AI Muses: Where Greek mythology and modern technology meet to create inspiring and innovative music. Using machine learning algorithms, AI-generated music serves as a limitless source of creative inspiration, much like the muses of ancient times.

Music Generating Transformers

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AGENDA

- AI Generated Music
- Research Question
- ML Algorithms
- Sources of Bias
- Dataset
- Citations

Music is the pleasure the human mind experiences from counting without being aware that it is counting.

—GOTTFRIED LEIBNIZ

Music and math have a deep connection, as many musical patterns and rhythms can be expressed as mathematical equations. With the help of AI, we can explore this connection even further, using algorithms and machine learning models to analyze and generate music based on their mathematical patterns.

Machine Creativity

The very first music synthesized with computers was at Bell Labs.

The First Human-Machine Music Collab 🔥💯💯

The first computer-generated music dates back to 1957 with "**The Silver Scale**" a 17-second melody created by Newman Guttman using the sound synthesis software Music I, developed at Bell Laboratories.

Musical Tools

Throughout history, humans have invented and refined machines capable of generating music, from mechanical music boxes to modern synthesizers.

AI GENERATED MUSIC; Learning to Imitate Art

midjourney v5: a robot playing the violin, canon 5 0 mm, cinematic lighting, film, photography, depth of field, award-winning

Paradigms of AI Music Generation

Expert Systems
Markov Chain Model
Neural Nets
Evolutionary Algorithms

The Rise of Generative AIs

Today, Generative AIs are pushing the boundaries of what is possible, serving as a limitless source of inspiration and innovation.

Potential for another source of inspiration for musicians.

These forms can act as a form of creativity and inspiration for musicians, and make music creation more accessible to those that don't have access to formal musical training or resources.

Make Faster Sound Assets

Generate background music for video games, films, and television shows.

AI GENERATED MUSIC

IMPACTS

BENEFITS

- Reduce time and effort of composers by using algorithms to create new music quickly and efficiently, allowing them to focus on refinement and perfecting final composition faster
- Creation of new and unique musical styles and genres through AI

DISADVANTAGES

- Concern about potential job losses and replacement of human musicians and composers
- Use of AI could lead to “homogenization” of musical styles via the algorithms and an overall decline in music quality

ETHICS

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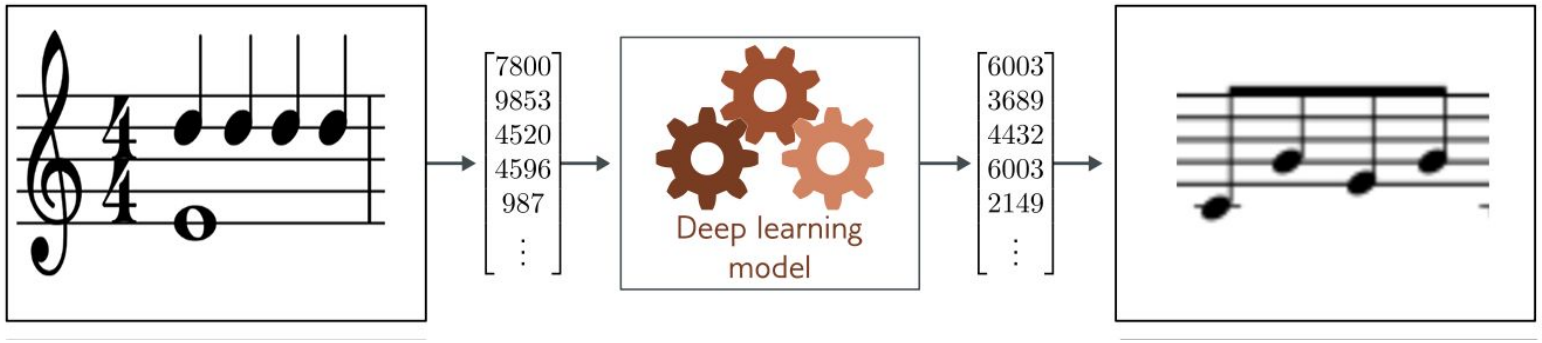
- In David Cope’s 1997 work, “Classical Music Composed by Computer”, the artist successfully demonstrated only partially using AI and that his work was the result of sufficient human creative input.
  - Each work should be individually evaluated. The more human involvement and AI used as a “tool” not the creator – the stronger the case for copyright protection

AI TRAINING

- In Oct 2022, Recording Industry Association of America (RCAA) declared AI based extractors and mixers were infringing on artists’ rights by using their music to train the AI model
- AI trained on dataset of public-domain/Creative Commons music and music submitted voluntarily by artists who have “opt-ed in”
  - Harmonai (Dance Diffusion)

RESEARCH QUESTION

How do different technical factors, such as model architectures and training techniques, affect the ability of generative AI music models to learn and replicate the styles of multiple composers, genres, or cultures?



