Research Article

Piano Teaching Improvement Based on Machine Learning and Artificial Intelligence

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With the development of modern piano and the increasing demand of people for music hobbies, the traditional piano teaching mode had exposed more and more problems. Artificial intelligence accelerated the development of music education to a certain extent and effectively improved the teaching effect of teachers to piano lovers. If artificial intelligence and machine learning were organically integrated, the application of intelligent piano can be more wide. Therefore, this paper proposed a piano teaching model based on machine learning and artificial intelligence, which aimed to provide support for improving the quality of piano teaching. Firstly, based on the analysis of machine learning-related theories, this paper expounded the characteristics of neural network in data processing and gave the process of the integration of machine learning and artificial intelligence and its application advantages in music teaching. Secondly, according to the interactive needs between intelligent piano and learners, this paper put forward intelligent piano teaching assistance methods and constructed an intelligent piano teaching service management system by improving the teaching information resource base. Finally, it analyzed the influence of artificial intelligence on piano teaching from different angles. In order to test the effectiveness of the piano teaching mode proposed in this paper, the piano learners under different teaching modes were investigated and counted. From the piano teaching effect and the evaluation results of the piano practitioners on the teaching mode, it was known that compared with the traditional piano teaching mode, the piano teaching mode proposed in this paper had achieved remarkable results in both theoretical teaching and practical operation. It can significantly improve the quality of piano teaching and promote the enthusiasm of learners.

1. Introduction

In recent years, with the continuous deepening of the application of deep learning technology, artificial intelligence has ushered in new development opportunities in some fields. In addition to being able to deal with some specific daily things, artificial intelligence has gradually demonstrated the wisdom of helping human beings jointly solve many problems [1]. Therefore, artificial intelligence has attracted extensive attention in more and more application fields. For example, in the field of medical application, in order to accurately diagnose the patient’s condition, doctors mainly rely on long-term accumulated clinical experience, while artificial intelligence doctors can use deep learning algorithm to determine the condition in a short time by retrieving the case database and formulate specific treatment plans at the same time [2]. The research shows that deep learning technology promotes the application of natural language recognition to a certain extent, and produces some well-known virtual assistants. For example, people can distinguish language information from different users in indoor places. Combined with the increasingly mature Internet of things technology, users can effectively control household appliances through virtual assistants, which not only greatly facilitates people’s lives, but also meets the various needs of different users.

It is known from the existing research that artificial intelligence is mainly to transplant human’s ability to recognize and process things to different machines and equipment, so that machines can provide some services for human beings [3]. With the rapid development of electronic technology, communication technology, and computer
technology in the field of music education, piano education has gradually got rid of the shackles of the traditional teaching mode. By constantly improving the relevant facilities and using artificial intelligence technology to meet the various needs of piano lovers, intelligent piano has emerged. Intelligent piano not only follows the basic characteristics of traditional piano, but also uses advanced machine learning and artificial intelligence technology to change the playing mode. By adding some auxiliary equipment and auxiliary teaching system, the intelligent piano not only has the function of tuning and mute, but also can switch between the traditional piano pronunciation and electroacoustic pronunciation, thus providing a hardware foundation for the realization of intelligent music score, online piano practice, piano distance teaching, and communication interaction [4].

With the development of artificial intelligence technology, intelligent piano has had a certain impact on music education. Although artificial intelligence has promoted the development of music education and replaced part of human work to a certain extent, it still needs to be continuously improved due to the integration of artificial intelligence and other technologies [5], for example, how to give play to the auxiliary function of artificial intelligence in piano teaching, stimulate the interest and enthusiasm of piano practitioners, and provide services for teachers to better improve teaching quality. At present, intelligent piano teaching only allows practitioners to complete some basic learning independently through the separation of teaching and learning, lacking some interactive functions, thus affecting the popularity of intelligent piano. However, there are still many problems to be solved for the details and in-depth learning in the process of piano practice. Therefore, based on the theory of machine learning and artificial intelligence, combined with the needs and characteristics of piano teaching, this paper puts forward an intelligent piano auxiliary teaching and management method, which provides a certain reference for modern piano teaching.

