ISSN: 2645-5439
www.jonarbset.ir

فصلنامه رویکردهای نوین در تحقیقات علوم پایه، فنی و مهندسی
سال ششم، شماره 21، تابستان 1402

The Benefits and Challenges of Artificial Intelligence Application in The Music Industry

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Abstract

Artificial Intelligence (AI) is one of the rapidly growing fields. AI is increasingly embraced in the music industry in different aspects, including composition, education, and creativity. The paper is organized into topics and subtopics to answer questions related to the general application of AI, its benefits in music composition, education, creativity, advantages, and ethical concerns. The paper asked whether AI technology is relevant to the music industry. AI is relevant because it is applied in music generation through composition and education. Musicians enhance their creativity by combining their sounds with machine intelligence. However, this technology is disadvantageous, especially in hindering human creativity. Ethical issues arise on copyright on who owns the AI-generated songs. AI is like any other technology that impacts people differently. It may apply the techniques of big data and machine learning techniques to assist composers and artists in generating songs. However, AI is still growing, and more studies are required. The users need to be more conversant with its functioning and future impacts. More research is necessary to understand how humans will live with technology that threatens to replace their creative abilities. The paper provides current knowledge on the topic and helps understand the relationship between humans, science, engineering, and technology. It reviews and criticizes the work done, including research on AI in the music industry.

Keywords: *Artificial Intelligence, Music Education, Information Technology, Ethics*

Introduction

Artificial Intelligence (AI) is a new technology that allows machines to perform human-like functions. AI has permeated almost every sector since humans want their roles replaced with faster and more efficient machines. The music industry has embraced AI with its application spanning different aspects. For instance, AI is applicable in music education and composition where the songs are not only from human input but also from machine contribution. AI helps generate lyrics, tone, and flow and enhances music creativity. In other instances, artists rely on AI to develop songs that align with the period. However, the technology is emerging and disruptive, subject to ethical challenges and disadvantages. AI is a relatively new technology; hence, only a few studies exist, necessitating an examination of the existing literature. The available research, however, creates a representative picture of the current state of AI in the music industry.

The article explores some issues or questions related to AI in the music industry. These issues are classified under the subtopics considering the evidence from the reviewed articles. These include the general application of AI in music and how AI is beneficial in music composition. It also examines the role of AI in music education and creativity, considering the milestones in the industry. Every emerging technology has disadvantages and ethics, especially as different music stakeholders deploy the technology.

General Application of Artificial Intelligence in the Music Industry

The music industry has employed AI in various aspects. AI is used in almost every element of music, including composition, production, marketing, and consumption. Multiple software programs assist new artists in creating music based on suggestions on what the consumer wants. Today people search for music online, and AI proposes songs similar to the ones the listener wants. The music platform examines the searches related to a person and suggests identical songs. Here, the machine understands the types of songs a specific listener wants and prioritizes the searches. AI assists by identifying different customer tastes and proposing songs matching them from thousands of songs online. Music streaming relies on AI to improve quality by eliminating background noise, optimizing bitrates, and reducing latency.

Birtchnell (2018) examines the role of AI in audio mastering engineering, one of the most prestigious careers in the music industry. The growth of technology is likely to replace audio mastering engineers and transfer this role to AI. The engineer's role is crucial since it involves identifying the sounds and joining them together for the success of the music. However, combining machine learning, big data, and algorithms is disruptive and will automate audio mastering careers (Birtchnell, 2018). Digitalization of the music industry in the past decade has already shaken it, and AI will be more disruptive. However, humans still enjoy intuitive performance and critical listening abilities ahead of AI. Based on a qualitative ethnographic inquiry, the article successfully explains the general application of AI in the music industry. The article is relevant to the reader because it directly shows how AI impacts the music industry. It, however, focuses more on the general use of AI, while the technology may also be specific. It does not demonstrate how audio mastering engineers can apply the technology to improve their work but instead explains how this technology will render them jobless. It is one of the best and most available scientific studies on the less researched topic because it relies on empirical data to link AI to the music industry.

