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Research Article

The Piano-Assisted Teaching System Based on an Artificial Intelligent Wireless Network

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In the recent technological era, we can note a tremendous development in the information technology sector, which has made all other sectors work to face a revolution and profit. In comparison with other organizations, educational departments have shown the best utilization of technology in their teaching and learning process. Teaching and learning (TaL) music and musical instruments are very challenging for teachers and students of remote areas. In this research work, TaL of piano playing is considered for the study by taking the MIDI and Audio Edited for Synchronous TRacks and Organization (MAESTRO) dataset. This dataset has virtual recorded piano performances with a label for notes and audio waveforms. The multiple signal classification (MSC) algorithm with the artificial intelligence (AI) is implemented on the dataset to train the students with artificial intelligence's support. This MSC algorithm is executed on wireless networks (WN) to classify the signal data after recording and updating the dataset. With the help of the MSC algorithm with WN, the selection of teachers becomes easier for the student. This proposed work shows effective results for the TaL performance.

1. Introduction

Artificial intelligence (AI) is one of the most often discussed topics in today's society for a variety of reasons, including its potential to replace humans. Technology innovation and a developing artificial intelligence business in the United States have elevated the country to the forefront of artificial intelligence research and development. During the 1960s, the British government began looking into the possibility of artificial intelligence. The National Engineering Department of the University of Edinburgh was created in the 1970s [1]. It has the distinction of being one of the world's oldest engineering departments. As a result of the attention and viewing that this website was received from countries such as Japan and the Soviet Union earlier in the year, it has advanced at a relatively rapid pace [2]. With the support of national policies, artificial intelligence (AI) has emerged as a vital tool in the advancement of the country's economic development, which has been particularly true in recent years. There have been tremendous developments in the fields of computer science, communication technology, and intelligent technology (which encompass all types of artificial intelligence), which have resulted in substantial improvements in the field of educational technology [3]. The rapid rise and broad use of modern information technology in both education and industry have resulted in the introduction of increasingly more educational materials into classrooms and instructional methods, such as multimedia, networks, social media platforms, and collaborative projects [4]. Modern information technology has earned a reputation for making significant contributions to the development of curricula and the reform of educational institutions as a result of its distinct characteristics. Electronic technology will become more widely available as digital communication and computer technology become more widely available, and the music and production industries will rely on it to boost their operations in the future [5]. When electronic music became the dominant form of music in the latter half of the twentieth century, the piano system was automatically renewed. When it comes to classic pianos, such as grand pianos and complete pianos, the practice piano system, which is an electronic device with intelligence, can be employed with

