**A close-up of a logo

Description automatically generatedResearch Paper – AI Music Composition**

**Introduction:**

Music holds a profound significance in the lives of many, a source of inspiration, solace and means to express oneself in a unique emotionally connecting way. As noted by Sena Moore (2012), music is older than language, yet we’re still discovering new ways to make it and use it. With constant advancements in Artificial Intelligence (AI), the realm of music composition has additional avenues for creativity, collaboration and perhaps preservation. Tnohis research paper delves into the intersection of AI and music composition, exploring its potential and challenges.

The motivation for this project stems from a personal appreciation for the power of music to evoke emotions, transcend boundaries, and immortalize artists. Growing up, music was not merely a form of entertainment but a lifeline, capable of uplifting spirits and fostering connections. Certain artists resonated deeply, their music ­­serving as a conduit for self-expression and reflection.

(Too personal for Research paper?)

Tragically, the passing of great artists leaves a void in the music industry and the hearts of fans worldwide. With AI technology, there lies a new frontier of composition to be explored and potentially enabling new forms of musical collaboration between fans and artists with AI replicated, imagine AI as a very convincing karaoke partner, any famous musician you choose. AI can emulate the styles, voices, and even the creative processes of these artists, offering a means to continue their musical journey posthumously.

**Relevance of AI in Music Composition:**

AI's role in music composition extends beyond mere replication, encompassing a spectrum of capabilities that redefine the boundaries of creativity and innovation. By leveraging machine learning algorithms, AI can analyse vast repositories of musical data, identify patterns, and generate compositions that resonate with individual tastes and preferences, replicating unique styles.

Furthermore, AI serves as a collaborator and catalyst for artistic exploration, enabling musicians to experiment with novel sounds, arrangements, and genres. Its adaptive nature allows for the customisation of musical elements, tailoring compositions to suit diverse contexts and audiences.

**Literature Review:**

**Discuss existing research on AI music composition:**

Initial approaches to AI music composition implemented rule-based systems, limited in flexibility yet laying the foundation for later progress, composers encoded predefined rules of harmony, melody, and rhythm into algorithms to generate compositions. More recently there has been a surge in generative models for music composition, leveraging techniques such as deep learning and neural networks. Learning from vast datasets of existing music to generate a new artwork that resembles stylistic coherence and creativity indistinguishable from a human composition. Variants of these models include recurrent neural networks (RNNs), long short-term memory networks (LSTMs), and generative adversarial networks (GANs), each offering a unique approach to music generation.

A notable example is the creation of the "Illiac Suite" by the American composer Lejaren Hiller and the physicist Leonard Isaacson in 1956. They used the ILLIAC I, one of the earliest computers, to generate music.

Referenced below is another approach called “A Hierarchical Recurrent Neural Network (HRNN) for Symbolic Melody Generation”, by Jian Wu and others, it consists of three LSTMs subnetworks working in a coarse-to-fine manner along time. Generating bar and beat profiles and notes, in turn the output of the high-level subnetworks is fed into the low-level subnetworks, serving as guidance to generate the finer time-scale melody. Compared with recently proposed models MidiNet and MusicVAE, the HRNN produces better melodies according to human evaluation (vol. 50, no. 6, June 2020).

Interactive AI systems empower musicians to engage with AI in real-time, for example - autotuning their voice while performing live. These systems respond to user input, adapt to personal preferences, and allow collaboration.

Despite significant progress, AI music composition poses several challenges, including the evaluation of generated compositions, preserving musical authenticity, and the ethical implications of AI-generated content. Copyright concerns are included in difficulties. Researchers are constantly offering various evaluation metrics such as coherence and emotional expressiveness to assess AI objectively. However, concerns of copyright, ownership and cultural authenticity remains an ongoing area of inquiry.

**Explore studies related to genre creation and style synthesis in AI-generated music.**

Review notable works in the intersection of AI and music, especially those addressing genre fusion.

In terms of genre fusion, “Jukebox: A Generative model For Music”, an OpenAI released in 2020 is a state-of-the-art generative model developed for creating music in various styles and genres. Trained on a diverse dataset of music spanning multiple decades and genres from pop, rock, jazz, rap, classical, Jukebox generates high-fidelity audio sample with realism and stylistic coherence. This model’s ability to synthesize music in diverse genres opens possibilities for genre fusion. Jukebox can focus on artist and genre to steer the musical and vocal style, and on unaligned lyrics to make the singing more controllable. It releases thousands of non-cherry-picked samples along with model weights and code, the open-source aspect allows the source code to be accessed freely to be redistributed and modified for further development and customization. The Jukebox model learns in an unsupervised way, clustering similar artists and genres close together. A very impressive model.

