activities to carry out only a part of the students, then the effectiveness of classroom teaching is not improved. Just like a movie, there cannot be only the main character, there must be other characters to show the halo of the main character, so teachers should pay attention to change the role of assessment, respect the unique personality of each student [5–7], fully mobilize each student’s enthusiasm for learning, so that each student can experience the charm of the subject of music. Teacher assessment, self-assessment, and mutual assessment are all forms of learning assessment, among which mutual assessment allows each student to participate in the process of teaching assessment and fully mobilize students’ learning enthusiasm. For example, teachers can encourage students to actively express their ideas in the following ways when explaining the knowledge of “Rock and Roll.” Firstly, students can raise their hands to express their views on rock music; secondly, students can discuss in groups to summarize the knowledge of rock music; finally, students can practice rock music singing in groups of two, in this way, students can actively participate in the process of music learning and thus feel the charm of the subject of music.

Collecting relevant information and data to enrich the information base of MTE University music teachers should pay attention to the breadth of music learning evaluation in the process of organizing TE, not only to pay attention to students’ achievements, but also to cultivate students’ emotional attitudes and values, and to evaluate students’ learning in a comprehensive manner. As a good music teacher, it is important for teachers to understand the students’ learning at each stage of their lives and to keep accurate records of the information so that they can use appropriate teaching methods to improve the effectiveness of classroom teaching. For example, in the process of organizing classroom teaching activities, university music teachers can set up a music teaching information database similar to a “music mini-site,” which contains self-evaluation, teacher evaluation [8], peer evaluation, parent evaluation, etc. Teachers can check the information in the database to understand the basic learning of students. Teachers can check the information in the database to understand the basic learning situation of students. In general, in the process of teaching in general universities, reforming the TE system of music can carry out the teaching work of music in a scientific and formalized way, and the main task of teaching music in universities can be successfully completed, so music teachers should respect students’ individuality in the process of organizing classroom teaching activities, make reasonable use of the TE system, and fully take into account students’ opinions. Therefore, music teachers should respect students’ individuality in organizing classroom teaching activities and make reasonable evaluation system for teaching, so that students’ learning enthusiasm can be fully brought out and every student can acquire certain music knowledge through classroom teaching activities.

For general UMT we can try to evaluate the teaching from three aspects: TE object. Including the evaluation of students’ learning also includes the evaluation of teachers’ work performance; from the teaching time to evaluate both the students when they enter the school and also to evaluate the students’ performance of four years of study when they graduate from the university mainly including the examination results, school or social awards, moral development during the students’ school study; from the teaching content to say that we teach and learn each subject of the profession to evaluate separately also to evaluate the students’ The comprehensive ability performance of students should be evaluated separately. The evaluation of music teaching in general universities must be carried out under the guidance of the correct teaching principles of the university [9]. The main ones are as follows: teaching activities should be
carried out under the principles of fairness, openness and impartiality. Principle of teaching objectivity: in the teaching process to know objectivity is the premise and basis of impartiality is the basic requirement of TE. Principle of teaching wholeness: music teaching work should start from the whole to correctly establish the overall concept and all-round, deep, multangle viewpoint for teaching work must be evaluated in many aspects to prevent the point to replace the surface to generalize the whole. Principle of teaching guidance: TE is the standard for testing and measuring the results of teaching practice, which serves the teaching practice and guides the teaching practice. Principle of scientific teaching: the basis and core of TE is science. Music teaching has a distinct scientific nature and the evaluation should also be scientific in nature. The assessment of students' learning is mainly the responsibility of the vocal teachers. There are three types of evaluation: one is diagnostic; the other is formative; and the third is summative. There are four methods of evaluation: one is observation; the other is investigation; the third is examination; and the fourth is examination. The evaluation of teachers' teaching is mainly the responsibility of leaders and administrators. The evaluation includes: one is the teaching situation is divided into preparation, lecture, counseling, etc.; the second is the teacher quality is divided into ideological, moral, business, and other qualities. The requirements of evaluation are: one is to determine the objectives under the premise of goal management to quantify the objectives in layers of decomposition; the second is to unify the criteria of judgment; the third is to evaluate the process to be open, fair and just [10]. The methods of evaluation are: one is to check the lesson plan; the second is to go into the classroom; the third is to check the students' learning achievement; the fourth is to observe the teaching; the fifth is to hold a student forum. In short, we should comprehensively evaluate the teachers' comprehensive ability and level and rate and score, and finally summarize the statistics and take the evaluation results as an important basis for teachers' rewards and punishments, appraisal, promotion and promotion, and evaluation of professional and technical titles.