Data-driven based algorithms can be applied in many industries. Machine learning has been involved in developing tools for musical excellence. Technology helps in creating a ritualistic interaction between musical instruments, the human body, and sounds. One technology that has embraced AI is Corpus Nil, which connects musical aspects, creating a formidable network of muscles, sounds, movements, and sensors to create a formidable music piece, as in the figure below (Caramiaux & Donnarumma, 2021).

Figure 1: *Picture of the performance Corpus Nil: An AI technology in Music (Caramiaux & Donnarumma, 2021).*

Furthermore, AI is applied to deconstruct a performer's sound and create expressivity so that a new song can emerge from different elements. The article is ideal and informative because it documents progress in AI applications in music. It is research on various projects related to AI in music hence reliable and addressing the assignment topic directly. Most of the information is referenced and, therefore, verifiable. The article, however, focuses on only a few AI projects, mostly Corpus Nil, a complex form of AI, failing to include more examples of AI in music. It is also not empirical research but a simple documented study, hence not generating data from actual participants.

Benefits of Artificial Intelligence in Music Composition

One specific area where AI is beneficial is music composition. Musicians are using AI to compose quality music using any device, including a smartphone or laptop, at a lower cost. They do not have to go to the expensive studio and have all the instruments. AI combines all the required elements in the composition, including tone, tune, lyrics, and words. One can source all this from the internet and combine them to compose a song. AI music composition works in a very simple version. The technology collects data on music composition and, using algorithms composes songs that align with the trends. An upcoming musician does not have to worry about their knowledge and skills but relies on technology.

AI is, however, beneficial due to its role in music composition. Musicians apply AI in creating music, generating tone, and creating lyrics. The article explores one of the newest technologies in the music industry called Music Composition and Melody Generation Adjustable (MCMGA). MCMGA helps construct music in real-time and reflect differing moods (Chen & Wen, 2021). AI leads to the success of this approach through a combination of melody predictor and an emotional expression to compose music that captures the mood of the moment, improving the quality and effectiveness of songs. The article is research-based and demonstrates how AI impacts the music industry based on credible and reliable research. However, it does not explicitly explore the connection between AI, technology, and the music industry, but it is understandable since this is a growing field and needs better research.

AI technology applies to the complex and simple music industry. According to Lopez-Rincon et al. (2018), AI applies in music composition where users rely on it for automatic song composition through computer systems (Lopez-Rincon et al. 2018). The article is relevant to the topic and reader because it expounds on different AI applications in the music industry. It explains how AI applies through programming, generative models, neural networks, and algorithms in music composition (Lopez-Rincon et al., 2018). The reader understands the topic comprehensively, which is possible based on the article. Readers can benefit from the article by understanding the applicability of AI in the music industry. There are multiple applications ranging from simple ones like declarative programming to complex ones, including deep learning, algorithms, and neural networks (Lopez-Rincon et al., 2018). It demonstrates that an algorithmic composition is not a new phenomenon but was born out of the desire to inculcate technology in music. The article is comprehensive compared to the others discussed in this paper because it covers more applications of AI in-depth. Although the author successfully informs the reader of the relationship, there is a need for empirical research on the topic.

Mind Band is one AI platform that assists music composition using common elements like emojis, humming, and images. The music composition model is anchored on the valence-arousal model using life elements to map them into music (Qiu et al., 2019). The platform functions by uploading emojis and images and humming and generating emotionally related music, as evident in the figure below.

