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Research Article

Application of Big Data Mining Technology in the Digital Construction of Vocal Music Teaching Resource Library

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In recent years, vocal music is becoming more and more important to daily life, which can cultivate emotion and adjust pressure, but at present, vocal music teaching is faced with an increasingly serious shortage of teacher resources. Therefore, it is particularly important to develop a vocal music teaching system using the computer-aided teaching function. First, the algorithm flow of the system is designed in detail according to the principle of computer neural network technology, the performance characteristics of vocal music are extracted by using Fourier transform and its improved function, and the key modules of the system are designed according to the system frame structure and data processing flow and gave the key design code. Finally, taking piano performance as an example, players with different steel bar grades were selected to test the accuracy of the system evaluation. The test results show that the system can reflect the real level of the performers, which is beneficial to vocal music teaching. The improvement of the vocal music teaching system is of great practical significance to adjust the traditional music teaching mode and make the education system more reasonable.

1. Introduction

With the development of my country's economy, the living standards of residents are improving day by day. As an important means of cultivating sentiment, piano performance is sought after by many people, and the number of students is large. However, at this stage, the number of teachers of piano performance in my country is extremely rare. Due to the teaching environment and time requirements caused by the shortage of teacher resources, the penetration rate of piano is not high. Therefore, a vocal performance evaluation system is developed for piano learning and uses the automatic identification technology of the computer to automatically record the performance information of the students and use the stored music information in the system to compare the performance of the students' piano performance and find out the deficiencies in the performance. The system not only replaces the teacher's teaching work to a certain extent but also has a certain auxiliary role for the relevant professionals in music creation [1].

Teaching quality is an important standard for measuring teaching and guiding teaching reform, which can objectively reflect the level of education and the degree of educational effect [2]. The purpose of teaching quality monitoring is to objectively evaluate the current situation of teaching and learning, identify problems and find out the causes of problems while affirming their achievements, and formulate effective and feasible improvement measures to help students better discover their own strengths and weaknesses [3]. The evaluation of teaching quality can start from two aspects: one is students, students are the most important subjects in teaching, and the quality of teaching can be objectively reflected by analyzing the learning effect of students [4]; the other is teachers, teachers are the students who acquire knowledge The main source, through the evaluation of teachers' teaching situation, can also reflect the level of teaching quality. In the past, evaluation methods mainly started from these two aspects, but the disadvantage was that they were either evaluated from the perspective of students or from the perspective of teachers, and few studies jointly evaluated from multiple perspectives [5].

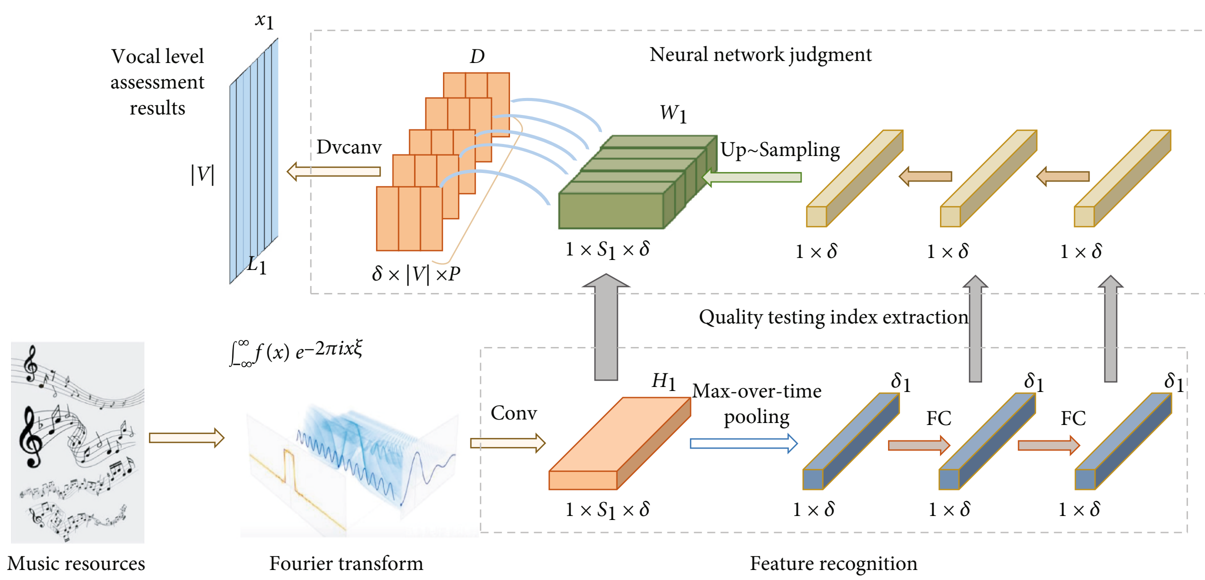

Figure 1: Application framework of big data mining technology in vocal music teaching.