2. Related Works

According to the research results obtained in recent years, the application of machine learning, computer vision, and artificial intelligence in various fields has achieved good results. With the increasing demand of people for spiritual life, some researchers began to apply artificial intelligence technology to the entertainment field and achieved some results [6]. For example, game AI enables game lovers to play different roles by interacting with players, which not only enriches game content, but also enhances people’s awareness and experience of entertainment. In recent years, game designers have begun to use artificial intelligence technology to develop some highly intelligent game software in order to attract more game lovers to participate in the interactive experience of the game [7]. Generally, the methods of applying artificial intelligence to game design mainly include finite state machine and behavior tree, but the workload of using these methods to design intelligent game software is large and difficult to maintain. For this reason, people adopt the organic integration of artificial intelligence and machine learning, for example, using machine learning methods to train game software that meets the needs of users and has strong adaptability.

With the popularization of artificial intelligence technology in the entertainment industry, the traditional way of entertainment has been greatly impacted. For example, intelligent piano has been favored by many piano lovers because of its integration into artificial intelligence technology, which has also changed the traditional piano teaching mode [8]. Intelligent piano is not only the integration of new electroacoustic technology, artificial intelligence technology, automatic control technology, and network communication technology, but also the product of the development of traditional piano. It effectively solves the problems of traditional piano in terms of education mode, class time, and space. Therefore, intelligent piano can meet the needs of modern music education. For example, the intelligent piano can use the live video to accompany the piano practice. In particular, there is no need to make an appointment in advance for the intelligent piano practice. Learners can interact with the instructor through the intelligent piano practice system at any time and report their daily piano practice to the teacher [9]. The piano teacher can view the learners’ learning duration, training content, and existing problems in the background, and solve the learners' shortcomings in the process of practicing the piano in real time through the intelligent sparring system.

The research shows that the application potential of artificial intelligence in the field of music teaching has not been brought into full play due to the influence of people’s different levels of music cognition. Artificial intelligence can help people analyze complex data and make it logical by integrating data resources. For example, after inputting some basic music theory knowledge into the machine database, the use of artificial intelligence technology to analyze and process the basic knowledge in the database can provide regular guidance for learners [10]. By constantly adding learners’ thinking and emotional element words to the machine database, the machine can provide intuitive guidance for learners through multi-level thinking. Using artificial intelligence technology, the tunes and notes in music works can be generated into virtual scenes, so that practitioners can intuitively feel the emotional charm of music, so as to stimulate students’ enthusiasm and interest in music. At present, in the teaching process of basic music courses, artificial intelligence can enable students to master basic knowledge and improve their music literacy through basic learning [11]. However, due to the lack of due knowledge background and cognitive ability, artificial intelligence technology can still not be applied to piano teaching in the advanced stage.

However, restricted by different software and hardware technologies and their applications, the development of intelligent piano is still in the trial stage, with both great opportunities and challenges [12]. Although the smart piano integrates relevant artificial intelligence and Internet of things technologies, the traditional piano teaching mode and offline training institutions still have a great impact on most
practitioners. Therefore, in the future, the smart piano needs to be recognized by piano lovers by continuously increasing the user base and enriching the course content. In addition, most of the existing intelligent pianos have some problems, such as imperfect functions, immature curriculum system, and single teaching methods. Therefore, it is necessary to promote the development of piano education from the perspective of perfecting the function of intelligent piano and improving teaching methods.

3. Machine Learning Theory

3.1. Artificial Neural Network Method. In order to obtain the best piano performance effect, we need to optimize various parameters that affect the performance. As the most basic artificial neural network model of machine learning, it is a nonlinear dynamic system that can deal with complex problems. It can take various external variable factors as training samples and extract relevant features through the training of neural network model, so as to obtain the optimal parameter combination. As a frontier field formed by interdisciplinary research in the twentieth century, artificial neural network is a complex nonlinear system. Artificial neural network contains several different neurons, and the system formed by a large number of neurons and networks is more complex. Similar to the general nonlinear system, artificial neural network has the characteristics of high dimension, continuity, and adaptability between different neurons.

Neuron is actually a mathematical model constructed by simulating biological neurons [13]. Its function is similar to biological neurons. The input-output structure model of neurons is shown in Figure 1.

![Working diagram of artificial neuron.](image1)

In the artificial neural network model, each neuron can obtain a group of signals from other neurons in the network, in which each input signal has a weight corresponding to it, and the activation state of neurons is determined by the weighted sum of this group of input signals.

