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Artificial Intelligence and the Integration of Industrial Revolution 6.0 in Ethnomusicology: Demands, Interventions, and Implications

ABSTRACT
This paper focuses on the integration of Artificial Intelligence (AI) and Industrial Revolution 6.0 in ethnomusicology, which is the study of music from diverse cultures. The challenges facing researchers in ethnomusicology necessitate the use of AI, which can aid in analyzing, transcribing, and preserving musical traditions. Furthermore, AI can be utilized to generate new musical compositions that integrate elements from various musical traditions. Meanwhile, the Industrial Revolution 6.0 technologies, such as AI, can facilitate the preservation and distribution of musical traditions, cross-cultural understanding, and new forms of music education through virtual reality and immersive experiences. However, the integration of these technologies also raises concerns about cultural exploitation and the authenticity of musical traditions. This study aims to examine the demands, interventions, and implications of AI and Industrial Revolution 6.0 in ethnomusicology, emphasizing the need for a collaborative and culturally sensitive approach that addresses ethical considerations, handles bias and accuracy, and balances AI with traditional methods of music analysis and interpretation. Ultimately, the study suggests that practitioners and researchers must approach the demands of AI and Industrial Revolution 6.0 with caution, consideration, and a spirit of collaboration in order to realize their potential advantages for ethnomusicology while avoiding ethical and cultural pitfalls.

KEYWORDS
Artificial Intelligence
Demands
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Implications
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Interventions

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Introduction

Ethnomusicology is the study of music from different cultures, with a focus on understanding the cultural and social context in which the music is created, performed, and consumed. With the rise of the fourth industrial revolution, the integration of Artificial Intelligence (AI) into various fields has become a crucial aspect of research and development (Al Momani et al., 2021; Joshi et al., 2023). In the context of ethnomusicology, the integration of AI can facilitate the analysis and interpretation of music from different cultures, providing new insights and opportunities for cross-cultural understanding (Seeger, 2004). This paper will explore the demands, interventions, and implications of AI and the integration of Industrial Revolution 6.0 in ethnomusicology. The demands for AI in ethnomusicology can be understood in the context of the challenges faced by researchers in the field. Ethnomusicology involves the analysis of music from different cultures, which often have unique characteristics and structures that may be difficult to interpret and understand. Additionally, many musical traditions are oral and do not have a notated form, making it challenging to preserve and study them. Therefore, there is a demand for AI to assist in the analysis, transcription, and preservation of musical traditions (Seeger, 2004).

One intervention that AI can make in ethnomusicology is the development of software and tools that can analyze and transcribe music automatically. For example, AI-based software can analyze the acoustic properties of a musical recording and automatically identify pitches, rhythms, and other musical features. This can facilitate the analysis and interpretation of the music and provide new insights into the structure and 'meaning' of the music (Trinity College Dublin, 2021; Zhang et al., 2022). Additionally, AI can be used to transcribe oral musical traditions, which can be challenging to reproduce using traditional music notation. Another intervention that AI can make is the development of virtual reality, enabling users to have an immersive experience of music from different cultures (Magnimind, 2019). Virtual reality can provide a more interactive experience, allowing users to explore the cultural and social context in which the music is created and performed (Mahmoud, 2023). This can facilitate cross-cultural understanding and provide a new way of experiencing music that is not possible with traditional media (Marr, 2021).

The integration of Industrial Revolution 6.0 in ethnomusicology has several implications for the field. Industrial Revolution 6.0, also known as Industry 4.0, refers to the integration of new technologies such as AI, robotics, and the Internet of Things into the manufacturing process. In the context of ethnomusicology, the integration of Industry 4.0 technologies can facilitate the preservation and dissemination of musical traditions. One implication of Industry 4.0 in ethnomusicology is the potential it creates for new forms of music production and dissemination. For example, AI can be used to generate new musical compositions that incorporate elements from different musical traditions. This can facilitate cross-cultural collaboration and provide new opportunities for musical innovation. Additionally, Industry 4.0 technologies can facilitate the distribution of music to a global audience, allowing for the preservation and dissemination of musical traditions that might otherwise have been lost.

Another implication of Industry 4.0 in ethnomusicology is its potential for the development of new forms of music education. Virtual reality and immersive experiences can provide a more engaging and interactive way to teach music from different cultures. Additionally, AI-based software can provide personalized music instruction, allowing students to learn at their own pace and with directly targeted feedback. This can facilitate the dissemination of musical traditions and provide new opportunities for cross-cultural understanding. However, the integration of Industry 4.0 technologies in ethnomusicology also raises concerns about the potential for cultural appropriation and exploitation (Cassar, 2023). For example, the use of AI to generate new musical compositions or to transcribe oral musical traditions can raise questions about ownership and authenticity. Additionally, the use of virtual reality and immersive experiences to teach music from different cultures can raise concerns about the commodification of culture and the potential for cultural exploitation (American University, 2019).

Theoretical Frameworks

This study is anchored by five theories on the demands, interventions, and implications of artificial intelligence and the integration of Industrial Revolution 6.0 in ethnomusicology, as follows:

Technological Determinism

This theory suggests that technology shapes and influences social, cultural, and economic

systems (Magnusson, 2019). It could be applied to the integration of AI and Industry 4.0 technologies in ethnomusicology by exploring how these technologies shape the way music is created, produced, and disseminated.

Cultural Appropriation

This theory addresses the power dynamics between dominant and marginalized cultures, and the ways in which dominant cultures often appropriate and exploit cultural practices from marginalized cultures (Cuncic, 2022; Roche & Burridge, 2022). It could be used to explore how far such appropriation and exploitation might be furthered by the capacity of AI and Industry 4.0 technologies to transcribe and generate music from different cultures.

Cross-Cultural Communication

This theory focuses on the challenges and opportunities of communication between individuals and groups from different cultures (Merkin, 2017). It could be applied to the use of virtual reality and immersive experiences to facilitate cross-cultural understanding and communication in ethnomusicology.

Postcolonial Theory

This theory examines the legacies of colonialism and imperialism and their ongoing impact on cultural practices, identities, and power structures (Lahiri-Roy & Belford, 2021). It could be used to explore the ways in which the integration of AI and Industry 4.0 technologies in ethnomusicology may reproduce or challenge colonial power dynamics and hierarchies.

Actor-Network Theory

This theory emphasizes the interconnectedness and agency of both human and non-human actors in shaping social and technological systems (Bartels & Bencherki, 2020; Nickerson, 2023). It could be applied to the integration of AI and Industry 4.0 technologies in ethnomusicology by examining the ways in which different actors (such as researchers, musicians, software developers, and AI algorithms) interact and shape the use and impact of these technologies.