The quality of music teaching is the lifeline of music education and the key to the sustainable and healthy development of music institutions of higher learning. For a long time, the assessment of music teaching quality is mostly based on mathematical models of evaluation systems, such as hierarchical analysis, fuzzy comprehensive evaluation method, gray system, cluster analysis and so on [11]. These methods can fully consider various evaluation factors and reflect experts' empirical knowledge, but these methods can hardly exclude various randomness and subjectivity in the evaluation process, ignore the nonlinear relationship between each evaluation index and teaching effect, and the results are highly subjective, which is difficult to truly reflect the teaching quality condition. Artificial neural network is an emerging discipline in the field of information science and technology research, which is an information processing system based on imitating the structure and function of human brain. With its own functions of simulating human thinking, nonlinear transformation and self-learning, neural network fully overcomes the above defects and is an effective method for teaching quality evaluation. In this paper, according to the actual situation of university teachers and students, a reasonable set of university music teachers' teaching quality evaluation system and the weights of each index are established, and then the values of each index are standardized using the affiliation function of fuzzy theory and used as the input values of the neural network, and the network is learned and trained according to the error regulations, and according to the given samples, a complete set of university teachers’ teaching quality evaluation knowledge base is finally obtained, which can be used to evaluate the music teaching quality of other teachers, and different evaluation results can be obtained according to the changes of corresponding factors.

The arrangement of the preceding paper is as follows: Section 2 describes all the related work needed for paper. Section 3 consists of all the methods used in paper and architecture the model to design the university music. Section 4 discusses the experiments follow in paper and evaluate the results of experiments. Section 5 concludes the paper.

2. Related Work

In this section, completely discuss the all the previous work used in this paper to make new results. Firstly, evaluate the current situation of university music education. This evaluation can better the ultimate and basic goals of higher education development. Secondly, a new innovative field which is rapidly developing named as machine learning instructional evaluation.

2.1. University Music Education Evaluation. The current situation of assessment of teaching work in music professional colleges and universities, the lack of content of the assessment itself is called "meta-assessment," such assessment content is also the assessment of the overall assessment activities content. Nowadays, China has not built the assessment system according to such a model, but still adopts the university teaching assessment system to promote the assessment content, and there is still no targeted content implementation for the monitoring and guarantee mechanism of the assessment content and the assessment system itself, which can have a very positive effect on improving the quality of assessment, protecting the legitimate rights and interests of the assessed and achieving the final assessment goal [12]. For the assessment of the content of the assessment itself, that is, the re-evaluation of the actual assessment, this type of assessment mode has the characteristics of re-evaluation. Therefore, the lack of this appraisal mode directly affects the scientific and validity of the appraisal. The imbalance in the mentality of the assessment subjects and the seriousness of the utilitarian characteristics of the educational model of assessment is for the future music teaching in music professional colleges and universities to better integrate the actual needs of society, and in such a trend to continuously improve the quality of education and teaching.
as well as teaching standards. Nowadays, music teaching and learning in music colleges and universities has received a lot of attention from educators, and such attention not only shows that music majors in colleges and universities want to achieve two-way improvement in education and talent training through such assessment work, but also shows the utilitarian nature of music colleges and universities themselves. Quality assessment results can have a direct impact on the reputation, student enrollment, funding, and other related aspects of the music program itself. Therefore, music institutions are very concerned about the final assessment results [12], and the overall assessment indicators are divided in detail in such a way as to enhance their own teaching objectives, so that such targeted improvements are better able to obtain the final assessment results. However, such improvements do not fundamentally improve the problems of music majors, and some music institutions even engage in formalism in order to better meet the final assessment requirements, resulting in blind comparison among music majors. Such a model of assessment would defeat the purpose of assessment and would run counter to the requirements of the education sector. The main way of information transmission in the evaluation of education and teaching in music professional colleges and universities is the single information communication between the relevant departments and colleges and universities, based on the self-evaluation of schools and providing relevant evaluation information from the schools’ own situation [13]. The main source of such assessment information is the school, and then the team of assessment experts is constructed according to the special characteristics of music majors, and the professional assessment team is constructed in this way. In the assessment method, the four aspects of “listening, seeing, checking, and discussing” are used to inspect the music schools, and the expert team will carry out the work in accordance with the information provided by the schools during the field visits. The information is mainly from the school itself, and the content of the information can show the social prestige, alumni achievements, and the influence and contribution to the development of the region. However, such information is not transmitted from outside and there is no smooth channel for information collection. Such a limited way of information collection often affects the authenticity and reliability of the final assessment results, leading to an overall decline in assessment standards. The university music assessment framework is shown in Figure 2.