**Problem Statement:**

Current AI music composition models often struggle to effectively fuse elements from multiple genres [reference], suffering due to bias towards certain genres or rigid genre specific models, limiting the combination, and collaboration of existing styles into new hybrid genres.

AI in music composition raises ethical and legal concerns relating to copyright, cultural appropriation, and ownership of creative works. Principles such as fairness, reliability, safety, privacy, security, inclusiveness, transparency, and accountability must be followed when ethically developing AI.

Highlight the challenges and gaps in current AI music composition systems regarding genre synthesis.

Querying systems such as ChatGPT lack deep understanding of the intricacy specifying different music genres, authentically embodying stylistic traits successfully blending multiple instruments, perhaps cultural contexts associating diverse genres.

Clearly defining a genre in terms of characteristics, aesthetics, mood, tempo, instrumentation

**Objectives:**

**Clearly state the objectives of your project.**

In this project the goal is to use an AI system to

* Test AIs ability to identify, compose and blend music genres.
* Utilise AI to create a new, unique music genre by blending multiple existing ones.

What else?

**Define what success looks like in terms of AI-generated music within the newly proposed genre.**

Ability of the AI system to produce music within the newly proposed genre that successfully and authentically embodies the desired traits, merging diverse influences from around the world.

How will we measure success?

* Coherence
* Consistency
* Demonstrate stylistic elements from selected genres.
* Evoke emotional responses in listeners (as per the associated genre).

The music produced should be coherent and consistent it should effectively incorporate stylistic elements from selected genres. It’s also important the music evokes an emotional impact on the listener, relating and resonating with the newly proposed genre. Capable of eliciting a range of emotions from introspective reflection to energetic excitement. Success will be measured according to human evaluation, artists, composers, or music enthusiasts.

* Survey (MS forms, or survey monkey)
  + Qs to collect info on coherence, consistency, stylistic elements and emotional response. (rank songs 1-10).

Lookup more research papers on how (it’s not just your opinion what makes a good composition)

For every song that AI creates, must be able to measure how much it achieved in each of the four bullet points (coherence consistency, genre elements, emotional response).

**Methodology:**

Describe the AI techniques and algorithms you plan to use for music composition.

The plan is to suggest artists to ChatGPT to blend and take inspiration from to suggest a new genre name, for example when we suggest Juice WRLD, Mac Miller, Tame Impala and Bob Marley we get, ‘Psychedelic Reggae Rap Fusion’.

Explain how you intend to incorporate the stylistic elements of Juice WRLD, Mac Miller, Tame Impala and Bob Marley into the AI-generated music.

Beautifully portrayed by Briana Younger in her article on the New Yorker, “The world often speaks of black boys and their anger but rarely of their sadness; Juice forced us to see”, Juice WRLD and Mac Miller are iconic for their introspective emotionally raw lyrics, exploring themes of mental health, personal struggles, and self-reflection, His catalogue became a soundtrack for mourning lost relationships as much as for mourning oneself”. (Dec 9 2019) AI-generated music can incorporate similar lyrical themes, taking inspiration from their storytelling and their undeniable self-expression. Jarad and Mac’s music is deeply rooted in hip-hop incorporating intricate flows and melodic hooks, AI attempts to capture the essence of their styles. Both artists also experimented with innovative production techniques, blending genres, and incorporating eclectic sounds into their music. The AI-generated composition can explore similar production styles, choosing diverse instrumentation sample-based beats, and atmospheric effects to create a dynamic and immersive sonic landscape.

Tame Impala’s music is characterised by its psychedelic soundscapes, dreamy atmospheres, and lush instruments (swirling synths, layered guitars, trippy effects) to create a surreal and immersive listening experience. Kevin Parker is known for melodic complexity and harmonic richness. Goal is to explore melodic motifs, chord progressions, harmonic structures inspired by Tame Impala’s music adding depth and texture to the overall sound of our newly generated compositions.

Bob Marley’s infectious groovy rhythms combine skanking guitar patterns with pulsating basslines and syncopated drumbeats capturing the essence of Marley’s iconic sound. Bob Marley’s lyrics often address social and political issues, advocating for love peace and unity. AI can take inspiration from these themes, producing similar ones of social awareness, reflecting global issues and cultural identity relating to human experience.

Selecting artists from diverse genres such as hip-hop, psychedelic rock and reggae, the aim is to blend their unique stylistic elements to create a new musical genre transcending conventional boundaries, combining the best qualities/sounds from each. Creating a musical experience transcending genre constraints, resonating with audiences from all cultural and generations.

