

Automating Spotify Playlist Creation using

Machine Learning

Interim Report

TU856

BSc in Computer Science

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Abstract

This project aims to create a new way for listeners to find music that they enjoy, using machine learning. This project explores the shortcomings of the music recommendation systems that are currently popular and aims to address such shortcomings through a new recommendation system. The project focuses on addressing perceived issues in the most widely used music streaming platform – Spotify.

This system will be presented through a web application that connects to a user’s Spotify account and accesses their data. The user is presented with a list of their Spotify playlists and may select one, from which a series of recommendations will be generated by a machine learning model. Prior to recommendation generation, a user is given the option of pre-emptively changing their recommendations, by increasing or decreasing variables about the mood and sound of the music. This aims to address the apparent issue of a user’s mood not being considered when they are being recommended music by Spotify’s current system.

Declaration

I hereby declare that the work described in this dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

Signed:

Alex Tsiogas\_\_\_\_

Alexandros Tsiogas

31/10/2023

Acknowledgements

Body text

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# 1. Introduction

**As least 2 pages, but as many as you like**

## Project Background

In a time where online music streaming services are more popular than ever, Spotify dominates the market. Stats gathered in 2022 show that Spotify have by far the greatest market share in this domain at 30.5% - over twice that of the nearest competitor, Apple Music (1).

Despite Spotify’s massive usage, listeners seem to be engaging less with their music recommendation functionality. Spotify offers several ways for users to explore new music, such as their “Radio” or “Daily Mix”, and yet surveys have found that more listeners are finding new music through traditional means. In a 2019 survey of over 500 music listeners, 45.9% of responses listed “Active search myself” as their main source of new music, while Spotify and other streaming services accounted for only 26.1% of responses (2).

These statistics raise questions over why Spotify’s dominance in the music streaming domain cannot be replicated in the music recommendation domain.

The shortcomings of Spotify’s recommendation systems are a matter of clear frustration for users. A 2015 (3) study found that only 3% of Spotify users find that Spotify generated recommendations always match their taste, while 68.75% of users stated they match their taste only sometimes. The fact that users’ moods aren’t considered when they are being recommended music was highlighted as “one of the most important drawbacks” of the recommendation system. 66.7% of users interviewed chose “mood” as the main influence factor on the music they want to listen to.

It is abundantly clear that Spotify is failing to satisfy its user’s desires to find new music that matches their mood, leading to many users searching elsewhere for new music. This project will attempt to address these shortcomings by developing a recommendation system that can better account for the mood of a user.

## Project Description

This project will take the form of an online web application. The app will be presented through web pages designed with HTML and CSS, and the underlying functionality will be made in the Python web framework “Flask”.

Upon entering the web app, users will be presented with a Spotify login screen that prompts them to log in with their username and password. Once they successfully log in, we are granted access to their saved playlists. This is achieved through the Spotify Web API, which enables the creation of applications that can interact with Spotify's streaming service. The user will then be presented with a list of their saved playlists, from which they can select a playlist as a basis for recommendation creation. The user may then alter some variables about the mood of the music they desire before recommendations are generated. The contents of the playlist and the mood values can then be passed through a machine learning model, which eventually outputs a series of recommendations. These recommendations can be saved directly to a user’s library through the user interface, via the Spotify Web API.

Include a diagram.

## Project Aims and Objectives

The main objective of this project is to produce a web application and machine learning model that are capable of producing music recommendations that account for user mood. In success, these recommendations will be superior to those produced by Spotify – this sentiment will be measured in the end evaluation. The milestones that will be reached throughout the project are as follows:

* Extensively analyse the strengths and shortcomings of the current Spotify recommendation algorithm and determine how my application can improve on it.
* Successfully build a Flask web app that grants access to a user’s Spotify library.
* Implement an aesthetically pleasing front end, with a visually pleasing UI that is easy to navigate and offers a good user experience.
* Create functionality through the Spotify Web API that allows the manipulation of a user’s library via the web application.
* Creation of elements on the web page that allow a user to change variables about the mood of their recommendations, which will be processed by the machine learning algorithm.
* Creation of a machine learning algorithm that can select songs from Spotify’s database to recommend to a user based on their selected playlist and their mood values.

## Project Scope

This project aims to be compatible with Spotify only, due to the popularity of the service and the availability of the Spotify Web API. Compatibility with other online music streaming services is considered out of scope.

The application aims to be presented in a web application – no mobile application is in scope.

While the machine learning algorithm will account for user mood, the application will play no role in determining the mood of the user - the user will describe their own mood through on-screen elements.