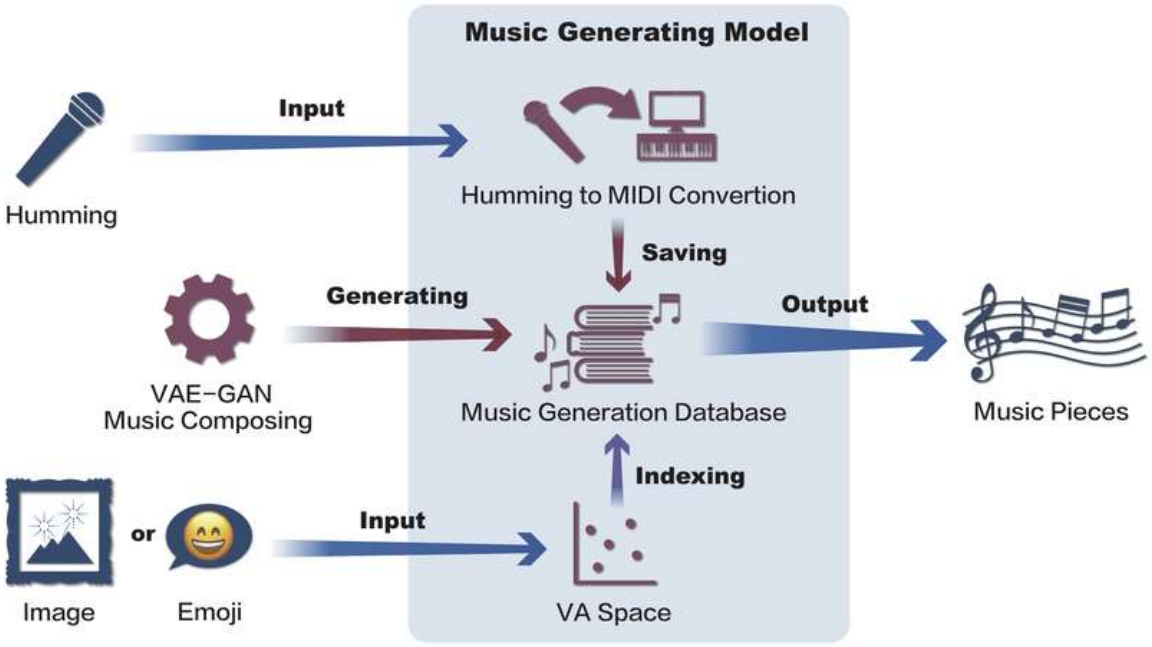


Figure 2: *Music generation model in a mind band system (Qiu et al., 2019).*

The platform doesn't require expertise, meaning anyone can compose songs using AI. The article effectively links real life with AI applications. Emojis and images are part of the actual world, which explains their use. However, the piece is complicated since it provides an in-depth application of the technology, which is difficult for ordinary users. Every technology requires some skills for users to be successful.

Tahiroğlu (2021) explores how music emerges as a social construct even as it is a product of cooperation between AI and humans. Modern music performance is through technological equipment, and hence these affect the music and the social aspects. AI is applicable in the music industry where AI-entity musical instrument helps produce real-time music synthesis audio samples. The technology is anchored on the generative adversarial network (GAN), which creates sample audios for musicians to ease music composition (Tahiroğlu, 2021). A core strength of the article is that it relies on evidence and other studies to provide in-depth information about the application of AI in music education. Although this technology was rolled out in 2020, the author effectively explains its success. Readers can see the association between the two even when they lack a comprehensive understanding of AI. However, the author fails to provide contrary views. This technology has been applied since 2020, and a good article identifies its shortcomings. A good article identifies the positives and shortcomings to enable the user to make the right decision. The article is ideal for informing the reader about the contribution of AI in music composition using an example.

Composers and musicians use AI to generate high-quality music and manage the sounds for different media. However, a unique aspect of AI is the use of technology in generating music for games. Most games require music in the background, which AI is instrumental in creating (Yang & Nazir, 2022). AI provides intelligent tools for making high-quality music in games to align with the needs of exceptional learners, including those with disabilities. The article's main strengths lie in its application of research and real-life examples of how AI assists the music industry. Music in games is a common phenomenon and one of technology's major applications. A major insight is how AI and other intelligence devices are used in the music industry in music composition. However, the article does not provide detailed information on the success of AI in music. The article only demonstrates AI's role in music education, not linking it directly to the music industry.

