

# Optimization and Future Prospects of Digital Music Creation Processes through Artificial Intelligence Technologies

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## Abstract

The rapid advancement of artificial intelligence has transformed digital music creation from a traditional human-centered model into a paradigm of human-machine collaboration. Artificial intelligence demonstrates substantial potential in domains such as music generation, arrangement, and audio processing, while simultaneously driving workflow optimization and fostering innovative modes of creativity. This study investigates the application of artificial intelligence across different stages of digital music production, analyzing its implications for creative efficiency, artistic expression, and the future trajectory of music development. By examining artificial intelligence tools in melody generation, rhythm construction, and harmonic design, the paper proposes concrete pathways for optimizing digital music creation processes and provides an outlook on emerging trends in artificial intelligence-driven music composition.

## Keywords

Artificial Intelligence (AI), Digital Music Creation, Workflow Optimization

## 1. Introduction

Technological progress has increasingly enabled artificial intelligence to permeate multiple domains of artistic creation. Music, as an art form deeply rooted in creativity and inspiration, is undergoing profound changes under the influence of artificial intelligence (AI). Within the broader field of contemporary music, digital music creation has emerged as a significant branch characterized by the extensive use of electronic equipment and digital technologies. The integration of AI has accelerated innovation in this domain, reshaping workflows from melody gener-

ation to sound processing. By enhancing efficiency and enabling new possibilities for artistic expression, AI is redefining the traditional boundaries of music creation.

Historically, music composition has relied primarily on the knowledge, skills, and inspiration of individual composers. However, this mode of creation is often constrained by time and individual capacity, particularly when addressing complex structures or diverse stylistic requirements. Consequently, the creative process has frequently been resource-intensive and time-consuming. The advent of AI tools now allows musicians to delegate specific compositional tasks to intelligent systems, thereby reducing their workload substantially. For instance, AI models trained on vast musical corpora can generate melodies and rhythms (Chen et al., 2023), or emulate specific stylistic idioms, accelerating the creative process while simultaneously broadening the scope of artistic exploration.

AI applications in music creation extend well beyond melody and harmony generation (Meng, 2023). Recent advances enable assistance in arrangement, audio mixing, and even affective expression. Deep learning models, for example, are capable of analyzing large-scale musical datasets, extracting structural features such as melody and harmony, and producing outputs with originality and distinctiveness. The emergence of generative adversarial networks (GANs) has further enhanced AI's capacity to both replicate and innovate musical styles, advancing from stylistic imitation toward creative innovation (Ma & Wu, 2021). In practice, platforms such as MuseNet (OpenAI), Magenta (Google), and Jukedeck have already been widely adopted in music production (Xing, 2024). These systems, trained on extensive repositories of musical data, generate compositions across genres and complexity levels, providing musicians with inspiration or even complete works. Moreover, AI-based audio processing techniques, including intelligent mixing and correction, offer refined control and improved sound quality.

Beyond technical contributions, the influence of AI on music composition raises profound theoretical and ethical questions. Recent scholarly work has expanded the discourse to encompass various dimensions of AI music generation. Recent research has surveyed the development history and technical routes of music AI, analyzing its current status across areas including music generation, rehabilitation, and education (Wei et al., 2025). A systematic review of the field since 2000 has identified frontier hotspots and evaluated AI music generation algorithms using quantitative methods (Yang et al., 2024). Research employing structural equation modeling has analyzed factors influencing generative AI adoption in pop music, finding that creativity enhancement and user engagement significantly impact AI tool adoption (Zhang & Kim, 2025). Additional studies have focused on AI tools for contemporary popular music production, demonstrating that audio-based AI tools better support artists' creative workflows than symbolic approaches (Deruty et al., 2022).

