Hindawi
Mobile Information Systems
Volume 2023, Article ID 9834547, 1 page
https://doi.org/10.1155/2023/9834547

Retraction

Retracted: Piano Intelligent Teaching Evaluation with IoT and Multimedia Technology

Mobile Information Systems

Received 11 July 2023; Accepted 11 July 2023; Published 12 July 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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

[1] D. Wang and Z. Bai, "Piano Intelligent Teaching Evaluation with IoT and Multimedia Technology," *Mobile Information Systems*, vol. 2022, Article ID 7636458, 10 pages, 2022.

Hindawi
Mobile Information Systems
Volume 2022, Article ID 7636458, 10 pages
https://doi.org/10.1155/2022/7636458

Research Article

Piano Intelligent Teaching Evaluation with IoT and Multimedia Technology

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Received 11 May 2022; Revised 4 June 2022; Accepted 7 June 2022; Published 4 July 2022

Academic Editor: Amit Gupta

With deepening of the economic development process, the overall spiritual and cultural needs of the people have increased, and quality education has received more and more attention. Piano education is an important part of quality education. Nowadays, piano education has also been able to move forward continuously. As the king of musical instruments, the piano is widely used in music learning. Learning the piano can exercise willpower, develop intelligence, and cultivate sentiment. With development of computer software as well as hardware, Internet of Things technology and multimedia technology provide the material basis and preconditions for intelligent piano teaching. Therefore, how to evaluate the impact of the IoT and multimedia technology on intelligent teaching of piano has become a very important topic. Based on this, this work combines BP network with artificial fish swarm algorithm (AFS) and proposes network model (IAFS-BP) for evaluating the quality of piano intelligent teaching in the context of Internet of Things and multimedia. The specific contents of this work are as follows: (1) Aiming at the shortcomings of AFS, an IAFS with mutation operator, dynamic vision, and step size is proposed. (2) In view of shortcomings for BP network, IAFS is used in BP network. By using the IAFS algorithm in the training of the weights as well as thresholds, the training speed and training accuracy of the network are improved. (3) This work has carried out a comprehensive and systematic experiment to verify effectiveness and feasibility of IAFS-BP applied to quality assessment of piano intelligent teaching in the context of the IoT and multimedia.

1. Introduction

The piano is a harmonic instrument. From the perspective of the development history of the piano, it has countless excellent works, as well as solo pieces. This is the eternal spiritual wealth of human beings. Nowadays, while people are pursuing material wealth, spiritual wealth is gradually being valued by everyone. With the development of the times, people realize that material wealth does not necessarily make people noble, and the increase of spiritual wealth will improve people's spiritual realm, which is our real wealth. Learning the piano will allow us to experience, contact, and comprehend the spiritual wealth that people have been pursuing. Learning piano is of great significance. First, piano teaching helps to improve musical perception, comprehension, and musical thinking. Second, piano teaching contributes to the healthy development of psychology, physiology, and thinking. Since piano performance requires active movement of each of the ten independent fingers, it requires excellent coordination and coordination of the whole body. Third, piano teaching helps to develop a good life style and spiritual quality. Fourth, piano teaching helps to improve psychological perception and self-regulation. During this period, the performer's ability to correctly understand other people's emotions is cultivated, and with the help of music, the ability to perceive other people's emotions is improved. In a word, learning piano plays a role in promoting all-round development, improving people's comprehensive ability level, and has important significance and effect on ability development and training [1–5].

Pianists can now use the Internet of Things and multimedia technologies to teach piano more effectively, thanks to computer software and hardware advances that have transformed the landscape. There is an Internet that connects things and things called the Internet of Things. Adapting to the times, it is also a component of the latest generation of information technology. On the one hand, the Internet of Things refers to a network system, but this system is based on the growth and extension of the Internet. Its core content and what plays a cornerstone role is Internet technology. On the other hand, the Internet of Things also expands the user side, and it is also applicable between items and items. This is to enable the exchange and communication of information between things. The Internet of Things is constantly growing, and many new technologies have emerged. Moreover, the corresponding technologies of the IoT in the fields of computing and perception have also been developed and expanded. The well-known third wave of world information development refers to development of IoT technology. IoT technology can be applied in life, which relies on the cooperation between objects, people and objects, and people. As a result, a network system that is larger and more complex than the Internet has been formed, and this system has also changed the relationship between people and things. This will not only have a greater impact on the existing way of life, but will also bring us great convenience and improve the efficiency of piano teaching [6–10].

Other types of vocal music, such as piano, and contemporary electronic music have become intertwined throughout the years. Throughout its history, it has been the result of the fusion of music and electronic technology. The term "multimedia" refers to the integration of computer technology with digital video and audio sources. Multimedia technology has the ability and precision to store enormous amounts of piano instruction materials, play films and music clearly, and help people learn, comprehend, and appreciate piano more vividly. Multimedia is a collection of piano teaching materials that can be used to teach piano. The composer employs diverse elements to edit, synthesize, and add various special effects to finally become a complete piano composition, according to the needs of production. The physical features of piano music are digitized and stored in multimedia devices as a means of disseminating it. The music from a digital piano is compressed, sent across a variety of mediums, and then played back when it has been received. Multimedia computers can help students learn the piano more effectively by combining video and audio elements. It is also possible to learn more thoroughly by interacting with the computer and the pupils [11–15].