them [6]. There is a significant need for this high-tech product in the sector, which encompasses both software and materials. In the context of learning to play the piano, practice is a simulated listening game that combines key pressing, foot control, and the playing of musical pieces [7]. You can record your piano playing, transmit the data to a piano machine, and then repeat the process with the help of an automatic practice program. Because of the piano practice application, people will be able to hear and appreciate the original piano compositions without having to sacrifice the pure, clean sound of the piano [8]. New applications for the conventional harp improve art, vocabulary, science, and technology, among other things. Several important artificial intelligence domains can be carried out independently by the Chinese government, and the country has a strong position in a number of these fields [9]. China has a strong position in certain areas of artificial intelligence research. The Chinese Academy of Sciences' Institute of Mathematical Engineering has begun a major data mining and information retrieval program as part of its mission to advance science and technology [10]. When confronted with a complex scenario, it is feasible to construct an adequate knowledge model by the application of several strategies such as computations. There is a wide range of physical events, project processes, and institutional relationships that may be explained using this paradigm. Artificial intelligence can be better understood if we build analogous systems employing modern electrical, optical, and biodegradable components, which can be built using modern components (AI). A consequence of this is that the human approach to learning about human brain devices and systems has been rendered ineffective by tests, which are a weapon of contemporary science [11]. The general performance of the system has seen very small improvements, and a number of important functions have been left out. A direct effect of this development is that the notion has moved from the stage of imitation to the level of actual implementation [12]. A few examples of study topics that are focusing on artificial intelligence technological solutions as well as broad scientific ideas include personal creativity, intellectual property tools, and intellectual property management systems, to name a few. There are a variety of instances in the expert plan, which is a model of intellectual skill that involves scientific research, practical application, and critical scientific usage [13]. In addition, as new study materials and challenges are presented to humans on a regular basis, the concepts of science and artificial intelligence are further developed, and computers are given an increasingly powerful tool for dealing with behavioral concerns that are not numerical in nature. Artificial intelligence (AI) is a discipline that focuses on the development of rules for the investigation of human intellect [14]. The human-like environment makes use of programs that allow computers to learn, exercise decision-making, and comprehend in a similar way to humans. Artificial intelligence can be used to train machines to think in the same way that people do. Computer-assisted learning includes the use of computers for teaching, interactivity, integration, and replication of text and visuals and the use of end-to-end resources, all of which are characteristics of this type of learning. As a revolutionary teaching tool, artificial intelligence makes use of multimedia technology to deliver the same learning content in a variety of formats while allowing several people to absorb it simultaneously, all at the same time [15]. A significant contribution to artificial intelligence research has come from computer science education and the Internet community. Artificial intelligence is being used to teach computer science in a new curricular technology that is being introduced. Students are given the opportunity to utilize their own customized learning and practice tactics in a safe and supportive setting, and their learning and thinking processes are studied. This assists students in learning more quickly and effectively [16]. When it comes to artificial intelligence, computer-assisted training has been a sluggish learner when it comes to new technologies. Artificial intelligence advancements will have a big impact on computer-assisted learning programs in the near future. Using the Internet and virtual networks, researchers are making progress toward developing smart, computer-assisted learning programs that will aid in the reformation of traditional courses and training programs. An expert system is computer software that instructs human specialists in a certain topic on how to solve a problem in a specific field. The use of neural networks in artificial intelligence applications is one of the most active and successful disciplines in the field of artificial intelligence applications [17]. Plans that have a great deal of expertise and competence behind them are referred to as "experienced." Using their knowledge and problem-solving approaches, a human expert may think and judge more effectively, as well as simplifying the decision-making process for other human experts and solving complicated problems. The problem of expert systems can always be solved by a process of interpretation, analysis, design, planning, monitoring and correction, directing, and controlling, among other methods of solution. The domains of inquiry, analysis, and design have advanced significantly since our forefathers' days of study, analysis, and design in these fields [18]. With the advancement of AI, this study is aimed at implementing artificial intelligence techniques to learn piano. This research focuses on evaluating the efficiency and accuracy of an online piano teaching platform using AI with wireless networks.

2. Methods

The design of an intelligent piano playing teaching system based on wireless networks analyzes the realization technique of the piano education process and provides a method of assessing piano playing while using a wireless network model for such difficulties in device piano teaching. That is, device teaching is such information sharing without communication. Furthermore, this document simulates the teacher's role in guiding students to continue playing procedure, which is critical in piano instruction.

Assume there are u training tests (A_n, S_n) as parameters of learning the wireless sensor network, where A_n is the device's eigenvector and S_n is the expected result of the data suggested. Assume that the aspect of the input signal is t; $A_n = (n_{n1}, n_{n2}, \cdots, n_{nt})$ is being used to demonstrate the n

