A 20-Year Review of AI Technology and Music Art Research in China

-- A Visual Analysis Based on Core Journal Papers of CNKI

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Abstract. This paper uses CiteSpace to visually analyze core journals related to the research on Artificial Intelligence and music art from CNKI. By generating keyword co-occurrence maps, keyword clustering maps, key word timelines maps, co-author and research institution networks, these graphs help summarize hotspots on the integration and development of AI technology and music art, evolutionary context and core research power,and therefore hopes to provide a theoretical reference for ai-empowering music teaching research and practice.

Keywords: AI Technology; Music Art; CiteSpace.

1. Introduction

Music and technological innovation have always gone hand in hand. Since the arrival of 21st century, advancements in AI technology have brought about significant changes to multiple fields such as music creation, performance, education, and analysis, and has reshaped the expression and dissemination mode of the musical art tradition. Against this background, reviewing the current research situation of AI technology and music art have important theoretical and practical value.

This article conducts a quantitative and visual analysis of relevant literature using CiteSpace (version 6.3.R1). It can convert large and complex bibliographic data into visual network, which helps readers to overcome reading limitations and to investigate research hotspots, evolutionary context and core research power from multiple graphs.[1-3]

This study also has certain limitations. The data source is limited to CNKI core journals. Future research could incorporate broader Chinese academic resources or international databases to construct a more comprehensive knowledge graph.[4]

2. Research Design

2.1 Data Source

This study is based on the CNKI database. The search conditions were set as follows: Advanced Search; Search Topic: music AND AI; Time range: 2005 to 2025; Journal types selected: Peking University Core, CSSCI, AMI, CSCD, WJCI, EI, SCI. Through manual screening, conference announcements, news reports, introductions, and other literature weakly related to the topic were excluded. Ultimately, 176 articles published between 2006 and 2025 were obtained as the core data for this analysis.[5]

2.2 Research Steps and Methods

The search results were exported in Refworks format and converted within CiteSpace. The time slice was set from 2005 to 2025. Term sources were selected as Title, Abstract, Author Keywords (DE), and Keywords Plus (ID). Node types were sequentially set to Keyword, Author, and Institution. The node selection criteria used the g-index. After several rounds of testing, a K value of 25 was found to provide relatively complete and reasonable data. For pruning, the Pathfinder algorithm and pruning the merged network were selected. For data pruning, simplifying the Pathfinder algorithm

and the integrated entire network were selected. The Pathfinder algorithm prunes each time-slice network which helps to highlight the core structures. Then the integrated entire network merges these trimmed slice networks, maintaining global simplicity and consistency, to provide the best data basis for identifying research hotspots and frontiers.[6-7]

3. Map Analysis

3.1 Annual Publication Volume

Figure 1 shows the changing situation of the annual publication volume of core journal on AI and music. From 2005 to 2008, a prolonged period, the annual publication volume at an extremely low level, fluctuated a minor ranging between 0 and 3, without a continuously rising trend. It is regarded as an initial exploration stage dominated by occasional attempts and individual case studies. This period of low output indicates that the academic community has not yet shown widespread attention to the cross-disciplinary topic of "AI and music integration". Because of the highly visible technical demonstration and following media and academic attention, a significant surge occurred in 2019, a turning point for the technology. Although a decline followed in 2020-2021, overall research interest had been ignited. Since 2022, publication volume noticeably recovered, showing sustained growth in 2024-2025. This continuous and steep growth suggests that increasing numbers of researchers, institutions, and journals are focusing on the applications and impacts of AI in composition, audio generation, performance practice, music copyright, ethics, etc. Research themes and methods are likely expanding from single technical validation to richer theoretical, practical, and interdisciplinary issues.[8-9]

