Analysis of Evaluation in Artificial Intelligence Music

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Abstract: The widespread application of artificial intelligence (AI) technology has profoundly changed various industries, including the music field. The application of AI technology in music creation and evaluation has already begun to show its impact, and this trend is expected to drive the development of the music industry. Specifically, AI technology can generate new music compositions by learning and simulating the styles and techniques of musicians in music creation. In terms of music evaluation, AI technology can objectively evaluate the quality and style of music compositions by analyzing elements such as pitch, rhythm, and chords, and provide objective evaluations of music compositions.

1. Introduction

The significance of evaluating artificial intelligence (AI) in music composition lies in its ability to explore the applications and trends of AI in the field of music. It aims to understand the role and advantages of AI technology in music composition and evaluation. Furthermore, it enables the analysis of the current status and issues of AI-based music composition and evaluation, seeking ways to enhance their effectiveness and application scope. Additionally, fostering the intersection of AI technology and the field of music can stimulate the development of the music discipline. Importantly, research on AI-based music composition and evaluation can provide more scientifically grounded methods for music creation and assessment in music education, the music industry, and for music consumers, carrying significant practical and academic value.

2. Research Objectives and Questions

The evaluation of AI in music composition is a rapidly evolving field, and its applications are already demonstrating significant influence in the music domain. The research aims to thoroughly investigate the existing issues in this field, explore potential solutions, and discuss ways to further promote its application and development. Recommendations for the advancement of AI-based music composition and evaluation are proposed, such as improving the accuracy and flexibility of AI algorithms to enhance the effectiveness and application scope of music composition evaluation.
This in-depth exploration of relevant issues in AI-based music composition and evaluation provides new perspectives and approaches for the development of the music field.

3. Methods and Metrics for Artificial Intelligence Music Evaluation

3.1. Distinction between Subjective and Objective Evaluation

In the realm of artificial intelligence (AI) music evaluation, two commonly employed methods are subjective evaluation and objective evaluation.

Subjective Evaluation: This method involves the subjective perceptions and cognitions of individuals in assessing music. Subjective evaluation methods encompass audience surveys and expert reviews. Audience surveys typically utilize questionnaire formats, allowing listeners to evaluate music based on their own perceptions and preferences. Expert reviews involve inviting professionals such as music experts, music education specialists, and composers to assess the music.[1]

Objective Evaluation: This approach involves evaluating music based on data and algorithms. Objective evaluation methods include music theory analysis, signal processing analysis, and machine learning. Music theory analysis typically assesses the quality of music by analyzing elements such as rhythm, harmony, and melody. Signal processing analysis evaluates music quality through mathematical analysis of music signals. Machine learning methods utilize extensive data for training and employ algorithms to automatically evaluate music.

In objective evaluation, specific metrics need to be established to assess the quality of music, such as smoothness, complexity, and emotional expression. These metrics can be selected and designed based on different music types and purposes. Concurrently, objective evaluation must consider its relationship with subjective evaluation to ensure the accuracy and reliability of the evaluation results.

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3.2.2. Methods and Techniques for Music Feature Extraction Analysis

Music feature extraction and analysis play a pivotal role in artificial intelligence music evaluation. The following are several commonly used methods and techniques:

1) Acoustic Feature Extraction: Researchers are analysing audio files to extract acoustic features

from music, such as pitch, rhythm, volume, and harmonics. Common algorithms include Short-Time Fourier Transform, Wavelet Transform, and Autocorrelation Function.

2) Music Theory Feature Extraction: Music theorists are extracting theoretical features from music, based on music theory, such as tonality, chords, and note distribution. Common algorithms include pitch analysis, chord analysis, and beat analysis.

3) Emotional Feature Extraction: Researchers are performing emotional analysis on music to extract emotional features, encompassing aspects like joy, sadness, and anger. Common algorithms include dictionary-based sentiment analysis and machine learning-based emotion classification.

4) Machine Learning Analysis: Data scientists are training models, which involves comparing extracted music features with actual evaluations, identifying correlations, and establishing models for evaluating and predicting new music. Common algorithms include Support Vector Machine, Decision Trees, and Neural Networks.[2]

5) Multimodal Feature Analysis: Researchers are integrating various media data, including audio, video, and text, and utilizing technologies like deep learning to extract multimodal features, achieving more accurate music evaluation. [3]

3.2.3. Design and Application of Evaluation Metrics

The design and application of evaluation metrics are crucial steps in assessing artificial intelligence music composition. In this phase, it is essential to select appropriate metrics to gauge the quality and innovation of AI-generated music. Common evaluation metrics encompass several aspects:

● Melody: Assessing the smoothness, hierarchy, and adherence to music theory fundamentals of the AI-generated music melody.

