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Application of Artificial Intelligence Technology in the Intelligent Construction of Music Education Teaching System in Colleges and Universities

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Abstract: - The appellation of the comprehensive framework designed to enhance the process of teaching and learning in music education is the Music Education Teaching System. In order to create an engaging and productive learning environment for students of all ages and ability levels, it blends a variety of pedagogical techniques, technology resources, and instructional strategies. In this manuscript, Application of Artificial Intelligence Technology in the Intelligent Construction of Music Education Teaching System in Colleges and Universities (AAIT-ICMES-PACDNN-EHOA) is proposed. Initially input data are gathered from Classical Music MIDI as CSV Dataset. The input data is fed to pre-processing using Pseudolinear Maximum Correntropy Kalman Filter (PMCKF) to identify missing data; then pre- processed data is fed to design the music teaching function system in Artificial Intelligence Technology utilizing PACDNN to analyse and construct the music teaching system. In generally, PACDNN doesn't express adapting optimization strategies to determine optimal parameters to ensure Construction of Music Education Teaching System. Therefore, Elk herd Optimization Algorithm (EHOA) is to optimize PACDNN which is to perfectly Using Artificial Intelligence Technology to Construct a Music Education Teaching System. Then the proposed AAIT-ICMES-PACDNN-EHOA is implemented in Python and Analysis is done on performance parameters including ROC, F1-score, Accuracy, Precision, Specificity and Recall. Performance of the AAIT-ICMES-PACDNN-EHOA approach attains 19.27%, 23.35% and 32.60% higher accuracy, 19.25%, 23.85% and 31.90% higher Precision and 18.87%, 22.95% and 32.99%higher Recall when analysed through existing techniques like Design of an artificial intelligence-based online interactive teaching platform for rural music education (DOITR-AI-SVM), Design of an online music education system based on artificial intelligence and multiuser detection algorithm (DOMES-AI-LDSMA), and Application of deep learning-based intelligent music signal identification and generation technology in national music teaching (IMSIG-NMT-LSTM) methods respectively.

Keywords: Artificial Intelligence Technology, Elk herd Optimization Algorithm, Music Education Teaching System, Phase-Aware Composite Deep Neural Network and Pseudolinear Maximum Correntropy Kalman Filter.

I. INTRODUCTION

More people are coming around to the idea of "music without borders" in the era of the Internet. Although musical expression varies somewhat among nations and areas, people can always relate to the ideas and feelings that music expresses. Music clearly conveys the significance of human life [1, 2]. Using music as a medium, people can artistically convey their thoughts and feelings through the creation of music [3]. Research on how music education affects psychology makes it simpler to understand how education brings about changes in psychological cognition and individual behaviour [4].The majority of pupils think that, to some degree, a teacher's skill level influences their own professional level [5]. In a traditional classroom, the instructor sets the agenda for instruction, assigns and grades assignments, and determines the course's content and workload [6]. On the other hand, on-going, in-depth research on education has revealed that student-centred learning frequently yields superior outcomes [7]. The world is home to an infinite variety and quantity of musical instruments, and music data are stored using an increasingly wide range of techniques [8]. Music genres have gradually developed as a result of the invention of musical instruments and the expansion of methods for storing music [9]. Text-to-speech conversion, speech compression coding, digital audio processing, and voice recognition have all become more precise and diversified as information technology has advanced [10]. The development of contemporary electronic music technology has been aided by the introduction of computers. Electronic music is a prime example of modern music technology, which has advanced rapidly in tandem with the rapidly expanding field of technological innovation [11, 12]. The reason for this is the quick development of signal processing and computer multimedia technologies, as well as their encroachment into the domains of music composition and enjoyment [13]. One cannot discuss AI applications in the music industry without mentioning music technology. The use of AI technology in music instruction is only one of the many industries

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it has transformed [14]. It is a revolutionary discovery that AI is being used to create music education teaching systems for colleges and universities. By utilizing AI, educators may more effectively customize each student's learning experience to meet their specific needs and preferences. [15, 16]. This introduction lays the groundwork for examining how AI is changing the field of music education and provides ideas into how AI might be used to develop intelligent teaching methods that benefit academic teachers and students alike. Parts of the multidisciplinary field of music technology are art and technology [17, 18].

Therefore, rather of imparting knowledge in the conventional manner and having students merely accept musical notions; an increasing amount of emphasis is placed on the educator's present knowledge and abilities during the music education process. This aligns with the fundamental components of education as outlined in educational theory [19, 20].

Due to its reliance on artificial intelligence and LDSMA, may not be able to appropriately comprehend complex musical expressions and accommodate a wide range of learning methods. The artificial intelligence with SVM-based online interactive teaching platform might have trouble meeting the unique cultural and educational requirements of these communities. EmployingLSTM may struggle with accurately capturing the intricacies of traditional music styles, hindering its effectiveness in national music teaching contexts. The over-reliance on DBN algorithmic interpretation, cultural uniformity, and disregard for various musical traditions are potential downsides. Difficulties with RNNs could include their inability to adjust to the unique demands of each student, their propensity to reinforce prejudices in music instruction. The limits of SCMA include the possibility of ignoring conventional teaching strategies, ethical issues with data privacy and algorithmic bias, and difficulties in promoting innovation.

In this research, a novel method for AAIT-ICMES-PACDNN-EHOA is presented. The system seeks to achieve higher Accuracy and Recall by combining EHOA with optimized PACDNN. Pre-processing methods is PMCKF. The suggested approach is put into practice using Python and contrasted to the state-of-the-art methods. It shows significant advancements in a number of measures, such as ROC, F1-score, Accuracy, Precision, Specificity and Recall.

Below is a summary of this research work's primary contribution:

- PACDNN is provided in order to maximize the accuracy of type categorization while minimizing the complexity of training and testing times.
- The AAIT-ICMES-PACDNN-EHOA model's resilience enables precise Music Education Teaching System in Application of Artificial Intelligence Technology.
- An approach that is efficient in terms of computation for Music Education Teaching System construction, as PACDNN employs an effective-stage Teaching System construction framework.
- The proposed method is put into practice on the Python platform, and its effectiveness is compared to that of current approaches.
- The proposed method yields superior outcomes when compared with other current techniques like DOMES-AI-LDSMA,DOITR-AI-SVM,IMSIG-NMT-LSTM.