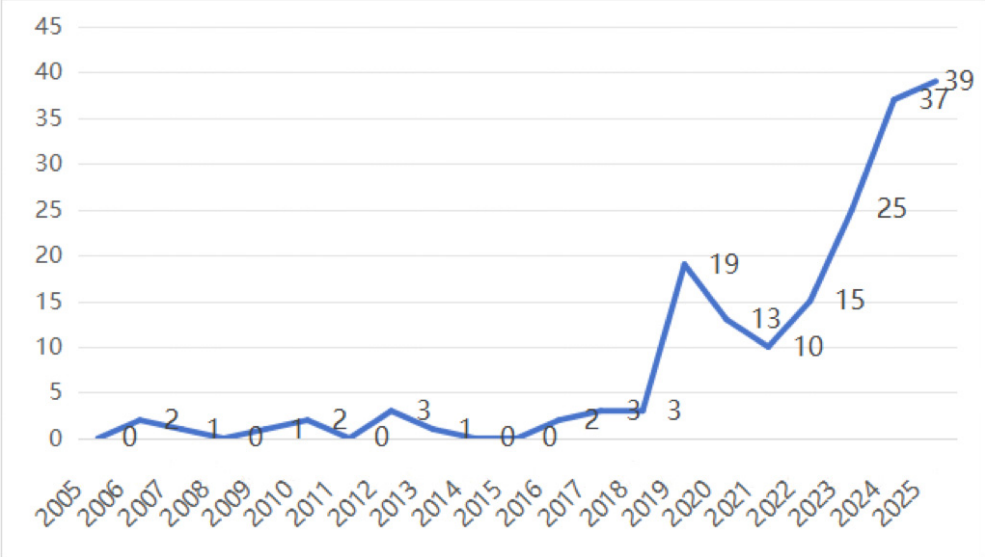

Figure 1. Annual Publication Volume on AI and Music Research

3.2 Keyword Maps

1. Keyword Co-occurrence Map

Keywords are highly condensed representations of a paper's theme and core viewpoints. The keyword co-occurrence map displays the co-occurrence relationships between keywords in the domain literature, understood as a network where keywords are nodes and co-occurrences are links. Node size reflects frequency; node rings and color reflect the active period on a timeline; a purple outer ring indicates high betweenness centrality. This is a common interpretation paradigm in CiteSpace.[10]

Node size represents the frequency of keyword appearance. Larger nodes indicate higher frequency, representing hot topics in the field. Link thickness represents the strength of co-occurrence

between keywords. Thicker links indicate that two or more keywords appear together in the same article more frequently. Node centrality is a key indicator of measuring the importance of keywords. The node has a high degree of centrality, it serves as an important hub within the domain,linking multiple subfields usually. When the betweenness centrality value of the intermediary is greater than 0.1, the node is displayed as a purple circle, which shows this keyword occurring frequently within the field and exerts significant influence.[11]

Based on the keyword co-occurrence maps of the topic of "music and AI" (figure 2), it displays the six most frequently occurring keywords, that "artificial intelligence", "machine learning", "chord recognition", "deep learning","music education", "music". "artificial intelligence" is the most highlights topic node in this domin. The volume of its nodes and the outer ring's intermediary markers indicate that this word not only occurs frequently, but also located at the hub position for cross-topic connections, effectively acting as a bridge between multiple thematic clusters.[12]

The network scale is N=206 (nodes), E=302 (links), and network density is 0.0143, indicating a sparse network. Visually, the map shows some density, but numerically, most keywords exhibit a "multi-centered, weakly linked" state, failing to form an integrated system with core research.