Benefits of Artificial Intelligence in Music Education

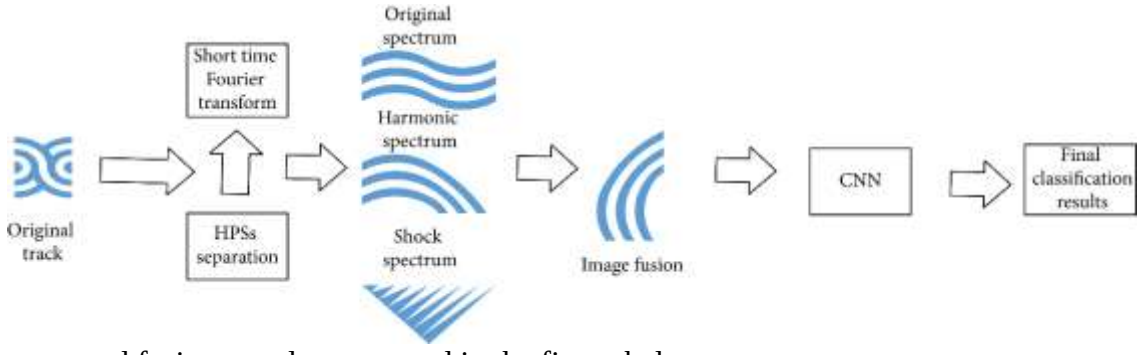
Music education captures the music enthusiast learning to play instruments and composing songs. AI is, however, shipping in by offering real-time lessons. AI mostly applies to learning instruments where the machines identify the learners' pace and learning ability. AI identifies when the learners have learned to play a specific instrument and propose another. Machines can easily know when learning occurs and present new, more challenging lessons and tasks. The technology ensures a smooth transition from one musical lesson to the next based on the individual learners' perspective based on AI-generated and individualized information. AI is also useful in aggregating different elements of music education, including sound, images, and words, into one cohesive system enhancing learning and making the process interesting.

Apart from music composition, AI is beneficial in educating music enthusiasts. Dai (2021) says that a new area of teaching music, called wisdom and intelligence teaching, is emerging due to the contribution of AI. Wisdom teaching combines new AI technologies to enhance music learning, including big data, machine learning, and the Internet of Things. AI shifts from traditional music teaching involving a classroom with chalk and blackboard to intelligent teaching (Dai, 2021). Students apply AI and smart devices to access music resources that align with their lessons and immediate needs before, during, and after class. Wisdom and intelligence teaching combine multiple elements in music education, including autonomous teaching, stimulation, cooperation, and experiences. AI is instrumental in identifying the students' psychological needs based on previous interactions creating tailor-

made lessons. Research on intelligence teaching using AI in music classrooms is limited, and this is one of the few recent studies. It is a high-quality source that demonstrates the developments in music teaching and informs new and advanced readers about the success of AI in the music industry. The ability to connect different technologies for an excellent classroom experience will likely improve.

The music industry develops from music education. Shang (2019) says that increasing technology applications among the population necessitates using AI in music education. A combination of AI and music education is the norm today. The paper is a comprehensive review that explores multiple articles that examine AI's role in music education (Shang, 2019). A comprehensive assessment is vital because only a few studies exist. The review combines a few studies from different researchers, allowing the review's consumers to get a broader perspective. An insight gained from the article is that AI is instrumental in education and will form the future trend in the technology-driven world. There are gaps in this paper on the application of AI in the music industry since music education is one part of the entire sector. The article fails to link education to actual music.

The music industry has experienced a gradual but sure shift toward technology. The music industry today applies the convolutional neural network (CNN) to extract and classify many features of a music signal (Fan, 2022). The main application, in this case, is reliance on the original music to create a new one. AI in the form of a harmonic/percussive sound separation (HPSS) algorithm is applied to separate the original piece into temporary components (Fan, 2022). AI will thus change how music reaches the users, considering the restructuring and input of CNN. Another benefit is music style recognition, where AI is applied in teaching music students how to convert the original track into a new song by separating different



spectrums and fusions, as demonstrated in the figure below.

Figure 3: *Style recognition in music learning (Fan, 2022).*

A music professor effectively demonstrates how technology disrupts the music industry using AI and music terms. The article is particular on a specific aspect of AI affecting music. It explores a current issue in the industry involving using older music signals to create new music genres. It needs to demonstrate how this technology will affect the end users, the listeners. It does not explain if the disruption will be positive or negative signals.