Remaining manuscripts arranged as below: Part 2 Literature review; Part 3 Proposed method, Part 4 Outcomes with discussions, Part 5 conclusion.

II. LITERATURE SURVEY

Several research works presented in the literatures were based The Knowledgeable Design of the College and University Music Education System. based deep learning; few of them are reviewed here,

Yan [21] has presented DOMES-AI-LDSMA. Here, carries out sufficient research on educators, including administrators, educators and learners, in order to fulfil the requirements of the music distant teaching unit. This research's artificial intelligence and SCMA system multiuser detection algorithm-based music online education system may significantly improve audience efficiency in learning music and has clear benefits for the educational process, according to the analysis presented in the conclusion. The system module contains online classes, music assignments from learners, basic information management, and other levels. Additionally, the music teaching function system was analysed and designed using the system analysis and design approach, assisted by artificial intelligence technology and the SCMA system multiuser detection algorithm.. It attains higher Accuracy and it provides lower Precision.

Zhang, et al.[22] have presented DOITR-AI-SVM. Here, investigates the elements of artificial intelligence-based music curriculum and creates a weighted least squares model for music education in remote locations. It also makes the nature of weighted linear regression more clear by studying the weight function. Due to the numerical characteristics of multidimensional random vectors, the coordinate coefficient number vectors of each instructional dimension were used to designate the national music education indicator to be the data set from the music teaching platform. It attains higher Recall and it provides lower Specificity.

Tang, et al. [23] has presented IMSIG-NMT-LSTM. Here, examining potential applications of intelligent music recognition technology in music education was the method's aim. An algorithm model was developed and implemented that uses the knowledge of Long Short-Term Memory networks to identify different musical messages and produce different types of music. Originally, the algorithm model was created to carry out the task of intelligent music generation by looking at the use of neural networks and machine learning in the field of music. This offers a conceptual basis for relevant studies. Next, a sizable amount of music data was selected in order to examine the generation and style discrimination model. It attains higher F1-score and it provides lower Specificity.

Xu, [24] has presented building a deep learning-based intelligent detection and learning platform for national music genres. Here, utilising five various kinds of ethnic musical instruments as the experimental objects, the parameter extraction feature and the recognition classification technique of an ethnic music genre based on the DBN are proposed. It also introduces the DBN in DL and the music feature extraction method. A proposed national network topology for the recognition and classification of musical instruments was based on the DBN. This has led to the development and testing of a learning system for music library categorization retrieval. The first hidden layer had the biggest impact on the prediction outcomes. When the input sample feature size was one-third of the first hidden layer node count, the network performance was almost convergent. It attains higher ROC and it provides lower Accuracy.

Wang [25] has presented Artificial intelligence-based platform design for teaching vocal music to music majors. Here, This essay presents the idea of artificial intelligence, examines the challenges facing college music departments, and delves particularly into the process of implementing an AI vocal based teaching program for music majors. The system architecture's design, for example, was primarily involved in this. It was made to satisfy the needs of the entire system. When asked, 82% of students answered they would rather learn music on a computer than in a traditional classroom. For music majors, an AI-based vocal teaching system that allows teachers to monitor students' learning through analysis and reasoning while letting students study independently was a useful tool. It attains higher Recall and it provides lower Specificity.

Yu, et al. [26] has presented Artificial intelligence developments and uses in music education. Here, the music industry has benefited from the promotion and application of advanced computer technology and information technology due to the on-going advancements in this field. Artificial Intelligence (AI), a by-product of the quick development of information technology, incorporates a wide range of multidisciplinary areas and introduces new ideas to music instruction. This approach looks at the advantages of AI in the field of music education, gives a thorough rundown of how it's used, and speculates on how it could grow in the future. With the help of AI, the marriage of smart technology and in-person instruction addresses the traditional mode's lack of individualization and raises students' enthusiasm in learning. It attains higher ROC and it provides lower Precision.

Liao, et al. [27] has presented Development and implementation of recurrent neural network-based tools for music education. Here, suggest building, using, and applying music education resources using a strategy and methodology based on recurrent neural networks (RNNs). Examine here the needs for user roles that educators, pupils, and system administrators have in the context of teaching and learning, paying special attention to what is necessary for distant learning in music. Here, also design a mobile teaching platform that aligns with the characteristics of music teaching. An artificial neural network was a model that simulates and links neurons, the fundamental building blocks of an animal or human brain, in order to promote the learning, memory, association, and pattern recognition processes of the nervous system. It attains higher Accuracy and it provides lower precision.

III. PROPOSED METHODOLOGY

In this section, Optimized PACDNN depend AAIT-ICMES-PACDNN-EHOA is proposed. This process comprises of four steps likes data collection, pre-processing, Network, and optimization. In the proposed

Construction of Music Education Teaching System, Classical Music MIDI as CSV Dataset undergo pre-processing to prepare them for further analysis. Following the pre-processing; the next step involves employing a PACDNN for Construction of Music Education Teaching System. Better statistical analysis for identifying at-risk students, more sophisticated data processing capabilities for personalized music learning experiences, and the capacity to automate administrative tasks to boost staff and faculty productivity and reduce their workload are some of the benefits of AAIT-ICMES-PACDNN-EHOA. The Elk herd Optimization Algorithm method is introduced for training the PACDNN. Block diagram of AAIT-ICMES-PACDNN-EHOA approach is represented in Fig 1. As a result, a thorough explanation of each step is provided below.