Statement of the Problem

This study set out to examine the demands, interventions, and implications of artificial intelligence and the integration of Industrial Revolution 6.0 in ethnomusicology. More specifically, it sought to answer the following questions:

1. What are the demands and interventions of artificial intelligence in ethnomusicology?
2. What are the demands and interventions of Industrial Revolution 6.0 in ethnomusicology?
3. What are the difficulties posed by using artificial intelligence to integrate the Industrial Revolution 6.0 in ethnomusicology?
4. How can the demands of artificial intelligence be nurtured to address the demands of Industrial Revolution 6.0 in ethnomusicology?
5. What are the implications of the demands of artificial intelligence and Industrial Revolution 6.0 in ethnomusicology?

The Demands and Interventions of Artificial Intelligence in Ethnomusicology

The demands of artificial intelligence (AI) in ethnomusicology can be broadly categorized into three areas: (a) music transcription, (b) music analysis, and (c) music generation.

Music Transcription

One of the key demands of AI in ethnomusicology is its capacity to transcribe music from different cultures quickly and accurately (Bates, 2016). Traditional methods of music transcription can be time-consuming and labor-intensive, requiring a high level of expertise and specialized knowledge. AI tools can be used to make automatic transcriptions of audio recordings into sheet music or MIDI files, making it easier for researchers to study and analyze different musical traditions. This can include transcribing music that is complex, polyphonic, or makes use of non-Western scales and tonalities.

Music transcription, which is the process of converting audio recordings of music into written form, can be a useful tool in ethnomusicology. As one of the demands of artificial

intelligence, music transcription can be addressed in ethnomusicology in several ways, including (Benetos et al., 2018; Roads, 1980): (a) Developing transcription tools: Ethnomusicologists can work with computer scientists and engineers to develop transcription tools that are specifically designed to transcribe music from different cultures and traditions. These tools can be developed using machine learning algorithms to recognize and transcribe different types of music. (b) Improving accuracy: Ethnomusicologists can use AI-based transcription tools to improve the accuracy of their transcriptions. AI-based tools can recognize patterns and structures in music that may be difficult for humans to detect, resulting in more accurate transcriptions. (c) Standardizing notation: Ethnomusicologists can work to develop a standardized notation system that can be used to transcribe music from different cultures and traditions. This can help to facilitate communication and analysis across different cultures and traditions. (d) Collaborating with musicians: Ethnomusicologists can collaborate with musicians from different cultures and traditions to develop transcription tools that are tailored to their specific needs. This can help to ensure that the tools are accurate and culturally sensitive. (e) Building databases: Ethnomusicologists can build databases of transcribed music that can be used for analysis and comparison across different cultures and traditions. These databases can be used to study musical patterns and structures and to develop new insights into the ways in which music is created and performed.

For example, in Figure 1 and 2, an ethnomusicologist is studying the traditional polyphonic vocal music of the Aka people in Central Africa, which is known for its complex interlocking vocal patterns and its use of non-Western scales. Transcribing this music manually is extremely challenging due to its polyphonic nature and unique tonalities. This concrete example demonstrates how AI can revolutionize music transcription in ethnomusicology by automating the transcription process, improving accuracy, and creating standardized notations. By developing specialized tools, collaborating with musicians, and building comprehensive databases, ethnomusicologists can gain deeper insights into complex musical traditions like those of the Aka people. AI not only makes the transcription process more efficient but also enhances the ability to study and preserve diverse musical cultures.