The evaluation of teaching quality has been carried out for many years, since its inception, the teaching quality monitoring and evaluation of my country's basic education have achieved remarkable results, basically meeting the standard requirements of quality monitoring, which has played a role in improving the teaching quality of my country's basic education. But at the same time, there are still some problems in the monitoring and evaluation of teaching quality. In the past, due to limited technology, in the process of data collection for teaching quality monitoring and evaluation in my country, data was mainly collected manually, that is, the school filled in the data with electronic forms, then reported the data layer by layer, and finally assigned a special person to summarize it [6]. In view of the large-scale and wide-ranging geographical situation in my country, and the uneven development level of various places, this single evaluation method inevitably ignores the evaluation of students' comprehensive development ability, limits the scope of teaching quality monitoring, and greatly affects the conclusion of monitoring. Accuracy, it is difficult to achieve the real purpose of teaching quality monitoring [7].

Teaching quality monitoring and evaluation based on big data can dynamically detect teachers' teaching status and students' learning effectiveness [8]. The data can be reflected according to the basic information in the teaching process. Based on the principle of neural network technology combined with the current popular education big data technology, this study developed a complete set of teaching quality monitoring system, enable it to realize online data collection, and apply to regional school daily management and service system, which will certainly improve the school in the current education level and the comprehensive competitiveness in transformation. It will provide powerful help for those who can walk in the forefront of educational innovation. It is of great significance to improve the quality of education and teaching and realize educational modernization [9]. Based on this background, this paper proposes an algorithmic framework for applying big data mining-assisted music teaching, as shown in Figure 1. First of all, according to the principle of computer neural network technology, the system algorithm process is designed in detail, the Fourier transform and its improvement function are used to extract the vocal music performance characteristics and then the vocal music detection index, and the neural network is used to judge the final effect and finally realize the purpose of auxiliary teaching.

2. State of the Art

This subject first needs to understand the content related to piano teaching software in various fields and then integrate the knowledge in various fields to carry out the research of this subject [10]. The ultimate purpose of this subject is to realize a software, so the computer aspect involves the most content, in the aspect of music theory. It mainly includes music notation, rhythm, and mode. In pedagogy, it includes learning mind and curriculum design [11].

MIDI technology is the most extensive music standard format in the arrangement world, which can be called "computers can understand the score." It mainly uses the digital control signals of notes to record music. The widely discussed digital piano teaching method P has been implemented in some music education institutions [12]. The system of digital piano teaching is composed of a master piano used by teachers to drive dozens of students to use pianos for group teaching, equipped with auxiliary teaching software, multimedia projectors, monitoring and monitoring systems, and other equipment [13]. The digital piano teaching system is similar to the learning system discussed in this paper, both use electronic technology for piano teaching, and the key part is the realization of teaching software [14]. The difference is that the digital piano teaching still adopts the method of teacher evaluation and guidance when students practice playing. This system uses the computer for evaluation and guidance [15].

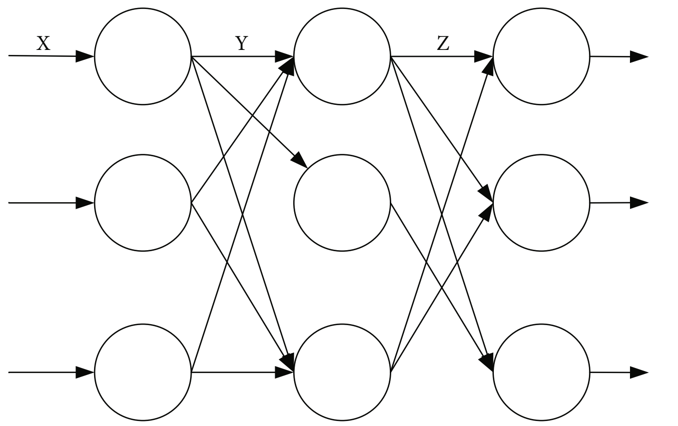

FIGURE 2: BP neural network structure.

Music recognition technology is a hot research topic, music recognition technology is mainly through the computer technology to identify the music and through the music recognition technology and can make the computer automatically identify the music melody, rhythm, type, style, and other information. This information can be used to objectively evaluate the level of music performance, to find similar music, or to push the same style and type of music to the user. Music recognition technology makes it possible to interact directly with computer applications through music itself. Music recognition is a technology that identifies and extracts various characteristics of music waveform signals. It has a wider range of applications, such as stage lighting control, audio file retrieval, and music fountain control. The method implemented by this system uses the MIDI keyboard to complete the input of music signals. In essence, the expression of MIDI signals is close to the attributes of "sound" in music theory. Extracting musical features from waveform signals is not involved [16].