Therefore, Internet of Things technology and multimedia technology have become an indispensable part of modern piano intelligent teaching. In this context, how to evaluate the quality of piano intelligent teaching under the networking and multimedia technology has become the top priority, which can effectively promote the healthy and rapid development of piano teaching. This work combines it with neural network and proposes a piano teaching quality assessment model based on the improved IAFS-BP algorithm. The specific contributions of this work are as follows: (1) Aiming at the shortcomings of AFS, an IAFS with mutation operator, dynamic vision, and step size is proposed. (2) In view of shortcomings for BP network, IAFS is used in the learning process of BP network. By using the IAFS algorithm in the training of the weights and thresholds, the training speed and training accuracy of network are improved. (3) This work has carried out a comprehensive and systematic experiment to verify effectiveness of IAFS-BP applied to quality assessment of piano intelligent teaching in the context of the IoT and multimedia.

2. Related Work

Reference [16] pointed out that, because of the family conditions, living habits, and hobbies of each piano learner, they had completely different personalities. Piano teacher must be aware of the differences of each student, so as to truly teach students in accordance with their aptitude. Literature [17] pointed out that teachers should learn to encourage students more and encourage students every bit of their growth. At the same time, it was planned to point out mistakes made by students' playing. Literature [18] pointed out that some parents blamed their children when they saw that other children's progress in piano learning was so fast that their own children were left behind. Some teachers also lacked patience with students and could not wait patiently and cultivate students' enthusiasm and autonomy in learning. If things went on like this, students would be resistant to learning how to play piano. For this type of students, we could only cultivate students' interest in piano patiently and passionately, so that students could be more active in learning piano, and they could also cultivate their own sentiments. Literature [19] pointed out that students are in the growth stage, and their minds were still in the developmental stage. Because age, environment, and other aspects affected each student's personality in a completely different manner, if a stereotyped teaching model was adopted, it was difficult to achieve an ideal teaching effect. Students who were more serious about their studies and had strong comprehension ability could be encouraged and praised, and students who were active in speaking can be praised orally. If teachers could encourage students and gave them some positive guidance, they could stimulate their enthusiasm for learning and enable students to better complete their learning tasks. Literature [20] pointed out that the introduction of cognitive theory into piano teaching should respect individual differences and cognitive abilities and pay attention to the chemical reactions between piano teachers and children, parents and students, and students and students. Literature [21] believed that the piano experiential teaching could be divided into four aspects: showing the situation through language, creating the situation through singing, simulating the situation through the body, and restoring the situation through performance, which helped to inspire students' learning and thinking methods.

Literature [22] pointed out that the concept of the Internet of Things was to connect users and the surrounding environment through interfaces, so that they became an organic whole, thereby realizing the construction of a social network. Literature [23] firstly expounded the specific content of the Internet of Things industry, emphasizing the importance of sensors. The development of industrial chains in various fields needs to rely on sensing equipment to integrate the information of objects into the network, so as to promote the effective supervision of equipment by the industry, so it had become the father of the Internet of Things. Literature [24] elaborated on the development of IoT industry from various aspects. IoT chain was a dynamic and continuous development process, and it formed a dynamic whole by aggregating networks and objects. Thereby, the information was exchanged, and it was not limited by time, and the timeliness was lasting. This enables different industries to have data on the processes they wanted to monitor anytime and anywhere. Literature [25] mainly focused on the two major aspects of safety and regulations. It believed that since security was the focus of global attention in the IoT industry, it was inevitable to conduct security analysis on the IoT operation interface. And it needed to match the corresponding laws to ensure that the IoT industry develops in the direction of legal compliance. Literature [26] pointed out that South Korea regarded the Internet of Vehicles as an important field for construction, and SK Telecom, the largest mobile operator in South Korea, had also established cooperative relations with many automobile companies and launched a variety of Internet of Vehicles products. It could carry out intelligent monitoring of automobiles, which was the application of IoT in Internet of Vehicles. Literature [26] pointed out that smart city was also an application field of IoT, and the most prominent was the construction of smart community. The United States built the world's first smart building. The building's health, light, electricity, and security were all realized with IoT. Reference [27] proposed that the United Kingdom invested a lot of research funds and government subsidies in Internet of Things research in 2015, and the research fields included eight fields such as transportation, energy, and environment.