Intelligence music learning is a new concept in the experimental stages of music education. The technology entails replacing the traditional classroom with a smart technology-driven environment where the AI identifies the student in learning abilities (Wang, 2022). The technology is based on an intelligent system considering a combination of hardware and software to enhance music learning. Some of the technologies involved include database servers, drives, and memories. AI can easily monitor the learners' artistic and aesthetic orientation progress and produce a new lesson every time they succeed in the previous ones. The technology is new and driven by AI, aiming to collect information from different music-learning materials and render learning relevant and exciting. A core strength of the research is its ability to rely on studies for conclusions. AI is in the developmental stages and is yet to roll out fully, but the article explains its success. It shows how technology is assisting the music industry to become effective by enhancing the learner. However, it focuses on how AI informs music education through intelligence learning without identifying the impacts.

Artificial Intelligence and Creativity

AI supplements general human creativity. Creativity is necessary for the music industry to create unique but exciting songs. AI aids creativity by providing suggestions in different stages and elements of the music industry. For instance, before composition, it provides the trends and listeners' preferences, informing the new artists of the ideal content of their songs. AI may not create new songs from scratch. However, it assists artists in making their songs better by improving their music and instrument combinations. It proposes ideas in messaging, type of instruments, and arrangement of words unleashing high-quality songs. AI eliminates some errors invisible to humans and increases their scope in music development.

Researchers and musicians are increasingly accelerating the uptake of AI in the music industry, and the subsequent collaboration may be between technology and humans. Some artists like David Cope are already composing songs using AI (Marr, 2021). Musicians and

nonmusicians are applying machine learning and algorithms to create music for social media audiences without requiring loyalty and using a small budget. AI brings artists together, increasing the possibility of making the next possible star. The article helps us understand AI in music by exploring how the technology is not disruptive but a creative source. It uses the example of the pandemic to show that AI is necessary since it enhances human creativity. It is a subjective article seeking to portray AI positively in light of technological changes. The article conflicts with the existing literature by presenting AI as more creative than humans, whereas studies show humans are always ahead and only feed the machine. However, it is just an online article by Forbes and not backed by research. It is possible to believe in the information because its authentic courtesy of the study. The article provides basic information about the topic and complements the previous articles.

The developments of neural networks have enhanced AI's ability to work with humans to develop creative content. Most of the research examines the collaboration between AI and humans with little attention on how AI can aid human-human interaction in music generation. According to this research involving 30 musicians (15 pairs), AI can reduce creativity risks and mitigate stalling and friction in creativity (Suh et al., 2021). The article is instrumental and different from the others since it examines how AI helps humans become effective. The article considering its heading addresses the assignment topic directly. It is relevant by informing how AI is a social glue that impacts the music industry through music composition. It differs from the others, looking at how AI assists music composition. It is a research-based article hence reliable by providing data-driven findings. However, the article is deficient because it only admits that AI can enrich creativity but does not define how it can impede the same. Nonetheless, the article sufficiently covers the core area under scrutiny by the assignment based on the author's responses.

AI is increasingly applied in a wide range of problem-solving scenarios. AI is useful in creative problem solving but with human input, since machines are not creative thinkers. Some AI technologies applied in music composition include MAGMA which relies on a stochastic, planning, and genetic algorithm approach anchored on Markov chains to generate songs, as shown in the figure below (Fox & Khan, 2013).