There are some foreign studies on teaching quality monitoring methods based on big data. In the domestic teaching quality analysis based on big data, we searched all over the large academic databases such as CNKI and VIP and found very little research in this area. The research also only introduces some technologies that use big data in teaching quality monitoring. Yokota et al. only introduce the significance and characteristics of big data for teaching quality evaluation. It can be found that the current teaching quality monitoring and evaluation based on big data are still in the theoretical stage [17].

To sum up, the research on teaching quality monitoring and evaluation methods based on big data is basically in its infancy in my country. Researching teaching quality monitoring and evaluation methods and then developing a teaching quality monitoring system based on big data have great application prospects [18].

3. Methodology

3.1. Introduction to Neural Networks. Data mining has produced a number of methods since its development, represented by BP neural networks and decision tree algorithms. Neural network algorithm is a widely used data mining method, which is an information processing system based on the principle of human neural networks. Because of its own processing, distributed storage and other characteristics are very suitable for dealing with nonlinear and those characterized by vague, incomplete knowledge or data problems. BP neural networks, or Back Propagation Networks, were designed in 1986 by Rumelhart. A multilayer feed-forward network proposed was by the home group. It can learn and store input-output relational mapping. According to the different functions and mechanisms, the learning model of this network technology includes three layers: input layer, hidden layer, and output layer, and its structure is shown in Figure 2 [19].

Assuming that the number of nodes in the input layer is n, the number of nodes in the hidden layer is q, the number of nodes in the output layer is m, the weight between the input layer and the hidden layer is v_{ki}, the conversion relationship is represented by f_1, and the weight between the hidden layer and the output layer is is w_{jk}, and the conversion relationship is represented by f_2, then the conversion from the input layer to the hidden layer can be represented by formula (1), and the conversion from the hidden layer to the output layer is as the following formula.

$$z_k = f_1\left(\sum_{i=0}^{q} v_{ki} x_i\right). \quad (1)$$

In the formula, z_k is the value after the input layer is converted to the hidden layer, x_i is the value of the input layer, and i is an integer from 1 to n as in the following formula.

$$y_j = f_2\left(\sum_{i=0}^{m} w_{jk} z_k\right). \quad (2)$$

In the formula, y_j is the value after the hidden layer is converted to the output layer, and k is an integer from 1 to m. The error in the network structure can be calculated by formula (3), such as the following formula.

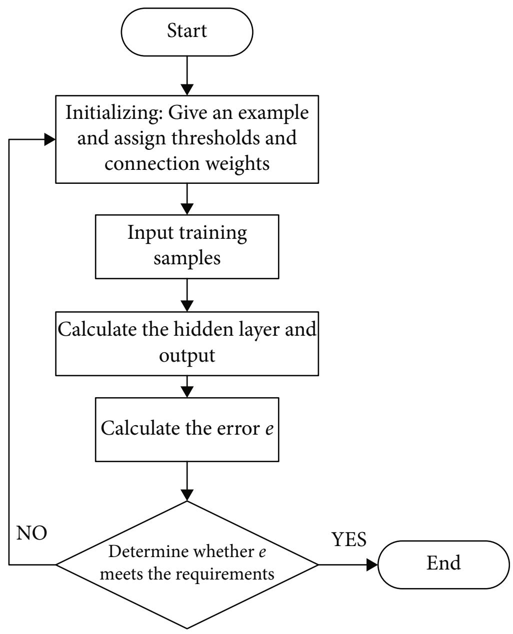

Figure 3: BP neural network algorithm flow.

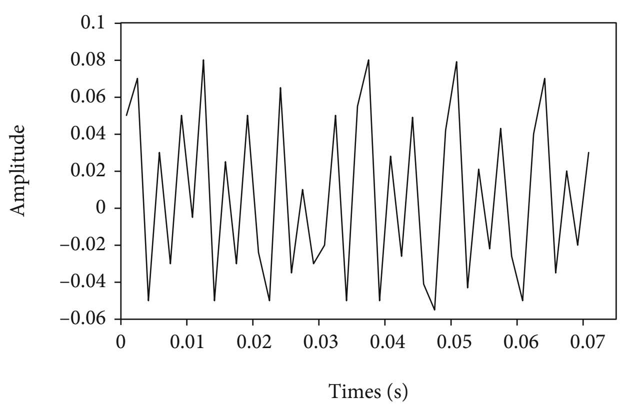

Figure 4: Waveform after extraction.

$$e = \frac{1}{2}\sum_{1}^{m+n}\sum_{1}^{m+n}(y-\bar{y})^2. \tag{3}$$

In the formula, e is the calculation error, and y is the average value of the hidden layer [20].

According to the above conversion rules, the algorithm flow of the BP neural network in the computer is obtained, as shown in Figure 3.