Literature [28] believed that multimedia technology was the integration of modern technologies such as computer technology and information technology. Integrating multimedia technology into teaching could help enrich teaching content and teaching form. Literature [29] believed that multimedia teaching could deepen and optimize the educational process. Deepening was reflected in educational content, and optimization was reflected in educational methods. With the help of multimedia, the deepening of teaching materials and teaching materials could be realized. At the same time, it could also change the traditional teaching method with the help of multimedia and realize the optimization of the teaching method. Literature [30] believed that the deep integration of multimedia teaching and classroom could present a new learning environment. And it realized the organic connection with the teaching structure. Literature [31] believed that multimedia teaching had many advantages, but it was necessary to notice disadvantages in process of applying multimedia teaching. Therefore, in process of using multimedia teaching, it was necessary to adopt different application frequencies and application methods in combination with different actual situations. Only in this way could students' enthusiasm for learning be fully mobilized.

3. Method

How to evaluate the quality of piano intelligent teaching under background of IoT and multimedia technology is an important topic. This work proposes improved IAFS-BP algorithm to solve this problem.

3.1. BP Network. The BP learning algorithm makes the problems existing in the learning method of the forward neural network get a new way of improvement, which greatly promotes the research work related to the forward neural network. With the in-depth research on neural networks, artificial neural networks are more and more applied to solve practical problems in life, and 80%–90% of them use BP neural networks. BP neural network can simulate nonlinear mathematical models and realize their mapping. It is widely used in target identification, condition monitoring, machine learning, and trace element determination.

Mainly through the following aspects to study the BP network: (1) Improve the activation function: the BP algorithm uses sigmoid function as activation function. When the input is too large or too small, the output will enter the saturation region, and the error will be relatively large, resulting in the algorithm not converging. Add a steepness factor to the activation function to improve the nonconvergence problem of the algorithm. (2) Weight optimization, generally by improving the numerical optimization method, the standard gradient descent method, or the numerical approximation method to improve the neural network weight: The employment of algorithms such as the genetic algorithm, particle swarm algorithm, or simulated annealing method to improve numerical optimization is widespread practice. (3) Network topology: BP network is made of input layer, hidden layer, and output layer. There is no clear statement on calculating hidden layers in actual applications, and it is often decided by experience or trials.

There are three layers in a BP network: input, hidden layer, and output layer. The hidden layer might comprise many layers. BP networks have three layers. Unconnected functions necessitate two or more hidden layers, but in other circumstances only one hidden layer is needed. Any function can be mapped using the BP network. The number of hidden layers and the number of nodes in each hidden layer must be determined when creating the network's topology. Figure 1 depicts a typical BP network diagram. The input node of the input layer transmits the nonlinear signal to the hidden node of the hidden layer. The output node of the output layer examines and weights the output results after the information has been processed through the hidden layer. The output of the nodes in this layer in the network is only affected by the nodes in the previous layer.

Between the input and output layers, the hidden layer serves as the network's internal mode. Feature extraction on input data can be performed by the hidden layer and transmitted to the output layer, which can discriminate the

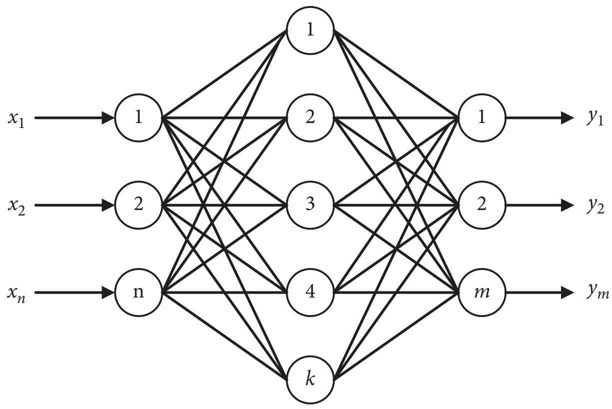

Figure 1: Structure of BP network.

input data from other input data. In the BP network, the initial network weights are randomly assigned, and through continuous adjustment, they become features that can express the input pattern.

To determine the number of hidden layer nodes, the number of nodes in the input and output layers must be taken into account, as well as the nature of the issues that need to be solved. The following conditions must be followed for determining the number of hidden layer nodes. It is essential that the number of nodes in the hidden layer is smaller than the sample count. Networks that include more hidden layer nodes than samples have a weak generalization ability and have no use in real applications. The number of training samples used in neural network learning is more than the number of link weights in the network, in order to accurately reflect the network's meaning. Choosing an optimum number of hidden layer nodes is critical when creating a neural network model. The network's performance will suffer if the number of nodes in the hidden layer is too small, and it will frequently fall short of requirements. Increasing the amount of hidden layer nodes will have a significant impact on the network's learning cycle, resulting in even more overfitting. The commonly used methods are

$$\begin{aligned} N_H &= A + 0.618(A - B), \\ N_H &= \log_2 A, \\ N_H &= \sqrt{A + B + C}, \end{aligned} \tag{1}$$

where A is input layer nodes, B is output layer nodes, and C is a constant.