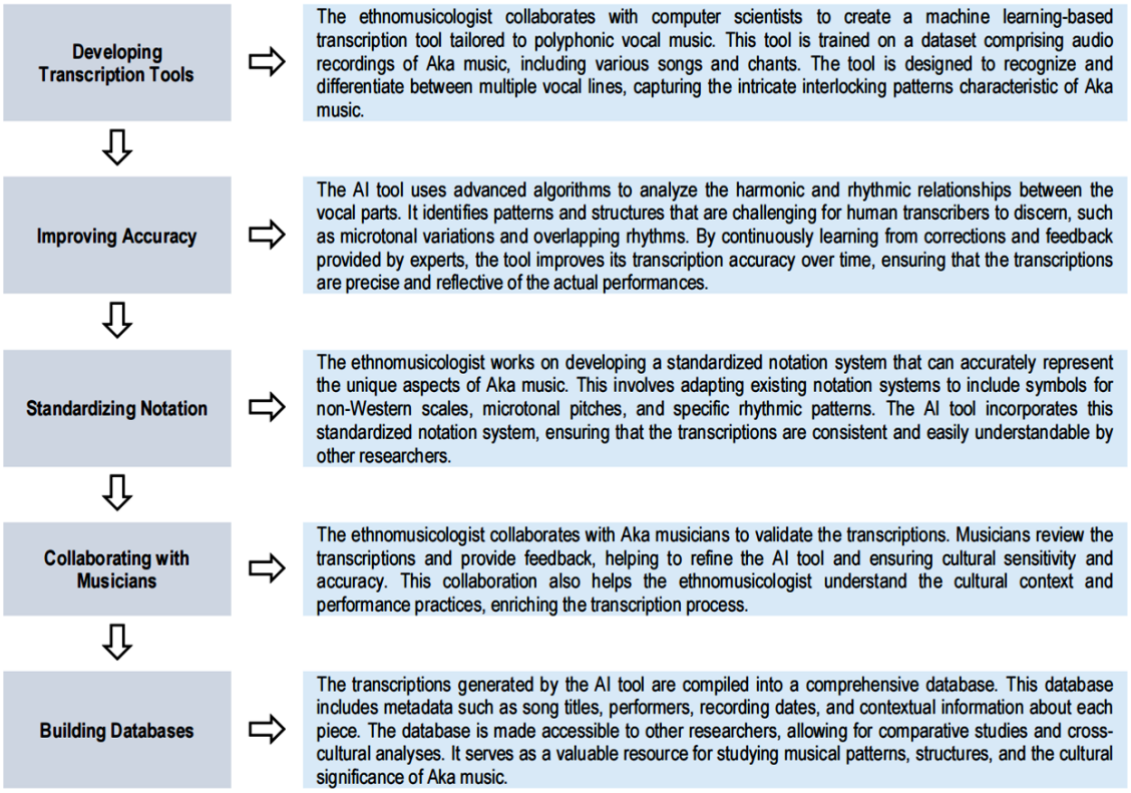

Figure 1. Music Transcription Step-by-Step AI Application

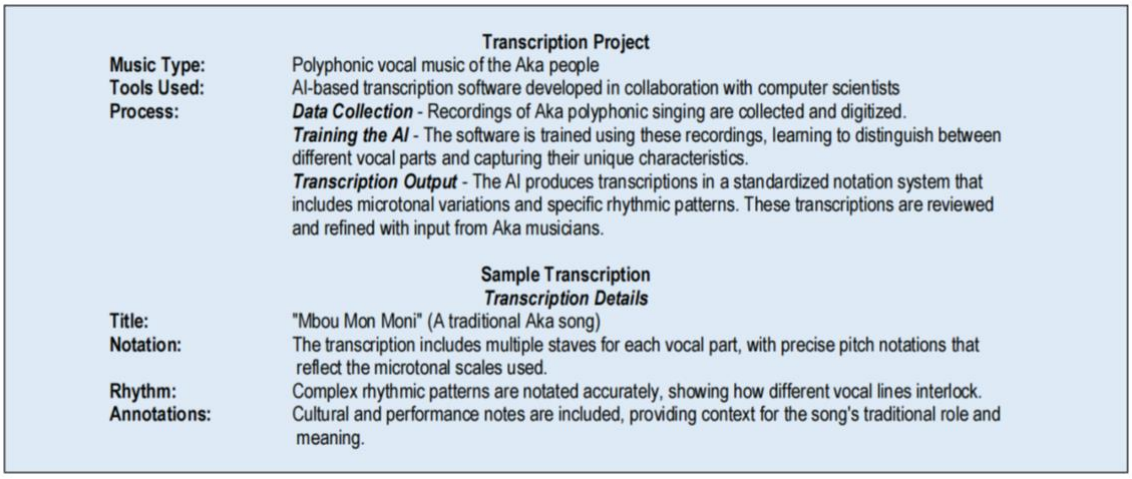

Figure 2. Music Transcription Concrete Example

Ethnomusicologists can address the demand for music transcription in AI by developing tools, improving accuracy, standardizing notation, collaborating with musicians, and building databases. These approaches can facilitate the study of music from different cultures and traditions and gain a deeper understanding of the ways in which music is created and performed.

Music Analysis

AI can also be used to analyze and categorize different types of music from around the world (Hong et al., 2022). For example, machine learning algorithms can be trained to recognize different rhythmic patterns or melodic structures, allowing researchers to understand better how different musical traditions are constructed and how they relate to each other. This can include analyzing music that is traditionally aurally transmitted rather than notated, or music that uses unique tuning systems.

Music analysis is a critical dimension of ethnomusicology, which is the study of music in its cultural context. The following are some methods by which music analysis can be addressed in ethnomusicology (Ajibade et al., 2022; Panteli et al., 2018): (a) Feature Extraction: The first step in music analysis is to extract relevant features from the audio signal. Ethnomusicologists can use machine learning algorithms to identify and extract features that are relevant to their research questions. These features could include rhythmic patterns, melodic contours, harmonic structures, and other aspects of the music. (b) Pattern Recognition: Once the relevant features have been extracted, ethnomusicologists can use machine learning algorithms to identify patterns in the music. For example, they could use clustering algorithms to group similar pieces of music together based on their rhythmic patterns or melodic contours. (c) Cross-Cultural Comparison: Ethnomusicologists often study music from different cultures and regions. Machine learning algorithms can be used to compare and contrast different musical styles and traditions. For example, they could use classification algorithms to identify the differences between different types of music from different regions. (d) Visualization: Machine learning algorithms can be used to generate visualizations of musical data. Ethnomusicologists can use these visualizations to explore patterns in the music and to communicate their findings to others.

For example, in Figure 3 and 4, imagine an ethnomusicologist researching the traditional music of the Ewe people from Ghana and the Javanese gamelan music from Indonesia. These two musical traditions are culturally rich and have distinct musical characteristics. This concrete example illustrates how AI can be applied in ethnomusicology to analyze and compare different musical traditions. AI helps researchers gain deeper insights into the structural and cultural aspects of music from around the world by extracting features,

recognizing patterns, enabling cross-cultural comparisons, and creating visualizations.