Music, as an art form, fundamentally prioritizes individuality, emotional depth, and originality. While AI demonstrates considerable potential in automating and

optimizing music creation, the tension between algorithmic efficiency and the need for personalized artistic expression remains unresolved. Questions persist as to whether AI-generated music can convey emotions comparable to human creativity, or whether such automation risks undermining the uniqueness of artistic output. At the same time, the adoption of AI in music production introduces legal and ethical challenges. Since AI systems are trained on large musical datasets, concerns regarding data provenance, copyright, and intellectual property have become increasingly prominent. Debates continue as to whether AI-generated works should be considered copyrightable creations, and how rights should be distributed between human composers and users of AI tools.

Looking forward, the continued evolution of AI technologies is expected to further optimize digital music creation processes through greater intelligence and personalization. Future systems will not only enhance generative capacities through iterative learning but also adapt to the specific needs of individual creators, thereby fostering closer human-machine collaboration. This progression is likely to catalyze fundamental transformations in the very nature of music composition. Critical questions remain regarding how AI will shape the future of music, redefine creative practices, and influence the trajectory of artistic development—questions that merit sustained scholarly attention.

## **2. The Development and Application of AI in Music Creation**

In recent years, AI has demonstrated remarkable potential in the field of music creation. AI not only assists composers in generating melodies and harmonies but is also capable of emulating diverse musical styles, optimizing arrangement and mixing processes, and even producing works of genuine innovation. With the advancement of deep learning and generative models, AI technologies are progressively reshaping traditional approaches to composition. The following sections examine the historical trajectory, current developments, and practical applications of AI in music creation.

### **2.1. Early Computer-Based Music Composition**

The earliest computer music systems primarily employed rule-based algorithms, in which melodies and harmonies were generated through predefined logical frameworks. A well-known example is David Cope's *Experiments in Musical Intelligence* (EMI) (Cope, 1992), which analyzed the structural features of classical compositions and, using pattern recognition techniques, produced new works imitating the styles of specific composers. While *Experiments in Musical Intelligence* achieved some success in stylistic emulation, its output was often perceived as mechanical and lacking emotional depth or genuine creativity.

Most early computer-generated music relied heavily on mathematical and logical formulations. This approach was inherently limited in both flexibility and expressive capacity. Music creation, however, extends beyond logical permutations; it encompasses emotional expression and the individuality of the human com-

poser—elements that rule-based systems struggled to capture. Consequently, early computer-generated works were often regarded as suitable primarily for experimental or conceptual purposes, with limited applicability in mainstream composition.

## 2.2. The Application of Deep Learning in Music Generation

The emergence of machine learning—particularly deep learning—marked a transformative stage in AI-driven music creation. Deep learning employs neural networks trained on vast datasets, enabling the automatic extraction of features and patterns to generate more complex and diverse musical outputs. Unlike rule-based systems, deep learning models uncover latent relationships within music, producing compositions with greater creativity and variability.

A notable application is the use of recurrent neural networks (RNNs), particularly long short-term memory (LSTM) networks. LSTM is well-suited for processing sequential data, making it effective for generating continuous melodies and harmonies. For example, Google's *Magenta* project employs LSTM models to produce melodic sequences (Kulshrestha, 2020), simulating the decision-making processes of human composers. The strength of recurrent neural networks lies in their ability to capture temporal continuity in music, resulting in smoother and more coherent sequences.

Beyond recurrent neural networks and LSTM, models such as GANs and VAEs have also been widely applied to music generation (Liang, 2023). These architectures not only generate melodies and harmonies consistent with musical structure but also produce stylistically distinctive and innovative works. GANs, through the adversarial interaction between generator and discriminator networks, can produce high-quality musical fragments, while VAEs, through encoding and decoding mechanisms, generate diverse musical materials. Collectively, these methods have significantly advanced both the automation and creative potential of AI-driven music composition.

## 2.3. Challenges and Limitations in AI Music Creation

Despite substantial progress, AI in music composition continues to face challenges related to quality, artistry, and innovation.

