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# A Study on Music Education Based on Artificial Intelligence

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**Abstract:** Artificial intelligence has developed rapidly and is widely used in various fields. Music robots with specific neural networks can understand, analyze, and create music. In this paper, based on the artificial intelligence technology, human music intelligence is analyzed through big data to explore and discuss the construction of various new interactive teaching music intelligent systems in the field of professional music education with music artificial intelligence technology as the platform, seeking a new mode of music perception, cognition, creation, and education.

**Keywords:** Artificial Intelligence, Music Perception, Music Cognition, Music Education

## 1. Introduction

Artificial intelligence (AI) falls in the three-way cross-cutting disciplines of natural, social, and technical sciences and is a new science and technology designed to study, simulate, extend, and extend human intelligence for applications in various fields. Music artificial intelligence is based on artificial intelligence technology. It analyzes human music intelligence through big data, simulates the information process of human sight, hearing, touch, feeling, thinking and reasoning, and constructs its own neural network and algorithm generation. It is finally applied to human music perception, cognition, study, and creation, and a new “human-computer interaction” music teaching model is established [1]. Traditional infant music perception education is divided into two categories: one is based on the daily lives of infants and young children, which is played as background music and often surrounds the periphery of the subject to perform subtle influences. Before they go to bed, they need to adjust their emotions and create a space atmosphere, or even to soothe the music during bedtime. At this time, the music should be quiet, soft and quiet. When they are playing and lively, they become cheerful and have



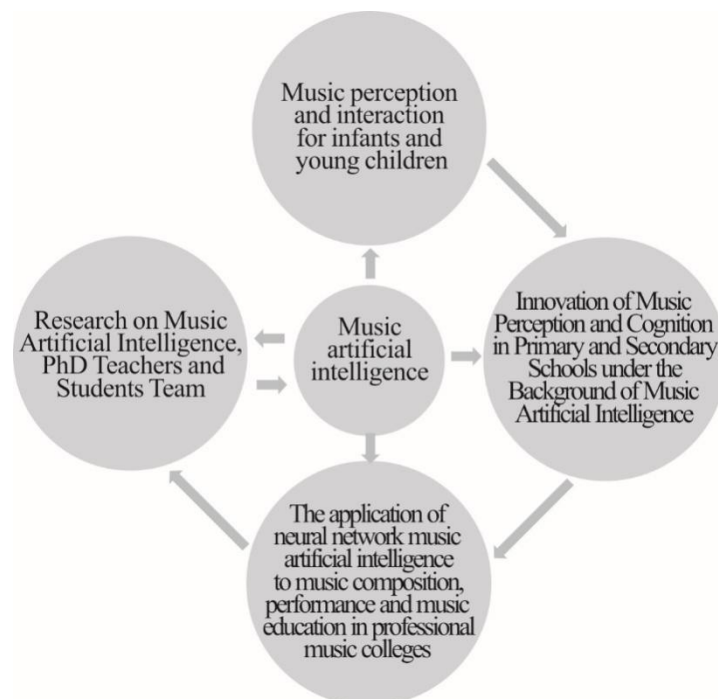
a certain rhythm. The synchronization of emotions and music help them grow up physically and mentally. This category is referred to as functional music [2]. In another category, basic music education is consciously and purposefully infiltrated in infants and young children's daily music perception, such as training the ability to imitate pitch and rhythm and beat. It is proven through scientific practice that the ability to fix pitch memory in music is critical for children at the age of 3-6 [3]. Musical rhythm training is of great help to infants' intellectual development and physical coordination. Currently, various types of early childhood music education institutions in the society mostly use unidirectional pitch and rhythmic rhythm training, and only through interaction during the class time period, which has a relatively large limitation. The development of music technology will enable infants and young children to perceive music more scientifically, reasonably, and pleasantly. Since 2016, China's artificial intelligence field has risen to the national strategic level [4]. Major domestic companies have also designed and produced massive intelligent robots with life characteristics, and gradually become a member of the family. They know astronomy, geography, Chinese, mathematics, English, science, music, art, etc. They are all proficient and can interact with each other in various life scenarios. The machine has language recognition capabilities, which can perform analysis based on the big data through its own neural network and starts to communicate with people. In infant music education, traditional infant music perception training has gradually moved to a new artificial intelligence music education model for active robot teaching and interactive communication [5]. "Music information retrieval technology is an important part of music technology. It is based on music acoustics and extracts audio features based on audio signal processing. The back station uses a variety of machine learning techniques in artificial intelligence." MIR technology extracts massive digital music audio information for automated technical analysis and classifies it according to the independent characteristics of each music. Music artificial intelligence screens big data information for early music education resources. A rich knowledge material library suitable for infant music education is established in the background, which forms its own standardized and accurate early education system [6]. The robot uses automatic language and speech recognition processing technology to sense the living scenes of infants and young children and their emotions, and automatically recognizes and plays functional music. The robot is like a music teacher at home. Combined with children's living habits, they use specific pitches and rhythms to accompany daily life, subtly, and step by step into primary music education. Based on the music artificial intelligence Internet, robots are like colossal music libraries. Traditional networks use keywords to find music. Currently, artificial intelligence can understand the speaking intentions of children and parents through its own neural network, interact with humans through voice, and provide various types of music services.