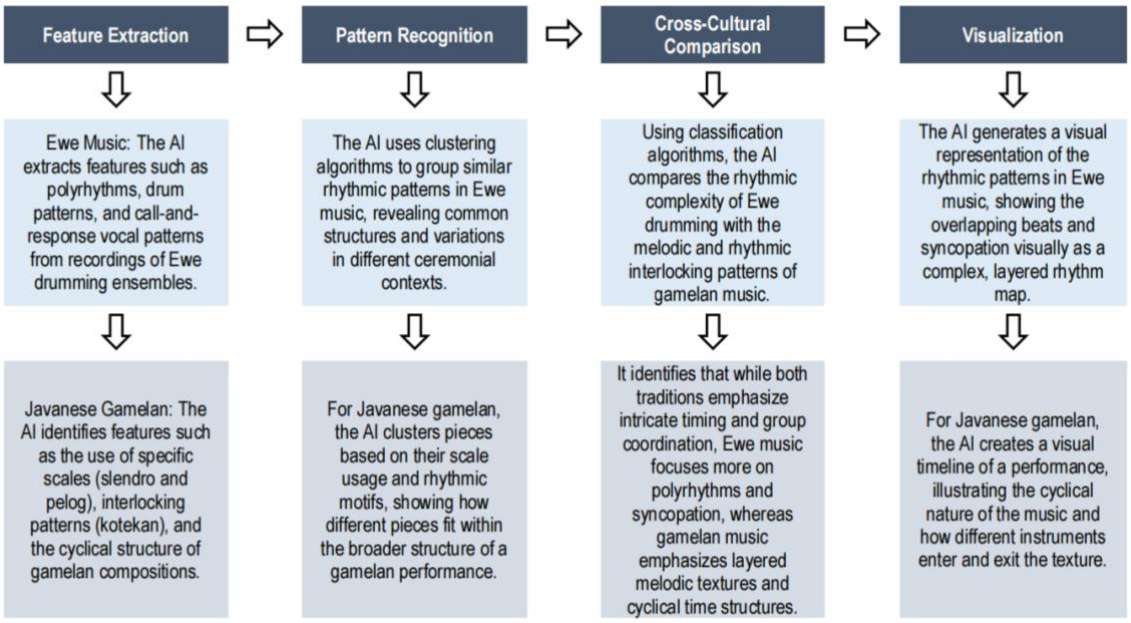

Figure 3. Music Analysis Step-by-Step AI Application

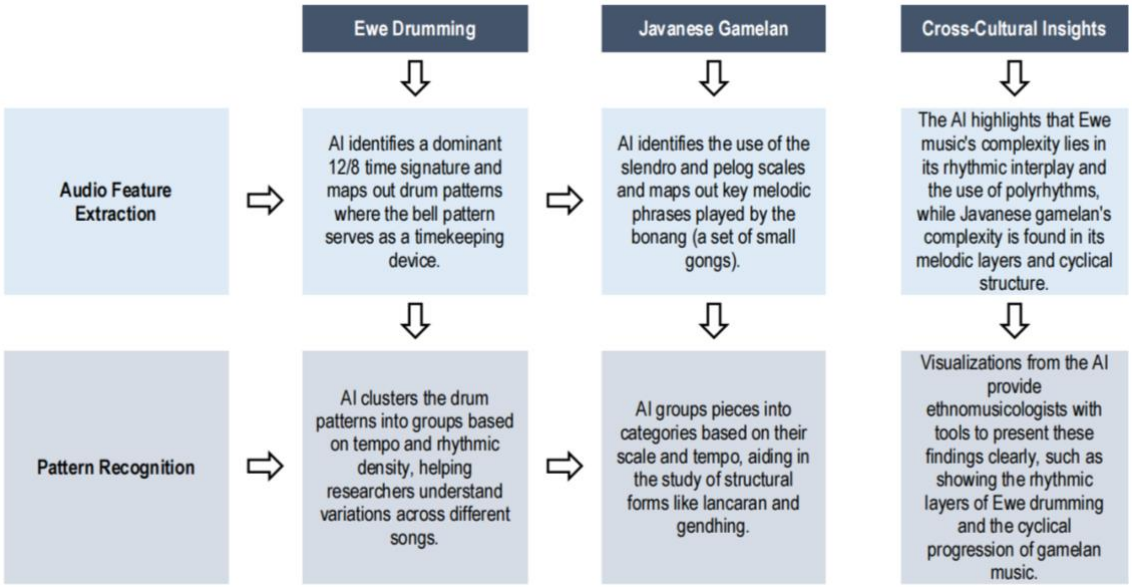

Figure 4. Music Analysis Concrete Example

The use of artificial intelligence and machine learning techniques can provide powerful tools for music analysis in ethnomusicology. However, it is important to remember that these techniques are only as good as the data to which they are applied, and ethnomusicologists must be careful to use appropriate methods and interpret the results with care.

Music Generation

Another demand of AI in ethnomusicology is the ability to generate new music that is inspired by or incorporates elements from different musical traditions (Blackwell et al., 2012). AI algorithms can be trained on large datasets of music from different cultures and used to generate new compositions that blend elements from different styles and traditions. This can include creating music that is stylistically consistent with a particular culture or region, or generating new musical fusions that combine elements from multiple musical traditions.

Music generation is an exciting area of research in artificial intelligence that has many potential applications in ethnomusicology. The following are some interventions that music generation can make in ethnomusicology (Balato et al., 2023; Rice, 2017): (a) Data Collection: Ethnomusicologists can collect large datasets of music from different cultures and regions to train machine learning models. The data can include audio recordings, sheet music, and other relevant information. (b) Style Transfer: Machine learning algorithms can be used to generate new music that is stylistically similar to existing pieces of music. This can be used to explore the influence of different musical traditions on each other and to create new pieces of music that are inspired by different cultures. (c) Improvisation: Ethnomusicologists can use machine learning algorithms to generate musical improvisations that are inspired by different cultures and traditions. This can help us to explore the creative potential of different musical styles and to generate new ideas for musical composition. (d) Collaboration: Ethnomusicologists can work with machine learning algorithms to create new musical collaborations between different musicians from different cultures. For example, a machine learning algorithm could generate a musical accompaniment that is inspired by one tradition while a musician improvises a melody that is inspired by another tradition.

For example, in Figure 5 and 6, an ethnomusicologist is studying the musical traditions of both Indian classical music of the Carnatic tradition and traditional Irish folk music. The goal is to create new musical pieces that blend elements from both traditions, exploring the creative potential of AI in generating cross-cultural music. This concrete example illustrates how AI can be employed in ethnomusicology to generate new, cross-cultural musical compositions. By collecting extensive datasets, utilizing style transfer, enabling

improvisation, and fostering collaboration, AI helps create innovative musical pieces that blend elements from different traditions. Such endeavors not only expand the creative possibilities in music but also promote greater cross-cultural understanding and appreciation. However, it remains essential to ensure the accuracy and cultural sensitivity of the AI-generated music by carefully curating the training data and interpreting the results thoughtfully.