● Harmony: Evaluating the coordination and harmony of the AI-generated music's harmonies.

● Rhythm: Examining the accuracy and regularity of the AI-generated music's rhythm, considering its adherence to music theory fundamentals.

● Overall Structure: Analyzing the tightness, logic, and innovation of the overall structure of AI-generated music.

● Innovation: Assessing the level of innovation in AI-generated music, considering the presence of novel creative elements and approaches.

● Emotional Conveyance: Determining whether AI-generated music effectively conveys emotions and can evoke emotional resonance with the audience.

When applying evaluation metrics, a combined approach of subjective and objective evaluation can be employed. Subjective evaluation can involve professional judges or the perceptions of general listeners, while objective evaluation can utilize computer programs to analyze music features. Additionally, the selection and application of evaluation metrics should consider the diverse styles and types of music composition. For instance, in pop music, metrics like the quality of lyrics and arrangement can be considered, whereas in classical music, factors like expressiveness and technical difficulty may be more relevant. The design and application of evaluation metrics require careful consideration of multiple factors, with adjustments and improvements made as needed.

4. Artificial Intelligence and Music Evaluation

4.1. Relationship between Artificial Intelligence and Music

The relationship between artificial intelligence (AI) and music is an emerging field that has witnessed increasing applications of AI in various musical aspects, driven by continuous technological advancements. AI technology can analyze musical elements, structures, harmonies, and more to engage in music composition, performance, production, and evaluation, bringing forth new

opportunities and transformations to the music industry.

AI in Music Composition: AI can generate music compositions resembling the styles and techniques of human musicians by learning and simulating their artistic attributes.

AI in Music Analysis: Through extensive data analysis, AI can learn patterns and trends from millions of music pieces, enabling it to evaluate and recommend music based on these insights.

AI-Human Collaboration: AI can interact and collaborate with human musicians, assisting them in enhancing their creativity and imagination.

In summary, AI technology plays a significant role in propelling the development of music, introducing new research directions, and posing challenges. In-depth research on the relationship between AI and music is crucial for fostering innovation and development within the music industry.

4.2. Current State and Future Trends of Artificial Intelligence in Music Composition

Currently, artificial intelligence (AI) in music composition has made significant progress. Technologies like DeepBach, capable of generating Bach-style harmonic music, FlowComposer, creating music resembling a specific artist, and Amper Music, automatically generating customized music, showcase the utilization of machine learning, deep learning, natural language processing, and other AI techniques to learn and simulate the styles and techniques of musicians, producing high-quality music compositions.[4]

Looking ahead, the development of AI in music composition is expected to accelerate, presenting both challenges and opportunities.

Efficiency and Quality Enhancement: AI in music composition will continue to improve the efficiency and quality of music creation. This development may challenge traditional approaches to music composition, raising questions about the potential of AI in generating high-quality symphonies or songs.

Impact on the Music Industry: AI in music composition will have a profound impact on the music industry. It can diversify and innovate music creation choices while providing more intelligent and personalized services to the industry, such as music recommendations and customized composition.

Challenges to the Role of Musicians: The development of AI in music composition poses challenges to the role and status of musicians. While traditionally, musicians needed unique imagination and creativity, AI can now generate high-quality music by learning and simulating their skills and styles. This raises questions about whether AI will become a dominant force in composition and whether musicians need to grasp AI technology.

In conclusion, the evolving landscape of AI in music composition holds promises for efficiency, innovation, and personalized experiences, but it also prompts discussions on the evolving role of musicians and the implications for traditional music creation.[5]

4.3. Issues in Artificial Intelligence Music Evaluation Methods

Currently, there are several methods for artificial intelligence (AI) music evaluation, including:

1) Manual Evaluation Method: Evaluation is conducted through expert ratings, audience assessments, and similar subjective measures.

2) Computer Analysis Method: This approach involves using computers to analyze musical features such as melody, rhythm, and chords to assess the quality of music.

3) Statistical Analysis Method: Utilizing statistical methods to analyze large volumes of music data and extract factors influencing music quality.