The main ways to improve the assessment of the teaching work of music professional colleges and universities include: the establishment of a new assessment model of intermediary mode music professional colleges and universities teaching assessment for who to assess to be more authoritative and persuasive, has become one of the most critical elements of the assessment work nowadays. The music talents cultivated by music professional colleges and universities will eventually be employed and developed in the society, and such talent team building is the key content of talent cultivation in colleges and universities, so social participation needs to be integrated into education evaluation, and only in this way can we ensure that the final evaluation content is more accurate and objective. The establishment of assessment system by means of intermediary assessment is a key element in line with the development direction of national higher education assessment [14]. The intermediary assessment system can not only make the final assessment results more scientific and effective, but also avoid the present assessment problems and effectively carry out the improvement and optimization of the assessment mode. In the construction of such an assessment model, the original sources of assessment information are expanded, and information on the needs of society for music professional institutions is better obtained. The establishment of the intermediary assessment system better provides a solid foundation channel for the communication of information between schools and various aspects of society, and promotes the development of higher professional music education. Refine the content of the evaluation system for the problem of comparison among universities in the early stage of evaluation work, it is necessary to have a more detailed evaluation system established, and to improve the evaluation system on the basis of the existing one, so as to better reduce the bad problems in the early stage by such refinement of the content. For refining the evaluation system, first of all, it is necessary to ensure the openness and transparency of the evaluation contents and related information, and adopt the way of regular public disclosure of the self-evaluation reports of music institutions, so that all parties in the society can monitor the authenticity of their contents in this way; then, the establishment of the evaluation professional team needs to follow the requirements of higher teaching work discipline after the actual inspection to ensure that the evaluation work can be done in accordance with the Integrity and self-discipline standards are required. The problem of falsification needs to be dealt with seriously to avoid the problem of untruthfulness in the assessment work, so as to ensure the scientific and validity of the assessment itself. Strengthening the differential content of assessment content, the education model of China’s music colleges and universities has been developed and reformed for many years, and a multilevel and multielement development pattern has gradually formed in the existing music teaching. In view of this, the educational development of music colleges and universities and the construction of the assessment index system also need to be adjusted in diversity according to the current development requirements. The change of educational diversity is the key content of the development of national higher education, and the teaching assessment work of music colleges and universities presents the characteristics of singularity, without good regional division of teaching, and different types and levels of music professional colleges and universities will present different development goals and development directions. The scientific and effective construction of the assessment index system requires personalized content enhancement on the basis of universality. The evaluation index system with the combination of universality and specificity can better ensure the ultimate requirements and basic goals of higher education development, and can bring a broader development space to
different levels and types of music professional institutions, better show their own characteristics, and can help schools find their own position and better development.