One major issue is the evaluation of generated music. Human composers traditionally assess quality through knowledge, aesthetic experience, and creative intent, but such criteria are difficult to apply to AI-generated works. Current evaluation methods largely depend on two approaches: subjective assessment by professional musicians and computational analysis of similarity between generated pieces and training data. Yet subjective evaluation lacks standardization, while similarity-based measures risk producing outputs that are overly derivative and deficient in originality.

Another limitation concerns emotional expression. Human compositions often embody rich emotional depth, conveyed through melody, harmony, and rhythm.

By contrast, AI systems struggle to comprehend human affect and aesthetics, resulting in outputs that may lack expressive depth or emotional resonance. While structurally coherent, such works often fall short in evoking the affective qualities characteristic of human creativity.

A further challenge lies in originality. Although AI can generate varied musical fragments, its reliance on training datasets often constrains creative outcomes, producing conservative works that mirror existing styles and forms. In some cases, this dependence leads to limited innovation, raising the critical question of how AI might move beyond imitation to achieve genuine creative breakthroughs. Addressing this issue represents an important direction for future research.

## 2.4. Innovative Applications of AI in Music Creation

Despite these challenges, AI applications in music creation continue to reveal significant promise, particularly in the following areas:

First, AI has been increasingly integrated into music education (Li & Wang, 2024). AI-generated works provide students with diverse materials to study different styles and compositional techniques, while also assisting educators in designing personalized instruction. For instance, AI can generate exercises tailored to specific stylistic or technical goals, thereby supporting skill development. Moreover, AI outputs serve as reference material and sources of inspiration, fostering students' creative engagement.

Second, AI is becoming more prevalent in digital art practices (Shen & Yu, 2021). Many contemporary artists and musicians now incorporate AI-generated fragments into their creative workflows, merging traditional musical elements with advanced technologies to produce innovative hybrid works. By rapidly generating diverse materials, AI expands artistic possibilities and helps artists transcend the limitations of conventional methods.

Finally, AI is increasingly applied in commercial contexts such as film scoring, advertising, and other forms of customized music production. AI systems can generate background music suited to particular scenarios, reducing both time and labor costs. This is particularly advantageous in industries like short-form video and advertising, where rapid production of stylistically appropriate music is essential. Consequently, AI demonstrates considerable commercial potential in providing scalable, context-specific musical solutions.

## 3. Evaluative Framework for AI Music Tools: Criteria and Comparative Analysis

Prior to discussing process optimization, it is essential to establish a clear evaluative framework for assessing various AI music tools. Such a framework allows for systematic comparison based on uniform criteria including functionality, creativity support, usability, and integration capability. The following table summarizes key AI tools in current use according to these dimensions: (Table 1)

**Table 1.** Comparative evaluation of representative AI music generation tools.

Tool Name	Primary Function	Creativity Support	Usability	Integration
OpenAI MuseNet	Multi-style composition	High	Medium	API-based
Google Magenta	Melody/rhythm generation	Medium	High	Open-source
Jukedeck	Royalty-free music	Low-Medium	High	Web service
Amper Music	Custom music production	Medium	High	DAW plugin
AIVA	Classical/film music	High	Medium	Standalone

This framework highlights that while tools such as MuseNet and AIVA excel in creative flexibility and stylistic range, others such as Amper and Jukedeck prioritize user-friendly integration and commercial applicability. Such differences illustrate that tool selection often involves trade-offs between creative autonomy and production efficiency—a critical consideration for optimizing music creation workflows.

#### 4. Optimization of Music Creation Processes Based on AI

With the rapid advancement of AI, the workflow of music creation has undergone significant optimization. Traditional processes typically include multiple complex and time-consuming stages such as conceptualization, composition, arrangement, recording, and mixing. The integration of AI not only enhances the efficiency and automation of these stages but also drives innovation in certain aspects of the creative process. Through continual refinement of algorithms and models, AI can rapidly generate melodies, harmonies, rhythms, and other musical elements, while also executing highly efficient audio processing. Such applications not only increase the efficiency of music production but also greatly expand the expressive possibilities available to creators. The following sections analyze the concrete manifestations of AI-driven process optimization in music creation and its transformative impact on compositional practices.