Both input signal forward propagation and error signal backpropagation are key components of the BP network's learning method. The input signal is routed through the input layer to the hidden layer, where it is processed before being transferred to the output layer. Layer nodes in BP networks only respond to the status of their preceding layer nodes. The steering error signal propagates the process if the actual output differs from the expected output. If a mistake occurs during training, it is referred to as an error signal. The difference signal is sent back to the hidden layer in a certain manner and subsequently to the input layer. The error signals of the neurons in different layers can be retrieved by returning the error to the neurons in those layers. Thereby, the related parameters of neurons in each layer are adjusted to achieve the optimization purpose of the network.

Taking the square of difference as error function, error can be expressed as

$$E = 0.5 \sum_{i=1}^{N} (t_i - o_i)^2, \tag{2}$$

where t_i is the true label, and o_i is the output.

The parameters are updated to

$$\begin{aligned} w' &= w - \alpha \frac{\partial E}{\partial w}, \\ b' &= b - \alpha \frac{\partial E}{\partial b}, \end{aligned} \tag{3}$$

where w is network weight, and b is bias.

3.2. Artificial Fish Swarm. In AFS, each fish is called a solution in the algorithm. Through the cooperation and communication of multiple artificial fish, place with highest food concentration, that is, global extremum, is jointly found. In the AFS algorithm, a group of artificial fish is initialized first, and the artificial fish updates its state by performing behaviors such as foraging behavior. After many iterations, the artificial fish finds the best value. In the algorithm, each artificial fish will move according to the state of itself and other artificial fish around, and each move of the artificial fish is equivalent to completing one iteration of the algorithm.

Foraging behavior is one of several examples of fish continually moving in the direction of greater food. Calculate the fitness value of a random state in the fake fish's field of vision, based on the fish's current state and fitness value. This is a more fit state for the fake fish when compared to the previous one based on fitness values. A random state is selected and the fitness values of the fake fish are compared. If the requirements are still not met, the action is performed again until the conditions for the next step are met or the number of search attempts is reached. If the artificial fish does not meet the conditions for the next step within the number of search attempts, the artificial fish will randomly swim in one direction within the maximum step size, and the artificial fish will reach a new state.

$$\begin{aligned} X_j &= X_i + RV, \\ X_{\text{next}} &= X_i + RS\frac{X_j - X_i}{X_j - X_i}, \\ X_{\text{next}} &= X_i + RS, \end{aligned} \tag{4}$$

where R is random function, V is the vision, and S is step size.

The swarming behavior means that individuals will flock to places where there are many fish, and individuals will move to the center of adjacent fish schools without causing congestion. In order to determine the set's fitness value, start in the center. This indicates that if the conditions are met, the center position is better than the existing state of the artificial fish, and the region is not overcrowded. In order to avoid foraging, the mannequin fish swims towards the center.

The tail-chasing tendency suggests that the fish pursues the fish with the best state surrounding it. Otherwise, search for the quantity of artificial fish within its vision. If the conditions are met, it implies that the state of the optimal individual is better than the current state of the artificial fish, and the area is not congested, and the artificial fish travels in the direction of the optimal individual found; otherwise the foraging behavior is done.

Which behavior should be selected as the execution behavior in the actual movement of the artificial fish should be analyzed according to specific problems. In general, tail-chasing behavior is better than flocking behavior, and flocking behavior is better than foraging behavior. Therefore, the artificial fish can be made to perform the tail-following behavior first, and if the tail-following behavior does not make the artificial fish better or causes congestion in the area, the clustering behavior is performed. Performing flocking behavior still does not make the artificial fish get a better state or will cause crowding in the area and then perform foraging behavior. Each artificial fish will try to perform tail-chasing and swarming behaviors before iterating and select the behavior that can make the artificial fish easier to move to a better position as its own execution behavior. If the two behaviors cannot make the artificial fish move in the direction of a better state, the foraging behavior is selected as the next behavior of the artificial fish.

A bulletin board will be set up to keep track of the greatest artificial fish currently available. As soon as a fake fish makes a movement, it uses the fitness function to determine its fitness value and then compares it to the state with the best artificial fish. To replace the artificial fish on the bulletin board with an artificial fish that is in a better condition, relocate the artificial fish and the accompanying value to a new location. To find the best value, keep searching until the algorithm completes and the final bulletin board displays the best value. An efficient optimization method is achieved by the abovementioned behavior of an artificial fish swarm algorithm. When the algorithm is cut off, most of the artificial fish gather near several local extremums, and relatively more artificial fish tend to gather near the global extremum.