Suppose \( n \) inputs are represented as \( x_1, x_2, \ldots, x_n \), and the corresponding weights are expressed as \( w_1, w_2, \ldots, w_n \), which, respectively, constitute the input vector \( X \) and the weight vector \( W \) of the neuron, then the processing result of the neuron on the input signal can be expressed as

\[
Y = \sum_{i=1}^{n} x_i w_i. \tag{1}
\]

Before the application of artificial neural network, it is necessary to train the neural network model. The sample set is used as the input value of the neural network model to train the network model, and the weight values between neurons are dynamically adjusted, so that the neural network model can get the corresponding output results when receiving data input.

The training methods of artificial neural network are mainly divided into unsupervised training and supervised training. The unsupervised training method does not need to set targets, its training set contains some input signals, and for any input value, the weight value can be modified to make the network model get the corresponding output results. When training the network, the unsupervised training method can extract the relevant feature information from the training sample set, store it in the neural network, and then classify the input objects according to the similarity of the samples. Because the unsupervised training method is difficult to effectively predict the output results, it is limited in application.

When using the supervised training method to train the model, the input vectors of all samples are required to have corresponding output vectors. When the output of the neural network model is different from the predetermined output vector, the weight vector of the network needs to be adjusted according to the difference between the two. When using the supervised training method, first, take a sample \((P, Q)\) from the sample set, where \(P\) is the input vector and \(Q\) is the predetermined output vector [14]. Secondly, the actual output \(O_i\) of the neural network model is calculated, and the error of the network model is calculated as follows:

\[
Er = \frac{1}{2} \sum_{i=1}^{n} (Q_i - O_i)^2. \tag{2}
\]

Finally, the weight vector of the network is adjusted according to the error value \(Er\). Repeat the above operation.
process for each sample until the error of all samples in the sample set does not exceed the specified value.

In order to avoid describing the mapping relationship between the input and output of training samples through mathematical equations in advance, BP neural network can be used [15]. As one of the widely used neural network models, BP network can learn and store the mapping relationship between input and output of samples. The steepest descent method and back propagation are used to dynamically adjust the weight value of the network model until the sum of square errors of the network reaches the minimum. As shown in Figure 2, the topology of BP neural network model includes input layer, output layer, and hidden layer.

Similar to the neurons of other network models, BP neural network has the functions of weighting, calculating, and transferring input samples. As shown in Figure 3, \( \mathbf{x} = [x_1, x_2, \ldots, x_n] \) represents the sample input from different neurons, and \( \mathbf{w} = [w_{1j}, w_{2j}, \ldots, w_{nj}] \) indicates the connection strength between different neurons and the \( j \)-th neuron, that is, the weight vector. \( y_j \) is the threshold, \( g(y) \) is the transfer function, and \( z_j \) is the output of the \( j \)-th neuron.

The net input value \( y_j \) of the \( j \)-th neuron can be expressed as

\[
y_j = \sum_{i=1}^{n} x_i w_{ij} + s_j,
\]

\[
y_j = W_j^T x + s_j,
\]

where the sample input from different neurons can be expressed as \( X = [x_1, x_2, \ldots, x_n]^T \) and the connection strength between different neurons and the \( j \)-th neuron is represented by \( W_j = [w_{1j}, w_{2j}, \ldots, w_{nj}] \).

After the net input \( y_j \) is processed by the transfer function \( g(y) \), the output \( z_j \) of the \( j \)-th neuron can be obtained. Its calculation formula is as follows:

\[
z_j = g(y_j) = g \left( \sum_{i=0}^{n} w_{ij} x_i \right) = g(W_j x),
\]

where \( g(y) \) is a monotonically increasing function. Since the signals transmitted by neurons are limited, \( g(y) \) is a bounded function; that is, there is a maximum value.

BP algorithm includes two processes: forward propagation of data and back propagation of error. The direction of forward propagation is from the input layer to the hidden layer, and then to the output layer. The processing results of neurons in each layer directly affect the neurons in the next layer. If the output result of the output layer is different from the expected value, it is necessary to go to the back propagation process of the error. Through the continuous alternating processing of the two processes, the network error is minimized, and the feature extraction and storage are completed.