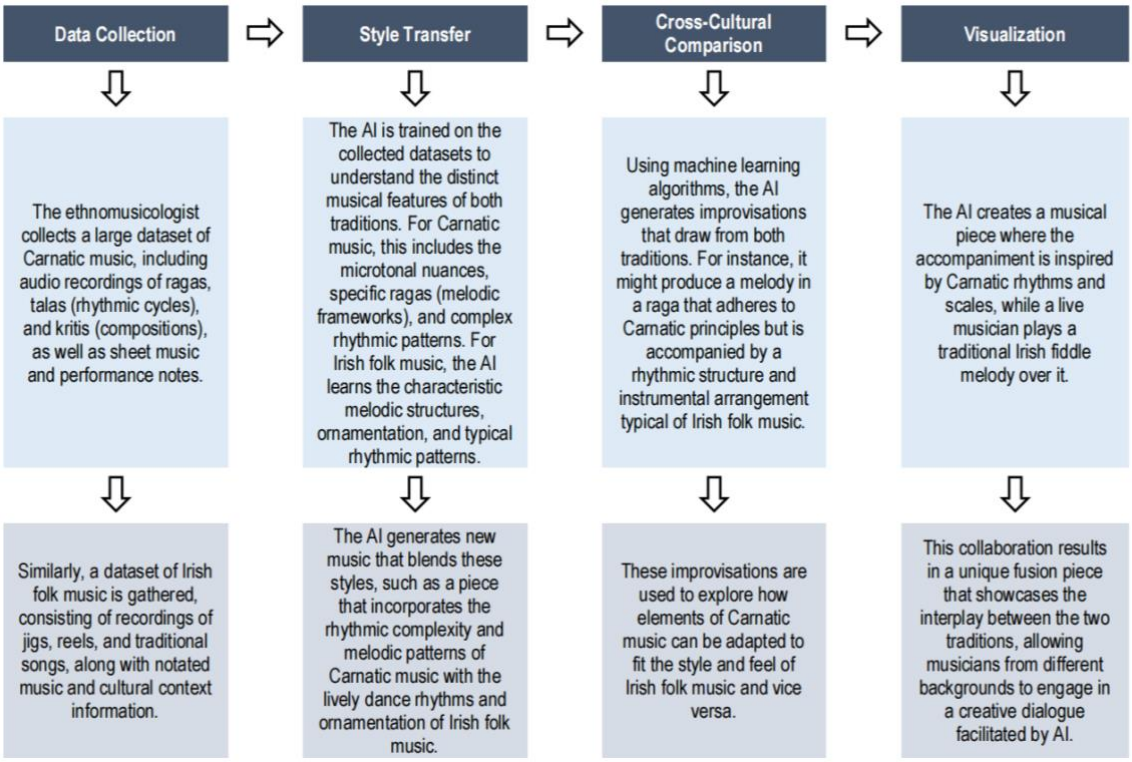

Figure 5. Music Generation Step-by-Step AI Application

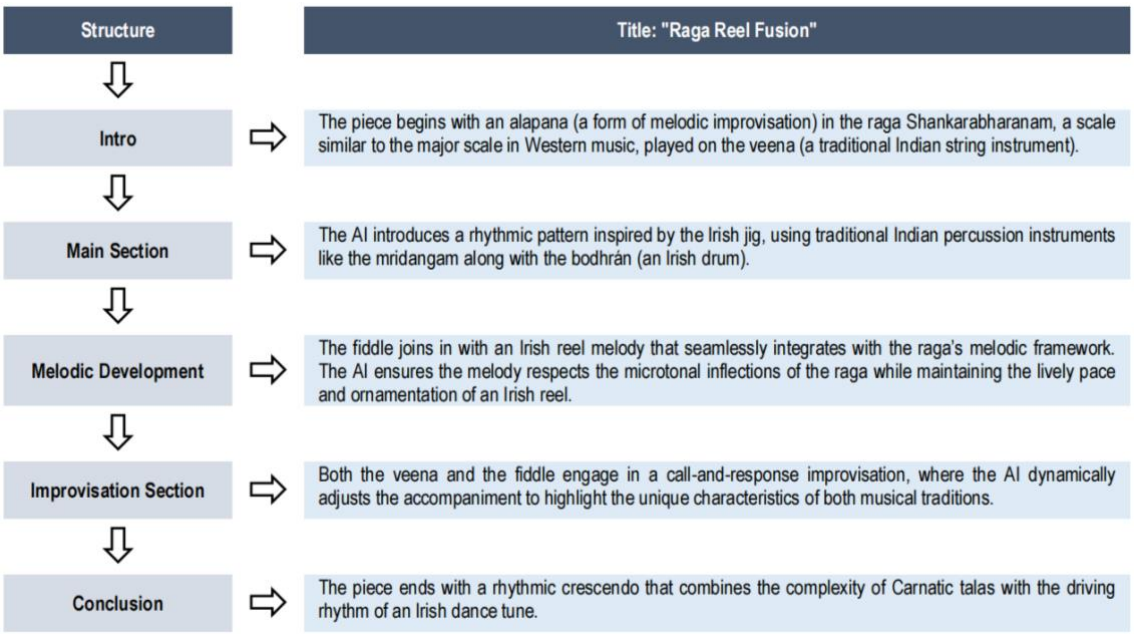

Figure 6. Music Generation Concrete Example

Music generation is a powerful tool for exploring the creative potential of different musical traditions and for generating new ideas for musical composition. However, it is important to remember that machine learning algorithms are only as good as the data to which they are applied, and ethnomusicologists must be careful to use appropriate methods and interpret the results with care. Thus, the demands of AI in ethnomusicology are focused on making music from different cultures more accessible, understandable, and engaging for researchers, musicians, and audiences around the world. While there are certainly challenges and ethical considerations that need to be addressed when using AI in this way, the potential benefits are significant and could help to promote greater cross-cultural understanding and appreciation of music from around the world.

The Demands and Interventions of Industrial Revolution 6.0 in Ethnomusicology

The demands of Industrial Revolution 6.0 in ethnomusicology are focused on the integration of new technologies and digital platforms to promote cross-cultural understanding, preserve cultural heritages, and facilitate collaboration between musicians and researchers. The following are some of the demands of Industrial Revolution 6.0 in ethnomusicology: (a) digital archiving, (b) online collaboration, (c) virtual reality and immersive experiences, (d) digital tools for music analysis, and (e) social media.

Digital archiving

The ability to create digital archives of music from different cultures is a key demand of Industrial Revolution 6.0 in ethnomusicology (Furste, 2017). This involves creating high-quality digital recordings of traditional music, as well as digitizing existing analog recordings to make them more widely accessible. Digital archiving allows researchers to access and study traditional music from different cultures and helps to preserve cultural heritage for future generations (Kantaros et al., 2023).

Digital archiving is an important aspect of preserving and promoting the cultural heritage of a community or group. In ethnomusicology, digital archiving can be addressed through various means, including (Landau & Topp Fargion, 2012; Treloyn & Emberly, 2013): (a) Building digital archives: Ethnomusicologists can collaborate with local communities to build digital archives of their music, dance, and other cultural expressions. These archives can be made accessible to scholars and the general public, thus promoting the preservation and dissemination of cultural heritage. (b) Digitizing existing collections: Many ethnomusicology collections are already in existence in various media, including audio recordings, photographs, and field notes. Ethnomusicologists can digitize these collections to make them more accessible to researchers and the public. This can involve transferring analog recordings to digital formats, or scanning photographs and field notes. (c) Developing metadata standards: Metadata standards are essential for organizing and describing digital collections, enabling users to search and retrieve relevant materials. Ethnomusicologists can develop metadata standards that are specific to their field, taking into account the particularities of musical traditions and cultural expressions. (d) Promoting open access: Ethnomusicologists can advocate for open access to digital archives, allowing scholars and the public to freely access and use these materials. This can foster collaboration, exchange, and innovation in the field of ethnomusicology.

Digital archiving can play a crucial role in ethnomusicology by helping to preserve and promote the cultural heritage of diverse communities, facilitating research and collaboration, and fostering public engagement and appreciation for musical traditions and cultural expressions.

Online collaboration

The ability to collaborate online with musicians and researchers from around the world is another demand of Industrial Revolution 6.0 in ethnomusicology (Tofalvy & Koltai, 2021). Online collaboration platforms such as Skype, Zoom, and Google Hangouts allow musicians and researchers to work together in real-time, regardless of their geographic location. This can facilitate cross-cultural collaboration and the sharing of knowledge and expertise between different communities.

Online collaboration can be addressed in ethnomusicology in various ways (Khulusi et al., 2020). One approach is through virtual research environments and digital platforms that allow for collaborative work among researchers, musicians, and other stakeholders in the field. These digital platforms can facilitate communication, data sharing, and collaboration among researchers and musicians across different geographic locations. One example of such a platform is the Smithsonian Folkways' Global Sound Archive, which provides access to more than 50,000 tracks from around the world and allows for collaborative editing, tagging, and commenting by researchers and musicians. Another example is the Collaborative Online Digital Audio Library (CODA), which allows for the collaborative creation of digital audio collections that can be used for research and teaching (Kantaros et al., 2023).