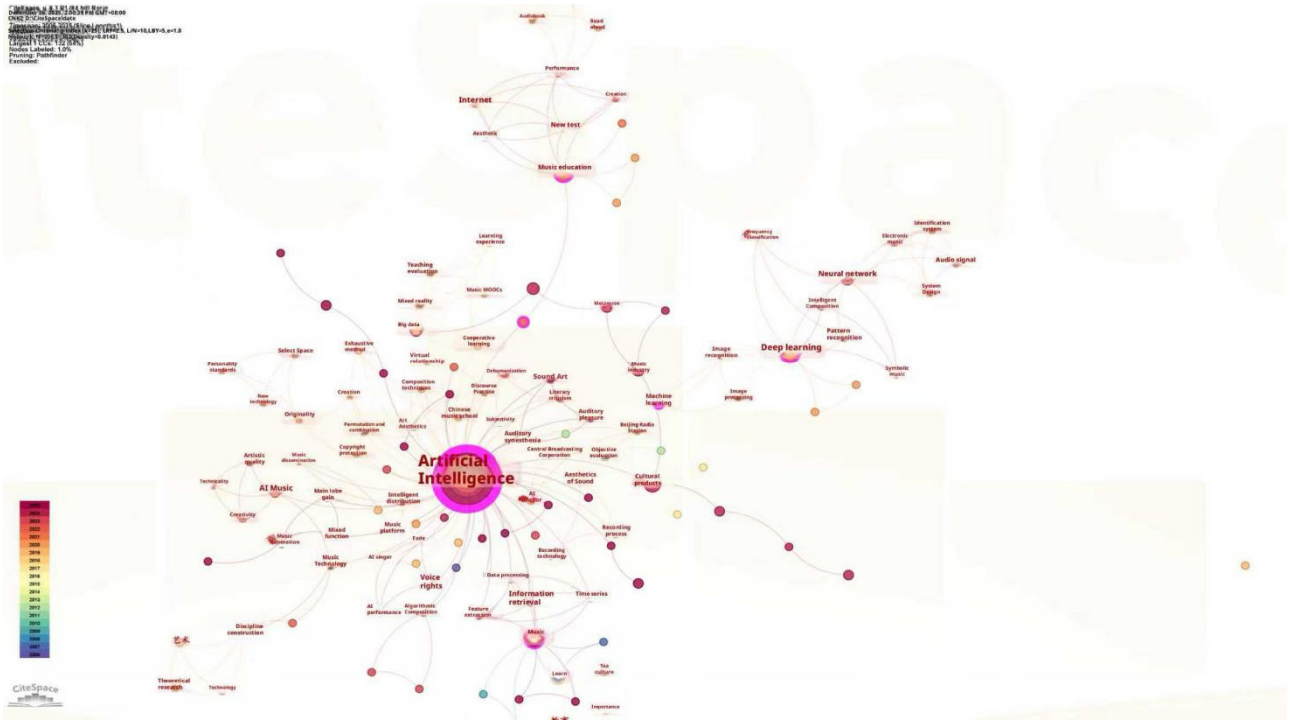

Figure 2. Keyword Co-occurrence Map for AI and Music Research

2. Keyword Cluster Map

Based on Figure 2, the LLR algorithm was used to partition the network into thematic clusters, resulting in the keyword cluster map (Figure 2). A modularity Q value greater than 0.3 suggests a significant cluster structure. A mean silhouette S value greater than 0.5 indicates reasonable clustering, and greater than 0.7 indicates highly efficient and convincing clustering. Figure 2 has a Q value of 0.8252 and an S value of 0.9924, together indicating that the clustering result is statistically very reliable. The cluster map contains 8 labels: #0 "artificial intelligence", #1 "electronic music", #2 "music", #3 "performance", #4 "AI art", #5 "music without humans", #6 "objective formal standards", #7 "internet education". Cluster ranking is based on the number of nodes contained within each cluster and does not directly equate to "academic importance" or "influence."

From the cluster map, "Artificial Intelligence" in the network is the core cluster that is the largest and links to numerous clusters, which shows this topic not only occurs frequently but also co-occurs with multiple research threads in the sample documents. Within the cluster,several relatively

consistent subfields of research can be identified:topics related to technology that mainly focus on deep learning, neural network and model method, topics related music informatics represented by music information retrieval, music signal processing and affective computing, and topics related application and practice with the core of performance, electronic music, and music education including online education. On the other hand, while the "methodology-driven approach" and "practical application" are proceeding simultaneously, it has prompted the academic focus on the standardized construction of AI technology applications in the art field and the resulting ethical issues.