3.2. Machine Learning Category. As an important branch in the field of artificial intelligence, machine learning mainly obtains an applicable model from data through learning. Machine learning mainly includes three kinds of algorithms: unsupervised learning, supervised learning, and reinforcement learning. Each algorithm learns according to different types of data [16].

Unsupervised learning mainly uses clustering method to group similar objects in the data set, as shown in Figure 4. For example, smart piano can classify users according to learners’ participation and divide learners into two
categories: high enthusiasm and low enthusiasm. On the basis of defining the relevant attributes of intelligent piano learners, different types of attribute information are weighted. Then, the input data of all learners are used as a data set for unsupervised learning algorithm. The algorithm can further divide the data of learners into two categories: one represents learners with high enthusiasm, and the other represents learners with low enthusiasm. Because the initial learner data set contains only basic attribute information, the initial learner data set is also called unlabeled data set. For the initial data set, unsupervised learning method can generate different types of tags in order to provide a basis for further data analysis. By using unsupervised learning algorithm, two types of tags with high enthusiasm and low enthusiasm can be mined [17].

Unlike unsupervised learning, supervised learning mainly learns each object and assigns it to different categories according to the results, as shown in Figure 5. Taking the above classification of intelligent piano learners as an example, in order to predict which learners will no longer participate in piano learning in the future, first of all, it is necessary to create a data set that contains not only the basic attribute information of learners, but also a label reflecting whether learners have given up piano practice. Then, taking this data set as the input of the supervised learning algorithm, the supervised learning algorithm processes the basic attributes of the learner and whether the learner will give up piano learning, and learns which attributes the learner will give up practicing the piano more easily, thus creating a learner prediction model. Therefore, according to the characteristics of new learners, the prediction model is used to output corresponding prediction labels to help piano teachers adjust the teaching methods of new learners. When using machine learning model to process and analyze data, whether supervised learning or unsupervised learning, it is necessary to select the attribute information of the input object and the corresponding model, so that the machine learning model can process data pertinently. Among them, the attribute information of the selected input object can reflect the expected label, and the selection model will affect the prediction ability of the new input data [18]. In addition, in practical applications, supervised learning and unsupervised learning usually need many iterations to achieve the desired results.

Reinforcement learning mainly adopts the method of sequential decision-making to learn the data set. Generally, it cooperates with the control robot and can be well applied in many fields. Taking the hand fingering in piano practice as an example, the CNN model can be used to detect and recognize the hand fingering features, and the common wrong gestures in performance can be used as a data set to strengthen the learning of the model [19]. According to the collected gesture information, the video hand recognition algorithm based on convolutional neural network is adopted to recognize the hands of the practitioners, and the CNN model is used to dynamically adjust the hands of the piano learners during practice [14]. By using the neural network of hand recognition, we can not only find the learners’ incorrect hand fingering in time and feed back relevant information, but also compare the learners’ performance with the standard repertoire and analyze the possible problems through the difference comparison.

Reinforcement learning belongs to a machine learning strategy, which mainly forms several related actions by observing objects and processing models. The process of observing objects is mainly to collect data by controlling sensors, while the process of action formation is to manipulate robot components or output results. Reinforcement learning model usually introduces reward mechanism to maximize the training effect. When training an intelligent piano practitioner, you can set the correct practice as a positive reward, and each error will give a negative reward, which will be given to the piano practitioner during the performance of the track [20]. By adopting the reward mechanism and the maximum reward strategy, piano practitioners can improve the performance effect through repeated training. Figure 6 shows the working process of reinforcement learning.

4. Piano Teaching Mode Based on Artificial Intelligence

4.1. Intelligent Piano Teaching Assistant Method. At present, the intelligent piano teaching method cannot be separated from the corresponding equipment support. The equipment can be built into the piano or connected to the piano as an independent accessory. No matter which method is adopted, the piano player depends on the contact detection of the keys when judging the specific keys. For example, the micro-switch of the piano can be used to detect the piano key. When the player presses the piano key, the switch will be turned on and the key signal will be transmitted to the sensing system. Although this method is very simple, it has a certain impact on the hand feel of players. Moreover, these external devices with independent accessories may affect the player due to their strict installation requirements.