3.3. Improved AFS. When the artificial fish gather in a relatively flat area, this part of the artificial fish is easy to fall random swimming process without purpose. Moreover, some fish are also easy to fall into the vicinity of local extrema, which easily leads to longer algorithm convergence time and degraded search performance. In response to this situation, a mutation operator is added here. When the performance is not improved during the search process, the mutation operator plays a role to mutate the artificial fish in the group. In AFS, a bulletin board records optimal individual state found in the algorithm, and it can be determined whether the search result has been improved through the value change. If the value on the bulletin board does not change after multiple iterations, mutation operation can be taken at this time. After the state of the optimal individual on the bulletin board is preserved, other artificial fish are initialized. In this way, the best individuals can be retained and other artificial fish can be prevented from doing useless work. This makes the fish jump local optimal solution to a certain extent and turn to find the global optimal solution.

The artificial fish swarm algorithm has higher global exploration capabilities and can fast converge if the selected vision is large. It is necessary to perform a substantial amount of math in order to account for the enormous number of artifactual fish that will be found. The algorithm's convergence slows down if the chosen vision is small. Although a higher step size helps speed up convergence, it is very easy to miss out on the best possible solution and the precision of the convergence is low. The accuracy of the algorithm can be improved by using a smaller step size, but this will have a negative impact on the method's speed of convergence. In this case, a dynamic vision and step size can be constructed, and while the algorithm runs, the vision and step size steadily decrease. Local search and convergence accuracy of the algorithm can be increased by setting up a dynamic vision and step size.

$$\begin{aligned} V &= D * V + V_{\min}, \\ S &= D * S + S_{\min}, \\ D &= \exp\left(-30 * \left(\frac{1}{K_{\max}}\right)^2\right), \end{aligned} \tag{5}$$

where $V_{\min}$, $S_{\min}$, and $K_{\max}$ are set parameters.

With dynamic vision and step size, the artificial fish can fast converge in the early search period by making the vision and step size greater in the early stages. A reduction in vision and step duration can narrow the scope of a search in the later stages, which reduces computation time and improves search accuracy.

The fish can escape the search's local optimal result by introducing a mutation operator. Dynamic vision and step size establishment is proposed in the algorithm. Early on, the fake fish are given bigger vision and step sizes so that they can swiftly congregate in the vicinity of the extreme point of convergence. For better search accuracy, the algorithm's vision and step size are lowered in later stages. Thus, an improved artificial fish swarm algorithm with mutation operator, dynamic vision, and step size is provided herein. The pipeline of IAFS is illustrated in Figure 2.

Initializing the fish swarm is the first step, followed by assigning a random value to the artificial fish in the feasible region, determining the maximum number of trial iterations, determining the maximum number of times the artificial fish recorded on the bulletin board has not changed, and determining the artificial fish's vision and step size. As a second stage, each artificial fish's fitness value is calculated according to the fitness function, and a small artificial fish with the smallest fitness value is selected and placed on a bulletin board. Establishing a dynamic vision and step size is the third step in the process. By attempting tail-chasing and

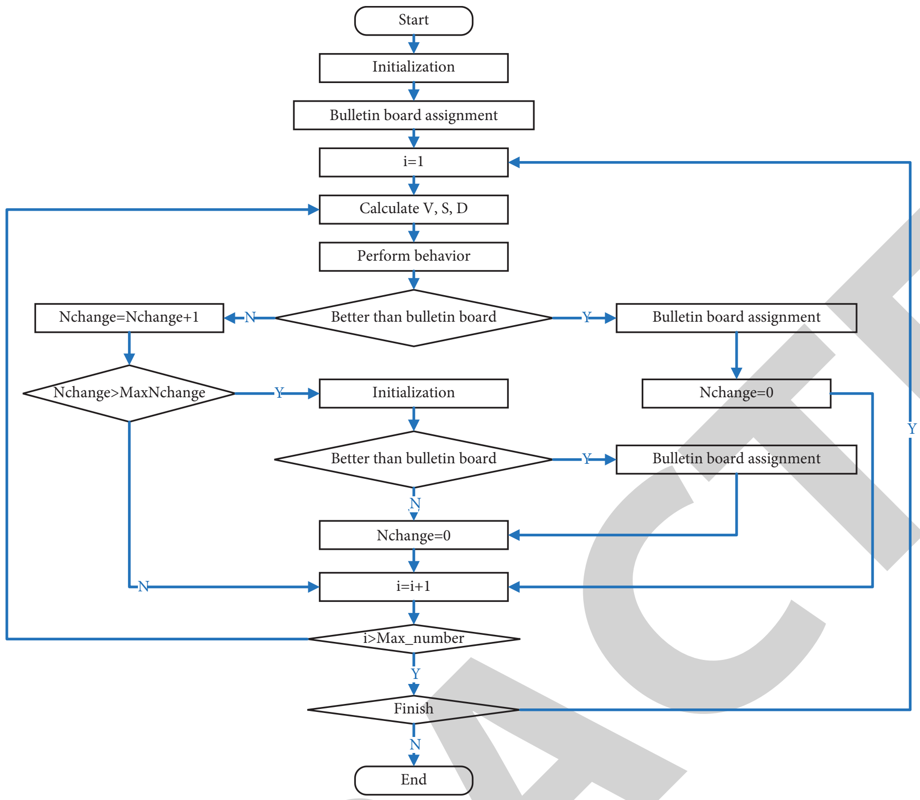

Figure 2: The pipeline of IAFS.