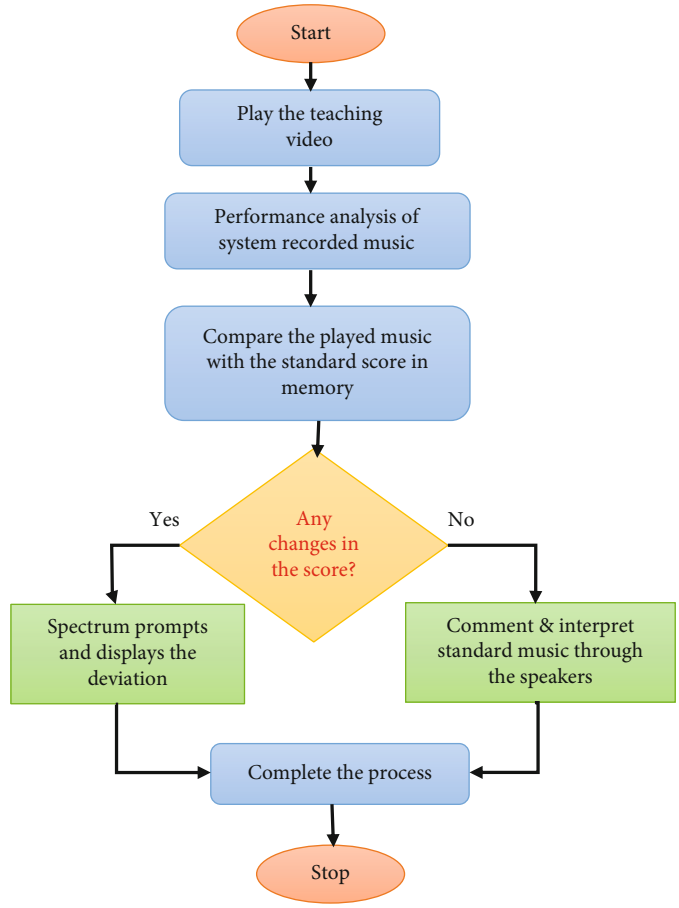

Figure 1: The proposed flowchart for the automatic playing of the piano.

sample's support vectors. $S_n = (n_{n1}, n_{n2}, \cdots, n_{nt})$ is being used to demonstrate the n sample's predicted output sequence. And $Q_n = (Q_{n1}, Q_{n2}, \cdots, Q_{nt})^S$ is being used to recognize the n sample's measured output variable. If the density between i neurotransmitter and the adjacent j neurotransmitter is E_{ij}, then $E_{ij} = E_{ij}$, where j is the j neuron's lower limit.

Step 1. Whenever the neurotransmitter is being used as such a unit of input value $Q_n = A_n$, the current surface region WSN_{nj} of a j neurotransmitter can be described as

$$\mathrm{WSN}_{\mathrm{nj}} = \sum_i E_{ji} Q_{ni} - \theta_j. \tag{1}$$

Step 2. In which Q_{ni} is the initial element's i neurotransmitter output, as well as the current element's j neurotransmitter output is just as continues to follow, and $f(WSN_{nj})$ is a transfer function. The calculation of Q_{ni} is given in

$$Q_{ni} = f\left(\mathrm{WSN}_{nj}\right). \tag{2}$$

Step 3. The training algorithm technique can also be used to train its system Q_{ni} with the help of a D_n which is a sigmoid activation function. The training courses' primary goal is to calculate the activation function (refer to the equation below):

Table 1: WSN with artificial intelligence in the system analysis.

Parameter	WSN algorithm	Structure converter	Database
Standard score	153	233	457
Command and interpret	167	252	442
Music memory	175	226	567

$$D_n = \frac{1}{2}\sum_{j=1}^{r}\left(l_{nj} - Q_{ni}\right)^2, \quad D = \sum_{n=1}^{u} D_n. \tag{3}$$

Step 4. In each training process Δ_n, equation (4) is used to reduce the E_{ji} error value based on the gradient.

$$\Delta_n E_{ji} = \eta \delta_{nj} Q_{nj}. \tag{4}$$

$\eta\delta_{nj}$ in Equation (5) represents the energy device:

$$\delta_{nj} = \left(l_{nj} - Q_{nj}\right) Q_{nj}\left(1 - Q_{nj}\right). \tag{5}$$

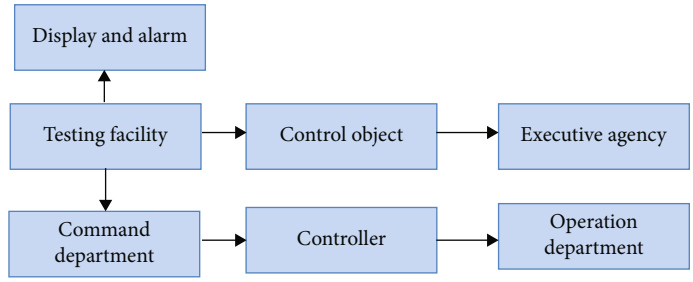

Figure 2: Piano teaching program for testing frequency analysis using WSN.

Q_{nj} represents the nonlinear activation unit, and δ_{nj} represents the energy device; then, the calculation will be made:

$$\delta_{nj} = Q_{nj}\left(1 - A_{nj}\right)\sum_{j}\delta_{nj}E_{ij}. \tag{6}$$

Step 5. Through wireless sensor network coaching h_{nj}, it is sensible to use AI mean standard errors as

$$\mathrm{AI} = \frac{1}{tu}\sum_{t=1}^{u}\sum_{j=1}^{t}\left(h\wedge_{nj} - h_{nj}\right)^2. \tag{7}$$

Step 6. In equations (8) and (9), n is the value connecting the j^{th} hidden layer network to the output unit weight matrix of β_j hidden nodes as well as the input nodes.

$$Q_{nj} = \sum_{j=1}^{n}\beta h(a + s + d)^{1/2}, \tag{8}$$

$$\sum_{j=r+1}^{n}\beta_j\left(g + a + A_j + d_c\right) = h_i, \tag{9}$$

where g and a represent the rhythm sense inside the dataset and d_c is the music frequency time.