3.2. Feature Extraction Technology for Vocal Music Teaching. Music feature recognition is a process of converting musical material into electronic signals. The basis of identification is the collection of musical features. This paper selects 4 pianos and divides them into different systems, using different playing methods and playing strengths and including each sound area. According to the background of the continuous

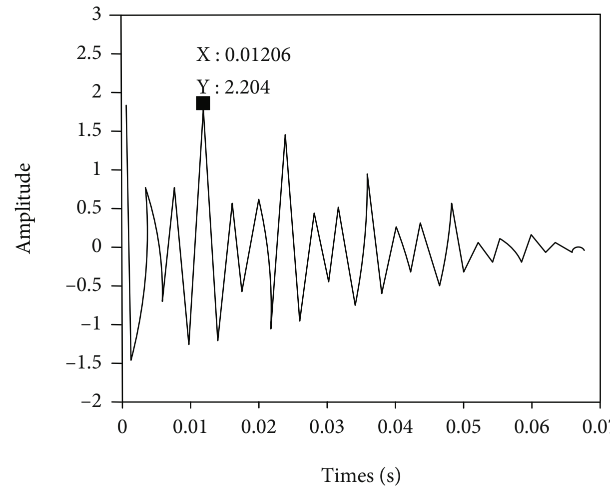

Figure 5: Waveform after processing.

medium hypothesis, it can be compared to the sound signal that the music information is composed of a large number of sample points, there is a gap in time between the sample points, and the music information composed of discrete sample points can be regarded as composed of countless frames without gaps. Since the voice signal is a nonstationary signal, it is meaningless to directly extract all the features of a complete audio file, but the audio changes slowly in a short period of time, which can be considered short-term smooth. At this time, the assumption of stability + continuity allows us to estimate statistical information with the help of observational data. This short-term smooth division is signal framing. The collected music information is obtained by Fourier transformation. For the time-domain waveform and frequency-domain waveform without the tone, the Fourier transform formula is as formula (4). Figure 4 shows the extracted waveform.

$$\begin{aligned} u(x,t) = {} & \frac{8v_0\delta}{\pi^2 a}\sum_{n=1}^{\infty}\frac{1}{n}\frac{1}{1-4\delta^2 n^2/l^2}\sin\frac{n\pi x_0}{l}\cos\frac{n\pi d}{l} \\ & \times \sin\frac{n\pi a t}{l}\sin\frac{n\pi x}{l}, \end{aligned} \tag{4}$$

where v_0 is the initial velocity of the string, a is the vibration acceleration, t is the vibration time, l is the string length, and δ is the half width of the strike.

Analyzing the waveform diagram in Figure 3, it can be found that there is a certain gap between the extracted music features and the actual value, and the relationship between electronic music and actual audio cannot be completely corresponded. Therefore, the extraction formula must be recorrected. Starting from the influencing factors of the waveform, the correction formula shown in formula (5) is constructed, the extracted waveform is modified according to the correction formula, and Figure 3 is modified according to formula (5). The image is shown in Figure 5.

Table 1: Management quality index system.

First-level indicator	Second-level indicator	Weight (with two decimal places)
Faculty (z_1)	Teacher's teaching level, professional ability, teacher's morality and style (z_{11}) Teacher teaching competence, teaching research (z_{12}) Teacher development and service attitude, competence Teacher structure (z_{13})	
Teaching environment (z_2)	Teaching funding investment and allocation (z_{21}) Teaching plan planning, training program design (z_{22}) Openness of teaching facilities (z_{23}) Number of quality courses (z_{24}) Social resource breadth (z_{25})	
Teaching conditions (z_3)	Practical teaching setting (z_{31}) The average reading rate of the library (z_{32}) Compliance with school rules and regulations (z_{33})	

$$S(\omega) = \begin{cases} A \dfrac{\alpha_1}{\alpha_1^2 + (\omega - \omega_t)^2}, & \omega_t - \alpha_1 \le \omega \le \omega_t + \alpha_1, \\ A \dfrac{2}{|\omega - \omega_t|}, & \text{other}. \end{cases} \quad (5)$$

In the formula, $S(\omega)$ is the modified ordinate value of vibration, α_1 is the parameter value of the waveform curve near the peak value of the adjustment waveform, A is the amplitude, and ω_t is the specified audio frequency or frequency multiplier.

3.3. Construction of Monitoring Indicators for Vocal Music Teaching Quality. Teaching quality is the lifeblood of education, it is related to the quality of talent training and the impact on social culture, and vocal music in college music is a traditional teaching subject, but also a compulsory basic course for music students, improving the quality of teaching is the common goal of all teaching units, so it is very necessary to take effective monitoring measures for teaching quality. According to the monitoring content, this paper determines to construct a monitoring index system from four aspects: school management quality, teachers' teaching process, students' learning behavior, and academic quality.

The school management quality indicators include teaching staff, teaching environment, and teaching conditions. The specific indicators are constructed as shown in Table 1.

Teachers' teaching process indicators include teaching content, teaching attitude, teaching skills, and teaching effects. The specific indicators are constructed as shown in Table 2.