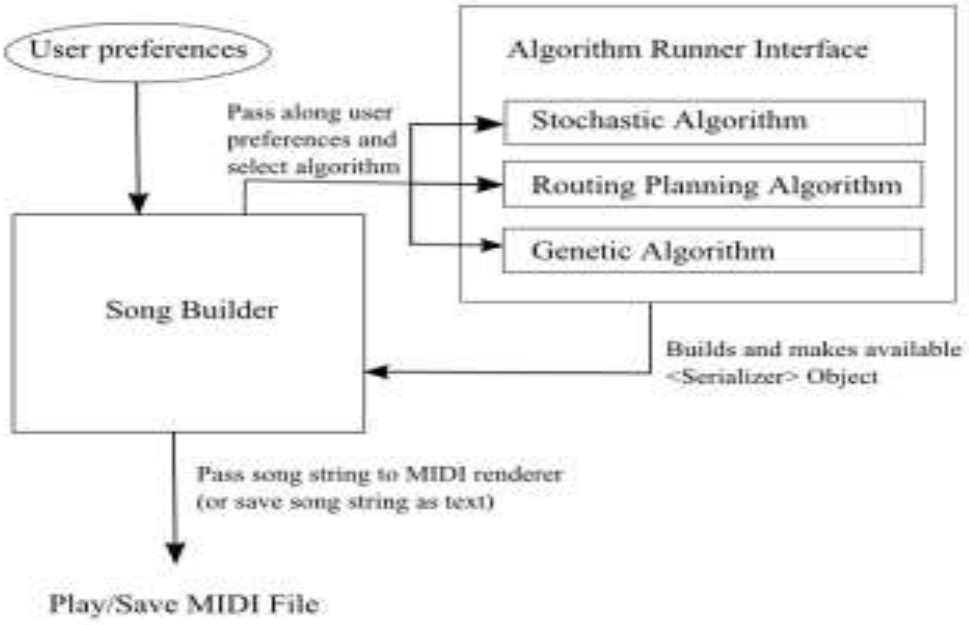


Figure 4: *MAGMA architecture (Fox & Khan, 2013).*

Although this technology is still experimental, it is ideal for creating a song the user is interested in. A core strength of the article is its ability to provide a detailed application of technology in composing music. It relies on available research to demonstrate how AI is useful in music composition based on the technical terms applied. The author explains the steps followed in song composition using the technology. However, there still needs to be more in the article related to the success and whether such promises progress. The limitation of MAGMA is ideal in providing in-depth information on the technology but then failing to link it to other well-developed technologies. A focus on experimental AI in music composition may imply that there are successful advancements.

Disadvantages of Artificial Intelligence Application in the Music Industry

Although there are benefits of AI in the music industry, it is also plagued by some disadvantages. AI hinders human contribution to the creative industry. Music is a creative sector, and humans should benefit from applying creativity from start to end. For instance, one should be in charge of a song from conceptualization to end. However, AI ships in and helps in creativity, reducing human contribution. The technology will likely diminish human creativity when AI compose songs on their behalf. AI in music is like having a machine draw an artwork and then credit it to humans. The application will also likely raise multiple

disputes, especially on whether the machine or humans in charge own the songs. Can the machines have a legal right if they compose a song with little or no human input?

Despite the literature portraying AI as successful other conflicting articles challenge the alleged benefits. Huppe (2022) argues that AI will likely change how people conceive music by eliminating humans' contribution. Machines will compose and actualize music by reducing or removing humans. AI-generated music also raises copyright issues for AI-generated music. In 2019, the US copyright office rejected an AI-generated art piece (Huppe, 2022). The rejection further poses a serious question, especially about who owns AI-generated music and who would receive payments if such music becomes popular. Such serious questions on the implications of technology on the music industry call for a sharper focus on the industry. The article, published by Forbes and authored by a music law professor, comes at a time when questions arise on the interaction between humans and technology. It does not examine the implications of technology on other industries that may be successful but only demonstrates how this will be challenging. As a law professor, the author ought to have offered a legal solution to the issue regarding the potential method of handling technology in music. For instance, every technology is under a person, and in AI, the person can be the owner.

AI has penetrated the creative industry, including music. Music producers and artists rely on algorithms to produce high-quality songs. According to the research, listeners and music professionals need a higher perception of AI-generated music, which disadvantages the technology. Listeners see AI-generated music as less credible, mainly due to the elimination of the creative ability which demonstrates the musician’s skills and talent (Tigre Moura & Maw, 2021). The article conflicts with the current literature by posing AI music as less acceptable. It is ideal for musicians wishing to use AI in generating music since it shows that AI creativity is not well received by a section of the listeners. At the end of the research, the authors point to the need for further study, indicating a gap not addressed. It helps identify music listeners’ perceptions but does not explain which specific aspect they hate. It does not show whether its words, instruments, or beats that hinder creativity when AI is applied.