grouping behavior, the artificial fish will then pick whatever action makes it easier for the fish to go into a better position for its own execution. Foraging behavior should be employed if not. The artificial fish on the bulletin board will be compared to the state it was in after one repetition in the fifth phase. It records the relevant information of the artificial fish on the bulletin board if its own state is better than the artificial fish on the bulletin board. The sixth step is to determine the variation conditions. If the mutation condition is met, go to the seventh step; otherwise go to the eighth step. The seventh step is to perform the mutation operation. The eighth step is to determine the termination condition. In the ninth step, the algorithm terminates and the optimal solution found is output.

3.4. IAFS-BP Network. The BP network's learning algorithm uses the gradient descent approach, which is easy to fall into the extreme value, resulting in a slow learning speed, and lastly it is difficult to locate the global extreme value. An algorithm called AFS is based on swarm intelligence. To counter the problem of BP's network being susceptible to local extreme values, it has good global search capabilities. IAFS enhances the algorithm's global search and convergence speed. The convergence speed and training accuracy of the BP neural network can be improved by utilizing the IAFS algorithm to train the weights and thresholds of the network.

For a three-layer BP network, the optimized parameters of each neural network can be transformed into an artificial fish, so that each artificial fish can be expressed as

$$X = (v, u, w, t), \tag{6}$$

where v and w are network weight, and u and t are network threshold.

Individual differences or sums of artificial fish constitute BP networks, and the intended optimization variables of the BP network are the state of the artificial fish. The fitness function of the improved artificial fish swarm algorithm is based on the difference between the actual output value and the expected value of the network, which is produced by inputting samples in the input layer. The artificial fish swarm approach is used to train the BP network's weights and thresholds. Search ends when the network's output achieves a desirable level of error accuracy, and the searched network is now the optimal network. The fitness function is

$$Y = 0.5 \sum_{i=1}^{M} \sum_{j=1}^{N} \left(t_{ij} - o_{ij}\right)^2, \tag{7}$$

where M is total samples, and N is neurons in output layer.

4. Experiment and Discussion

4.1. Dataset and Evaluation Metric. This work uses a self-made dataset to evaluate the quality of piano intelligent teaching in the Internet of Things and multimedia environment. The produced dataset is divided into training set and test set. The specific information is shown in Table 1. The input feature of each piece of data is a 9-dimensional index,

Table 1: The dataset information.

Training set	Test set	Total set
3941	1503	5444

the specific information is shown in Table 2, and the corresponding labels are divided into 5 quality levels.

The evaluation used in this work is precision and recall; the calculations are as follows:

$$\text{Precision} = \frac{TP}{(TP + FP)},$$
$$\text{Recall} = \frac{TP}{(TP + FN)}. \quad (8)$$

Table 2: The data feature information.

Index	Meaning
x_1	Intonation
x_2	Rhythm
x_3	Speed
x_4	Strength
x_5	Accompaniment
x_6	Teaching target
x_7	Teaching content
x_8	Learning attitude
x_9	Teaching effect

4.2. Evaluation on Network Training. In neural networks, the training of the network is very important. Only when the network can gradually converge can it be used for subsequent tests. To verify the convergence of the IAFS-BP method proposed in this work, its training loss and performance are first analyzed. The experimental results are illustrated in Figures 3 and 4.

As the training progresses, the loss decreases and precision increases. And when training reaches 60 iterations, both data indicators tend to converge, and the subsequent changes are small. This shows IAFS-BP method can be effectively trained.

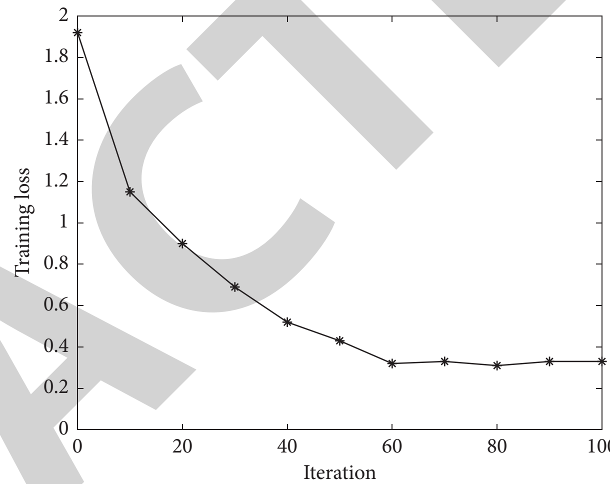

Figure 3: The training loss of IAFS-BP.

4.3. Method Comparison. To further verify effectiveness for IAFS-BP algorithm applied to evaluation of piano intelligent teaching quality in IoT and multimedia environment, it was compared with other evaluation methods. The compared methods include logistic regression, decision tree, and SVM. The experimental results are illustrated in Table 3.