The indicators of student learning behavior include learning goals, learning performance, style of study, learning effect, and ideological morality. The specific indicators are constructed as shown in Table 3.

4. Result Analysis and Discussion

4.1. Design and Application of Neural Network System. The vocal music performance evaluation system uses computer recognition technology to judge the performance of the performer and scores the performance according to rigorous computer logic and preestablished performance standards. The system will convert the music into electronic information in advance according to different music. The music score played by the performer in the system is filtered and processed to extract the music features, and the neural network model compares the electronic music score with the player's music score information and finally outputs the comparison results. Genres have a definable musical style, so the author uses this feature to design a basic model for learning the strength and weakness of a piece of music. As shown in Figure 6, there are two main layers in this model: the bidirectional LSTM (Bi-Directional LSTM) and the linear layer.

According to system frame structure, starting from the processing sequence of the internal data of the system, according to the working principle and working sequence of the system, this network is used to learn more complex style information that cannot be trained on the genre network. StyleNet has subnets of GenreNet that are used in StyleNet to learn the style of a particular genre. In StyleNet, there is an interpretation layer that can be shared by the GenreNet child network. This greatly reduces the parameters that the network needs to learn. And StyleNet is like a conversion tool that can convert music into different styles. As Figure 7 shows, this is a multitasking learning model.

The system will preprocess the musical score and store it in the form of electronic information. The player's musical score information is extracted and sorted by musical features and compared with the stored musical score information. Finally, the score is scored according to the comparison result, and the scoring result is output.

After the system is completed, its application effect is tested and verified. For the same piece of music, three performers were selected to perform, one of them was a piano teacher, student 1 was grade 8 piano, student 2 was grade 7 piano, and the scores of the three performers were shown in Table 4.

It can be found from the table that whether it is a single score in the performance or the average score of multiple

Table 2: Teaching process index system.

First-level indicator	Second-level indicator	Weight
Teaching content (u_1)	The teaching objectives are clear, meet the requirements of the teaching content, highlight the key points and difficulties, and have sufficient reasoning (u_{11}) The teaching logic is clear, the organization is clear, the content is substantial and skilled, the arrangement is reasonable, and the examples are appropriate (u_{12}) Seriously arrange and correct assignments, and regularly organize Q&A (u_{13}) Combining theory with practice, focusing on guiding students to think positively (u_{14})	
Teaching attitude (u_2)	Fully prepared lessons, work with enthusiastic, conscientious, and dedicated (u_{21}) Abide by the teaching discipline, go to and from get out of class on time (u_{22}) Teachers are rigorous in their studies, strict in teaching, dignified in appearance, harmonious in atmosphere, and respect for students (u_{23})	
Teaching skills (u_3)	Teaching in Mandarin, the language is accurate and vivid, the writing on the blackboard is neat, and the layout is reasonable (u_{31}) Flexible and diverse teaching methods, pay attention to cultivating students' ability to analyze and solve problems (u_{32}) Able to use various teaching aids such as network and multimedia reasonably (u_{33})	
Teaching effect (u_4)	Able to complete teaching tasks, students can accept and master the course content (u_{41}) Be able to initially use the course content to solve specific problems in the subject or related subjects (u_{42}) Promote the improvement of students' thinking ability and learning ability (u_{43})	

Table 3: Student learning behavior index system.

Primary target	Secondary target	Weight
Learning target (v_1)	The purpose of learning is clear and the attitude towards learning is correct (v_{11})	
Learning performance (v_2)	Adhere to preview before class, listen carefully during class, and review carefully after class (v_{21}) Complete homework on time and correct in time (v_{22}) Actively speak and take notes in class (v_{23}) Strong learning ability, good at asking questions, dare to question (v_{24})	
Style of study (v_3)	Late arrivals and early departures (v_{31}) Good classroom discipline and high attendance (v_{32}) Active participation in discussions, harmonious teacher-student relationship (v_{33})	
Learning result (v_4)	Master classroom knowledge and be able to apply it (v_{41}) Comprehension, independent thinking, analysis, and problem solving skills (v_{42})	
Moral (v_5)	Honest and trustworthy, love to work (v_{51}) Respect teachers and help others (v_{52}) Collective sense of honor (v_{53})	

performances, the scores in the system from high to low are the teacher, student 1, and student 2, and the real pianos of the three players. This score ranking can objectively reflect the performance level of the performers. Therefore, the system has a good evaluation effect on the professional level, and the evaluation accuracy is also relatively high. Students can use this system to train their own professional vocal music level.