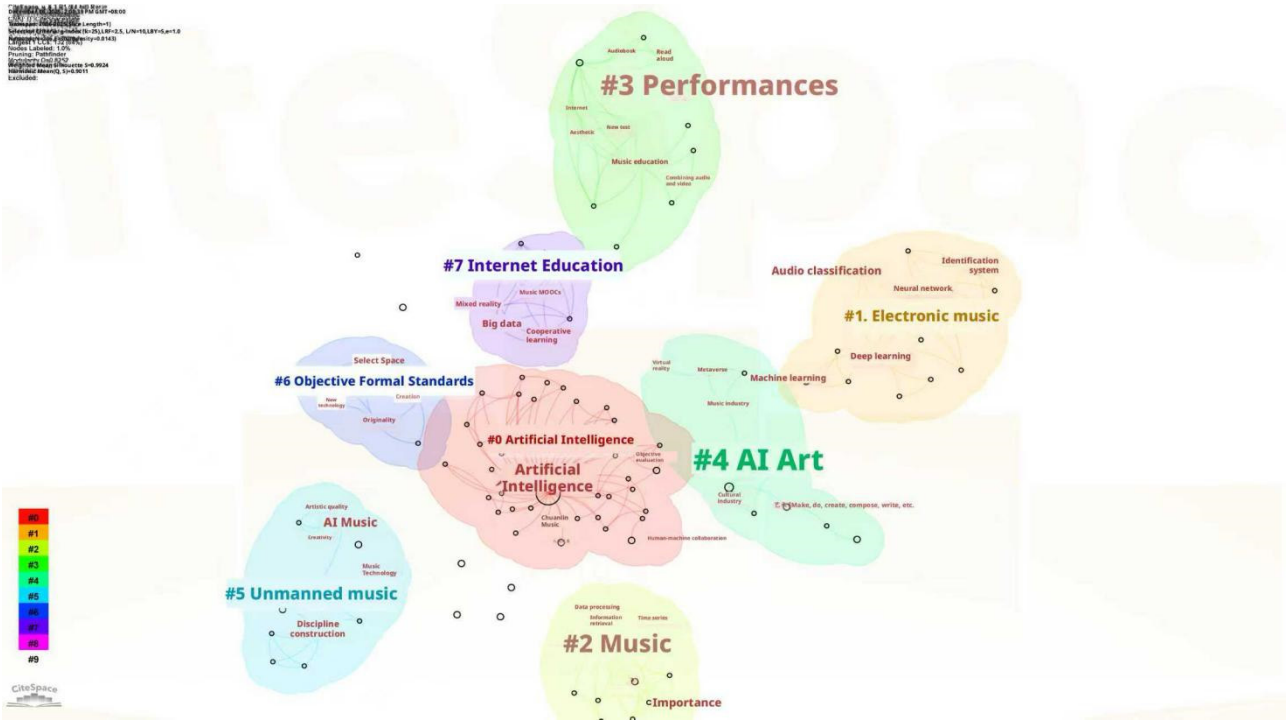

Figure 3. Keyword Cluster Map for AI and Music Research

3. Keyword Timeline Map

The keyword timeline map can discover the evolution of research hotspots. In timeline map, the solid line represents a period of research hiatus activity, whereas the dotted line indicates the period of research hiatus.

