

Music Streaming Services with AI Implementation

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1 Introduction

There is no debate that nowadays humanity constantly moves towards automation in every aspect of our daily lives, one of them being music. According to a new report from MIDiA, an entertainment research firm, 523.9 million people are subscribed to music streaming services (second quarter of 2021) [14]. Over 60,000 new tracks are uploaded only to Spotify every day [12] and AI is critical in helping sort through the options and delivering recommendations to listeners based on what they have listened to in the past. The problem is that most recommendations are too simple and uninteresting, the music that is being suggested to users only depends on the artist that they listen to and not the actual music style.

Most Streaming Services use special algorithms that help users in numerous different ways from assistance in exploration to recommendations based on users actions and data. These algorithms are called *Music Recommendation Systems (MRS)* and they choose items from music databases for the users based on specific item attributes and guide users through large music libraries. MRS analyse users actions such as liked/disliked songs, song skipping and feedback given, where user explains what they like/do not like in order to produce individual recommendations. Research paper "Unboxing the Algorithm"[16] showed that users "*reacted positively to the understandable dialogue with the prototype*" and "*valued the element of surprise during algorithmic music discovery*", meaning that AI is a helpful tool for user experience and there is potential in developing this area.

Furthermore, I believe that it is important to understand how AI is used in creation of new music, because it can seriously impact the Music Industry, resulting in great change of user experience while using music streaming applications. Therefore, this report will also contain the overview of new AI-based technologies that are now used in music creation.

2 What Changed?

2.1 Music made by AI

Such services as AIVA[1], that "compose emotional soundtrack music" are becoming more and more popular, due to the fact that copyright laws do not apply to them. The company built an AI system that uses machine learning to train itself by reading over 30 000 classical music scores from the world's greatest composers[6]. The system looks for patterns in the scores to infer a set of mathematical rules that are adopted to create original compositions.

Mastering is the final step of the production process, where music engineers make music sound balanced, cohesive, uniform, professional and ready for commercial release. LANDR[2] is a cloud-based music creation platform that has an automated mastering engine which utilises machine learning to replicate the processes human engineers make when making a track[3].

2.2 Music's Mood

Today music can be analysed to find its mood[8]. A study *Music Emotion Recognition: Toward new, robust standards in personalized and context-sensitive applications*[10] shows that by using *Music Emotion Recognition (MER)* algorithm it is possible for AI system to figure out the mood of any song. This system uses *Taxonomy* which is a particular annotation scheme of music theory and cognition studies for emotion modeling to split music into complex and basic emotions that complete the "*Core Affect*" of a musical composition.

2.3 Stem Technology

What is a "*Stem*" in music? Essentially it is an individual piece of a whole song (vocal, drums, melody, etc.)[7]. The Stem Algorithm allows to split those stems into single parts by isolating the rest. "Cassiopeia"[4] is an example of a neural network that extracts instrumentals and voice tracks from songs. The goal of using stems is to make music creation and mixing easier for DJs, musicians, sound producers, engineers as well as other music professionals. However, it not only helps to make music, but also provides endless possibilities for users to listen to the same song with different stems in it.

3 What Now?

In this section we will look how existing Streaming Services use AI and try to improve their recommendations for users.

3.1 Spotify

Spotify is an undisputed leader in the music streaming industry that provides "Discover Weekly" playlist that is put together using 3 main algorithmic

models[11]:

- Collaborative Filtering - algorithm that looks at user-created playlists that include the same tracks that the given listener plays, then it analyses the songs other users included in the same playlists and filters out common ones to suggest to the listener.
- Natural Language Processing (NLP) - is a tool that translates human speech to text. Spotify uses it to assign *key words* to songs and artists to then recommend songs with similar *key words* to listener.
- Audio Models - algorithm that helps less popular songs end up in "Discover Weekly".
- Convolutional Neural Networks - system that inspects audio files and makes a list of its properties to then compare it to what user listens to and suggest alike compositions.

3.2 Apple Music & Shazam

Apple Music builds the AI-powered *Genius Playlists*[11] which are created when a user likes or adds to his library a single song. The app then scans through the entire catalog of previously played playlists, liked and disliked songs, and skips, collecting pieces that it considers to be in the same *vibe* and puts them in an instant playlist for a listener.

3.3 Others

Amazon Music offers help of their AI companion - Alexa - to find new music. Alexa is capable of speech recognition and, therefore, it quickly finds songs based on lyrics that user remembers.

Pandora, a less popular streaming service, is incredibly good at making personal recommendations[13]. Pandora analyzes hundreds of attributes of the songs using AI technology to match users taste, making the recommendation independent of genre or artists.