4.2. Evaluation Method of Vocal Music Teaching Process. In order to evaluate the teaching process of vocal music, the evaluation system is constructed by using computer technology. When constructing the frequent item sets of the association algorithm, the map function will read the database repeatedly. Due to multiple data nodes, if the amount of data is large and the data distribution of each node is uneven, some data nodes will wait for a long time during the operation process. It causes waste of resources, so consider that when grouping data, an average distribution mechanism is adopted to distribute data evenly on each node, and the number of groups can be set according to the actual situation. At the same time, when calculating the candidate item set, if the count of some item sets is found to be very small, according to the set minimum threshold, the item sets that are directly excluded because they are smaller than the minimum threshold value, although the item sets are no longer calculated, but the database. The data still exists, so when reading the database, it will cause repeated reading and increase the time complexity. Based on this problem, consider that each time the algorithm reads the database to construct the item set, delete the item sets according to the minimum threshold, and delete the item sets according to the minimum threshold. Update the database, delete the useless data in the database, and reduce the repeated reading of invalid data in the database.

According to the designed teacher evaluation table, a hierarchical structure is established from top to bottom,

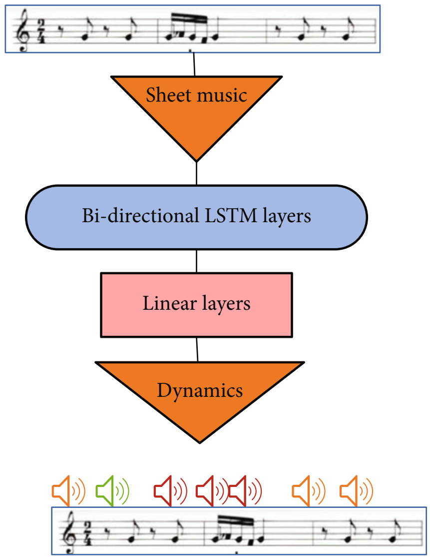

Figure 6: System framework.

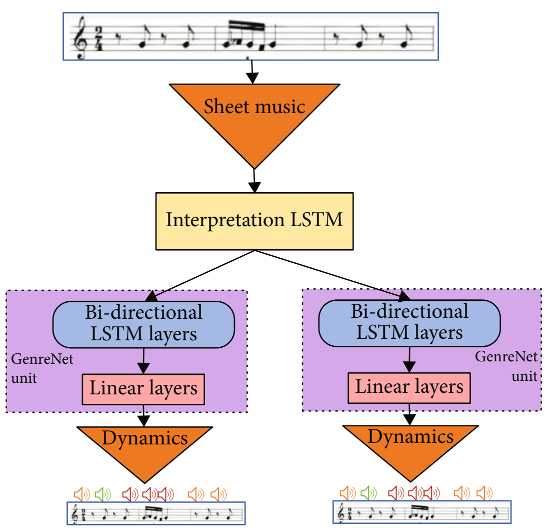

Figure 7: Multitasking learning model.

Table 4: Scores of the three performers.

Group	Playing score	Playing score	Playing score	Playing score	Playing score	Mean
Teacher 1	0.94	0.96	0.95	0.93	0.92	0.94
Student 1	0.85	0.88	0.85	0.87	0.85	0.86
Student 2	0.75	0.75	0.71	0.77	0.72	0.74

and the indicators at all levels are compared pairwise to establish an indicator judgment matrix. According to the sum of the same-level indicators to be 1, first calculate the weight of the first-level index from top to bottom, then calculate the second-level index with the first-level index, multiply the index weight by the index score, and then use the weight of each evaluation subject to obtain the final. For the scoring results, for the weight value of each evaluation subject, the calculation method for calculating the weight value can be used. Generally, students account for the highest proportion (about 0.5 ~ 0.6), followed by teachers' mutual evaluation (about 0.2 ~ 0.3).), and finally teacher self-evaluation and leadership or supervision each have a weight of about 0.1. The specific weight calculation process is as follows:

(1) Constructing a pairwise judgment matrix

Set up an expert group to compare the indicators at the same level. For example, for the teacher evaluation form, among the four first-level indicators, u_1 is more important than u_2, u_3, and u_4. The expert group will give a comparison based on the comparison and judgment. The $4 * 4$ judgment matrix is established in this way. In order to maintain the uniformity of the values given by experts, a comparison scale needs to be established, as shown in Table 5.

With the scale given above, the comparison value is given by the expert to determine the form of the matrix. It can be seen from the actual situation that the constructed matrix should be an $n * n$ square matrix due to the matrix established by the pairwise comparison between the indicators. And the matrix has the following characteristics. The two values at the symmetrical position should be in the reciprocal relationship. For example, the comparison value of u_1 relative to u_2 is u_{12}, and the comparison value of u_2 relative to u_1 is u_{21}, then, u_{12} is equal to the reciprocal of u_{21}, and this matrix is called a positive-reciprocal matrix. The form is as follows:

$$U = \begin{Bmatrix} u_{11} & u_{12} & u_{13} & u_{14} \\ \dfrac{1}{u_{12}} & u_{22} & u_{23} & u_{24} \\ \dfrac{1}{u_{13}} & \dfrac{1}{u_{23}} & u_{33} & u_{34} \\ \dfrac{1}{u_{14}} & \dfrac{1}{u_{24}} & \dfrac{1}{u_{34}} & u_{44} \end{Bmatrix}. \tag{6}$$

Through this matrix, the weights are calculated for the indicators, and the process is as follows.