Compared with other evaluation methods, IAFS-BP can achieve the highest performance. Compared with the best-performing SVM methods in the table, 3.8% precision improvement and 3.6% recall improvement are obtained, respectively.

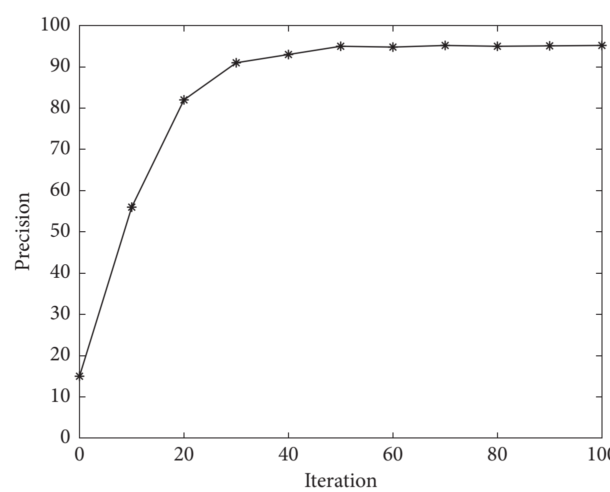

Figure 4: The training precision of IAFS-BP.

4.4. Evaluation on Mutation Operator. The mutation operator is used in the IAFS-BP algorithm. To verify effectiveness, this work compares evaluation performance with and without mutation operator. The experimental results are illustrated in Figure 5.

After using mutation operator, IAFS-BP obtains a precision improvement of 2.5% and a recall improvement of 1.8%, respectively, which proves the effectiveness and correctness of the strategy.

Table 3: Comparison with other methods.

Method	Precision	Recall
Logistic regression	85.3	82.2
Decision tree	88.3	87.5
SVM	91.4	90.1
AFS-BP	95.2	93.7

4.5. Evaluation on Dynamic Vision. The dynamic vision is used in the IAFS-BP algorithm. To verify effectiveness, this work compares evaluation performance with and without dynamic vision. The experimental results are illustrated in Figure 6.

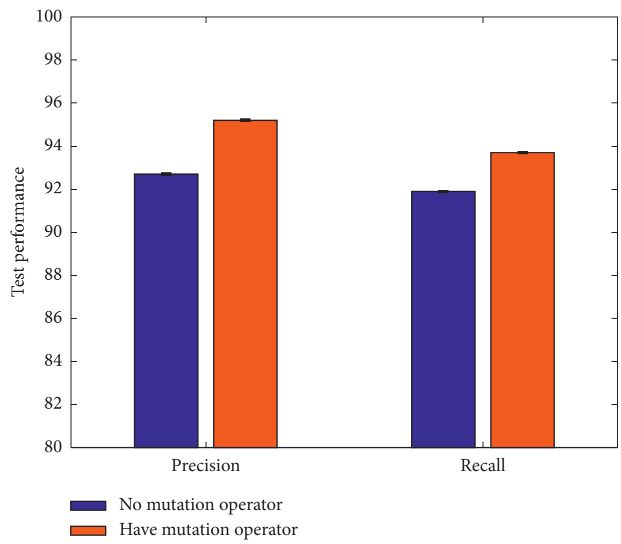

Figure 5: Evaluation on mutation operator.

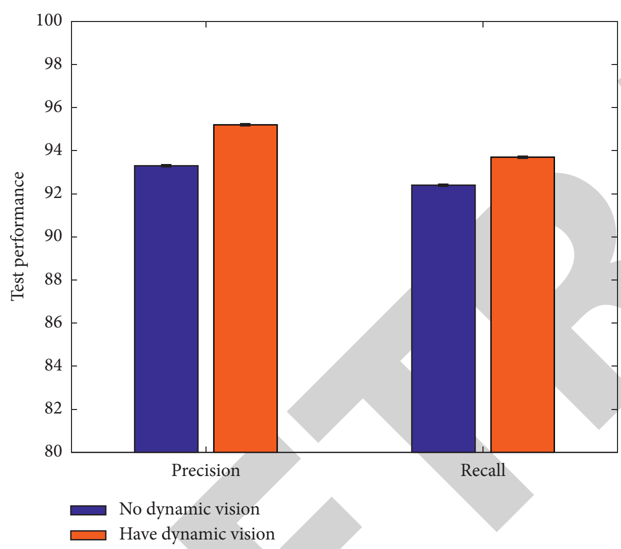

Figure 6: Evaluation on dynamic vision.