4 What the Future Might Look Like

4.1 Intelligent AI

As I have previously mentioned the current problem for most Streaming Services is simplistic and uninteresting recommendations. In my opinion, with all the technologies described above, it is possible to make better recommendations. The core aspect of that is to look for *similar music, not artist and try to describe music style to AI*. It can be possible to bring auto created playlists that will be split into different mood sections, changing depending on time of the day, and give users an option of choosing what to listen to[5].

4.2 Music Creation for Streaming

In 2021 a project "Lost Tapes of the 27 Club"[17] drove a lot of attention of both musicians and computer scientists. Originally aimed to change the conversation about mental health in the music community "Over The Bridge" - the company behind these new songs - used AI to recreate songs by artists that have passed away. Project used Google "Magenta" that uses machine-learning to teach computers to recognise patterns[9].

When the public heard those songs they were shocked at first, but still enjoyed new songs. Therefore, my view is that in the near future we may see completely new songs created by AI based on user preferences or neural networks in streaming services that analyse individual listener's likes and attempt to create original songs based on that[15].

References

- [1] About AIIVA : <https://www.aiva.ai/about>.
- [2] About LANDR : <https://www.landrr.com/en/online-audio-mastering/>.
- [3] About LANDR Mastering: <https://support.landrr.com/hc/en-us/articles/115009725688-What-is-LANDR-Mastering->.
- [4] About LALAL.AI and their algorithm: <https://www.lalal.ai/about/>.
- [5] Damak K, Nasraoui O and Sanders WS (2021) Sequence-Based Explainable Hybrid Song Recommendation. *Front. Big Data* 4:693494. doi: 10.3389/fdata.2021.693494.
- [6] Ai that composes complex instrumental music for movies, games, advertising and other types of digital media. *CORDIS: European Commission*, July 2020. Web Article: <https://cordis.europa.eu/article/id/421438-ai-composers-create-music-for-video-games>.
- [7] Sophia Atkinson. Stems in music production: What are they why are they useful? February 2021. Web Article: <https://www.musicgateway.com/blog/how-to/stems-in-music-production-what-are-they-why-are-they-useful>.
- [8] Laura Gorrieri. Discover music's mood with expert.ai. *towards data science*, November 2021. Web Article: <https://towardsdatascience.com/discover-musics-mood-with-expert-ai-459fb2e73b57>.
- [9] SKYLAR GRACE. The ai behind the 'lost tapes of the 27 club'. *Student Pocket Guide*. Web Article: <https://www.thestudentpocketguide.com/2021/05/entertainment/technology/ai-lost-tapes-27-club/>.

- [10] Juan Sebastián Gómez-Cañón, Estefanía Cano, Tuomas Eerola, Perfecto Herrera, Xiao Hu, Yi-Hsuan Yang, and Emilia Gómez. Music emotion recognition: Toward new, robust standards in personalized and context-sensitive applications. *IEEE Signal Processing Magazine*, 38(6):106–114, 2021.
- [11] Tigran Hovsepyan. How ai is transforming music streaming services. *plat AI*, September 2021. Web Article: <https://plat.ai/blog/how-artificial-intelligence-is-transforming-music-streaming-services>.
- [12] Tim Ingham. Over 60,000 tracks are now uploaded to spotify every day. that’s nearly one per second. *Music Business Worldwide*, February 2021. <https://www.musicbusinessworldwide.com/over-60000-tracks-are-now-uploaded-to-spotify-daily-thats-nearly-one-per-second/>.
- [13] Rajasimha Koppula. How music streaming services are tapping into the ai vibe. *PRESCOUTER*, March 2018. Web Article: <https://www.prescouter.com/2018/03/music-streaming-services-ai/>.
- [14] Mark Mulligan. Global streaming music subscription market. January 2022. <https://www.midiaresearch.com/blog/music-subscriber-market-shares-q2-2021>.
- [15] Ty Pendlebury. Music streaming service uses ai to make up music on the spot. *C—net*. Web Article: <https://www.cnet.com/tech/services-and-software/music-streaming-service-uses-ai-to-make-up-music-on-the-spot/>.
- [16] Anna Marie Schröder. Unboxing the algorithm: Understandability and algorithmic experience in intelligent music recommendation systems. 49, June 2021. URN Identifier: <http://mau.diva-portal.org/smash/record.jsf?pid=diva2>
- [17] JAXON SILVA. The lost tapes of the 27 club: A project on what could’ve been. *MUSTANG NEWS*, APRIL 2021. Web Article: <https://mustangnews.net/the-lost-tapes-of-the-27-club-a-project-on-what-couldve-been/>.