Additionally, online collaboration can be addressed through virtual conferences, workshops, and seminars that allow for researchers and musicians from different parts of the world to come together and share their work (Hacker et al., 2020). These virtual events can also incorporate interactive features such as live chat rooms, breakout sessions, and virtual performances. Furthermore, online collaboration can be addressed through the use of social media platforms such as Facebook and Twitter, which allow for researchers and musicians to connect and share information and resources. Online discussion forums and mailing lists can also facilitate collaboration among researchers and musicians with shared interests in particular topics or regions. Online collaboration can be addressed in ethnomusicology through the use of digital platforms, virtual conferences and workshops, social media, and other online communication tools that enable collaboration and information sharing among researchers, musicians, and other stakeholders in the field.

Virtual reality and immersive experiences

The use of virtual reality and immersive experiences is another demand of Industrial Revolution 6.0 in ethnomusicology (Yin et al., 2021). Virtual reality headsets can be used to create immersive environments where users can explore different cultural contexts and listen to music from around the world in a more interactive and engaging way. This can help to promote greater cross-cultural understanding and appreciation of music from different cultures.

Virtual reality and immersive experiences offer a unique opportunity for ethnomusicologists to engage with music and culture in innovative ways (Ajibade et al., 2023; Bravo et al., 2022; Prasad & Roy, 2017). The following are a few methods by means of which virtual reality and immersive experiences can be addressed in ethnomusicology: (a) Preservation and access to cultural heritage: Virtual reality technology can be used to recreate cultural heritage sites and experiences, such as traditional music performances or ceremonies. This can provide a new way for people to engage with and learn about music and culture, especially for those who may not have access to these experiences in person (Kantaros et al, 2023). (b) Enhancing research and analysis: Ethnomusicologists can use virtual reality to simulate environments and experiences related to their research, such as recreating traditional musical instruments or performances. This can provide a more immersive and interactive way for researchers to engage with their subjects, potentially leading to new insights and perspectives (Mahmoud, 2023). (c) Collaborative performance and education: Virtual reality can also facilitate collaboration and education across geographic distances. Ethnomusicologists can work with musicians and performers from around the world to create virtual musical performances or educational experiences that can be shared and accessed by anyone with a VR headset.

Virtual reality and immersive experiences offer ethnomusicologists new opportunities to engage with music and culture, to preserve and share cultural heritage, and to collaborate across distances in ways that were not possible before.

Digital tools for music analysis

The use of digital tools for music analysis is another demand of Industrial Revolution 6.0 in ethnomusicology (Yang, 2017). Software programs such as Sonic Visualiser and Ethnomusicology Toolkit allow researchers to analyze and transcribe music from

different cultures in new ways, using digital tools such as spectrograms, frequency analysis, and time-stretching. This can help to uncover new insights into traditional music and promote greater understanding of different musical traditions.

Digital tools for music analysis offer numerous possibilities for ethnomusicology, including automated transcription and analysis of audio recordings, data visualization, and statistical analysis (Chudy et al., 2020; Franke, 2019): (a) Automated transcription: Digital tools can transcribe audio recordings of music, making it easier for researchers to analyze the music in detail. For example, tools like Transcribe! and Sonic Visualiser can automatically transcribe audio recordings, making it easier for researchers to analyze the music in detail. (b) Data visualization: Digital tools can help researchers visualize and analyze large amounts of data. For example, tools like Tableau and Gephi can be used to create interactive visualizations of ethnomusicological data, making it easier to see patterns and trends. (c) Statistical analysis: Digital tools can also be used for statistical analysis, allowing researchers to identify patterns and trends in ethnomusicological data. For example, software like R and SPSS can be used to analyze large datasets and identify statistical relationships between different variables. (d) Digital archives: Digital tools can be used to create and manage digital archives of ethnomusicological materials, including audio and video recordings, photographs, and field notes. These archives can be made accessible to researchers and the public, helping to preserve and share important cultural heritage.

Digital tools for music analysis offer numerous possibilities for ethnomusicology, including automated transcription, data visualization, statistical analysis, and digital archiving. By using these tools, researchers can gain new insights into music and culture and make their research more accessible to a wider audience.

Social media

The use of social media platforms such as Facebook, Twitter, and Instagram is another demand of Industrial Revolution 6.0 in ethnomusicology (Kalaiarasi et al., 2019). Social media can be used to share information and resources, promote cross-cultural understanding, and connect musicians and researchers from around the world. This can help to build networks and communities of practice that support the study and preservation of traditional music (Mahmoud, 2023).

Social media offers a unique platform for ethnomusicologists to engage with audiences, share their research findings, and connect with other scholars in the field. The following are some of the ways social media can be used in ethnomusicology (Gubner, 2018; Harrison, 2016): (a) Sharing research: Ethnomusicologists can use social media platforms like Twitter, Facebook, and Instagram to share their research findings, articles, and other related content with a broader audience. Social media allows researchers to reach people who may not have access to academic journals or conferences, and it also provides an opportunity to engage with non-academic communities interested in music. (b) Building networks: Social media can help ethnomusicologists connect with other scholars and researchers in the field. Platforms like LinkedIn and Twitter allow for the creation of professional networks and can facilitate collaborations on research projects, conferences, and other events. (c) Public engagement: Social media can be used as a tool to engage with the public and share ethnomusicological research with a wider audience. Ethnomusicologists can use social media to post educational content, such as videos explaining different music traditions or sharing stories about particular musical practices. (d) Data collection: Social media can be used as a source of data for ethnomusicological research. Researchers can collect data on musical practices and traditions by studying social media conversations and interactions related to music.

Social media offers many opportunities for ethnomusicologists to engage with audiences, share their research, and build networks with other scholars in the field. However, it is essential to be mindful of the ethical and cultural implications of using social media for research purposes.

For example, in figure 7, an ethnomusicologist is working to preserve and promote the traditional music of the Sámi people in Northern Europe. The Sámi musical tradition, particularly the *joik*, is an integral part of their cultural heritage. The goal is to use advanced digital technologies to archive, analyze, and share this music globally, fostering greater appreciation and understanding. By leveraging the technologies of Industrial Revolution 6.0, the Sámi music preservation project illustrates how digital archiving, online collaboration, virtual reality, digital analysis tools, and social media can be effectively integrated into ethnomusicology. These interventions not only preserve cultural heritage but also enhance cross-cultural understanding and collaboration, making traditional music accessible and engaging for a global audience. This

comprehensive approach ensures that the rich musical traditions of the Sámi people are not only preserved but also celebrated and understood by future generations worldwide.