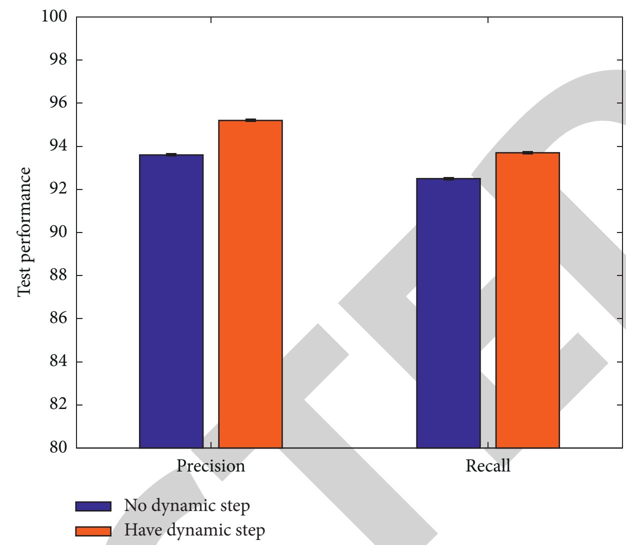

Figure 7: Evaluation on dynamic step.

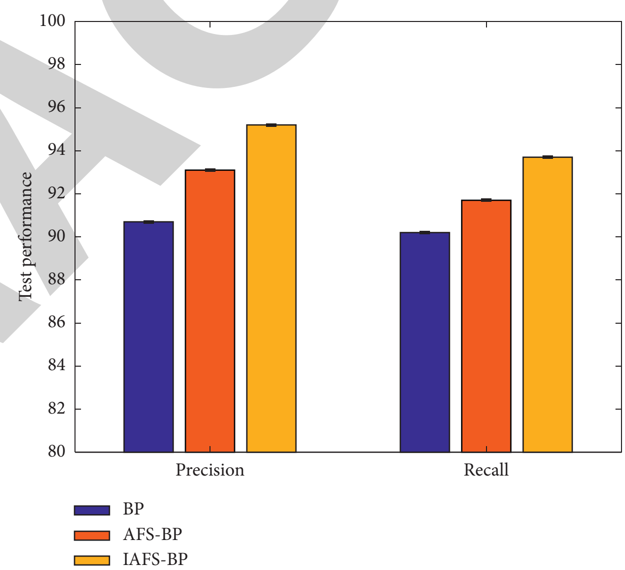

Figure 8: Evaluation on IAFS.

After using dynamic vision, IAFS-BP obtains a precision improvement of 1.9% and a recall improvement of 1.3%, respectively, which proves the effectiveness and correctness of the strategy.

4.6. Evaluation on Dynamic Step. The dynamic step is used in the IAFS-BP algorithm. To verify effectiveness, this work compares evaluation performance with and without dynamic step. The experimental results are illustrated in Figure 7.

After using dynamic step, IAFS-BP obtains a precision improvement of 1.6% and a recall improvement of 1.2%, respectively, which proves the effectiveness and correctness of the strategy.

4.7. Evaluation on IAFS. This work uses IAFS to optimize the BP network. To verify effectiveness, this work compares evaluation performance of traditional BP algorithm, the AFS-BP algorithm, and IAFS-BP algorithm. The experimental results are illustrated in Figure 8.

The evaluation performance obtained by the traditional BP algorithm is the lowest. When the AFS algorithm is used to improve it, a certain degree of performance improvement can be obtained. When the AFS is improved, the evaluation performance can be further improved. This can prove the reliability and effectiveness of the IAFS algorithm proposed in this work.

5. Conclusion

At present, the upsurge of learning piano is constantly surging, and more and more students and parents can realize the importance of learning piano and the advantages it brings. With Internet of Things technology and multimedia technology, as a fashionable and advanced teaching method, its ultimate purpose is to improve quality of teaching. IoT and multimedia teaching methods have natural advantages, which are reflected in the more flexible and diverse teaching methods for teachers. This can also track and manage students' learning results and processes in a timely manner, which is reflected in the students' interest and efficiency in learning, and better improves their ability. Over time, a virtuous circle has been formed between teachers and students, and the ultimate goal of teaching has been achieved. In this context, how to evaluate the quality of piano intelligent teaching under background of IoT and multimedia technology is an important topic. This work proposes an improved IAFS-BP algorithm to solve this problem. The specific results of this work are as follows: (1) AFS will fall into an invalid search process when searching for flat areas. AFS adopts a fixed vision and step size and has a fast convergence function. But later in search, most of the artificial fish were clustered in nearby areas. If the vision remains unchanged, the corresponding calculation amount will increase, and the step size will remain unchanged, which will prevent the artificial fish from moving in the optimal direction. This paper introduces an improved AFS algorithm. It can refine the search and improve search accuracy. (2) For network training, the BP algorithm not only takes a long time to train, but also tends to fall in local extreme values during training process. In this work, IAFS algorithm is used in BP network training. The improved IAFS-BP has better performance, such as global optimization ability, algorithm convergence speed, and search speed. (3) This work has carried out a comprehensive and systematic experiment to verify effectiveness of IAFS-BP applied to quality assessment of piano intelligent teaching in the context of IoT and multimedia.

Data Availability

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

Conflicts of Interest

The authors declare no conflicts of interest.

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