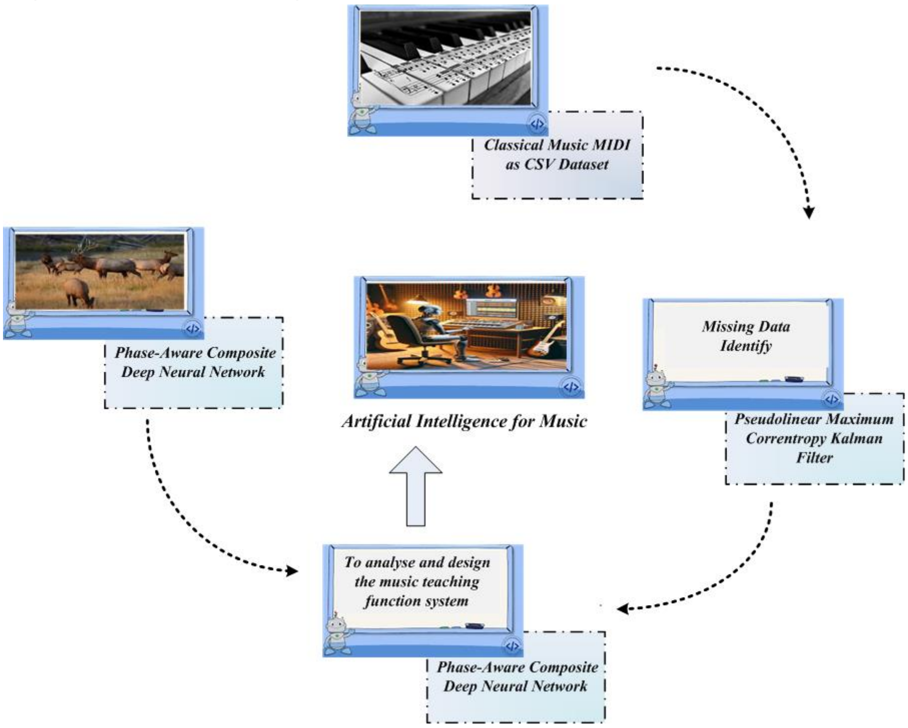

Figure1: Block Diagram for Proposed AAIT-ICMES-PACDNN-EHOA Method

A. Data Acquisition

This section, data are gathered from Classical Music MIDI as CSV Dataset [28]. CSV representations of thousands of classical classics are included in this dataset. There is only a separate for a composer if there are more than 100 files available, as this dataset is meant for machine learning based on a composer. The 'ALL' folder contains songs by all composers, even those with fewer than 100 files. These composers are shown in this file.

B. Pre-processing Using Pseudolinear Maximum Correntropy Kalman Filter

This section, Pseudolinear Maximum Correntropy Kalman Filter (PMCKF) [29] technique is utilized to identify missing data. The utilization of the Pseudolinear Maximum Correntropy Kalman Filter in artificial intelligence systems for building music education programs in colleges and universities is advantageous because it can improve noise management, optimize instructional strategies, and create individualized learning experiences all of which can transform pedagogy. A complex technique that combines concepts from the maximum correntropy criterion with Kalman filtering is the pseudolear maximum correntropy Kalman filter. PMCKF is appropriate for real-world applications where data corruption may occur since it strengthens resilience against outliers and heavy-tailed missing data distributions by utilizing the maximum correntropy criterion; and it given as equation (1),

$$S_k = BS_{k-1} + V_{k-1} \tag{1}$$

Where, S_k denotes state vector; B denotes data's transition matrix; V_{k-1} denotes zero-mean of dataset. Regarding the creative layout of college and university music education curricula, PMCKF can be crucial. It makes it possible for the system to adjust and pick up on insights from missing observations, enhancing the entire level of input and data given to teachers and students; and it given as equation (2),

$$g_k = E_k S_k + \eta_k \tag{2}$$

Where, g_k denotes value of pseudolinear measurement; η_k denotes value of pseudolinear measurement; E_k denotes Optimal estimating matrix. Processing various forms of data, such as audio signals, student performance indicators, and musical scores, is a part of teaching music; and it given as equation (3),

$$C_k = V_k S_k + \mu_k \tag{3}$$

Where, C_k denotes pointed miss data; μ_k denotes missed data. Through the use of PMCKF in the context of an AI-powered music education program, higher education institutions can improve the precision and dependability of a range of tasks. PMCKF can be used for data processing tasks like tracking student progress over time or reducing noise in audio recordings; and it given as equation (4),

$$\hat{S}_k = \hat{S}_{k|k-1} + \overline{K}_k (s_k - E_k \hat{s}_{k|k-1}) \tag{4}$$

Where, $\hat{S}_k$ denotes data estimation; $\overline{K}_k$ denotes real data value Furthermore, it can aid in the creation of intelligent suggestion systems for customized music education programs that take into account each student's unique learning preferences and advancement; and it given as equation (5),

$$\hat{S}_{k|k,t} = \hat{S}_{k|k-1} + \tilde{K}_k (s_k - E_k \hat{s}_{k|k-1}) \tag{5}$$

Where, $\tilde{K}_k$ denotes Filled data. By processing PMCKF method the input data's missed values are filled. Then the pre-processed data are fed to analyse and design the music teaching function system.

C. ConstructingAI Music Teaching System Using PACDNN

In this section, PACDNN[30] discussed to analyse and construct the music teaching system.Improved comprehension of musical subtleties, better adaptation to individual learning styles, and the promotion of personalized learning experiences are certain advantages of using a Phase-Aware Composite Deep Neural Network in the intelligent methods for teaching music education at colleges and universities. A state-of-the-art method for utilizing artificial intelligence (AI) technology in music education is the PACDNN, which is designed with the purpose of intelligently building instructional systems for higher education institutions. This novel framework is designed to improve student teaching and learning by fusing cutting-edge AI techniques with a sophisticated understanding of music theory and pedagogy; and it given as equation(6),

$$P \cdot \left(\left(\frac{R}{P} \right)^2 + \frac{R}{P} \cdot \frac{N}{P} \right) = \frac{R^2 + R \cdot N}{P} \tag{6}$$