Step 7. With the context of learning to play the piano, practice is a simulated listening and searching for a new region A within its visual range. Whenever the region$A$could be revised any longer within the visible region and the normal meets,$h_1 > h_2$ random behaviour would be able to evaluate using

$$A_j = A_j + \mathrm{random}(\mathrm{Vis}) - \mathrm{if}(h_1 > h_2),\ A_i + \mathrm{random}(\mathrm{stp}) * (A_{\max} - A_i), \tag{10}$$

where random(Vis) specifies the visual range and random(stp) represents the steps.

The architecture for analyzing the system in Figure 1 describes the automatic playing of the piano. If teaching and research are not placed at the forefront of the educational process, they will lose their significance. Piano accompaniment and piano solo are two separate types of piano playing, despite the fact that they are frequently confused with one another. The majority of people believe that practicing piano solo is more important and necessitates more time than other types of music. In fact, this is a false assumption to make. When learning to play the piano, a number of tasks must be done with the support of fellow students and musicians; certain piano music is difficult and requires practice with other musicians in order to be successful. It is a very different experience to sing and play the piano. Even though only one player is necessary to practice on a piano, it is likely that the effects of the practice will be less than desired. This necessitates the teaching of piano principles in piano education, as well as more in-depth instruction in piano skills and a larger concentration of cognitive skills such as speed, coherence, and noise. It is vital to be knowledgeable with many different types of piano music in order to function effectively in a group. Because of the use of artificial intelligence in this series of works, both the performance of automated musicians and the performance of piano playing have improved significantly, as has been demonstrated. Due to the rapid advancement of science and technology, researchers began combining digital control and mechatronics into piano training systems in order to improve their effectiveness. The students have chosen the piano class with a chosen teacher which is considered in this architecture. After selecting a specific piano teacher's style, the student will start playing the recorded video. On or after listening to the classes, the student can review the class to make further analysis. With the aid of the study, the played music is compared with the standard score provided by the students. If there is a significant deviation in the played music, then make an automatic messaging to prompt the deviation to modify and update the database. This architectural model works with artificial intelligence (AI) and wireless network (WN). The overall architecture works in the wireless network as the teacher, and the learners will be remote. Hence, the video will be played online, and there might be some delay in the signal. In this proposed model,

Table 2: Result analysis for frequency of use of Prolog language.

	Mean	Standard deviation	Size (GB)
Testing	1.54	275	65.87
Frequency	1.67	162	39.46
Database	1.14	242	48.69

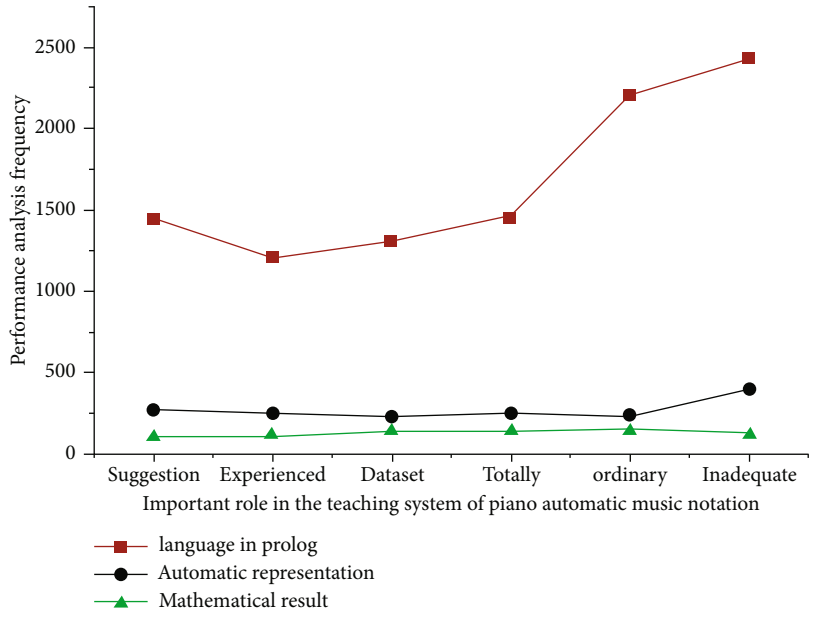

Figure 3: The WSN with artificial intelligence using analysis of frequency in the affective dimension of music.