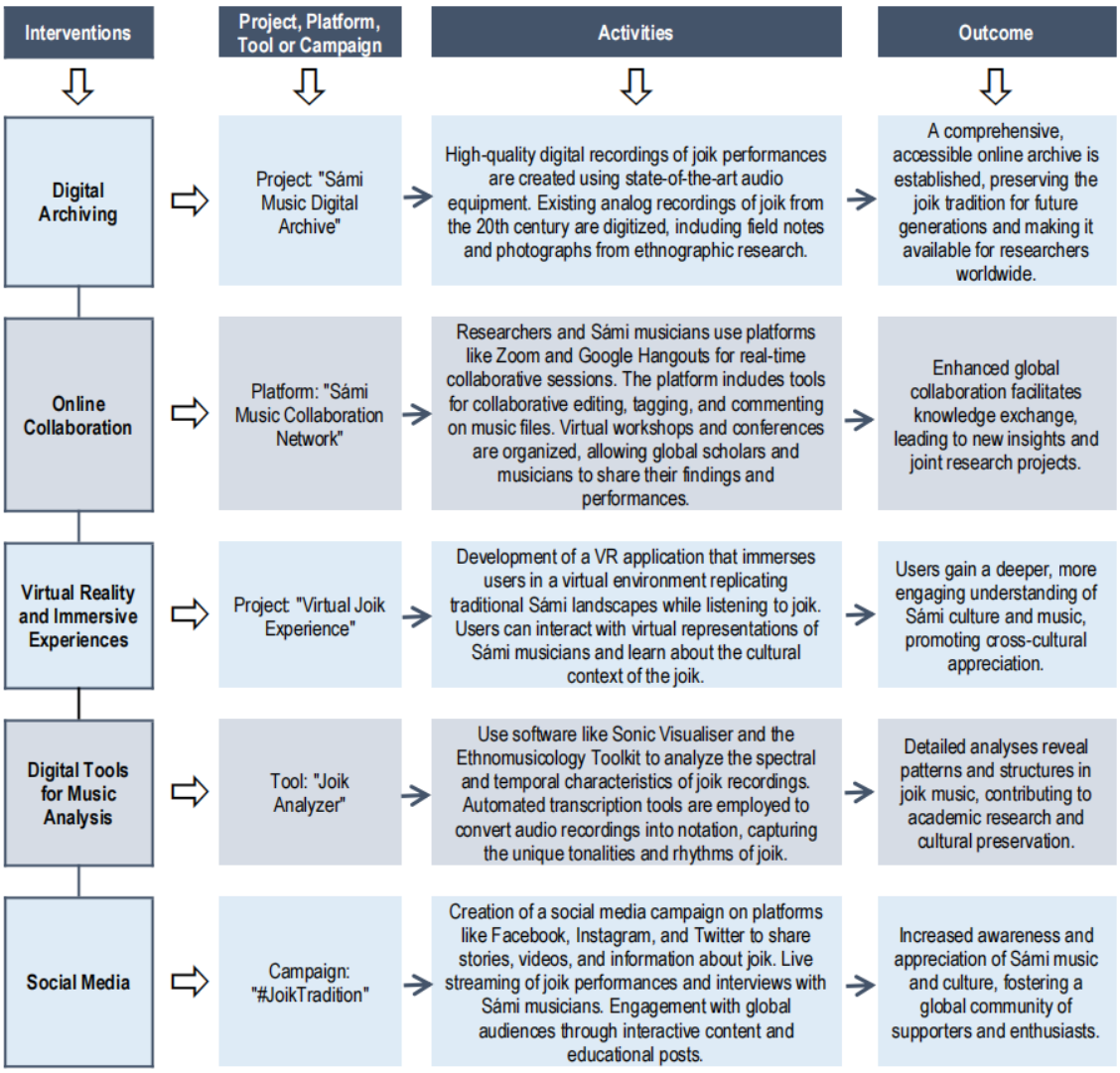

Figure 7. Example of Interventions of Industrial Revolution 6.0 in Ethnomusicology

Consequently, the demands of Industrial Revolution 6.0 in ethnomusicology are focused on the integration of new technologies and digital platforms to promote cross-cultural understanding, preserve cultural heritage, and facilitate collaboration between musicians and researchers. While there are certainly challenges and ethical considerations that need to be addressed when using new technologies in this way, the potential benefits are significant and could help to promote greater cross-cultural understanding and appreciation of music from around the world.

The Difficulties of Integrating Artificial Intelligence and Industrial Revolution 6.0 in Ethnomusicology

While the integration of artificial intelligence (AI) and Industrial Revolution 6.0 in ethnomusicology offers many potential benefits, there are also several challenges and difficulties that should be addressed. The following are some examples of the difficulties of integrating AI and Industrial Revolution 6.0 in ethnomusicology:

Lack of data

One of the primary difficulties of using AI in ethnomusicology is the lack of data available for training machine learning algorithms (Buenaflor et al., 2022; Casey et al., 2008; Holzapfel et al., 2018; Tabuena & Villareal, 2024). While there are certainly large datasets of music available online, many traditional musical styles and genres are not well-represented in these datasets. This can make it difficult to train algorithms to accurately transcribe, analyze, or generate music from different cultures.

Cultural sensitivity

Another difficulty of using AI in ethnomusicology is the need for cultural sensitivity and understanding (Born, 2020; Hesmondhalgh, 2008). Music is deeply tied to cultural identity and can be seen as a form of cultural heritage. As such, researchers and developers should be careful to approach the use of AI in ethnomusicology with cultural sensitivity and respect for the traditions and communities they are working with.

Ethical concerns

There are also ethical concerns around the use of AI in ethnomusicology (Falk, & Ingram, 2011; Grant, 2018). For example, there is a risk that AI could be used to exploit or appropriate traditional music and cultural heritage for commercial purposes. Researchers and developers should be careful to ensure that their work is respectful, transparent, and aligned with the values and priorities of the communities they are working with.

Bias and accuracy

Another difficulty of using AI in ethnomusicology is the risk of bias and inaccuracy in machine learning algorithms (Amilevičius, 2020; Widmer, 2003). For example,

algorithms trained on the basis of Western music may not accurately transcribe or analyze music from other cultures that use different scales, rhythms, and tonalities. Researchers and developers should work to ensure that their algorithms are trained on diverse datasets and are sensitive to the unique characteristics of different musical traditions.

Interpretation and meaning

Finally, there is a risk that the use of AI in ethnomusicology could lead to a loss of the interpretive and creative aspects of music analysis and interpretation (Dushniy et al., 2022; Silverman, 2008). While AI can certainly be used to transcribe, analyze, and generate music, it may struggle to capture the nuanced meanings, cultural context, and emotional depth of traditional music. Researchers and developers must be careful to balance the use of AI with more traditional methods of music analysis and interpretation.

Hence, the integration of AI and Industrial Revolution 6.0 in ethnomusicology offers many potential benefits, but also presents significant challenges and difficulties that must be carefully addressed. Researchers and developers must work to ensure that their work is culturally sensitive, ethically sound, accurate, and meaningful, and that it aligns with the values and priorities of the communities they are working with.