Where, N denotes dimension of the input layer; R denotes column state of data; P denotes selected data. PACDNN is a deep neural network synthesizer that uses deep neural networks (DNNs) to analyse and produce musical data. PACDNN are especially sensitive to phase information. The PACDNN can more faithfully represent the minute details of musical expression; and it given as equation (7),

$$Z(d,l) = X(d,l) + R(d,l) \tag{7}$$

Where, $Z(d,l)$ denotes normalized data; $X(d,l)$ denotes volume of dataset; $R(d,l)$ denotes missed data's coefficient. Within the framework of intelligently constructed music education teaching systems, the PAC-DNN presents a number of significant benefits. It makes learning experiences personalized and adaptive possible by constantly modifying the course material according to each student's unique needs and level of development; and it given as equation (8),

$$X(d,l) = |X(d,l)| e^{j\phi_{S(v,l)}} \tag{8}$$

Where, ϕ denotes phase of network layer; $|\cdot|$ denotes magnitude of layer; e denotes exponential function. By continuously analysing student performance and feedback, the PAC-DNN can adjust its method of instruction to maximize learning results and target certain areas that require improvement; and it given as equation (9),

$$IRM(d,l) = \left(\frac{|X(d,l)|^2}{|X(d,l)|^2 + |R(d,l)|^2} \right)^{\frac{1}{2}} \tag{9}$$

Where, IRM denotes Ideal ratio mask of network; $R(d,l)$ denotes selected data; v denotes data frame index; l denotes processed data. The development of interactive and captivating instructional resources, such virtual music teachers and immersive learning environments, is made easier by the PAC-DNN. Through the simulation of authentic musical situations and the provision of immediate feedback and direction, these resources enable students to enhance their abilities more successfully and independently; and it given as equation (10),

$$SMM(d,l) = \frac{|X(d,l)|}{|Z(d,l)|} \tag{10}$$

Where, SMM denotes Spectral Magnitude Mask of network Finally, PACDNN analysed and constructed the music teaching system. Here, Elk herd Optimization Algorithm (EHOA) is employed to optimize the PACDNN. Here, The PACDNN's weight and bias parameters are enhanced using EHOA.

D. Optimization Using Elk herd Optimization Algorithm

The proposed Elk herd Optimization Algorithm (EHOA) [31] is utilized to enhance weights parameters $d\ and\ l$ of proposed PACDNN. The Elk Herd Optimization Algorithm (EHOA) is an EHOA optimization technique based on the collective behavior of elk herds and inspired by nature. Benefits of the Elk Herd Optimization Algorithm include the ability to create innovative curricula through data-driven insights in the clever building of music education teaching systems in colleges and universities, as well as the ability to optimize teaching strategies and seamlessly integrate different musical pedagogies. It's comparable to how elk herds cooperate to select the optimum feeding areas through communication. Elk Herd Adaptation (EHOA) uses elks as potential solutions to optimization issues; the interactions and movements of the elks are governed by mathematical formulas drawn from the dynamics of the elk herd.By allowing the data to converge towards favourable regions of the solution space through repeated updates and modifications, the objective is to determine the optimal or nearly optimal solution. Here, step by step procedure for obtaining appropriate PACDNN values using EHOA is described here. In order to optimise the optimal PACDNN parameters, a uniformly distributed population must be created. The step process in its entirety is then displayed below.

Step 1: Initialization

The EHOA's starting population is, initially generated by randomness. Then the initialization is derived in equation (20).

$$B = \begin{bmatrix} y_1^1 & y_2^1 & \cdots & y_n^1 \\ y_1^{21} & y_2^2 & \cdots & y_n^2 \\ \vdots & \vdots & \cdots & \vdots \\ y_1^{EHS} & y_2^{EHS} & \cdots & y_n^{EHS} \end{bmatrix} \tag{11}$$

Where, B denotes elk herd; EHS denotes the total population of Elk herd; n denotes the n^{thh} number of EHOA while fighting with others and y denotes each solution of EHOA.

Step 2: Random generation

The input weight parameter $d\ and\ l$ developed randomness via EHOA method.

Step 3: Fitness function

From initialised values, an arbitrary solution is generated. It is calculated by optimizing parameter. Then the formula is derived in equation (21)

$$Fitness\,Function = optimizing\ [d\ and\ l] \tag{12}$$

Where, d is used for increasing the Recall and l is used for increasing the accuracy.

Step 4: Exploration Phase for optimizing d

The EHOA model creates families according to the bull rate. The total number of families is first ascertained. Bulls are then identified as the elks of numbing that have the highest fitness scores at the top of EH. Next, the bulls are selected from EH according to their fitness scores. This is to simulate battle dominance contests, where the strongest elks win more harems and are given precedence. This allows the herd's location to be determined using equation (13).

$$C = \arg\min \ g(x^i + d) \tag{13}$$

Where, C denotes total number of families; $g(x^i)$ denotes objective function. The bulls in the family then start competing with each other to produce families. The harems are matched to each bull using the roulette-wheel selection approach; the harems are matched to their bulls based on how their relative fitness values compare to the total fitness values. In technical terms, each bull in the family has a selection probability that is calculated by dividing its absolute fitness value by the total of the absolute fitness values of all the bulls in the family. This calculation is represented by equation (14).

$$I_j = \frac{g(x^i + d)}{\sum_{k=1}^{D} g(x^k)} \tag{14}$$

Where, I_j denotes bulls based on their selection probability; $h(x^i)$ denotes objective function; D denotes total number of families k denotes $EHS - D$ reflect the harem and Figure 2 shows the corresponding flowchart.