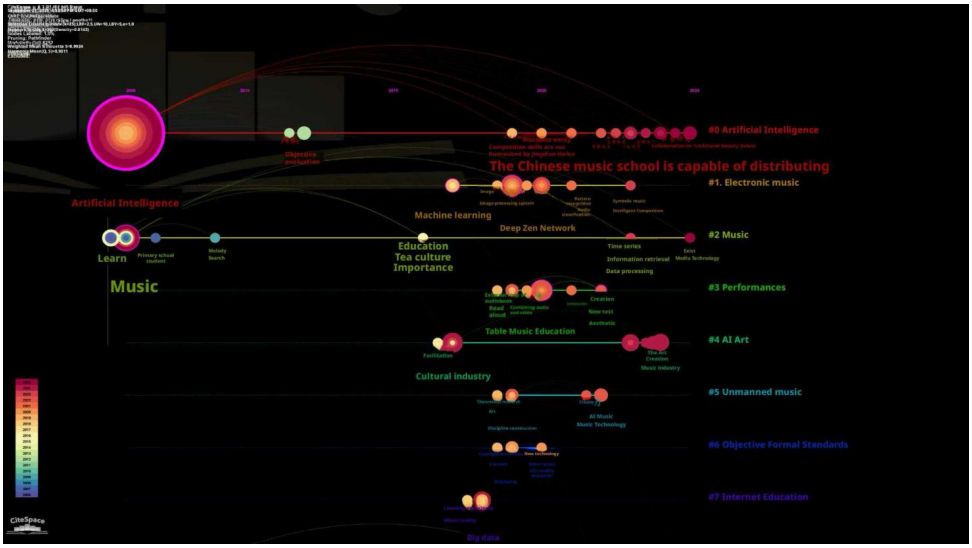

Figure 4. Keyword Timeline Map for AI and Music Research

Analysis shows that research hotspots exhibit clear phasing and cluster persistence: artificial intelligence as the core theme has been active for a long time. On the timeline, artificial intelligence clustering exhibits cross-period distribution: some nude appeared in 2006, while it had a long blanking period around 2011. Around 2019, there were a large number of nodes and arc lines extending to the right, which sprang up some keywords, such as "composing technique", "Chinese music school", "Human-machine collaboration", "sound research", "digital art" and "fair use", showing that this has been continuously discussed and co-occurring in different years, and has become significantly active in recent years. Cluster #1 "Electronic Music" was completely blanked before around 2016 and was clearly active between 2016 to 2023. Springing up the technical words like "machine learning", "deep neural network", "identification system", "symbolic music" and "intelligent composition" have become a "tool" to support other clusters. Its popularity peaked around 2019 and then gradually declined to a low level. Performances, electronic music, and education, these represent the application or practice nodes. On the timeline, they have emerged in the warmer colors of recent years and have coexisted with artificial intelligence through connections, suggesting a substantial intersection between methodological innovation and specific applications. Cluster #4 AI art was an application-oriented cluster rising in around 2016. It focus on researching about music industrialization. Cluster #6 objective form standard has risen significantly, indicating that the academic community's demand for evaluation methods, measurability and standardization has gradually increased. Cluster #7 internet education has been closely linked with online teaching and related dissemination issues after the pandemic.

3.3 Research Forces

1.Co-author

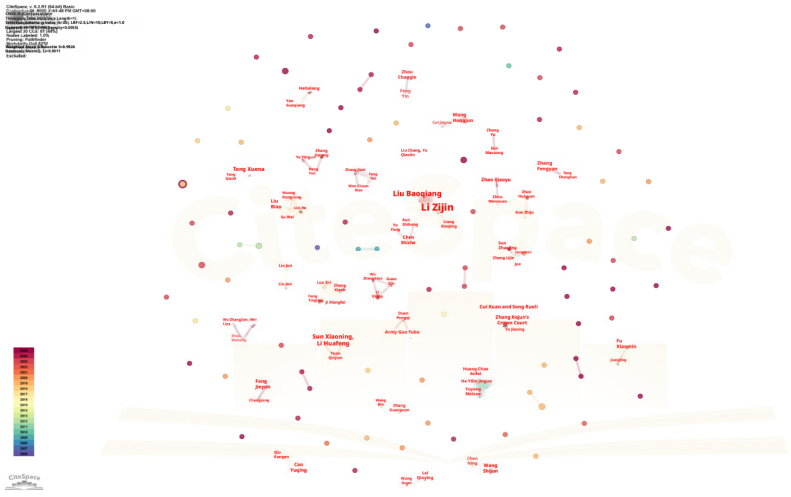

Figure 5. Collaborating Authors

The nodes represent the authors, the size of the nodes reflects the frequency of publication, the connections between the nodes indicate the strength and existence of the cooperative relationship, and the color changes represent the time-evolution characteristics. From the co-authorship network graph generated by CiteSpace, it can be seen that the author group in this field has formed a certain foundation. The nodes of scholars such as Tong Xue-na, Yang Qian-li, Han Baqiang, Li Zijian, Zhao Xiaoyu, Song Ruofan, and Zhang Kejun are more prominent, indicating that they are the main forces in each cooperative sub-group. These core authors have formed relatively close cooperative relationships within their respective research teams or institutions, and can carry out continuous research on specific research directions, becoming the key to promoting the deepening of local research. However, the network density is only 0.0055, and the connections between the authors are relatively few and scattered, which means that the overall correlation degree of academic cooperation in this field is weak. Most researchers are still in a relatively isolated research state.

Combined with the analysis of the color scale (lower left corner), the frequency of new node appearances has increased in recent years, especially after 2021, reflecting rising research interest and an expanding researcher pool. However, the "looseness" of the collaboration network has not improved with the growth in researcher numbers.

2. Research Institutions

Node size represents the frequency or influence of an institution in the sample (larger = more important). Node color gradients over time, from cool to warm colors, indicate institutional activity; warmer colors suggest higher output or citation in more recent years. Observing the color gradient, core institutions near the center of the map mostly show warm tones, indicating increased research and collaboration activity approximately between 2019-2025. Institutions related to music engineering, recording arts, music information, and artificial intelligence show higher concentration. Purple rings around nodes indicate betweenness centrality. Label density is set low, displaying only the most significant nodes for observing the overall structure.