2.2. ML Instructional Evaluation. As a brand-new field that has been developing rapidly for more than a decade, ML has received more and more attention from researchers, and it has obvious advantages over shallow models in both feature extraction and modeling. Among them, deep learning is good at mining increasingly abstract feature representations from raw input data, and these representations have good generalization ability. It overcomes some of the problems that have been considered intractable in AI in the past [15]. And with the significant growth in the number of training data sets and the dramatic increase in chip processing power, it has been effective in areas such as target detection and computer vision, natural language processing, speech recognition, and semantic analysis, and therefore has contributed to the development of artificial intelligence. Deep learning is a hierarchical ML method that includes multilevel nonlinear transformations, and deep neural networks are the main form at present [16]. The connection pattern between neurons is inspired by the organization of animal visual cortex, and convolutional neural networks are one of the classical and widely used structures. The local connectivity, weight sharing and pooling operations of convolutional neural networks enable them to effectively reduce the complexity of the network, reduce the number of training parameters, make the model invariant to translation, distortion and scaling to a certain degree, and have strong robustness and fault tolerance, and are also easy to train and optimize. Based on these superior properties, it outperforms standard fully connected neural networks in various signal and information processing tasks. The block diagram of ML and music evaluation method is shown in Figure 3.

Currently, the TE in most universities is basically composed of four parts: student evaluation, peer evaluation, teacher self-evaluation and expert evaluation, among which student evaluation, peer evaluation and teacher self-evaluation are basically used as a reference and do not directly determine the final evaluation results. The final result is that the university provides all the relevant information in its possession and the results of the first three kinds of evaluation to the expert evaluation team, which gives the final rating and opinions to the teachers. Although this evaluation method is scientific [17], it is impossible to have a comprehensive grasp of the teaching level of teachers due to the complexity, independence and creativity of teachers’ teaching work and the lagging and group nature of teaching effects, based only on students’ learning results and the evaluation results and data of students, peers and teachers themselves. In addition, in the process of peer assessment, the reliability of measurement and statistics is not enough due to the small number of people, and the reliability and validity of the evaluation are relatively poor and easily influenced by non-teaching factors. Similarly, in the process of teachers’ self-evaluation, due to the influence of subjective factors such as social expectations and self-value protection, they often cannot evaluate their own teaching objectively and are prone to the situation that tolerance errors are influenced by these factors, and the objectivity of peer evaluation and teachers’ self-evaluation is often discounted in terms of evaluation results [18]. Thus, the final evaluation of teaching by the expert group based on these evaluation results and data is bound to lead to certain errors in the evaluation results. In view of the above problems, a comprehensive evaluation of music teachers’ teaching quality is conducted with the goal of helping music teachers to improve their teaching quality and outstanding music teachers to summarize their teaching experience. Combined with the actual university music teachers’ teaching quality evaluation, the neural network method is used to evaluate the teaching quality of university teachers, making full use of and analyzing the evaluation information of students, teachers and experts to form learning samples, and then using the neural network to account for the learning rules to derive the final evaluation results. The model not only solves the evaluation of teaching quality influenced by multiple factors from multiple perspectives, but also solves the repeated evaluation of re-evaluation in the fuzzy comprehensive evaluation method, has self-learning and self-adaptive functions, makes full use of empirical knowledge, weakens the human factors in weight determination, and makes the evaluation results more just and reasonable [19].

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**Figure 2:** University MTE system.
3. Method

In this section, all the methods used in the paper are briefly discussed. Firstly, the model architecture is explained which is helpful to evaluate the music teaching quality in colleges and universities. Second, the method details is discussed and tells whether the training of music stop or continue on the basis of checking errors and accuracy requirement.

3.1. Model Architecture. The evaluation of music teaching quality in colleges and universities is a multivariate, fuzzy and complex nonlinear problem. The indicators affecting music teaching quality are multifaceted, and the multiple indicators affecting teaching quality present complex non-linear relationships with teaching quality, which are difficult to be accurately described by a definite mathematical model. Neural network, as an approximator of complex nonlinear correlations, provides the possibility to solve the above problems. In order to make the teaching quality evaluation results more accurate and establish a more applicable evaluation model, this paper proposes a neural network-based university music teachers’ teaching quality evaluation model, and the model structure is shown in Figure 4.