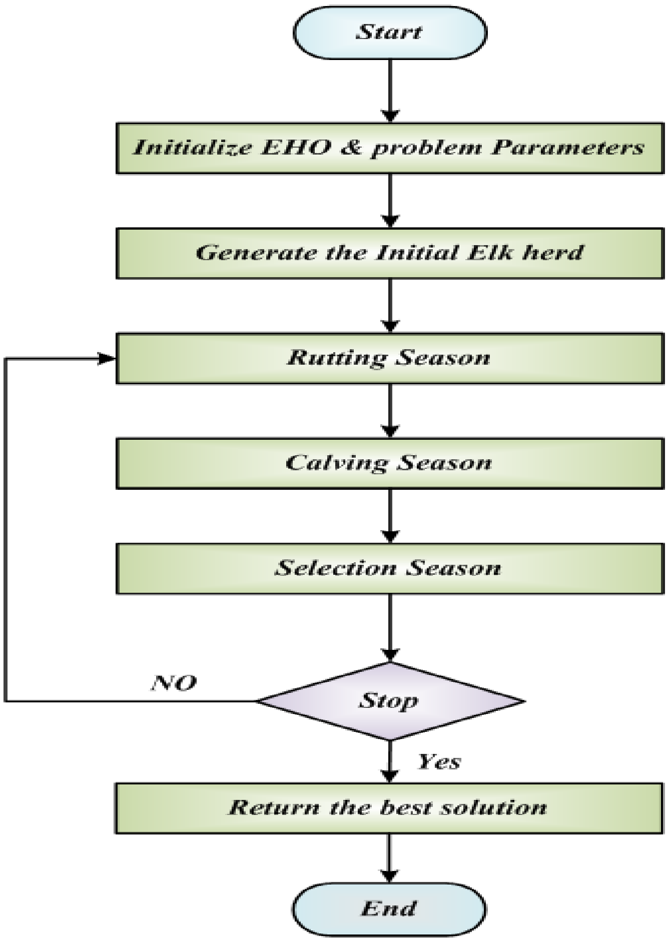

Figure2: Flow Chart of EHOA for Optimizing PACDNN

Step 5: Exploitation phase for optimizing l

The exploitation phase, inspired by biology. Every family's calves are produced throughout the calving season with traits mainly from its father bull and mother harem. If the calf's index is the same as that of its bull father in the family, it is reproduced and is represented by equation (15)

$$w_i^j(t+1) = w_i^j(t) + l + \beta.(w_i^k(t) - w_i^j(t)) \tag{15}$$

Where, $w_i^j(t+1)$ denotes clave season; $w_i^j(t)$ denotes mother harem; $w_i^k(t)$ denotes randomly selected elk; β denotes the random value within the range $[0,1]$. Consider that a higher value of improves diversity by raising the likelihood that random components will participate in the new calf. If the calf's index equals that of its mother, it will inherit the traits of both its mother's harem and father, the bull; Equation (16) represents this.

). $w_i^j(t+1) = w_i^j(t) + \sigma(z_i^{hj}(t) + l - w_i^j(t) + \gamma(w_i^r(t) - w_i^j(t))$ (16)

Where, $w_i^j(t+1)$ denotes clave season; $w_i^j(t)$ denotes mother harem; $w_i^k(t)$ denotes randomly selected elk; $w_i^{hj}(t)$ denotes father bull; σ *and* γ denotes the random value within the range of $[0,1]$.

Step 6: Termination criteria

The weight parameter value of generator d *and* l from PACDNN is optimized by utilizing Elk Herd Optimization Algorithm (EHOA)and Until it meets its halting threshold, $y = y+1$, it will keep repeating step 3.Then AAIT-ICMES-PACDNN-EHOA defectively predict the knee osteoarthritis by higher accuracy, higher recall with error.

IV. RESULT AND DISCUSSION

Experimental results of AAIT-ICMES-PACDNN-EHOA are discussed. The simulation is implemented in Python using Classical Music MIDI as CSV Dataset. The Classical Music MIDI as CSV Dataset model is to Constructing a Teaching System for Music Education Using AI Technology Using a variety of performance measures, such as F1-score, Specificity, Accuracy, Precision, Recall and ROC Attained result of AAIT-ICMES-PACDNN-EHOA method is analysed with existing techniques likes DOMES-AI-LDSMA [21], DOITR-AI-SVM [22] and IMSIG-NMT-LSTM [23] methods.

A. Performance Measures

This is a crucial step for determining the exploration of optimization algorithm. Performance measures to evaluate to access performance like Specificity, F1-score, Accuracy, Precision, Recall and ROC are analysed.

1) Accuracy

Accuracy describes analyse and constructing rate that are correctly analysed and constructed. The formula is derived in equation (17).

$$Accuracy = \frac{(TP+TN)}{(TP+FP+TN+FN)} \quad (17)$$

Here, TP represents True Positive; TN represents True Negative; FP represents False Positive and FN represents False Negative.

2) Precision

As it develops an AI-Based Music Education Teaching System, it makes an estimate of the number of favourable outcomes. Then the formula is derived in equation (18).

$$\mathrm{Pr}ecision = \frac{TP}{(TP+FP)} \quad (18)$$

3) Recall

Recall is a performance metric commonly used in convergence application. It is given in equation (19),

$$\mathrm{Sensitivity} = \frac{TN}{(FP+TN)} \quad (19)$$

4) F1-score

The F1-score evaluation parameter is examined and the performance equation is given.. Then the formula is derived in equation (20).

$$F1-Score = 2 \times \frac{recall \times precision}{recall + precision} \quad (20)$$

5) Specificity

It estimates the proportion of negative instances and expressed in equation (21),

$$Specificity = \frac{TP}{FN + TP} \quad (21)$$

6) ROC

It is graphical depiction of Construction method at numerous value settings. To create it, plot the real positive rate versus the false positive rate for various values. Here, ROC is constructed in to FP rate, TP rate**.** Thus given in equation (22)

$$False\,Positive\,Rate = \frac{FP}{FP+TN}$$

(22)

B. Performance analysis

Figure 3 to 8 illustrates simulation result of AAIT-ICMES-PACDNN-EHOA method. The performance metrics are analysed with existing DOMES-AI-LDSMA, DOITR-AI-SVM, IMSIG-NMT-LSTM methods respectively.