In order to enable players to practice the piano and practice the piano well, an intelligent platform integrating different system resources can be adopted [21]. The
Intelligent piano is generally composed of the intelligent system of the Internet of things and the piano. It not only maintains the traditional physical string striking method and sound production, but also uses the Internet of things technology to cross the space-time limit and realize human-computer interaction through the connection between pianos. The intelligent piano teaching assistant system can not only provide learners with various guidance services and high-quality resources, but also form a closed loop between piano learning and practicing, teaching and counseling, in class and out of class. It can not only improve the efficiency of teaching and learning, but also promote the reform of piano teaching.

Through the intelligent system of the Internet of things, the smart piano can not only collect and restore the playing sound, but also achieve the same playing strength and rhythm. At the same time, playing by imitating real people can achieve better results. With the associated function of the intelligent system of the Internet of things, learners can practice piano at home under the guidance of teachers through remote means. Teachers can not only conduct remote teaching, but also demonstrate for learners through video and piano keys at the same time, so as to restore the playing sound in real time. Through close interaction and experience, smart piano can not only improve the efficiency and enthusiasm of learners’ piano practice, but also solve the problems of learners’ inattention or difficulty in practicing. In addition, in the process of intelligent piano teaching, learners can truly feel the sound of piano body resonance rather than the sound of video transmission. From this, it can be seen that the intelligent piano teaching method is difficult to achieve in terms of accuracy and the sense of rhythm and rhythm of music. As shown in Figure 7, it shows the interactive process between intelligent piano and learners.

The traditional demonstration teaching method is that the teacher shows the material objects to the students in the teaching process, and obtains the required knowledge through actual observation or experience. This method of imparting knowledge can enable students to acquire intuitive perceptual knowledge to a certain extent and have a deep grasp of the knowledge learned, so as to effectively link theory with practice. In the process of piano teaching, teachers’ fingering, skills, and the use of pedals when playing the piano need to be shown to learners. However, due to the limitations of the piano itself, some display contents have limitations. Therefore, we can use artificial intelligence technology to establish an intelligent piano teaching assistant system. The system receives the signals from teachers’ piano demonstrations from different angles and converts these signals into images or audio-visual output to terminal equipment. Through this “one to many” teaching mode, we can achieve real-time teaching for all students and then improve students’ learning efficiency.

With the increasing number and demand of piano learners, the intelligent piano teaching assistant system can better meet the requirements of modern piano education only by integrating artificial intelligence technology with multimedia means and forming an interactive teaching mode. First of all, the intelligent piano-assisted teaching method needs to provide teachers with a teaching observation system. By installing a high-definition observation camera in the classroom, the teacher can control the
interactive teaching observation system and realize the movement of the camera in the teaching process. It can not only observe the performance of all students, but also correct errors and supervise the learning status of students in time.

Secondly, the use of intelligent piano-assisted teaching method needs to provide students with an online consultation system. According to the signal sent by the student requesting the teacher, the teacher can control the observation camera, move it above the requester, and accept the student’s online request, so as to realize the online guidance function. Using the function of online consultation system can avoid affecting other students’ piano practice and distracting their attention.

4.2. Intelligent Piano Management System. The traditional piano teaching management usually has the problem of separation between teaching and learning, and the intelligent management system based on artificial intelligence technology can avoid the shortage of manual management. When piano learners practice independently in their spare time, students can view the homework tracks assigned by the teacher through the client of the intelligent management system [22]. At this time, the intelligent piano teaching service system can automatically detect the time and times students practice the piano and the interval between stops, and use the intelligent evaluation system to analyze and evaluate students’ performance and performance effect when playing the piano, so as to track and manage students’ playing process in real time. In the intelligent management system, teachers can track students’ feedback in the learning process in real time and guide students to complete piano learning and practice.

The intelligent piano management system mainly includes the management of teaching information resources and teaching activities. The intelligent piano management system contains a large number of learning resources, which provide a guarantee for the intelligent piano teaching activities. Teaching resources can not only provide information technology support for teachers to formulate teaching plans and design teaching plans, but also provide learning resources for students’ preview, classroom practice, and after-school review. The teaching resource database not only expands the information of traditional piano teaching materials, but also digitizes the music score, teaching materials, and other information resources, so as to provide the retrieval function of resources and information for students and teachers. In addition, the teaching resource library in the intelligent piano management system also includes video, audio, music games, and other resource modules, which provides rich information resources for piano teaching. As shown in Figure 8, it is composed of the teaching information resource library included in the intelligent piano management system.