Table 3: Performance analysis of frequency of use of the Prolog language.

	Language in Prolog	Automatic representation	Mathematical result
Suggestion	1443	278	114
Experienced professional	1316	249	125
Dataset	1502	236	147
Ordinary reliable	2315	236	161
Inadequate credibility	2539	423	145
Totally credible	1556	262	153

it is considered that the signal for playing the video in online mode is standard for the students. If the student finds some deviations in the video, they can comment and review for further notifications. According to the words, AI will help choose different teachers and play the video through the wireless network. AI will do the updating of the processes in the database.

During specific complex scenarios, the traditional way of classroom study is suitable for the piano teaching-learning process and hence to overcome. This challenge and continue the teaching process in your progressed manner. It is mandatory to process the new technology in this circumstance to solve this challenge. In this research, the intelligence wireless network concept is implemented. To need the uses for located who are acting of nodes at remote areas will be in communication with teacher who is different location. Whenever classroom session about it gets started it intimated interactive system, both the teachers and students may be using the interacting system like mobile, laptop or any other devices with the support of internet working technology with these technology is advancement. It makes it easy to get communicated, and continue the teaching-learning mechanism for the piano class.

Table 4: Overall evaluation and test piano teaching system and experimental results.

Piano teacher	Overall evaluation	Communication command	Rhythm sense
Music 1	0.956	0.723	0.856
Music 2	0.823	0.835	0.821
Music 3	0.971	0.878	0.842
Music 4	0.974	0.989	0.979
Music 5	0.949	0.848	0.845
Music 6	0.947	0.846	0.756
Music 7	0.889	0.873	0.734
Music 8	0.824	0.789	0.876
Music 9	0.712	0.843	0.951
Music 10	0.943	0.9	0.87

3. Results and Discussion

For this research, the data has been validated using the multiple signal classification (MSC) algorithm. This algorithm has generated the results. In order to understand the

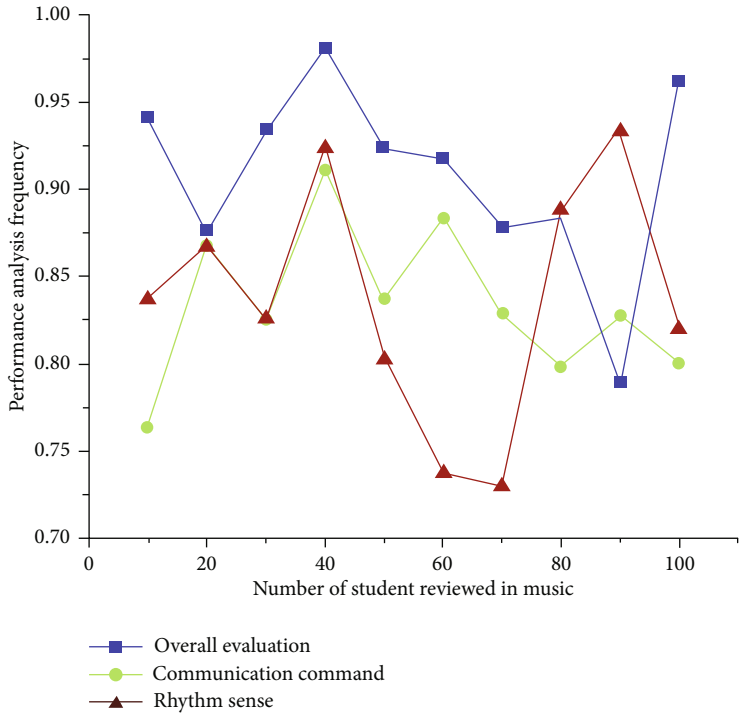

Figure 4: Performance analysis of the teaching system's effect evaluation.