##### 4.1. Musical Material Generation and Creative Assistance

One of the most direct applications of AI in music creation lies in the generation of musical materials, including melodies, harmonies, and rhythms. Traditionally, composers must devote substantial time to developing melodies, experimenting with harmonic combinations, and refining rhythmic variations. AI, however, can analyze vast corpora of music data and quickly generate fragments tailored to specific styles or emotional contexts. Deep learning models such as GANs and VAEs are capable of producing high-quality musical content from scratch, while simultaneously emulating the stylistic tendencies of particular composers.

Beyond generation, AI also provides intelligent assistance throughout the creative process. By analyzing existing materials, algorithms can propose multiple melodic and harmonic options, or generate innovative fragments that inspire new

directions. This is particularly valuable when composers encounter creative bottlenecks, as AI-generated outputs can stimulate fresh ideas. For instance, projects such as OpenAI's *MuseNet* and Google's *Magenta* demonstrate the potential of AI to generate works in diverse styles and instrumentations (Gera, 2025) thereby broadening the horizons of music composition. In future workflows, AI will likely be further integrated into both material generation and creative support, simultaneously enhancing efficiency and fostering innovation.

#### 4.2. Arrangement and Structural Optimization

AI also plays an important role in arrangement and structural refinement. Traditional arrangement requires composers to assign instruments, adjust orchestration, and organize musical structure based on melodic and harmonic content. With the incorporation of AI, these processes become more efficient while preserving artistic quality.

By analyzing large-scale datasets, AI systems learn orchestration patterns, structural conventions, and stylistic features, thereby producing arrangements that are both coherent and stylistically appropriate. In addition to basic instrumentation, AI can adapt timbre, dynamics, and balance according to melodic and structural features, resulting in more natural and contextually suitable orchestrations. Deep learning-based arrangement tools can already generate multi-instrument orchestrations and automatically adapt distribution and voicing for different styles. With such tools, composers can devote less time to technical tasks and focus more on creativity and artistic expression. Furthermore, AI can identify and resolve structural issues—such as awkward modulations or overly repetitive sections—thus improving overall fluidity and artistic integrity.

#### 4.3. Intelligent Mixing and Audio Processing

In traditional workflows, mixing and audio processing are critical to the final presentation of a work, but they require considerable expertise and time. These processes involve complex tasks such as equalization, dynamic control, and the addition of spatial effects like reverb and delay. AI-powered intelligent mixing technologies are increasingly streamlining these processes and enhancing their efficiency.

By analyzing extensive datasets of professionally mixed tracks, AI systems can automatically adjust volume balance, dynamic range, and frequency response. Commercially available intelligent mixing tools—such as Sonible's Smart EQ (Fernando et al., 2021) and iZotope's Neutron (Mourgela, 2023)—are capable of analyzing audio signals and automatically applying equalization settings to align with perceptual norms and stylistic demands. Furthermore, AI can employ pattern recognition techniques to apply appropriate spatial effects, adding depth and dimensionality to the mix.

This intelligent approach not only reduces production time but also enhances precision and customization. AI systems can adapt processing to specific genres and creative intentions, assisting creators in achieving their desired soundscapes.

As AI mixing technologies continue to evolve, audio processing in music production will become increasingly automated and intelligent, offering creators highly professional solutions.

#### **4.4. Music Generation and Human-Artificial Intelligence Collaborative Creation**

Beyond optimizing individual stages, AI has fostered new modes of human-AI collaborative creation. Traditional music composition relies entirely on the composer's skill and creativity, whereas AI introduces an intelligent partner into the process. Collaboration between human and machine not only increases efficiency but also unlocks new creative potential.