Ethical Issues in Artificial Intelligence

Using machines in any industry raises ethical concerns, which could be more complex for AI in the music industry. AI relies on data to generate music, meaning it may collect data from other people and musicians, especially the dead ones. Such data is used without the

owners' consent. The data is used for inclusion or exclusion without the owner's consent, creating ethical concerns. There are also issues on whether music generated by machines can be termed creative. Doing so is unethical and injustice since there was the assistance of other forces. Some musicians use AI to generate music and copyright it, further engaging in unethical conduct.

According to Karlberg (2022), music startups have embraced AI to accomplish more, produce dynamic music, and create music using better tools. However, like any other technology, these startups face the challenge of ethics when applying AI. They are concerned with copyright issues and how much data they can use (Karlberg, 2022). Startups must be responsible when using AI to ensure accountability, openness, safety, privacy, oversight, data governance, and transparency. Therefore, the structured interview research article comprehensively explores the soft aspect of technology that needs to be examined. Ethics may lead to the collapse of a business, including a startup. Hence, it leads to a deeper understanding of the issues that the application of AI in music should consider. The article differs from the others above since it deviates from applying technology to ethics in AI. It, however, needs to go deeper into the ethical issues experienced since it only identifies broad ethical concerns with no specific examples. It does not determine how AI affects the listeners regarding ethical concerns since it focuses on music producers and artists.

AI has been applied in music for several decades in creating specific songs and recommending them based on the users' tastes and preferences. AI, however, penetrated the human creativity domain that was a reserve of people. Once AI is useful in creativity, it plays a role when earning money from it (Sturm et al., 2019). The article dwells deeply on engineering praxis and copyright, two issues that emerge with the application of AI in music. The article is, therefore, relevant because it identifies and explains some of the areas of contention when technology becomes part of the industry. It relies on the available research to untangle the challenges associated with copyright and engineering praxis. The author illuminates the important role of AI in music that encourages creativity. A focus on only these two areas allows the author to explore them in-depth and, in the process, uncover more information about the topic. For instance, it shows that AI assists musicians in generating words and looking for sounds and vocals. The article is relevant to the topic because it directly explains it by demonstrating how AI assists the music industry. The reader can benefit from reading it and understanding how copyright issues affect AI in music. One of the

core weaknesses of the article is that it is not empirical research. However, this is mitigated by the heavy use of resources to support the claims made.

The solution to the Problem

Although studies show that AI benefits the music industry, two main problems arise, including diminishing human creativity and potential copyright challenges. One solution is limiting the application of technology. AI should play a support role and avoid the creativity part. For instance, musicians should not generate actual words from AI but can use them in music education. They can learn vocals, musical instruments, and tone and apply the skills rather than asking the machine to create their specific songs. In this way, technology will assist in music generation but not create music. Musicians can use the traditional method of song composition by writing the songs and the message. This will solve the copyright problem. Another way of solving the copyright problem is recognizing the artist using AI. AI cannot operate independently, but humans develop it or apply it to a specific song. This should be credited to the songs since machines cannot earn money. The people using AI in music demonstrate creativity in linking technology and human, hence the product owners.

Conclusion and Outlook

The purpose of the article was to review AI in the music industry. The article identified the current literature on the topic and explored the state of knowledge. According to this article, AI is one of the disruptive technologies affecting the music industry in various ways. It is applied generally in developing music and musical instruments. AI is also applicable in music composition and education, where composers and educators rely on algorithms to generate music that aligns with the times. AI adds creativity to music, which is a disadvantage since it reduces human creativity. Ethical issues arise from the application of AI in music, posing serious challenges to use. Although knowledge is essential, it is limited because it eliminates the human aspect, which is the basis of music creativity. Another area for improvement of the current understanding is the need for more research on the effectiveness of AI in the music industry since it is an emerging field. The topic is, however, relevant in science, engineering, and technology because it demonstrates how humans can interact with technology to create quality products like songs. Further research is, however, necessary on ways of retaining human creativity in music as artists embrace AI. Research is also essential

to understand how AI will interact with humans to make work easier without hindering creativity.