3.2. Method Details. The structure diagram of BP neural network is shown in Figure 5. Including the input layer, output layer, and the hidden layer, let the input layer input be \( x_n \), then its output is

\[
O_i^{(1)} = x(i), \quad i = 1, 2, \ldots, n.
\]

Let the BP neural network implied layer weight coefficient be \( w_{ij}^{(3)}, f[\cdot] \) denotes the mapping function, then its input and output calculation formulae are expressed as

\[
\text{net}_i^{(3)}(k) = \sum_{j=1}^{m} w_{ij}^{(3)} O_j^{(2)}(k),
\]

\[
O_i^{(3)}(k) = f[\text{net}_i^{(3)}(k)].
\]

Let the BP neural network output layer weight coefficient be \( w_{\alpha j}^{(2)}, g[\cdot] \) denotes the mapping function, then its input and output calculation formulae are expressed as

\[
\text{net}_i^{(2)}(k) = \sum_{j=1}^{m} w_{ij}^{(2)} O_j^{(1)}(k),
\]

\[
O_i^{(2)}(k) = f[\text{net}_i^{(2)}(k)].
\]

For the \( p \)-th sample, its actual output and network output are \( O_p(k+1) \) and \( O_p^{'}(k+1) \), respectively, then its error is calculated as

\[
E_p = \frac{1}{2} [O_p(k+1) - O_p^{'}(k+1)]^2.
\]

For all training samples, their total error is calculated as

\[
E = \sum_{p=1}^{P} E_p = \sum_{p=1}^{P} \frac{1}{2} [O_p(k+1) - O_p^{'}(k+1)]^2,
\]

where \( P \) denotes the number of training samples.

The adjustment process of \( w_{ij}^{(2)} \) and \( w_{\alpha j}^{(3)} \) is specified as

\[
w_{ij}^{(2)}(k) = \alpha w_{ij}^{(2)}(k) - \eta \frac{\delta E}{\delta w_{ij}^{(2)}(k)} + \alpha \omega_{ij}^{(2)}
\]

\[
w_{\alpha j}^{(3)}(k) = \alpha w_{\alpha j}^{(3)}(k) - \eta \frac{\delta E}{\delta w_{\alpha j}^{(3)}(k)} + \alpha \omega_{\alpha j}^{(3)}
\]

where \( \eta \) is the learning rate; \( \alpha \) is the momentum factor. The initial values of some parameters of BP neural network, such as \( w_{ij}^{(2)} \) and \( w_{\alpha j}^{(3)} \) are determined empirically to determine the initial values. BP (back propagation) back propagation network is a multilayer feed forward network trained according to the error back propagation algorithm has nonlinear mapping ability, generalization ability, error tolerance ability is currently one of the most widely used the learning rule of BP network is to continuously adjust the network weights to minimize the sum of squared network errors by back propagation using the most rapid descent method. To build the teaching quality evaluation model, we first select the representative teaching quality evaluation indexes as input information from the input layer to the output layer after the implicit layer processing. If the actual output of the output layer does not match the desired output, it is transferred to the back-propagation stage of the error. The error back propagation is the back propagation of the output error in some form through the implied layer to the input layer, and the error is distributed to all units in each layer so as to obtain the error signal of each unit in each layer, which is used as the basis for correcting the weight of each unit. This signal forward propagation and error back propagation process of adjusting the weights of each layer is carried out repeatedly until the optimal weights are found so that the error of the network output is reduced to a predefined minimum error. The new samples are then fed into the trained network to obtain the corresponding output values.