With the increasing function of artificial intelligence in data collection, analysis, and prediction, the application of artificial intelligence technology in piano teaching can improve the piano learners’ practicing efficiency and level. According to the piano course evaluation requirements, the intelligent piano auxiliary teaching system can be developed by using artificial intelligence technology, and then the user’s PC terminal can be connected with the cloud service terminal of the intelligent system through the cloud computing center, so as to build an intelligent management service platform for teaching activities [23]. Teachers use this service platform to set up piano course evaluation standards. Through this platform, students can automatically match the played tracks with the evaluation standards, mark the wrong music symbols, and feed back to students in the form of evaluation reports, so as to achieve personalized guidance and targeted evaluation of piano learning. As shown in Figure 9, the intelligent management service platform for teaching activities built through the cloud computing center can not only provide users with teaching information.
Through the intelligent management service platform of teaching activities, learners can not only timely detect their own playing effects, but also accurately master the learning methods and contents of piano courses. At the same time, teachers can effectively reduce the workload and improve work efficiency through the intelligent management service platform of teaching activities. In addition, the system can also integrate the data of all students' playing results and further systematically analyze the teachers' teaching effectiveness, which not only helps teachers to fully understand the teaching process, but also helps teachers to reflect and improve the teaching content and methods. The analysis and evaluation results of the system can not only provide reference for teachers to further process management and comprehensive evaluation of students, but also stimulate the enthusiasm of piano learners.

Although the intelligent piano teaching assistant system can bring some help to learners, it may also have some negative effects. Because the intelligent piano teaching system is different from human beings in emotional resonance, if learners rely on the auxiliary functions provided by the intelligent piano teaching system for a long time when practicing, for example, blindly pursuing the score of playing music evaluation when practicing, the music they play will be boring due to the lack of detail processing and music emotion [19]. Therefore, learners should take the intelligent piano teaching system as an auxiliary tool for piano teaching, which cannot be completely replaced by it. Only when the intelligent piano teaching system is organically combined with the teaching process, can the function of the intelligent piano teaching assistant system be brought into play.

In view of the impact of the intelligent piano teaching service system on teachers, compared with the traditional piano teaching mode, the working efficiency of piano teachers has been significantly improved, and the quality of learners' piano practice has also been greatly improved. Although the level of students' piano practice mainly depends on teachers' teaching ability, the traditional piano teaching methods are usually not ideal for learners' piano practice level and learning efficiency. With the help of the intelligent piano teaching system, teachers' teaching pressure has been relieved, and learners' piano practice level has been significantly improved. For example, learners can use the intelligent piano teaching service system to directly correct some basic problems such as notes and rhythms that often go wrong when practicing the piano. Teachers can use more time to pay attention to the processing of music details and the expression of music emotions when students are in class.

Although the intelligent piano teaching system alleviates the teaching burden of teachers to a great extent, artificial intelligence brings new pressure to piano teachers. Using the traditional piano teaching mode, teachers can often carry out teaching discussion, teaching experience exchange, and other activities, and continuously improve their teaching level by learning some successful teaching methods. However, after adopting the intelligent piano teaching mode, teachers can only continuously improve their teaching ability and teaching quality to meet the requirements of modern teaching design and the various needs of learners. At the same time, through the teaching resources provided by the intelligent piano teaching service platform, they can continuously integrate their own teaching ability, so as to continuously improve their teaching level. With the continuous development of artificial intelligence technology and other related technologies, in the future piano teaching, teachers should constantly adapt to the changes of the new teaching mode.

5. Analysis and Evaluation of Teaching Effect

In order to test the feasibility and effectiveness of the piano teaching model based on machine learning and artificial intelligence in practical teaching application, two different classes were randomly selected from some piano learners as
experimental teaching objects. According to the existing piano teaching plan, under the condition of not affecting students’ normal piano practice, random tests were conducted on the learners, and the learners with no significant difference between the two classes were taken as the experimental group and the control group, respectively. Suppose class 1 is the control group and class 2 is the experimental group, with 20 students in each class. The control group used the traditional piano teaching mode, and the experimental group used the intelligent piano teaching mode. Through the piano teaching experiment, under the same examination method, content, and evaluation standard, the students’ piano theoretical knowledge and playing effect of the two classes were tested.