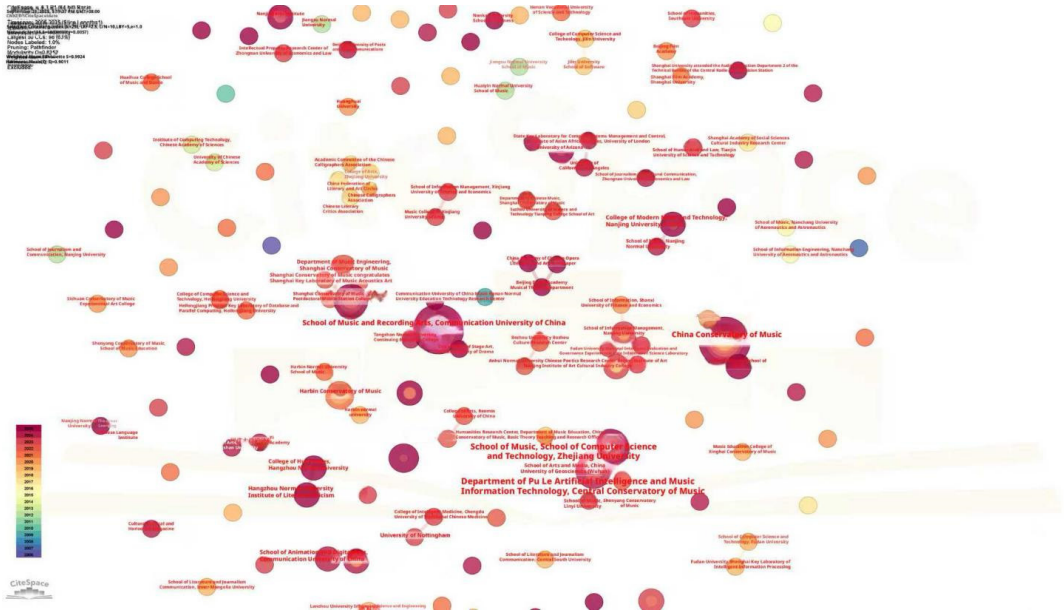

Figure 6. Research Institutions

Map network scale metrics: Number of Nodes N = 155, Links E = 68, Network Density = 0.0057. The institutional distribution shows a clear pattern of "a few key institutions — multiple scattered participants": Institutions represented by the Central Conservatory of Music, Shanghai Conservatory of Music, Communication University of China, and several traditional music colleges form the core nodes of publication and project activity in this field. Many other universities or research institutions are distributed on the periphery of the map as single points or small-scale teams. The Central Conservatory of Music, since around 2019, has established a relatively comprehensive discipline and research platform for "Music AI and Music Information Technology," gathering interdisciplinary faculty and specialized research resources, becoming a leading force in the field's academic production. The Shanghai Conservatory of Music, through its Music Engineering Department, cultivates graduate students and research projects in electronic music, music technology, and "music AI," while also promoting the construction of interdisciplinary laboratories combining AI and music therapy in recent years, demonstrating the institution's emphasis on the "AI + Music" direction in discipline setup and research platforms. The School of Music and Recording Arts at Communication University of China emphasizes the application of technologies such as VR and AI in the cultivation of media music, recording, and new media sound practice. This indicates the leading position of art colleges in the integration of technology and practice-oriented research. On the one hand, core institutions, due to their abundant talents, equipment, and access to industrial resources, can quickly

form research clusters with high output. On the other hand, the density of the overall collaborative network and the degree of cross-disciplinary participation are not high.

4. Conclusion

Research on AI music has developed a knowledge system with a clear core and increasingly rich branches. However, the sparsity of the keyword network and the looseness of the collaboration network also implies that a deeply integrated academic community has not formed up till now. There is still vast room for deepening the dialogue between "technology empowerment" and "artistic essence". Looking ahead, AI music research is facing a critical turning point. It requires us not only to focus on the refinement of algorithms and the expansion of applications, but also to return to the humanistic core of music and delve into fundamental topics such as the aesthetic principles of human-machine collaboration, the subjectivity of creation, copyright ethics, and evaluation standards. Only by strengthening interdisciplinary and cross-institutional cooperation and promoting the concurrent progress of theoretical research and practical innovation can we open up new possibilities for music art in the era of artificial intelligence, ensuring its inheritance and rejuvenation in the tide of technology.

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