In this model, AI functions not merely as a tool but as a creative “partner.” Composers provide stylistic guidelines and compositional requirements, while AI generates multiple alternatives, which are then refined through iterative feedback and revision. This interactive process accelerates creation while producing stylistically diverse and structurally varied works. For example, Google's Magenta project has pioneered explorations in human-AI collaboration, producing innovative compositions through the joint contributions of machine learning models and human creators. Such collaborative approaches extend beyond composition to areas such as film scoring, advertising, and game music. As AI models advance, this paradigm of collaborative creation will become increasingly widespread and sophisticated, with AI serving not only as a supportive tool but also as an active driver of artistic innovation.

#### **4.5. Workflow Automation and Efficiency Enhancement**

In addition to optimizing specific stages, AI also promotes automation and efficiency across the entire music production pipeline. By integrating multiple AI tools, stages such as data collection, material generation, arrangement, and mixing can be executed with a high degree of automation. Comprehensive platforms—such as AI-VA and Amper Music—already consolidate several stages into unified systems, allowing users to generate complete compositions simply by specifying requirements (Martin & Avila Rojas, 2022).

Such automation greatly accelerates production, particularly in commercial contexts where rapid turnaround is essential. AI enables the swift creation of customized works aligned with client needs, thereby reducing production cycles and costs. Music creators with a higher level of acceptance of AI technologies are also able to produce more diverse and enriched creative outcomes (Ma et al., 2025). Automation also minimizes human error and leverages big data analysis to optimize creative decisions, offering composers more precise and intelligent support.

### **5. Future Trends and Prospects**

With the rapid advancement of AI, the future of music creation presents vast opportunities and immense potential. Although significant progress has already

been made in applying AI to compositional workflows, this is only the beginning. As the technology continues to mature, AI will not remain merely an auxiliary tool but may evolve into a central driving force of creativity, fundamentally reshaping the ecosystem of music creation. The following sections examine future trends in the application of AI to music composition and the broader implications they may entail.

### **5.1. Personalization and Customization of Creation**

Future AI-driven music composition will increasingly emphasize personalization and customization. AI systems can generate works tailored to individual preferences, emotional needs, and stylistic inclinations. For example, through machine learning, AI can analyze a user's prior compositions or listening history to provide personalized suggestions and generate musical materials that align with individual tastes. This capacity for customization is not limited to personal music-making but will also play an important role in commercial, advertising, and game music, offering clients highly tailored musical content.

A key trend in this direction is emotion-driven music creation. AI systems are expected to achieve real-time recognition and analysis of creators' emotional states, enabling the generation of melodies and musical elements that match those emotions. Moreover, with emotion recognition, AI can make dynamic adjustments during the creative process, allowing compositions to resonate more deeply with listeners. Such emotion-based personalization will enhance both the expressive depth of musical works and their capacity for emotional connection, thereby advancing music creation toward a more human-centered direction.

### **5.2. Deepening Human-AI Collaborative Models**

Human-AI collaborative composition will continue to develop and may become one of the dominant modes of music creation in the future. With advances in algorithms, AI will no longer be limited to generating basic elements such as melodies and harmonies, but will also contribute to deeper dimensions of creation, including structural design, emotional expression, and innovation. The emerging paradigm will be more flexible, transforming the relationship between composer and AI from tool use into genuine co-creation.

A crucial development in this regard will be real-time interaction between AI and human creators. Future AI systems are likely to feature high levels of interactivity, enabling real-time communication, feedback, and iterative refinement during the compositional process. Creators may direct AI through natural language instructions or musical fragments, while AI generates responsive outputs aligned with creative goals. This iterative feedback loop will allow AI to evolve into a true "creative partner," capable of suggesting new directions and participating in artistic decision-making.