Based on artificial intelligence technology, human music intelligence is analyzed in this paper through the big data to explore and discuss various new interactive teaching music intelligent systems

built based on music artificial intelligence technology in the field of professional music education and seeks a new model for music perception, cognition, creation, and education.

## 2. Music Perception and Cognition

Given the current situation, in the context of the development of artificial intelligence, the research, promotion, and application of music artificial intelligence in the field of music education will be improved (as shown in Figure 1).



**Figure 1.** Relationship between music artificial intelligence and music education

Music education in primary and secondary schools in China mainly includes the following aspects: the appreciation of music, theoretical study (basic music theory and music history), and technical skills (learning instrument performance, singing, chorus, band training). The current teaching situation is that students like music, but it does not mean that they like to take music lessons. Given this common phenomenon, music teachers continue to innovate various new teaching models, such as increasing the use of multimedia teaching and modern network information technology; through the research and application of the teaching methods of the Orff, Kodaly, and Dalcroz systems to maximize the students' participation in teaching. In view of the rapid development of artificial intelligence in the new era, the author proposed that the construction and configuration of “3D artificial intelligence music classrooms—primary and secondary music scene space” in primary and secondary schools would greatly increase students' interest and enthusiasm for studying music. The teaching ideas of new ideas and technologies

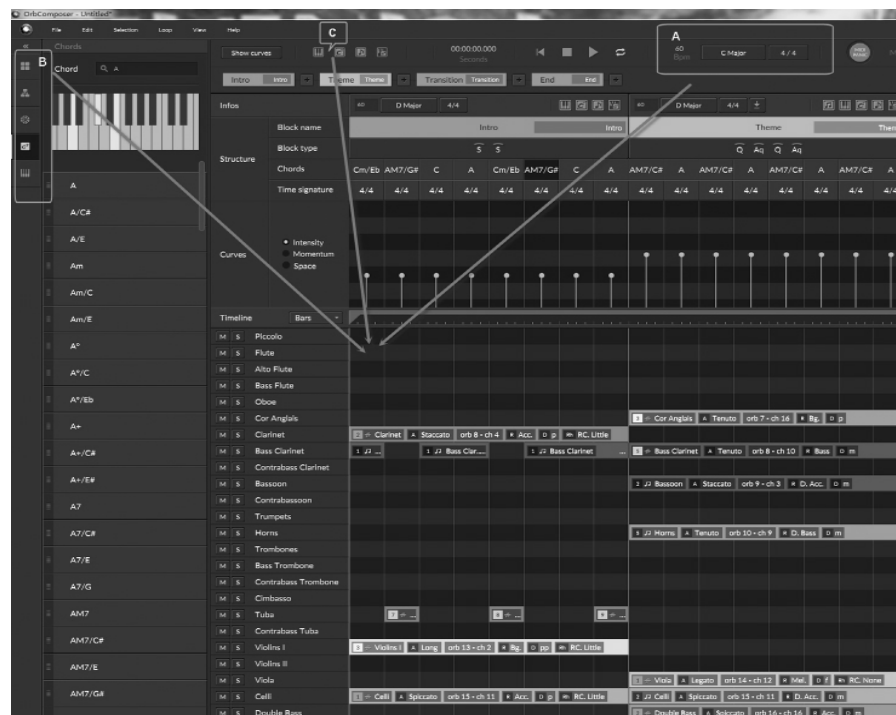
provide some exploration, research, and thinking.

### **3. Undergraduate Education in Music**

Certainly, the traditional undergraduate professional music education and the teaching system are important, and the new era of artificial intelligence technology into music education is also imperative and mutually reinforcing. Music artificial intelligence will provide a new multi-dimensional teaching practice platform for undergraduate professional music education.

#### *3.1. Application of music artificial intelligence in the composition subject*

The traditional theory of composition technology has a modular teaching system, such as harmony, texture, and music paragraph structure. Music AI can not only simulate its teaching system but also possess efficient and independent powerful composing arithmetic capabilities. The first artificial intelligence music composition software Orb Composer is of great significance (as shown in Figure 2). Currently, six basic music templates are introduced in the software, including wind music, string music, piano, electronics, Pop-Rock, and Ambient pre-selection. Good music environment. Through the following simple steps: A. setting the speed, tempo and tone; B. selecting the block structure determines the overall melody structure of the work, selecting chords and musical instruments (preset basic music templates are available); C. selecting the automatic generation. Orb Composer software can instantly create a specific style of music. The artificial intelligence of music enables those who know a little about music to complete the “composition” dream immediately. For those who have some music composition skills, the software can trigger their creative inspiration, and the automatically generated works can be personalized and professionally modified. The essential use of Orb Composer software is shown as follows:



**Figure 2.** Orb Composer, an intelligent music composition software for artificial intelligence

### 3.2. Application of music artificial intelligence in the discipline of music performance

In the traditional music performance discipline, music is used to perform image formation and form expression. With the development of artificial intelligence, the intervention of music artificial intelligence will be a new form of music performance of “human-computer interaction”. The “Information Philharmonic” system invented by Professor Christopher Raphael of the School of Information Computing and Engineering at Indiana University in the United States could provide solo and soloists with a complete and professional orchestra accompaniment in real-time. In November 2018, it held the “AI Night—Music Artificial Music Accompaniment System Concert” jointly with the Central Academy of Music. In addition to using artificial intelligence technology to concert classical music, it also performed concerto to Chinese music “Great Wall Caprice”. “Information Philharmonic” system has a powerful artificial intelligence system learning ability and can generate various calculation methods. It can interactively change according to the change of the player's music rhythm and continuously adjust and improve his own accompaniment ability.

For the editing of different categories of music by AI, it can process different music performance discipline data:

- 1) Boolean type

$U_i$  is the  $i$ -th element in  $U$ , that is,  $i \in 1, 2, 3, \dots, n$ .  $A_j$  represents the  $j$ -th element in  $U$ ,  $j = 1, 2, 3, \dots, n$ .  $S_{ij}$  represents the attribute value of the  $i$ -th element, and the  $j$ -th attribute.  $a_{jk}$  represents the  $k$ -th attribute value  $k \in 1, 2, 3, \dots, t$  in the  $j$ -th attribute, where  $t$  represents the class number of an attribute.  $N(a_{jk})$  represents the count of  $a_{jk}$ , and the dependency between attribute-value pairs can be expressed by the membership function of the attribute value, as shown in formula (1):

$$\mu_A(S_{ij}) = N(a_{jk})/n, k = 1, 2, \dots, n \quad (1)$$

Where  $n$  represents the data number.

## 2) Numeric type

Suppose  $l$  represents the number of classes of attributes,  $C_l$  represents the first class,  $N(C_l)$  represents the number of attributes in  $C_l$ ,  $C_l^{(i)}$  represents the  $i$ -th attribute value in class  $l$ , and the membership function of the attribute value represents as shown in formula (2):

$$\mu_A(C_l^{(i)}) = N(C_l)/n, l = 1, 2, 3, \dots, i = 1, 2, 3, \dots \quad (2)$$

## 3) Class attributes

The membership function of the class attribute is shown in formula (3):

$$\mu_A(C_l^{(i)}) = N(C_l)/n, l = 1, 2, 3, \dots, i = 1, 2, 3, \dots \quad (3)$$

The meaning of the variable is the same as the membership function of the above numeric type.

## 4) Null membership function

$$\mu_A(S_{ij}) = \begin{cases} \min(\mu_A(S_{ij})), r_0 \leq l_0 \\ mid(\mu_A(S_{ij})), l_0 < r_0 < h_0 \\ \max(\mu_A(S_{ij})), r_0 \geq h_0 \end{cases} \quad (4)$$

The null membership function is shown in formula (4), where  $S_{ij}$  is the attribute value of the  $i$ -th element and the  $j$ -th attribute.  $r_0$  is the proportion of the value Null in all data,  $h_0$  is the corresponding threshold with a higher percentage, and  $l_0$  is the corresponding threshold with a lower percentage.

#### 4. New Directions in Music Research

Currently, intelligent music interactive teaching platforms have sprung up, and they have customized personalized teaching based on big data analysis. Teachers teach online and restore the one-to-one and one-to-many teaching scenes. Combining the music recognition technology in the new music artificial intelligence technology makes the teaching interaction interesting and can provide answers, grading, and learning suggestions at any time, which is efficient and at a low cost. Hence, to ensure that the learning platform is stable, safe, advanced and easy to use, and that the professional music knowledge in the platform is accurate, rational, continuous, and authoritative, professional music discipline groups and technical team of science and technology should cooperate closely for a long time; leading and guiding their respective student teams with graduate tutors in music and science majors, and jointly applying for horizontal and interdisciplinary related scientific research projects, which is conducive to the long-term continuous research and development of this scientific research.

There are many views about whether artificial intelligence can replace human beings, but it is an inevitable fact that chess and Go have been defeated by artificial intelligence. They cannot replace humans, but they are superior in many respects. Currently, robots can understand, analyze, create music, and apply to music teaching. With the continuous improvement of computer computing capabilities, and the development and research of robots' deep learning in the context of big data, a new music ecosystem of music artificial intelligence + database + music teaching that interacts with apps + social functions will be an inevitable trend in the future.

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