Nurturing the Demands of Artificial Intelligence in Addressing the Demands of Industrial Revolution 6.0 in Ethnomusicology

To nurture the demands of artificial intelligence (AI) in ethnomusicology in addressing the demands of Industrial Revolution 6.0, researchers and developers should focus on several key strategies such as follows:

Collaborative research

One effective way to nurture the demands of AI in ethnomusicology is to engage in collaborative research that involves both AI experts and ethnomusicologists (Ajibade et al., 2023; Bracknell, 2015; Negi et al., 2023). By bringing together experts from different fields, researchers can combine their knowledge and skills to develop more effective and culturally sensitive AI tools for ethnomusicology.

Diverse datasets

To address the lack of data available for training AI algorithms in ethnomusicology, researchers should work to gather more diverse and representative datasets of music from different cultures and traditions (Gómez-Cañón et al., 2021; Rabbi et al., 2022; Rochina-Chisag & Tabuena, 2022). This can be done through collaborations with ethnomusicologists and musicians from around the world, as well as through the use of online repositories and archives.

Cultural sensitivity and ethical considerations

To address the cultural sensitivity and ethical concerns around the use of AI in ethnomusicology, researchers should be transparent and consult with the communities they are working with (Martin et al., 2021). This involves taking a collaborative approach and involving community members in the design and implementation of AI tools, as well as ensuring that the data and algorithms used are respectful and aligned with community values.

Addressing bias and accuracy

To address the potential for bias and inaccuracy in AI algorithms, researchers should work to develop algorithms that are trained on diverse datasets and that are sensitive to the unique characteristics of different musical traditions (Pagano et al., 2023). This can involve the use of machine learning techniques that are designed to mitigate bias and ensure accuracy, as well as the use of traditional methods of music analysis and interpretation to complement AI tools.

Balancing AI with traditional methods

Finally, to address the risk of losing the interpretive and creative aspects of music analysis and interpretation, researchers should balance the use of AI with traditional methods of music analysis and interpretation (Dwivedi et al., 2021; Tabuena, 2021; Tabuena, 2020). This can involve using AI to automate certain aspects of music analysis and interpretation, while relying on more traditional methods for more nuanced and interpretive aspects of the analysis.

Accordingly, nurturing the demands of AI in ethnomusicology to address the demands of

the Industrial Revolution 6.0 requires a collaborative and culturally sensitive approach that involves diverse datasets, ethical considerations, addressing bias and accuracy, and balancing AI with traditional methods of music analysis and interpretation. By focusing on these strategies, researchers can develop more effective and culturally sensitive AI tools for ethnomusicology that address the demands of the Industrial Revolution 6.0.

The Implications of the Demands of Artificial Intelligence and Industrial Revolution 6.0 on Ethnomusicology

The demands of artificial intelligence (AI) and the Industrial Revolution 6.0 on ethnomusicology have significant implications for the field such as follows:

Preservation of cultural heritage

One of the most significant implications of AI in ethnomusicology is its potential to help preserve cultural heritage (Istvandity, 2021). By using AI tools to analyze and archive musical traditions from around the world, researchers can ensure that these traditions are documented and available for future generations to learn from and appreciate.

Increased access to music

Another implication of AI in ethnomusicology is its potential to increase access to music from around the world (Brusila et al., 2022; Tabuena et al., 2022a). By digitizing and analyzing musical traditions from different cultures and traditions, researchers can make this music more widely available to the public, including those who may not have had access to it previously.

New approaches to music analysis

The demands of AI and Industrial Revolution 6.0 on ethnomusicology also drive the development of new approaches to music analysis (Sleeper, 2018; Tabuena & Hilario, 2021; Tabuena et al., 2022b). By using AI to automate certain aspects of music analysis, researchers can focus their attention on more interpretive and creative aspects of analysis, leading to new insights and understandings of musical traditions.

Ethical considerations

However, the implications of AI and the Industrial Revolution 6.0 in ethnomusicology also raise ethical considerations (Price, 2017; Tabuena et al., 2021). As mentioned earlier,

researchers should take a culturally sensitive and collaborative approach to the use of AI in ethnomusicology, ensuring that the data and algorithms used are respectful and aligned with community values.

Changes in the role of the ethnomusicologist

Finally, the demands of AI and the Industrial Revolution 6.0 on ethnomusicology are likely to change the role of the ethnomusicologist (Hartley, 2022). With the increasing use of AI tools in music analysis, the role of the ethnomusicologist may shift from being the primary analyst to being a facilitator of AI tools, helping to interpret and contextualize the results generated by these tools.

Therefore, the demands of AI and Industrial Revolution 6.0 on ethnomusicology have significant implications for the field, including the preservation of cultural heritage, increased access to music, new approaches to music analysis, ethical considerations, and changes in the role of the ethnomusicologist. As with any technological innovation, it is important for researchers and practitioners to approach these demands with care, consideration, and collaboration to ensure that they benefit the field and the communities it serves.

Conclusion

The needs of artificial intelligence in ethnomusicology center on enhancing accessibility, comprehensibility, and engagement with music from diverse cultures for musicians, researchers, and audiences worldwide. Though challenges and ethical concerns should be addressed, the possible advantages are substantial and could encourage cross-cultural understanding and appreciation of music globally. On the other hand, the necessities of Industrial Revolution 6.0 in ethnomusicology concentrate on integrating new technologies and digital platforms to advance cross-cultural understanding, preserve cultural heritage, and foster cooperation among musicians and researchers. Although challenges and ethical considerations should be tackled when using novel technologies, the possible benefits are substantial and could promote cross-cultural understanding and appreciation of music worldwide.

Combining AI and Industrial Revolution 6.0 in ethnomusicology could have numerous benefits, but it also poses significant difficulties and challenges that should be carefully

addressed. Developers and researchers should ensure that their work is culturally sensitive, ethically sound, accurate, and meaningful, and that it aligns with the values and priorities of the communities they work with. To achieve this, nurturing the demands of AI in ethnomusicology to address the demands of Industrial Revolution 6.0 necessitates a collaborative and culturally sensitive approach that employs diverse datasets, addresses ethical considerations, handles bias and accuracy, and balances AI with traditional methods of music analysis and interpretation. Researchers can develop more effective and culturally sensitive AI tools for ethnomusicology that address the demands of the Industrial Revolution 6.0 by concentrating on these strategies.

Thus, the demands of AI and Industrial Revolution 6.0 on ethnomusicology have significant consequences for the field, such as preserving cultural heritage, enhancing music access, introducing novel approaches to music analysis, ethical considerations, and alterations in the role of the ethnomusicologist. As with any technological innovation, it is critical for practitioners and researchers to approach these demands with caution, consideration, and collaboration to ensure that they benefit the field and the communities it serves.

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