Assign random values to the weight matrices \( V, W \). The learning rate is set to a decimal number between 0 and 1 and set a precision \( E_{min} \) achieved after training the network. Input training samples \( X^p = (x_1, x_2, \ldots, x_n), p \) is the serial number of the sample team \( x_1, x_2, \ldots, x_n \) denotes the \( n \) indicators of teaching quality evaluation. The implied layer output vector \( Y = (y_1, y_2, \ldots, y_m) \), and the output layer output vector \( O \) is the final evaluation expectation output evaluation is set as \( d_p \). For the implied layer: \( y_j = f_1(\text{net}_j), \text{net}_j = \sum_{i=0}^{n} v_{ixj}, j = 1, 2, \ldots, m \), where \( f_1 \) is the input layer transfer function \( v_i \) denotes the input \( i \)-th neuron to the \( j \)-th neuron in the hidden layer. For the output layer: \( O = f_2(\text{net}), \text{net} = \sum_{j=0}^{m} w_{yj}, \) where \( f_2 \) is the implied layer transfer function, \( w_j \) denotes the weight of the \( j \)-th neuron in the implied layer to the neuron in the output layer.

The mean square error \( E_{mse} = 1/P \sum_{p=1}^{P} (O_p - d_p)^2 \) is chosen to calculate the output error of the network by updating the weights to make the output error decreasing. The weights are adjusted by defining the error signals \( \delta^o_i, \delta^y_j \) for the output layer and the hidden layer, respectively.
\[ \delta^0 = (d - O) f'_2(\text{net}), \delta^j = \delta^0 w_{ji}'(\text{net}_j), \]

\[
\begin{align*}
\Delta w_j = -\eta \frac{\partial E}{\partial w_j} = \eta \delta^0 y_j, \\
\Delta v_{ij} = -\eta \frac{\partial E}{\partial v_{ij}} = \eta \delta^j x_i,
\end{align*}
\]

where \( \eta \) denotes the learning rate. Train all samples and check the total error if the total error reaches the accuracy requirement, then stop training otherwise repeat the training until \( E < E_{\text{min}} \).

4. **Experimentation and Evaluation**

In this section, all the experiments performed to make a conclusion is discussed and the results taken from the performing experiment is also discussed and elaborating the evaluation of teaching music quality by choosing some music students and further procedure explain in preceding topic of paper.

4.1. **Music Education Evaluation Criteria.** According to the three aspects of UMT objectives, teaching contents, and teaching methods, we proposed a university MTE system. The evaluation indicators are shown in Table 1.

According to the three aspects of UMT objectives, teaching contents and teaching methods, we proposed a university MTE system.

\[ x_{ij} = \frac{c_{ij} - \tau_j}{S_j}, \]  

where \( x_{ij} \) is the standardized data of \( c_{ij} \), \( c_i \) is the mean of the \( j \)-th indicator that is not standardized; \( S \) is the standard deviation of the \( j \)-th indicator that is not standardized.

\[ \tau_j = \frac{1}{M} \sum_{i=1}^{M} c_{ij}, \]

\[ S_j = \sqrt{1/M - 1 \sum_{i=1}^{M} (c_{ij} - \tau_j)^2} \]

If the standardized data is still greater than 1, the data will be assigned a value of 1.

4.2. **Dataset.** In this paper, after analyzing and standardizing the data of music teachers’ teaching quality ratings according to a university, 12 teachers as evaluation samples, as in Table 2, and divide the data into two parts, and select the front 8 groups as learning samples for training weights, the implicit layer selects 16 output units with learning accuracy \( \epsilon = 0.000001 \), and the back remaining 4 groups as test samples. After 10,000 times of learning, the training results are shown in Table 3, and the evaluation results and expected output evaluation results of the latter 4 groups of data testing are shown in Table 4.

4.3. **Experimental Setup.** In order to analyze the effectiveness of the teaching quality assessment model of universities based on data mining algorithm, an example analysis is conducted, in which the platform settings for the example analysis are shown in Table 5.

4.4. **Experimental Results.** As can be seen in Tables 3 and 4, the evaluation of the latter four groups of teachers using the results of the network training is very close to the expected
Data Services and Applications

Data Analysis and Processing

Multimodal Prediction
Music Teaching Quality Assessment
Music teaching scoring

Tensor Plus
Tensor subtraction
Tensor multiplication
Vector
Tensor linking
Tensor multiplication
Tensor unity multiplication

Parallel tensor computation based on tensor chains
Neural network algorithm

Data representation and decomposition

Student Performance Statistics
Classroom Performance
Students' music foundation

Figure 4: Model structure.