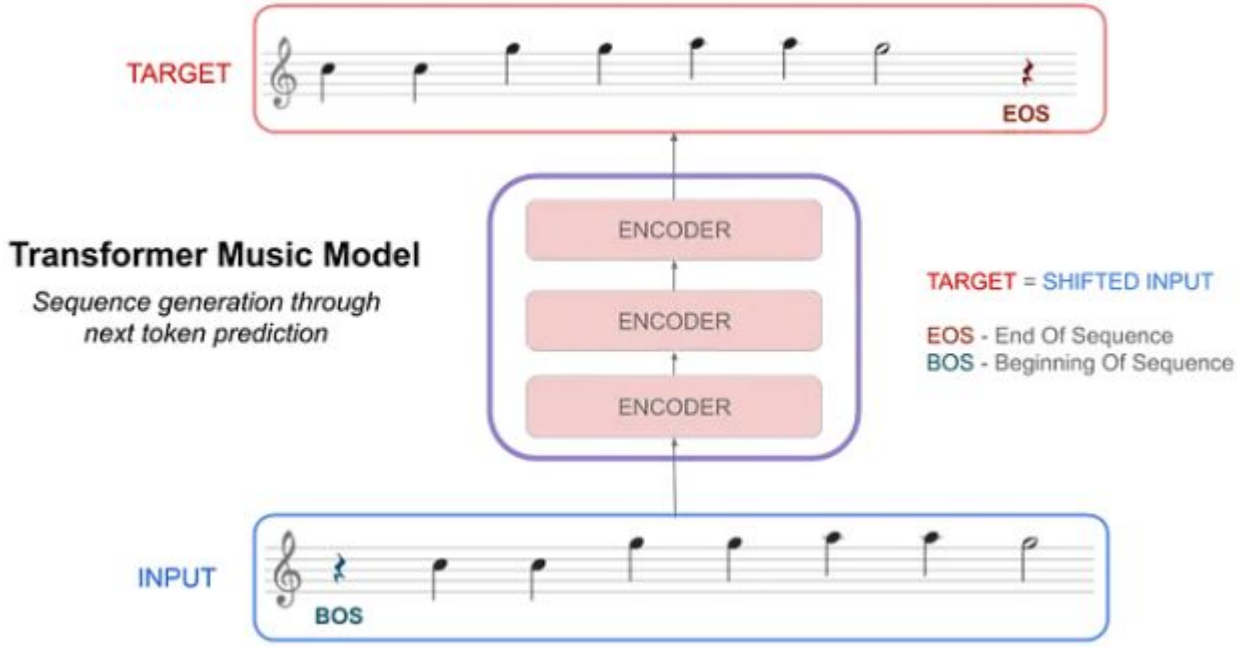
Methods

Autoregressive Models

generating new music sequences by modeling the statistical dependencies between the notes in a sequence.

RNN + LSTM	Transformer
Music Recommender Systems	Music Generation
Style Transfer	Harmonization
Collaborative composition	Music Variations
Music Generation	Interactive Music Generation

Transformer Method



1. Convert data (music files) into sequence of tokens
2. Build and train the model to predict the next token

Transformer Method

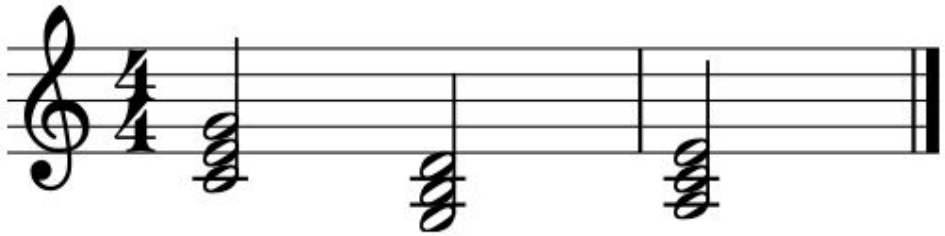
“HookTheory” Example with the most popular chord in pop music: “I - V - vi - IV” chord