First, normalize the matrix as follows:

$$u'_{ij} = \frac{u_{ij}}{\sum_{k=1}^{n} u_{kj}}. \tag{7}$$

Use the normalized matrix to calculate the weight, that is, the average value of each horizontal vector sum of the matrix is the weight of the corresponding index, as follows:

$$\omega_i = \frac{1}{n} \sum_{i=1}^{n} u'_{ki}. \tag{8}$$

Table 5: Comparison scale.

Significance	Value
Both elements are equally important	1
One element is slightly more important than the other	3
One element is significantly more important than another	5
One element is definitely more important than the other	7
One element is definitely more important than the other	9
The median of the comparison scale over which the two comparison factors lie	2, 4, 6, 8

Table 6: Average stochastic consistency index scale.

n	1	2	3	4
Value	0	0	0.58	0.9

Table 7: Eigenvalues, contribution rate, and cumulative contribution rate.

Main ingredient	Index	Eigenvalues	Contribution rate	Cumulative contribution rate
1	Z_{11}	3.1713	13.66%	13.66%
2	Z_{12}	3.0274	13.04%	26.7%
3	Z_{14}	2.9543	12.73%	39.43%
4	Z_{13}	2.8645	12.34%	51.77%
5	Z_{22}	2.2314	9.61%	61.38%
6	Z_{21}	2.2256	9.59%	70.97%
7	Z_{23}	2.2115	9.53%	80.5%
8	Z_{31}	2.0102	8.66%	89.16%
9	Z_{24}	1.4535	6.26%	95.42%
10	Z_{33}	0.7635	3.29%	98.71%
11	Z_{32}	0.2343	1.01%	99.72%
12	Z_{23}	0.0643	0.28%	100.00%

Due to the nonobjectivity of the judgment matrix in the process of forming, it is necessary to check the consistency of the matrix. Conformance requirements are as follows:

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} < 0.1. \quad (9)$$

The matrix is considered reasonable if the formula is satisfied, otherwise, the expert needs to readjust the matrix. In the formula, CI represents the consistency index, which is expressed as

$$\mathrm{CI} = \frac{\lambda_{ma} - n}{n - 1}. \quad (10)$$

In the formula, RI represents the average random consistency index. For a positive and negative matrix of size n, there is a corresponding consistency index value, which is usually regarded as a fixed value.

The eigenvector of the judgment matrix that has passed the consistency test is the weight value corresponding to each index.

The acquired data is processed according to the steps of principal component analysis, and the eigenvalues, contribution rate, and cumulative contribution rate of the correlation coefficient matrix of the standardized original data are obtained, as shown in Table 6. The principal component analysis step mainly includes five steps: standardizing the original data, calculating the correlation coefficient, calculating the features, and determining the principal components and the synthetic principal components.

When the cumulative contribution rate is larger, the less data information is lost, that is, the more information of the original index can be covered. It can be seen from Table 7 that the cumulative contribution rate of the first 9 index factors has reached 95.42%. This shows that these 9 factors basically represent the information of 12 indicators. When analyzing the management quality of the school according to the evaluation results, it can be seen from the contribution rate that the influence of the last three factors is relatively low. Basically, focusing on the first nine factors can improve the quality of vocal music teaching.

5. Conclusion

Today, with the increasing development of computer technology, how to bring information technology into vocality teaching has always been a hot issue. Chinese music education in the 21st century is moving in the direction of quality education, and music education for higher teachers shoulders the heavy responsibility of cultivating music teachers. The field of education is facing new challenges, and the reform of vocal music teaching for senior teachers should meet the needs of the development of the century. In this paper, a computer neural network information system is used to evaluate the performance level of vocal players, and a vocal performance evaluation system is developed and applied to piano teaching. According to the data collection of academic performance and answering situation, use statistical analysis indicators to form corresponding analysis reports from different analysis subjects. The key factors of teaching is study the contribution rate of each index to determine the importance of each index and form the final evaluation result, and analyze whether the standard is met and judge the management quality gap between schools. Finally, the main conclusions of this study are as follows:

(1) According to the internal logical relationship of the computer neural network, the system network algorithm flow is designed, and the algorithm is applied to the system construction

(2) Music feature extraction is the key link of the system. In this paper, based on the Fourier transform, the player's voice information is transformed into a waveform that can be recognized by the computer, and the image is modified according to the transformation characteristics. The player's actual musical characteristics match

(3) The system framework and key modules are designed and researched, and some program codes are given. Finally, three performers are selected to analyze the evaluation effect of the system. The results show that the system can reflect the real level of the performers. It is beneficial to the development of piano teaching to discover the lack of players

Data Availability

The labeled dataset used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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References

[1] A. M. Kist, Z. Julian, and G. Pablo, "Rethinking glottal midline detection," *Scientific Reports*, vol. 10, no. 1, pp. 211–251, 2020.