### **5.3. Integration of AI with Multimedia Creation**

The future of music composition will not be confined to audio; rather, AI will

increasingly merge with multimedia artistic production. As an integral component of film, gaming, and virtual reality, music will benefit from AI's ability to generate contextually adaptive content in real time. For instance, in gaming or virtual reality environments, AI can compose music dynamically in response to changes in setting, character emotions, or player actions, thereby enhancing immersion and interactivity.

In film scoring, AI will be able to analyze scripts, emotional arcs, and narrative pacing to automatically generate suitable compositions. This will not only improve efficiency but also provide directors and production teams with more flexible musical options. In the future, AI-generated music will expand beyond isolated audio content to form part of multi-sensory, multimedia experiences, deeply integrated with visual art and narrative to create richer, more multidimensional works.

#### **5.4. Transformation of Music Education and Popularization**

The application of AI in music education is poised to bring transformative changes to learning and creative accessibility. Traditional music education often requires years of training and professional guidance, particularly in advanced fields such as composition, orchestration, and theory. By contrast, future AI-driven tools will democratize music education, making it more accessible to a broader audience. Intelligent composition systems and AI-assisted learning platforms will offer beginners instant feedback, personalized learning paths, and automated compositional suggestions, simplifying and clarifying the creative process.

AI will not only generate musical works but also provide step-by-step guidance, helping learners understand complex topics such as harmony, orchestration, and theory. Future educational platforms may integrate AI to deliver real-time evaluation and tailored instruction, reducing learning cycles and unlocking creative potential. Educators, in turn, can use AI-generated materials for demonstrations or employ AI analytics to evaluate students' compositions with greater precision. This transformation will expand participation in music-making globally, fostering both cultural transmission and innovation.

#### **5.5. Copyright and Ethical Issues in AI-Generated Music**

The growing application of AI in music creation raises urgent copyright and ethical questions (Sturm et al., 2019). One of the most pressing concerns is authorship and ownership of AI-generated works, as current legal frameworks lack clarity on the intellectual property rights of AI-produced content. Future legal standards must be established to define ownership and protect the rights of composers and developers. Recent legislative and judicial developments worldwide suggest several concrete policy options to address these challenges.

First, implementing differentiated regulatory frameworks based on risk classification, inspired by China's recent policy documents such as the Opinions on

Deepening the “AI Plus” Initiative (State Council of the People’s Republic of China, 2025), could be highly effective. This approach would involve stringent review and explicit licensing requirements for high-risk applications like direct commercial replication of specific artists’ styles, while simplifying procedures for low-to-medium-risk scenarios such as AI-assisted composition for personal or educational use, thereby balancing copyright protection with innovation facilitation. Second, mandating technical compliance and traceability mechanisms, based on China’s mandatory national standard Information Security Technology-Identification Methods for AI-Generated Content (GB 45438-2025) (Ministry of Industry and Information Technology of the People’s Republic of China & State Administration for Market Regulation, 2025) and the Identification Methods for AI-Generated Content enacted by the Cyberspace Administration of China and other departments in 2025, is crucial.

Equally significant are the ethical debates surrounding originality and the value of human creativity. While AI enables efficient and prolific creation, it also sparks concerns about the marginalization of human composers and the authenticity of machine-generated art. Questions remain as to whether AI-produced music can embody genuine artistic merit and emotional depth, or whether it undermines the unique contributions of human creators. These issues demand sustained critical examination from both artistic and technological communities.

### **5.6. Prospects and Challenges of Technological Development**

Despite its broad potential, the application of AI in music creation continues to face technical and practical challenges. First, AI-generated works often lack nuanced emotional expression and artistic depth in comparison with human compositions. Advancing toward music that meets human aesthetic standards and embodies distinctive innovation will be a key direction for future research. Second, the widespread availability of AI may foster overreliance, raising the question of how creators can balance efficiency with originality. Addressing these challenges will be crucial in determining the long-term role of AI in music creation.