5.1. Piano Teaching Effect Test. From the comparison of the assessment results of piano theoretical knowledge, it was known that the two groups of students had better ability to master piano theoretical knowledge. The average score of the control group was 83.5, and the average score of the experimental group was 87.4. After examination and test, there was no significant difference between the two groups. From the comparison of the results of piano hand type test, it was found that although different piano teaching modes had certain effects on learners’ hand type, there was no significant difference between the two groups. However, from the comparison results of the piano touch mode, spectrum recognition, and rhythm control ability test results, the average scores of the students in the experimental group were 92.6, 91.5, and 88.6, respectively, and the average scores were higher than those in the control group. After examination and test, there was a certain significant difference between the two groups. It can be seen that the piano teaching mode proposed in this paper mainly focused on the learning of piano key touching mode and optimized the ability of spectrum recognition and rhythm control, so that learners can participate in the whole process of piano teaching in real time. Therefore, when learners improved their ability to master the details of piano practice and emotions to a certain extent, they will soon be recognized by everyone. The self-confidence gained in the process of piano practice had also improved the enthusiasm of learners in training, and the teaching effect had been significantly improved. The comparison results of piano teaching effects between the two groups are shown in Table 1.

5.2. Evaluation and Comparison of Piano Teaching Mode by Piano Practitioners. In order to facilitate the research object to objectively evaluate the intelligent piano teaching mode proposed in this paper, this experiment uses the form of questionnaire and interview to investigate the impact of the intelligent piano teaching mode on the experimenter. Among them, it mainly evaluates the students’ performance from three aspects: learning enthusiasm, emotion of practicing piano, and learning effect. All evaluation indexes are expressed by mean and standard deviation, and the later data are processed by statistical software. From the score results of the experimental group in various items, the scores of the experimental group are about 5 points higher than those of the control group, especially in terms of learning effect. Therefore, the evaluation results of students in the

Table 1: Comparison of piano teaching effect between two groups of learners.

| Item          | Theoretical knowledge test | Hand test | Key touch mode test | Spectrum identification test | Rhythm control test |
|---------------|-----------------------------|-----------|--------------------|-------------------------------|--------------------|
| Control group | 83.5                        | 85.1      | 85.2               | 84.7                          | 81.3               |
| Experimental group | 87.4                      | 86.4      | 92.6               | 91.5                          | 88.6               |
| P             | >0.05                       | >0.05     | <0.05              | <0.05                         | <0.05              |

Table 2: Comparison of evaluation results of the impact of piano teaching mode on learners.

| Item          | Practice enthusiasm | Playing emotion | Learning effect |
|---------------|---------------------|-----------------|----------------|
| Control group | 19.26 ± 2.13        | 38.24 ± 3.35    | 84.37 ± 7.25   |
| Experimental group | 23.41 ± 2.59      | 42.46 ± 3.85    | 90.36 ± 7.38   |
| T             | 2.215               | 2.362           | 3.583          |
| P             | <0.05               | <0.05           | <0.05          |
6. Conclusion

Artificial intelligence accelerated the development of music education to a certain extent and changed the traditional piano teaching mode. However, there were many problems in the integration of artificial intelligence with other technologies, which affected the application of artificial intelligence in piano teaching. In order to effectively improve the quality of piano teaching, this paper proposed a piano teaching model based on machine learning and artificial intelligence. By analyzing the relevant theories of machine learning and its application characteristics in music teaching, this paper put forward the auxiliary method of intelligent piano teaching, constructed an intelligent piano teaching service management system, and analyzed the various effects of artificial intelligence on piano teaching. Finally, taking piano learners under different teaching modes as the object, this paper made an investigation and analysis from the aspects of piano teaching effect and the learners’ learning motivation. According to the statistical results of the questionnaire survey conducted by each group on the evaluation of different piano teaching modes, the students in the experimental group evaluated the teaching methods, learning enthusiasm, and other indicators above the good level, as shown in Figure 10. Therefore, students are generally satisfied with the intelligent piano teaching mode proposed in this paper.

Data Availability

The labeled data set used to support the findings of this study is available from the author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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