[2] L. S. James, H. Sun, K. Wada, and J. T. Sakata, "Statistical learning for vocal sequence acquisition in a songbird," *Scientific reports*, vol. 10, no. 1, pp. 1–18, 2020.

[3] T. F. Wright and E. P. Derryberry, "Defining the multidimensional phenotype: new opportunities to integrate the behavioral ecology and behavioral neuroscience of vocal learning," *Neuroscience and Biobehavioral Reviews*, vol. 43, no. 3, pp. 96–99, 2020.

[4] G. Jack, B. Samuel, and M. Richard, "Low-dimensional learned feature spaces quantify individual and group differences in vocal repertoires," *eLife*, vol. 43, no. 9, pp. 101–104, 2021.

[5] X. Chen, "Ahmed Syed Hassan music emotion analysis based on PSO-BP neural network and big data analysis," *Computational Intelligence and Neuroscience*, vol. 31, no. 1, 66 pages, 2021.

[6] N. Aguilar de Soto, F. Visser, P. L. Tyack et al., "Fear of killer whales drives extreme synchrony in deep diving beaked whales," *Scientific Reports*, vol. 10, no. 1, pp. 1–9, 2020.

[7] L. Annika, W. Susanne, and H. Anja, "Gentle interactions with restrained and free-moving cows: effects on the improvement of the animal-human relationship.[J]," *PLoS One*, vol. 15, no. 11, pp. 293–302, 2020.

[8] M. Low Daniel, R. Gregory, and R. Vishwanatha, "Uncovering the important acoustic features for detecting vocal fold paralysis with explainable machine learning," *medRxiv: the preprint server for health sciences*, vol. 11, no. 7, pp. 127–130, 2021.

[9] T. Sheng-Yang, T. Yu, and C.-W. Lin, "Demographic and symptomatic features of voice disorders and their potential application in classification using machine learning algorithms," *Folia phoniatrica et logopaedica: official organ of the International Association of Logopedics and Phoniatrics (IALP)*, vol. 70, no. 3-4, pp. 136–139, 2020.

[10] A. Philippsen, "Goal-directed exploration for learning vowels and syllables: a computational model of speech acquisition," *KI-Künstliche Intelligenz*, vol. 35, no. 1, pp. 53–70, 2021.

[11] S.-V. Grace, P.-M. Valeria, and T. F. Wright, "Individual vocal signatures show reduced complexity following invasion," *Animal Behaviour*, vol. 40, no. 5, pp. 155–158, 2021.

[12] B. A. Shikhara, S. V. Aniruddha, and K. S. Seshadri, "Behavioural context shapes vocal sequences in two anuran species with different repertoire sizes," *Animal Behaviour*, 2022.

[13] R.-S. Cristina, K. Okan, and C. Pascal, "Cardiovascular mechanisms underlying vocal behavior in freely moving macaque monkeys," *iScience*, vol. 25, no. 1, pp. 132–136, 2022.

[14] T. Yuki, K. Yoshitaka, and K. Shinji, "Establishment of a radiation-induced vocal fold fibrosis mouse model," *Biochemical and Biophysical Research Communications*, vol. 16, no. 6, pp. 582–589, 2022.

[15] V. H. Annemie, B. Anne, and T. Isao, "Dynamic vibration mode decomposition of auto-oscillating vocal fold replicas without and with vertical tilting," *Journal of Sound and Vibration*, vol. 516, no. 5, p. 116504, 2022.

[16] C. H. Na and E. D. Jarvis, "The role of sex chromosomes and sex hormones in vocal learning systems," *Hormones and Behavior*, vol. 132, no. 5, pp. 1225–1275, 2021.

[17] Y. Kazuya, I. Satoshi, and T. Kousuke, "Numerical analysis and physical consideration of vocal fold vibration by modal analysis," *Journal of Sound and Vibration*, vol. 514, no. 9, pp. 27–37, 2021.

[18] A. Manuela, B. Alvino, and D.'. A. Alessandro, "Do differences in educational attainment measures impact on the assessment of cognitive performance in multiple sclerosis," *Journal of the Neurological Sciences*, vol. 429, no. S, pp. 659–662, 2021.

[19] Y. Po-Yu and C. Yu-Chao, "The haptic 3D virtual reality dental training simulator as a good educational tool in preclinical simulation learning," *Journal of Dental Sciences*, vol. 17, no. 1, pp. 123–145, 2022.

[20] W. Horner, J. O. DeLancey, and D. Rooney, "The Heaney transfixion stitch: a cognitive task-analysis based educational video," *American Journal of Obstetrics and Gynecology*, vol. 226, no. 3S, pp. 3489–3512, 2022.