Figure 5: Neural network structure.

Table 1: Music teaching quality evaluation index system.

<table>
<thead>
<tr>
<th>Indicator code</th>
<th>Indicator content</th>
<th>Indicator weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Good knowledge of content and accurate concepts</td>
<td>0.12</td>
</tr>
<tr>
<td>2</td>
<td>Outstanding focus and appropriate examples</td>
<td>0.11</td>
</tr>
<tr>
<td>3</td>
<td>Clearly organized and vivid language</td>
<td>0.08</td>
</tr>
<tr>
<td>4</td>
<td>Inspiring thinking and cultivating ability</td>
<td>0.09</td>
</tr>
<tr>
<td>5</td>
<td>Practical and applicable materials</td>
<td>0.10</td>
</tr>
<tr>
<td>6</td>
<td>Appropriate assignments and serious corrections</td>
<td>0.07</td>
</tr>
<tr>
<td>7</td>
<td>Careful tutoring, answering questions on time</td>
<td>0.08</td>
</tr>
<tr>
<td>8</td>
<td>Teach according to the material and pay attention to teaching improvement</td>
<td>0.09</td>
</tr>
<tr>
<td>9</td>
<td>Discipline and strict assessment</td>
<td>0.07</td>
</tr>
<tr>
<td>10</td>
<td>Full of spirit, teaching and educating people</td>
<td>0.08</td>
</tr>
<tr>
<td>11</td>
<td>Overall teacher satisfaction</td>
<td>0.11</td>
</tr>
</tbody>
</table>
output, indicating that the model has a small evaluation error, and it can be seen that the test results are within a very small range of the absolute value of the error of the expert evaluation, and the results of the simulation evaluation are very close to the results of the expert evaluation, indicating that the model has good fault tolerance and generalization ability.

4.5. Comparison of Results. The analysis of the higher mathematics teaching quality assessment accuracy in Table 4 revealed that: (1) the average of higher mathematics teaching quality assessment accuracy of SVM was 84.93%, and the error of higher mathematics teaching quality assessment was the largest. This is because its parameters are determined in a random way, which cannot establish an assessment model describing the complex changing characteristics of higher mathematics teaching quality, resulting in many overfitting points of higher mathematics teaching quality assessment and the worst higher mathematics teaching quality assessment effect. (2) The average precision of higher mathematics teaching quality assessment by data mining algorithm, which is much higher than that of SVM. This is because the model in this paper introduces BP neural network and parameter adaptive optimization algorithm, establishes an assessment model that can track the complex change characteristics of higher mathematics teaching quality with high accuracy, overcoming some problems in the current assessment process, and improves the assessment effect effectively.

5. Conclusion

The reform of MTE in general colleges and universities can promote and facilitate the scientific and formalized development of music teaching in colleges and universities. The supervisory and guiding role in achieving and accomplishing the ameliorate and development of music teaching objectives, teaching contents and teaching development in colleges and universities. Promote the overall development of students' moral, intellectual, physical, aesthetic and labor to improve the quality of teaching to cultivate more excellent vocal music talents. This paper takes the process of evaluating the teaching quality of college music teachers as a system, studies the problem of college teaching quality from the perspective of input, output, information and control of
the system, and applies computer technology and mathematical methods simultaneously as tools in the study of this problem of college teaching quality. Based on the survey and analysis data of the teaching quality of college music teachers, the principles and methods of the evaluation model of the teaching quality of college music teachers are elaborated based on the optimized neural network theory and the software system of the evaluation of the teaching quality of college music teachers is developed from the perspective of computer database development and programming. The software imported the survey data (including the comprehensive evaluation score of teaching quality and the evaluation score of its influencing factors) for the calculation of teaching quality score and compared and analyzed the calculated values of the test samples with the survey data values and the degree of their conformity was quite good, which indicated that it was practical and feasible to use the optimized BP neural network theory method for the analysis and calculation of teaching quality evaluation of college teachers.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

References