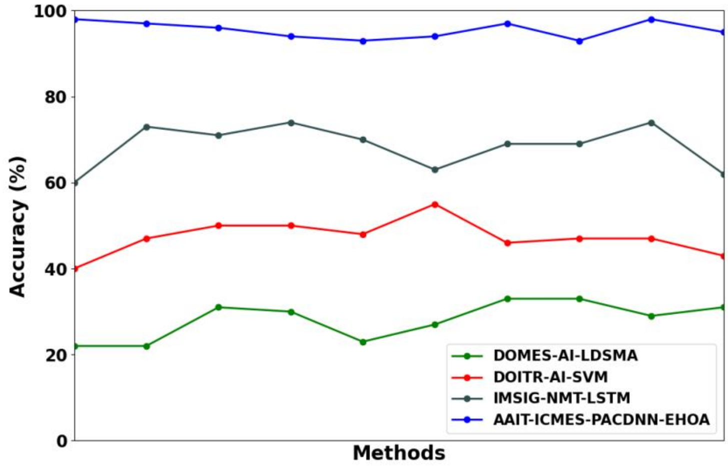

Figure3: Performance analysis of Accuracy

Figure 3 shows accuracy analysis. The accuracy graph shows how well a proposed model for a music teaching system works and can be a useful tool for evaluating its effectiveness. This type of graph usually shows the accuracy rate of the system over time, enabling stakeholders to examine the system's efficacy in handling music data visually. The proposed of AAIT-ICMES-PACDNN-EHOA attains 19.27%, 23.35% and 32.60% higher Accuracy for AI music teaching system construction which are analysed with existing DOMES-AI-LDSMA, DOITR-AI-SVM, IMSIG-NMT-LSTM methods respectively.

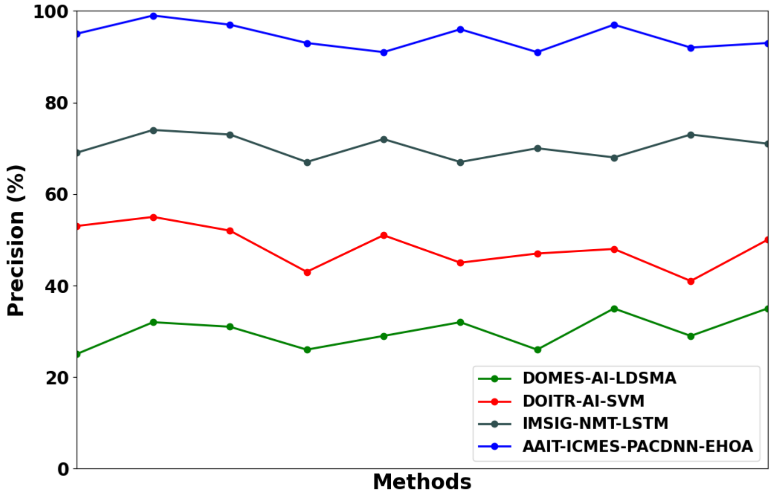

Figure 4: Performance analyses of Precision

Figure 4 shows Precision analyses. The Precision and effectiveness of teaching techniques are demonstrated by the above precision graph in the use of AI technology in music instruction. The graph demonstrates how AI improves education by customizing it to meet the needs of each unique student. The graph provides a graphic depiction of AI's influence on raising the level of music instruction at universities. The proposed of AAIT-ICMES-PACDNN-EHOA attains 19.25%, 23.85% and 31.90% higher Precision for AI music teaching system construction which are analysed with existing DOMES-AI-LDSMA, DOITR-AI-SVM, IMSIG-NMT-LSTM methods respectively.

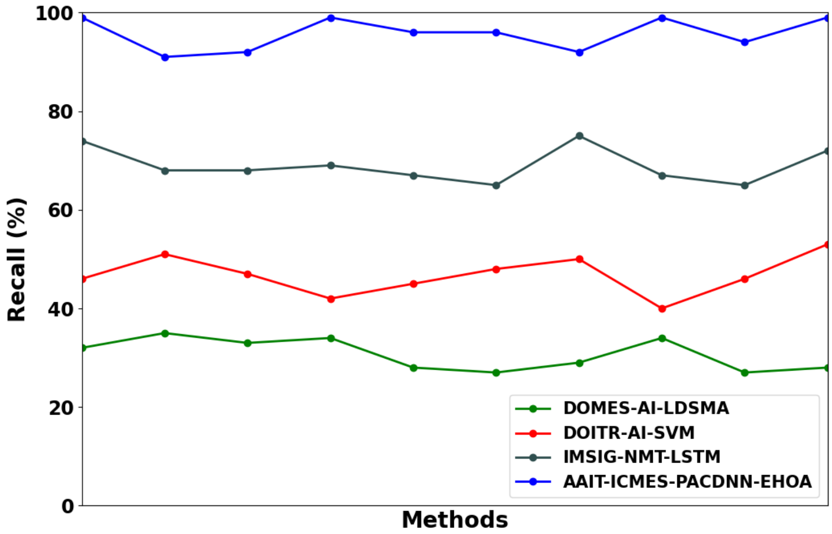

Figure 5: Performance analyses of Recall

Figure 5 shows accuracy analyses. The recall graph above shows how efficiently the machine can recover relevant musical content. It compares the fraction of relevant music items retrieved to the total pertinent data available. A proposed greater recall rate indicates a more efficient mechanism for retrieving requested content. This recall graph is critical for testing and enhancing AI algorithms that will improve music instruction experiences in academic contexts. The proposed of AAIT-ICMES-PACDNN-EHOA attains 18.87%, 22.95% and 32.99%higherRecall for AI music teaching system construction which are analysed with existing DOMES-AI-LDSMA, DOITR-AI-SVM, IMSIG-NMT-LSTM methods correspondingly.