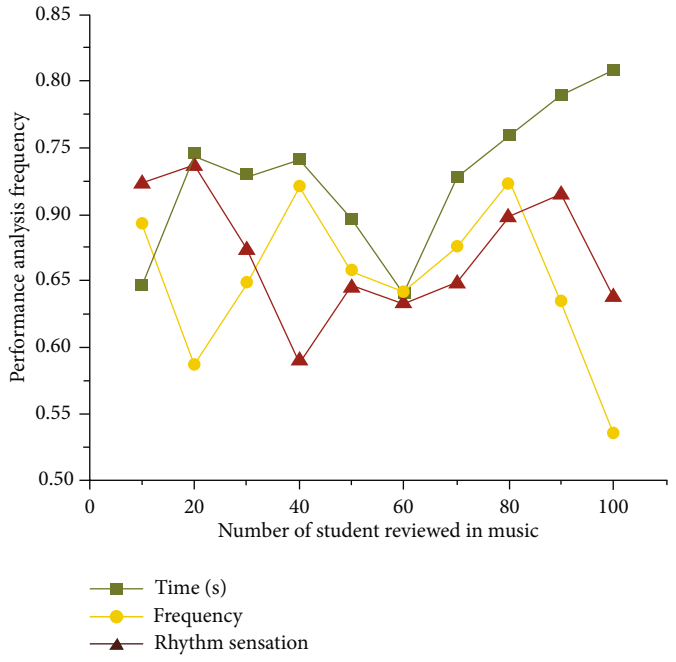

Figure 5: The piano music frequency analysis of the teaching system's effect evaluation diagram.

utilization of WSN with AI in the system analysis, the parameters like music memory, standard score, and "command and interpret" have been used (Table 1).

The recording will be streamed online, and there may be some signal delay. In this developed framework, the signal for recording audio in an online mode is assumed to be structure converter for students. If a student notices any inconsistencies in the audio, they can respond and review it for future updates. According to the words, AI will assist in selecting different teachers and playing the audio via the wireless sensor network. AI will update the methods in the dataset.

The frequency analysis in recording and transmitting the video data through wireless networks is represented in

Table 5: Frequency analysis for piano music teaching education.

Piano teacher	Time (s)	Frequency	Rhythm sensation
Music 1	0.657	0.663	0.712
Music 2	0.712	0.576	0.743
Music 3	0.783	0.652	0.618
Music 4	0.764	0.721	0.565
Music 5	0.699	0.678	0.687
Music 6	0.665	0.698	0.634
Music 7	0.743	0.612	0.673
Music 8	0.716	0.767	0.667
Music 9	0.715	0.649	0.795
Music 10	0.823	0.599	0.691

Figure 2. From this figure, it can be elaborated that a controller is the role played by the teacher who is responsible for preparing the course material for online piano classes. After preparing the resources, it will be forwarded to the operation department who will play the video according to the student's request or depending on the classroom schedule. In the testing facility, the quality of the video will be analyzed and will be updated with the duration and the teacher details. If there is any issue, a display alarm will be generated and will be forwarded to the executive agency and the command department to make further updating in the resources (Table 2).

As the video is transmitted in the audio and MIDI files have been associated with 3 (ms) testing and frequency into specific musical pieces compiled with mean, standard deviation, and size of GB performance. Digital audio is at least CD quality with the sample rate of 44.1–48 kHz along with the resolution of 16-bit PCM stereo.

The Prolog language is a type of programming language with a modeling process and the ability to think intelligently. It is associated with the field of graphics and information technology comprehension, including propositions as well as judgment comprehension cases. The Prolog programming term is generally used in data sets, ordinary, mathematical result, totally credible, inadequate credibility, automatic recognizing, as well as other fields. As seen in Figure 3 and Table 3, it also is commonly applied in the field of music education and the quantifier and mathematical expression system of piano music performance.

For the raw data shown in this dataset, we collaborated with the organizers of the International Piano-e-Competition. During each competition installment, Prolog performs on automatic representation, which is concert-reliable and credibility pianos with an integrated high-precision MIDI capture and playback system. The fidelity of the recorded MIDI data is high enough that the audition stage of the competition can be judged (refer to Table 3) remotely by listening to contestant performances reproduced over the wire on another Prolog instrument. A piano-assisted teaching system is an online class created for the analysis of the frequency in the wireless network. Based on this, it analyzes the normal online education teaching class frequency in the wireless network. In those class online materials is believed that corrected to analysis is represented for the ordinary and reliable.