Transformer Method

“HookTheory” Example with the most popular chord in pop music: “I - V - vi - IV” chord

1. Input “I - V - vi” chord:

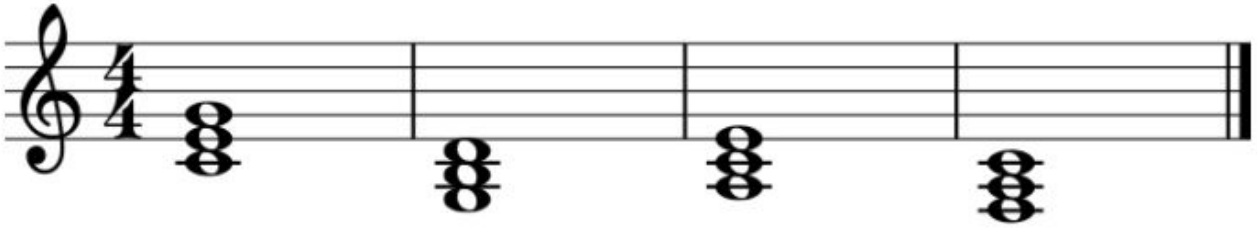
It looks like this: [C-E-G] — [G-B-D] — [A-C-E]



Model Input: First 3 chords (I-V-vi)

2. Predicted “IV” chord:

Here’s what we get back (3 input chords are included):



Model predicted the final chord — IV

Potential Sources of Bias

There are many biases presented in musical generation that we may need to keep in mind. Including, but not limited to:

Sampling bias: Training datasets can be heavily biased towards one genre of music or towards one style of music. This can lead to reduced efficacy in other genres or styles of music.

Algorithmic bias: The length of the training sequences can also affect the model's accuracy. If the model is trained on shorter sequences, it may struggle to generate longer musical pieces.

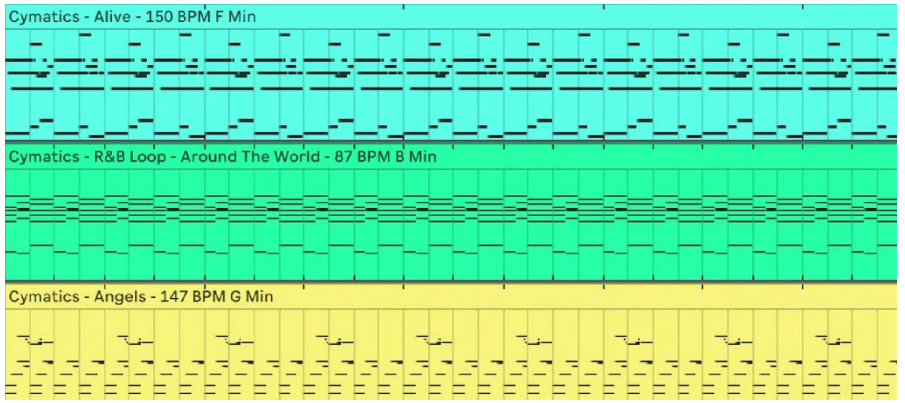
Measurement bias: Annotations (labels) in the dataset are prone to subjective human bias and human errors.

Datasets

**The dataset(s) is subject to change. We intend to explore them during our development process, and that some datasets may be modified, added, or removed.*

The Lakh MIDI Dataset v0.1	The Maestro Dataset	Aligned Scores and Performances (ASAP)	r/datasets Largest MIDI Dataset User-curated MIDI	Tegridy MIDI Dataset
collection of 176,581 unique MIDI files, 45,129 of which have been matched and aligned to entries in the Million Song Dataset. https://colinraffel.com/projects/lmd/	Contains over 200 hours of MIDI recordings of classical piano music https://github.com/fosfrancesco/asap-dataset	236 distinct MIDI musical scores and 1067 performances of Western classical piano music from 15 different composer. https://github.com/fosfrancesco/asap-dataset	User-curated MIDI dataset of over 130,000 Midi Files of Pop, Classical, EDM, Video Game, Movie/TV Theme https://www.reddit.com/r/datasets/comments/3akhxy/the-largest-midi-collection-on-the-internet/	User-curated list of multi-instrumental MIDI dataset intended for AI Musical Generation https://github.com/asigalov61/Tegridy-MIDI-Dataset

Music Representation
Musical data can be seen as symbolic and discrete in nature. **Musical Instrument Digital Interface** (MIDI), a standard file format for representing musical data, including notes, velocity, timing, and control changes.



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