References

Birtchnell, T. (2018). Listening without ears: Artificial intelligence in audio mastering. *Big Data & Society*, *5*(2), 2053951718808553. https://doi.org/10.1177/2053951718808553

Caramiaux, B., & Donnarumma, M. (2021). Artificial intelligence in music and performance: a subjective art-research inquiry. *Handbook of Artificial Intelligence for Music: Foundations, Advanced Approaches, and Developments for Creativity*, 75-95.

Chen, N., & Wen, G. (2021). Music composition feasibility using a quality classification model based on artificial intelligence. *Aggression and Violent Behavior*, 101632. https://doi.org/10.1016/j.avb.2021.101632

Fan, M. (2022). Application of the music industry based on the deep neural network. *Scientific Programming*, *2022*, 1-6. https://doi.org/10.1155/2022/4068207

Fox, R., & Khan, A. (2013). Artificial intelligence approaches to music composition. In *Proceedings of the International Conference on Artificial Intelligence (ICAI)* (p. 1). The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldCom).

Huppe, M. (2022). Artificial Intelligence has significant Implications for ownership In the Music Industry. Retrieved Jan 30, 2023, from https://www.forbes.com/sites/forbesbusinesscouncil/2022/12/12/artificial-intelligence-has-big-implications-for-ownership-in-the-music industry/?sh=237d022d5797

Karlberg, P. (2022). What ethical dilemmas do AI music startups face? Retrieved Jan 30, 2023, from http://www.diva-portal.org/smash/get/diva2:1684436/FULLTEXT01.pdf

Lopez-Rincon, O., Starostenko, O., & Ayala-San Martín, G. (2018, February). Algorithmic music composition based on artificial intelligence: A survey. In *2018 International Conference on Electronics, Communications, and Computers (CONIELECOMP)* (pp. 187-193). IEEE. https://doi.org/10.1109/CONIELECOMP.2018.8327197.

Marr, B. (2021). How Artificial Intelligence (AI) Is Helping Musicians Unlock Their Creativity. Retrieved Jan 30, 2023, from

https://www.forbes.com/sites/bernardmarr/2021/05/14/how-artificial-intelligence-ai-is-helping-musicians-unlock-their-creativity/?sh=4f2dfa670045

Qiu, Z., Ren, Y., Li, C., Liu, H., Huang, Y., Yang, Y., ... & Zhang, K. (2019, October). Mind band: a piece of cross-media AI music composing platform. In *Proceedings of the 27th ACM international conference on multimedia* (pp. 2231-2233). https://doi.org/10.1145/3343031.3350610

Shang, M. (2019). The application of artificial intelligence in music education. In *Intelligent Computing Theories and Application: 15th International Conference, ICIC 2019, Nanchang, China, August 3–6, 2019, Proceedings, Part II 15* (pp. 662-668). Springer International Publishing.

Suh, M., Youngblom, E., Terry, M., & Cai, C. J. (2021, May). Ai as social glue: Uncovering deep generative AI's roles during social music composition. In *Proceedings of the 2021 CHI conference on human factors in computing systems* (pp. 1-11). https://doi.org/10.1145/3411764.3445219

Sturm, B. L., Iglesias, M., Ben-Tal, O., Miron, M., & Gómez, E. (2019, September). Artificial intelligence and music: open questions of copyright law and engineering praxis. In *Arts* (Vol. 8, No. 3, p. 115). MDPI. https://doi.org/10.3390/arts8030115

Tahiroğlu, K. (2021). Ever-shifting roles in building, composing, and performing with digital musical instruments. Journal of New Music Research, 50(2), 155-164. https://doi.org/10.1080/09298215.2021.1900275

Tigre Moura, F., & Maw, C. (2021). Artificial intelligence became Beethoven: how do listeners and music professionals perceive artificially composed music? *Journal of Consumer Marketing*, *38*(2), 137-146.

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. https://doi.org/10.1155/2022/5503834

Yang, T., & Nazir, S. (2022). A comprehensive overview of AI-enabled music classification and its influence in games. *Soft Computing*, *26*(16), 7679-7693. https://doi.org/10.21203/rs.3.rs-1089338/v1