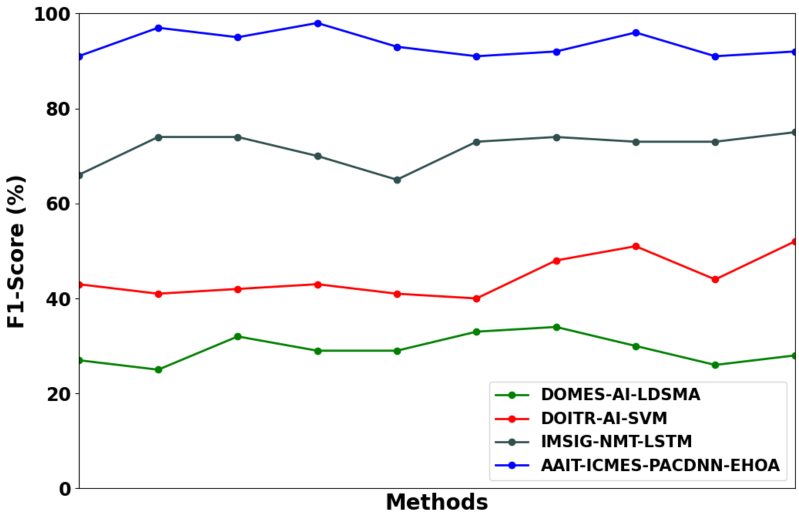

Figure 6: Performance analyses of F1-Score

Figure 6 shows accuracy analysis. The above F1-score graph shown is used to evaluate the effectiveness of AI algorithms in a variety of applications, including the development of music education teaching systems in higher education. The above F1-score graph displays the algorithm's capacity to accurately synthesize musical data, allowing for the creation of more intelligent and effective teaching systems customized to the demands of college and university students. The proposed of AAIT-ICMES-PACDNN-EHOA attains 19.17%, 22.75% and 32.98% higher F1-Score for AI music teaching system construction which are analysed with existing DOMES-AI-LDSMA, DOITR-AI-SVM, IMSIG-NMT-LSTM methods respectively.

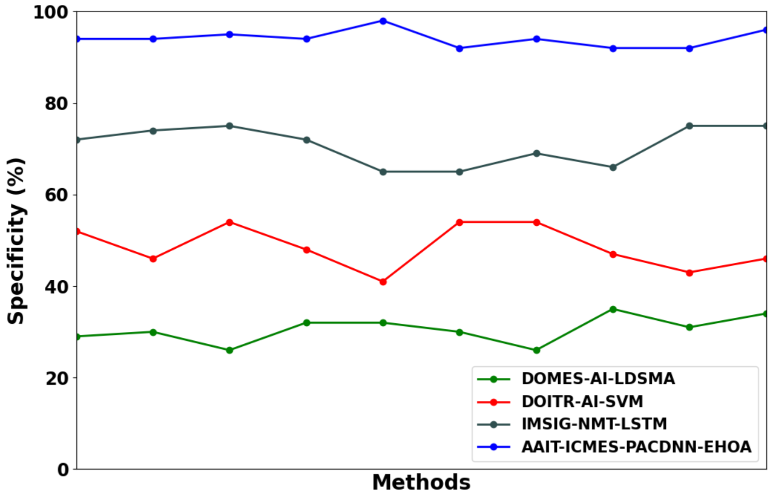

Figure 7: Performance analyses of Specificity

Figure 7 shows accuracy analyses. The specificity graph clearly shows specialized needs and objectives, allowing for the accurate development of intelligent teaching systems. The graph indicates significant areas where AI may improve music instruction, such as individualized learning paths. This personalized strategy ensures that AI is effectively integrated to address the intricacies of music teaching in higher education institutions. .Figure 3 shows accuracy analysis. The proposed of AAIT-ICMES-PACDNN-EHOA attains 19.787%, 23.25% and 31.98% higher Specificity for AI music teaching system construction which are analysed with existing DOMES-AI-LDSMA, DOITR-AI-SVM, IMSIG-NMT-LSTM methods respectively.

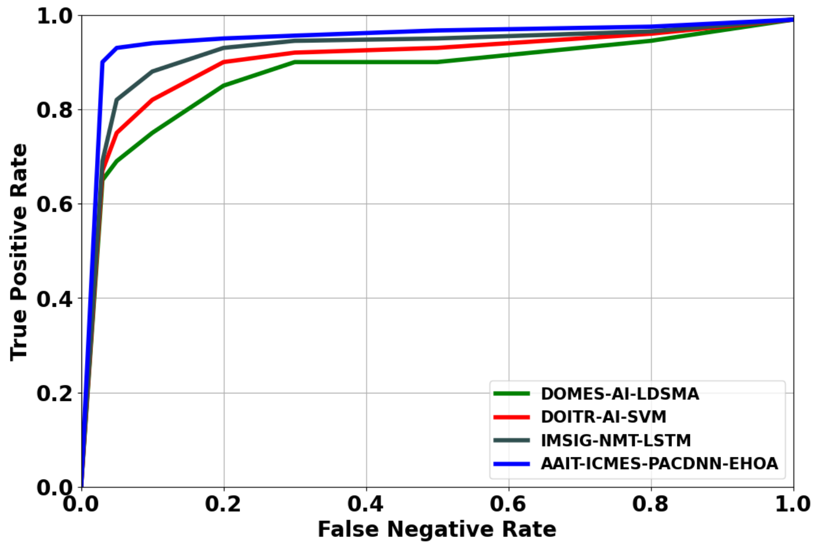

Figure 8: Performance analyses of ROC

Figure 8 depicts ROC analyses. The trade-off between true positive rate and false positive rate for AI music teaching system creation is shown in the ROC graph above. This graph shows how well the model can distinguish between data and those that are not across different values. Higher ROC values indicate better discriminating capacity. The area under the ROC curve indicates how well the model performs overall. The proposed AAIT-ICMES-PACDNN-EHOA method provides 0.97%, 0.98% and 0.99% greater ROC analysed with existing techniques likes DOMES-AI-LDSMA, DOITR-AI-SVM, IMSIG-NMT-LSTM methods respectively.

V. CONCLUSION

In this part, the use of AAIT-ICMES-PACDNN-EHOA is successfully executed. The simulation is implemented in Python. According to the experimental results, AAIT-ICMES-PACDNN-EHOA performed better when used with the Co-training technique than when used separately regards Accuracy and Recall. The performance of AAIT-ICMES-PACDNN-EHOA approach attains 19.787%, 23.25% and 31.98% higher specificity, 19.17%, 22.75% and 32.98% higherF1-score, 0.97%, 0.98% and 0.99% higher ROC when analysed with existing methods like DOMES-AI-LDSMA,DOITR-AI-SVM,IMSIG-NMT-LSTM respectively. Future research suggests, in the near future, when big data and AI are employed effectively, online learning can also provide students with an excellent classroom experience similar to in-person instruction, increasing their willingness to accept online learning as a mode of instruction.