The different overall evaluations of an audio signal are made up of piano music transmitting communication signal features (refer to Table 4). They are also not qualitatively motivated and classify a rhythm sense signal's distinctness in the sequential or frequency field. Because music has a wide range of variability (refer to Figure 4), physiological feature extraction and interrelated musical frames.

Because music has a wide range of variation (refer to Figure 5), physiological feature extraction is performed in short intersecting skylights. In Figure 5, the analysis is based on the number of students who reviewed the online piano music learning classes corresponding to the frequency of the music. It can be observed that the frequency and the rhythm sensations are having inverted values in relation to the student's response in certain cases.

The parameters of an audio wave signal are made up of various aspects of a piano music signal. They are not conceptually motivated and classify a piano signal's (refer to Table 5) distinctness in the space-time or frequency field. There is a minor difference in the time, frequency, and rhythm sensation in the considered music composed by the piano teacher.

Piano music teaching and learning classes are handled online with the aid of artificial intelligence in wireless networks. Artificial intelligence is implemented in the application to aid in the automatic playing of the recorded video. Also, another significant role played by AI is suggesting tracks for the students depending on their requirement and the comments they post. All the communication made by the students and the responses will be updated in the database by the AI technique. In this AI technique, music signal classification concept is implemented as an artificial intelligence technique to classify the newly updated music data and update in the corresponding genre. The following is a flow of steps for calculating the score for the online piano class: reduced lettered components represent both these performances, while "Q" reflects the query, comparison, or effectiveness. Node 1: sort performance results from equivalent to similar. Node 2: remove the greatest similar performances to end up leaving interference floor. Nodes 3 and 4: insert extra comparable performance-related appearances one at a time to evaluate how well they can obstruct the noise surface (refer to Figure 6). The incorporation of stringed instrument recognition technology into children's piano learning can increase their interest in learning and strengthen the impact of piano education. Specifically, for this performance of the model for musical instrument acknowledgement is improved besides designing the model on the basis of a neural network and optimizing the structure. The experimental results indicate that an instrument-recognizing model based on AI technology can satisfy the requirements of piano education while also increasing students' interest throughout piano learning.

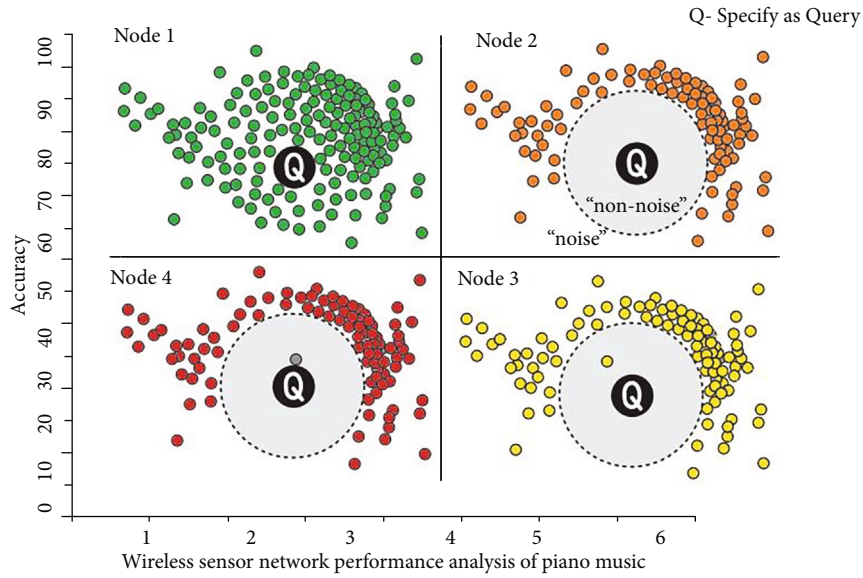

Figure 6: Wireless sensor network performance analysis of piano music.

4. Conclusion

In the field of artificial intelligence, we study all human intelligent behaviours and their underlying laws. There are several fields involved, including computer science, political science, and information systems as well as neurophysiology, psychology, and philosophy. In this paper, a music-aided learning system is based on multiple signal classification (MAC). The use of artificial intelligence to assist in the teaching of music is becoming increasingly popular. In a piano performance, there is a 94.3 percent utilization rate of artificial intelligence-related technology obtained from this study. As a result, in both the piano performance and TaL model, the AI assistant is critical to the process.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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