### **5.7. Dataset Bias and Cultural Homogenization in AI-Generated Music**

As AI continues to influence music creation, an often overlooked issue is dataset bias, which can impact the diversity and originality of AI-generated music. AI systems are typically trained on large datasets that reflect existing cultural and musical trends. If these datasets are not representative of diverse musical traditions, AI models may generate compositions that favor dominant musical styles, leading to a form of cultural homogenization. This could result in the marginalization of less mainstream genres and cultural expressions, limiting the scope of creative possibilities that AI can offer.

For example, many widely used AI music generation platforms are primarily trained on Western classical and popular music datasets, which may exclude or

underrepresent music from non-Western cultures. Consequently, AI-generated compositions could exhibit stylistic preferences and structures that reflect the biases inherent in these datasets. To ensure the future of AI-generated music is culturally diverse and representative, it is essential to curate more inclusive datasets that reflect a broader range of musical traditions. Additionally, future AI systems should be designed to account for cultural differences, promoting the inclusion of diverse musical forms while respecting the uniqueness of cultural identities.

### **5.8. Real-World Case Study: AI in Music Creation**

To illustrate the optimization claims of AI in music production, one notable example is the Suno AI application, which enables quick and easy music composition and mixing. The Suno platform leverages advanced machine learning models to generate musical compositions with minimal input from users. Creators can specify the desired music style, and within a few minutes, Suno generates a full musical arrangement.

A case study on the Suno AI application found that the platform allows users, even without formal training in music theory, to produce compositions that are stylistically rich and sonically balanced (Nugroho & Manggala, 2024). The AI-powered tool has been praised for streamlining the workflow, allowing for faster production cycles without sacrificing creativity. By using Suno, musicians can experiment with different musical structures and arrangements, relying on AI to facilitate the creative process. However, the case study also highlighted challenges, such as the limited customization options and potential ethical concerns related to AI-generated music. Despite these drawbacks, the Suno application represents a significant advancement in how AI can optimize music arrangement and mixing, making professional-level music production accessible to a broader audience.

## **6. Conclusion**

This study has examined the application of AI in digital music composition, highlighting its crucial role in optimizing creative workflows and exploring potential trajectories for future development. AI has become an indispensable tool in music creation, demonstrating remarkable capabilities in enhancing efficiency, enriching creative content, and enabling personalized music generation. By integrating AI into the compositional process, notable improvements have been achieved in speed, quality, and innovation, while providing composers with greater freedom and flexibility to concentrate on emotional expression and artistic creativity.

With the maturation of technologies such as deep learning, GANs, and VAEs, the application of AI in music has extended beyond traditional tasks of analysis and generation, progressively moving toward a stage of human-AI co-creation. AI not only simplifies certain procedural aspects of composition but also introduces new creative dimensions, enabling composers to explore novel sonic domains and modes of expression. Nevertheless, the limitations of AI in music generation must not be overlooked. Current AI-generated works still fall short of hu-

man compositions in terms of emotional depth and structural complexity. Enhancing the artistic quality and emotional resonance of AI-generated music remains an urgent challenge for future technological advancement.

Furthermore, the widespread adoption of AI in music raises pressing concerns regarding copyright and ethics. Questions surrounding the ownership of AI-generated works, the originality and creative value of such compositions, and the protection of human creators' roles amid technological progress represent core issues yet to be resolved. Both academia and industry must work toward establishing a balance between technological innovation and legal regulation, ensuring that AI fosters musical development while safeguarding the rights and artistic contributions of human creators.

Looking ahead, AI is expected to play an increasingly significant role in personalized music generation, cross-media artistic creation, and collaborative modes of human-machine composition. As technologies continue to advance, AI is poised to unlock unprecedented possibilities for music creation. In summary, while the application of AI in digital music composition holds immense promise, it is also accompanied by complex technical, legal, and ethical challenges. Striking a balance between technological progress and humanistic values will be essential for AI to become a genuine driving force in musical innovation, ushering digital music creation into a new stage of development.

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### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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