REFERENCE

[1] Tang, C., & Zhang, J. (2022). An intelligent deep learning-enabled recommendation algorithm for teaching music students. *Soft Computing, 26*(20), 10591-10598.

[2] Wang, X., Zhao, S., Liu, J., & Wang, L. (2022). College music teaching and ideological and political education integration mode based on deep learning. *Journal of Intelligent Systems, 31*(1), 466-476.

[3] Wei, J., Karuppiah, M., & Prathik, A. (2022). College music education and teaching based on AI techniques. *Computers and Electrical Engineering, 100*, 107851.

[4] Wen, X. (2021). Using deep learning approach and IoT architecture to build the intelligent music recommendation system. *Soft Computing, 25*(4), 3087-3096.

[5] Tsai, C.C., Chung, C.C., Cheng, Y.M., & Lou, S.J. (2022). Deep learning course development and evaluation of artificial intelligence in vocational senior high schools. *Frontiers in Psychology, 13*, 965926.

[6] Zhu, X. (2022). Prediction Model of Piano Collective Class Teaching and Learning Effect Based on Deep Learning. *Computational intelligence and neuroscience, 2022.*

[7] Li, J., & Zhang, B. (2022). The application of artificial intelligence technology in art teaching taking architectural painting as an example. *Computational Intelligence and Neuroscience, 2022*.

[8] Shuo, W., & Ming, M. (2022). Exploring online intelligent teaching method with machine learning and SVM algorithm. *Neural Computing and Applications, 34*(4), 2583-2596.

[9] Tedre, M., Toivonen, T., Kahila, J., Vartiainen, H., Valtonen, T., Jormanainen, I., & Pears, A. (2021). Teaching machine learning in K–12 classroom: Pedagogical and technological trajectories for artificial intelligence education. *IEEE access, 9*, 110558-110572.

[10] Liu, J., & Fu, F. (2023). Convolutional neural network model by deep learning and teaching robot in keyboard musical instrument teaching. *Plos one, 18*(10), e0293411.

[11] Li, P.P., and Wang, B. (2023). Artificial intelligence in music education. *International Journal of Human–Computer Interaction*, 1-10.

[12] Hu, X. (2023). The role of deep learning in the innovation of smart classroom teaching mode under the background of internet of things and fuzzy control. *Heliyon, 9*(8).

[13] Lan, Q., & Fan, N. (2022). Evaluation system of music art instructional quality based on convolutional neural networks and big data analysis. *Journal of environmental and public health, 2022.*

[14] Ikegwu, A.C., Nweke, H.F., & Anikwe, C.V. (2024). Recent trends in computational intelligence for educational big data analysis. *Iran Journal of Computer Science, 7*(1), 103-129.

[15] Yao, Y., & Xia, J. (2022). Optimization of Ideological and Political Education Strategies in Colleges and Universities Based on Deep Learning. *Computational Intelligence and Neuroscience, 2022*.

[16] İçen, M. (2022). The future of education utilizing artificial intelligence in Turkey.*Humanities and Social Sciences Communications, 9*(1), 1-10.

[17] Lv, Z., Poiesi, F., Dong, Q., Lloret, J., and Song, H. (2022). Deep learning for intelligent human–computer interaction. *Applied Sciences, 12*(22), 11457.

[18] Xu, K. (2021). Recognition and classification model of music genres and Chinese traditional musical instruments based on deep neural networks. *Scientific Programming, 2021*, 1-8.

[19] Tan, M., & Cao, Y. (2022). Evaluation of the online music flipped classroom under artificial intelligence and wireless networks. *Wireless Communications and Mobile Computing, 2022.*

[20] Zhe, T. (2021). Research on the model of music sight-singing guidance system based on artificial intelligence. *Complexity, 2021*, 1-11.

[21] Yan, H. (2022). Design of online music education system based on artificial intelligence and multiuser detection algorithm. *Computational Intelligence and Neuroscience, 2022.*

[22] Zhang, Y., & Song, W. Design of an online interactive teaching platform for rural music education based on artificial intelligence. *Applied Mathematics and Nonlinear Sciences*.

[23] Tang, H., Zhang, Y., & Zhang, Q. (2022). The use of deep learning-based intelligent music signal identification and generation technology in national music teaching. *Frontiers in psychology, 13*, 762402.

[24] Xu, Z. (2022). Construction of intelligent recognition and learning education platform of national music genre under deep learning. *Frontiers in Psychology, 13*, 843427.

[25] Wang, X. (2022). Design of vocal music teaching system platform for music majors based on artificial intelligence. *Wireless Communications and Mobile Computing, 2022*, 1-11.

[26] Yu, X., Ma, N., Zheng, L., Wang, L., & Wang, K. (2023). Developments and applications of artificial intelligence in music education. *Technologies, 11*(2), 42.
[27] Liao, S. (2022). Construction and application of music teaching resources based on recurrent neural network. *Mobile Information Systems, 2022*.
[28] https://www.kaggle.com/datasets/vincentloos/classical-music-midi-as-csv
[29] Zhong, S., Peng, B., Ouyang, L., Yang, X., Zhang, H., & Wang, G. (2023). A Pseudolinear Maximum Correntropy Kalman Filter Framework for Bearings-Only Target Tracking. *IEEE Sensors Journal*.
[30] Hasannezhad, M., Yu, H., Zhu, W.P., & Champagne, B. (2022). PACDNN: A phase-aware composite deep neural network for speech enhancement. *Speech Communication, 136*, 1-13.
[31] Al-Betar, M.A., Awadallah, M.A., Braik, M.S., Makhadmeh, S., & Doush, I.A. (2024). Elk herd optimizer: a novel nature-inspired metaheuristic algorithm. *Artificial Intelligence, 57*(3), 48.