**Research 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. Music is older than language [Would be good to get a reference for this if possible], yet we’re still discovering how to make it and how to use it. With constant advancements in Artificial Intelligence (AI), the realm of music composition has additional avenues for creativity, collaboration and perhaps preservation. This 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.

Tragically, the passing of these artists left a void in the music industry and the hearts of fans worldwide. [I think you might get away with the last paragraph but this line is a bit too personal for a research paper. Really things should only be written if they are factual and give context to this piece of research. While Juicewrld dying did have an impact on you, it’s not relevant to the general field of exploring AI and music composition.] With AI technology, there arises a glimmer of hope [not factual, would need to be something more like “with AI technology, there lies a new frontier of composition to be explored..”] for preserving their legacy and enabling new forms of musical collaboration. AI can emulate the styles, voices, and even the creative processes of these artists, offering a means to continue their musical journey posthumously. [Last sentence very good].

**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. [very good].

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. [very good].

**Literature Review:**

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

(Earlier) (Earlier isn’t the best word here, maybe say initially) 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. In recent years 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. 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. [very good].

Referenced below is another approach called “A Hierarchical Recurrent Neural Network (HRNN) for Symbolic Melody Generation”, by Jian Wu et al. 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 evaluated by humans. [Do you have a reference for this last sentence? Or does that also come from the “Jian Wu” paper?]

Interactive AI systems empower musicians to engage with AI in real-time, autotuning their voice while performing live for example. 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. [very good].

**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 condition an artist and genre to steer the musical and vocal style, and on unaligned lyrics to make the singing more controllable. They release 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. [very good].

**Problem Statement:**

Current AI music composition models often struggle to effectively fuse elements from multiple genres, suffering due to bias towards certain genres or rigid genres specific models, limiting the combination, and collaborating 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.

Clearly define the problem you aim to address – the creation of a new music genre by AI. [This isn’t exactly a problem, moreso a goal you’re trying to achieve. The problem lies around AIs inability to effectively fuse different genres. You’re aiming to address this problem by exploring… the creation of a new music genre by AI] .

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

[The challenges and gaps are the things that AI is struggling with, what issues did other researchers find when they tried to compose music with AI? You’ve mentioned the problem above, which is AI can’t mix genres, but what specifically are the challenges. How are you going to use AI to try and avoid or overcome these challenges? You’re trying to make the point that you’ve read and understood what previous researchers have tried and you can see an opportunity to try it a different way]

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. [This is worded a bit funny, not too sure what it’s saying]

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

[Defining all of these things gives context to what you’re going to try to do with your research. Explain what aspects of music composition you want to experiment with, and how you intend to do it].

**Objectives:**

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

In this project the goal is to use an AI system to create a new unique music genre blending multiple existing ones. Including complementary instruments, tempos, [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.

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. [Not sure if that sentence is needed]. Success could also be measured by human evaluation, artists, composers, or music enthusiasts. [I think you could do with one or two more lines on how success will be measured, this is kind of the “experiment” part, so it’s important to try and treat it like a scientist as much as you can. So you could say you’re looking for:

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

And then you have to be definite about ho you’re going to measure the sucesss, so don’t say “Success could be measure by..” say “Success will be measured according to…”

And then you have to decide how. You might need to look up some more research papers and see how they measured it, because (unfortunately) it can’t just be your opinion on what’s a good chune. For every song that the AI creates you have to be able to measure how much it achieved each of the four bullet points up there (coherence, consistency, genre elements and 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’. [Pretty good and I think that also addresses one of my comments further up, where I said to say specifically what you’re experiment will be. Try to give a bit more detail though, like I think you could probably put together a list of questions that you’ll ask ChatGPT each time, or even just paste in the first question you asked ChatGPT. Also, in research papers you generally try to write in the past tense, so you would say “The plan was to suggest”, not “The plan is to suggest”.

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

Juice WRLD and Mac Miller are iconic for their introspective emotionally raw lyrics [this needs a reference, otherwise it’s just your opinion and not a fact], exploring themes of mental health, personal struggles, and self-reflection. AI-generated music can incorporate similar lyrical themes, taking inspiration from their storytelling and their undeniable self-expression [again, a little too opinionated, unless you can reference it]. 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. [very good].

[Maybe one closing paragraph on the four artists as a group? As in why did you choose artists from these genres and what outcomes might you expect from mixing them?]

**Data Collection:**

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

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.

**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**

* [**https://www.youtube.com/watch?v=NS2eqVsnJKo**](https://www.youtube.com/watch?v=NS2eqVsnJKo)
* [**https://www.ceeol.com/search/article-detail?id=780725**](https://www.ceeol.com/search/article-detail?id=780725)
* [**https://ieeexplore.ieee.org/abstract/document/8918424?casa\_token=YVTnZo\_iyDwAAAAA:QAX-8W3rTs7NLDpUpZ-ASPKvoDPSXGZShZY\_WDdHgMGds4BITHgtg2XBWX-NW\_bD2SBK\_Sa8DA**](https://ieeexplore.ieee.org/abstract/document/8918424?casa_token=YVTnZo_iyDwAAAAA:QAX-8W3rTs7NLDpUpZ-ASPKvoDPSXGZShZY_WDdHgMGds4BITHgtg2XBWX-NW_bD2SBK_Sa8DA)
* [**https://openai.com/research/jukebox**](https://openai.com/research/jukebox)

**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 could describe it was when the rhythm and beat came on my soul would rise with the flow of emotional positive energy from the artists working with the tune.

These certain artists happen to be Juice WRLD and Mac Miller who unfortunately have passed. At the time I watched all the existing footage of Jarad Higgins as he was only around for a couple years, now with AI’s assistance it almost feels like he’s still alive as it can manipulate voices to sound like his. Jarad had an incredible ability to freestyle, he motivated me to practise and learn myself in hope of one day freestyling with him. Perhaps with AI that could be possible now. Allowing fans to try and recreate music in a style he may have. 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,