**Data Collection:**

Discuss the dataset you will use to train the AI model.

\*\*Selecting a variety of released, unreleased, songs, albums, mixtapes, playlists from selected artists.

Compile dataset of lyrics from the above including studio sessions displaying progression of each artist over time as they discovered their individual sound. Referenced for generating AI-written lyrics.

Thoroughly analyse production techniques and instrumentations used, studying the structure and flow of beats, samples, melodies, vocal effects to replicate their signature sound.

Collect audio samples, stems, acapella recordings from Tame Impala’s live performances and songs.

Study the melodic motifs, chord progressions and harmonic structures present in Kevin’s work. His visually distinctive soundscapes using production techniques emulate the unique psychedelic style.\*\*

By querying ChatGPT 3.5, recommending the above artists to blend it will generate a name for our new genre, ‘Psychedelic Reggae Rap Fusion’.

Next it will be prompted for a chord progression to be written, a bassline, notes for melody, lyrics

Explain how you plan to curate data that reflects the musical styles and characteristics of Juice WRLD and Mac Miller, Tame Impala and Bob Marley.

**System Architecture:**

Provide an overview of the AI music composition system you're developing.

Detail the components of your system, including any pre-processing steps, model architecture, and post-processing steps.

Pre-process previously created dataset comprising of compositions from selected artists. This dataset will server as the training data for the AI model, to learn artist’s style and characteristics.

Examine dataset to find similar chord progressions, melodic patterns, rhythmic structures, also used to train the model.

Code a deep learning model such as RNN used to learn and generate musical compositions.

Implement training algorithm which optimises the model parameters based on input data and desired output. Iteratively adjusting model’s weight to minimise the difference between generated compositions and targeted stylistic elements of selected artists.

Validate trained model using separate validation dataset and conduct testing to evaluate its performance in generating compositions which accurately reflect musical styles of targeted artists.

Post-process to refine and enhance generated compositions, improving coherence, structure and quality (tempo).

(Incorporate feedback into training process?)

**Implementation:**

Present the technical details of your AI music composition implementation.

Include code snippets, diagrams, or flowcharts to illustrate key aspects of your system.

**Evaluation:**

Define the metrics you'll use to evaluate the success of your AI-generated music.

Using metrics to evaluate the success of this project may be subjective, however assessing the smoothness and logical progression of melodies and harmonies within generated compositions.

Coherence and musical logic throughout are a necessity. Timing and overall groove may be assessed.

Evaluate the level of originality and creativity composed by the AI system. Consider the emotional engagement and reflection resonating with the listener.

Present results, comparing AI-generated music samples to the stylistic elements of Juice WRLD and Mac Miller.

**Discussion:**

Interpret the results, discussing the strengths and limitations of your AI music composition system.

Address any unexpected challenges encountered during the project.

**Conclusion:**

Summarize the key findings of your research.

Discuss the contributions of your work to the field of AI music composition.

**Future Work:**

Propose potential avenues for future research or improvements to your system.

Consider how the project could be extended or refined.

**References**

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* [**The Beautiful Vulnerability Of Juice WRLD – Briana Younger December 9 2019**](https://www.newyorker.com/culture/postscript/the-beautiful-vulnerability-of-juice-wrld)

**Introduce the motivation for the project.**

**Explain the relevance of AI in music composition.**

AI can assist artists in generating and mastering tracks, collaborating with the user.

It can also adapt to individual musical styles, autotuning each composer uniquely.

Additionally, AI can compose music for those who can no longer. Growing up music would lift my mood, I couldn’t go a day without it, certain artists would immediately lift my spirit, certain tracks giving instant goosebumps. The only way I can describe it is when the rhythm and beat started, my soul would rise with the flow of emotional positive energy emanating from the artists creating the music.

The particular artists that resonated with me, growing up, are Juice WRLD and Mac Miller, both of whom have now unfortunately passed. At the time I watched all the existing footage of Jarad Higgins (Juice WRLD), as he died when he was just 21; but now with the assistance of AI it almost feels as if he’s still alive, as it can manipulate other voices to sound like his. Jarad had an incredible ability to “freestyle”, he motivated me to practise and learn myself, with the dream of one day freestyling with him. Perhaps with AI that could be possible now. Fans can try and recreate music in his style, or collaborate on new songs.

Briefly introduce Juice WRLD, Mac Miller, and their influence on the proposed genre.

Juice WRLD was in the process of creating his own musical genre,