However, these evaluation methods face certain challenges that require further exploration and resolution. For instance, the manual evaluation method is prone to inaccuracies due to the subjective influence of evaluators. The computer analysis method is constrained by limitations in feature

extraction and algorithm design, making it difficult to comprehensively and objectively assess music quality. The statistical analysis method necessitates extensive data support, and factors uncovered may not fully encompass various aspects of music quality.[6]

Therefore, the development of AI in music evaluation demands further exploration and innovation in evaluation methods. Leveraging the advantages of AI technology to address existing issues is crucial for enhancing the objectivity and accuracy of evaluations, catering to the diverse needs of music assessment across different domains. The primary issues in AI music evaluation include the following:

1) Lack of Unified Evaluation Standards: Due to the diverse types and styles of music, there is a lack of universally recognized evaluation standards.

2) Subjectivity Absence in AI Evaluation: Computer evaluations often focus solely on the technical indicators of music, lacking the subjective aspect of human perception.

3) Insufficient Data Samples: AI music evaluation relies on extensive music data as a foundation, but the currently available music data remains limited.

4) Limitations in Feature Extraction and Algorithm Design: Computer analysis methods face constraints in feature extraction and algorithm design, making it challenging to comprehensively and objectively assess music quality. Further improvements in feature extraction methods and algorithm design are needed to enhance the comprehensiveness and accuracy of evaluations.

5) Data Demands and Overlooking Factors: Statistical analysis methods require substantial data support, and factors uncovered may not fully encompass various aspects of music quality. Effectively utilizing limited data and ensuring that the factors unearthed comprehensively reflect music quality are essential considerations.

Currently, there are several issues in AI music evaluation methods that require further research and resolution. Considering these challenges, the development of AI in music evaluation necessitates the exploration of innovative and improved evaluation methods. Addressing existing issues, leveraging the advantages of AI technology, and enhancing the objectivity and accuracy of evaluations to meet the diverse needs of music assessment across various domains are critical directions for future research.

Therefore, how to establish universally recognized AI music evaluation standards, integrate computer-based evaluations with human subjectivity, and address the issue of insufficient data samples are topics that require thorough exploration.

The development of AI music composition technology presents vast prospects and challenges, demanding continuous research and exploration. A systematic and comprehensive study of the field of AI music composition and evaluation, exploring the relationship between AI and music, can provide valuable insights and directions for further development. Music composition and evaluation constitute a complex and diverse process, with this research primarily focusing on the integration of AI and music. However, considerations for other factors may not be fully exhaustive. Current objective evaluation metrics mainly rely on the structure and features of music, necessitating further exploration and research in aspects such as emotion and artistic expression.

The evaluation metrics and methods designed in this study require validation and refinement through more experiments to enhance their accuracy and reliability.

In the future, with the continuous advancement of AI technology and increasing demands in the music industry, AI music composition and evaluation are expected to become more widespread. In composition, optimizing algorithms and models further can lead to more natural and high-quality music creation. Regarding evaluation, exploring more objective and comprehensive metrics, strengthening the integration of subjective and objective indicators, and improving the accuracy and reliability of evaluations are crucial. Additionally, AI music can be applied in areas such as music education, healthcare, and entertainment, bringing forth more possibilities and innovations.

5. Conclusions

In conclusion, the intersection of artificial intelligence and music composition and evaluation marks a pivotal juncture in the evolution of both fields. The exploration of AI's role in music creation and assessment not only unveils the transformative potential of technology but also unravels complex challenges that demand continuous scrutiny and innovation.

This journey into the realm of AI and music has allowed us to understand the profound impact of machine learning, data analysis, and algorithmic prowess in generating music that echoes the nuances of human creativity. As we delve deeper into refining AI music creation and evaluation methods, the significance becomes clear – the fusion of technological precision and artistic expression.

The challenges encountered, such as the quest for unified standards, the delicate balance between AI objectivity and human subjectivity, and the need for extensive and diverse datasets, underline the dynamic nature of this interdisciplinary pursuit. Overcoming these challenges holds the key to unlocking the full potential of AI in reshaping the landscape of music composition and evaluation.

Looking ahead, we envision a future where AI-driven music not only meets but exceeds our expectations. Optimizing algorithms for natural music creation, advancing evaluation metrics, and diversifying AI applications in music open new horizons. The collaborative dance between AI technology and the art of music promises to compose a symphony of innovation, creativity, and meaningful contributions to diverse sectors.[7]

As we stand at the precipice of this transformative journey, the synthesis of artificial intelligence and music is poised to orchestrate a harmonious future where creativity knows no bounds, and the appreciation of music becomes a seamless blend of human ingenuity and technological prowess.

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