## Thesis Roadmap

**Chapter 2 – Literature Review**

This chapter will describe the research conducted and literature reviewed thus far in the project.

**Chapter 3 – System Design**

This chapter will describe the planned design of the final system, including diagrams describing architecture and visuals. It will also introduce the methodologies to be used in development.

**Chapter 4 – Testing and Evaluation**

This chapter will describe a plan for the eventual testing and evaluation of the finished project.

**Chapter 5 – Prototype Development**

This chapter will present the prototype that has been created, and will detail all work completed and milestones achieved thus far in the development process.

**Chapter 6 – Issues and Future Work**

This chapter will outline any issues faced in the development process so far and will discuss potential ways of resolving these issues going forward. It will also identify a plan of future work needed to complete the project, which will be structured as a GANTT chart.

# Literature Review

## 2.1. Introduction

In this chapter I will describe all research conducted and literature reviewed thus far in the project.

## 2.2. Alternative Existing Solutions

The shortcomings of the Spotify recommendation system are an issue that developers have been trying to address a great deal in recent times, as is evident in the sheer volume of web and mobile applications that have been developed that utilise the Spotify API to build on the application’s core functionality.

**Discz**

One such application is the mobile app “Discz” - a massively successful music recommendation app that operates using the Spotify API. The app allows users to swipe through songs and give their sentiments on them, in a binary “like” or “dislike”. The app uses the users swiping data to learn about the user’s taste, and gradually improve its recommendations.

A screenshot of a phone

Description automatically generated

Figure 1: Discz' swiping functionality

The Discz app uses a machine learning algorithm in its recommendations, which proves the feasibility of my project, and means the app can serve as a comparison to my finished product, and a source of research and comparison for my initial design. The popularity of ‘Discz’ is highlighted in a 2022 Rolling Stone Article, which finds that “more than 15 million songs have been discovered and saved on the app to date” (4). This figure clearly shows the desire that music listeners have for better ways to find new music.

The Discz app serves as an inspiration and a comparison for some facets of my app. One such way is that it eliminates the need for the user to manually add songs to a playlist. The flow of the recommendation system is easy to follow - a user repeatedly swipes left or right, and once they are satisfied with what they have selected, all the songs can be added directly to a newly created playlist. This simple recommendation flow is something I found to be very intuitive, and it aids in streamlining the playlist creation process. It is something I have drawn inspiration from in the design of my own app, where a user will be able to generate recommendations and export them to their Spotify library with the click of a button.

There are some areas where Discz succumbs to the same shortcomings of the Spotify recommendation system – it does not directly account for user mood. The recommendations are not mood based, and the user gets no direct say over what they are recommended. As previously discussed, users want to have their mood considered when they are being recommended music, hence why mood based recommendation is a primary goal of my project.

**MagicPlaylist**

One application that does make some attempt to account for user mood is MagicPlaylist. Much like my application, this is a web app that offers music recommendations, using the Spotify Web API. The homepage presents the user with a number of “moods”, upon which they can have a playlist generated.

A collage of two people

Description automatically generated

Figure : The "moods" feature of MagicPlaylist

A screenshot of a computer

Description automatically generated

Figure : Recommendations generated by MagicPlaylist

The strongest merits of this app lie in its UI and UX. The UI is exceptionally intuitive throughout, with every “mood” framed in a large clickable button with a relevant background image.

A screenshot of a computer

Description automatically generated

Figure : The MagicPlaylist UI

The landing page is tidy and concise, comprising of just a search bar and the “mood” buttons. The capabilities of the website are described elegantly in the header ­- “*Type your favourite songs and create perfect playlists. Magic!”* - and a user can easily intuit the how to generate a playlist from here, making user experience straightforward. Comparing it to similar applications in the music recommendation space, MagicPlaylist is one of the most accessible for users. In my research, it served as an inspiration for the design of my UI, and the general flow of user interaction with the website.

The application does however lack somewhat in the mood-based recommendations. The user plays no role in defining the moods - they are predetermined within the application. This detracts from the user’s control over what they are recommended, as none of the predetermined moods may match exactly what they desire. I aim to grant the user more control over describing their mood, by allowing them to fine tune multiple “mood variables”, that their suggestions will be based upon.

Due to it being so close in nature to my application, MagicPlaylist may well serve as a comparison in my final evaluation.

## 2.3. Technologies

Programming languages, operating systems, etc.

## 2.4. Other Research

Domain specific research

## 2.5. Existing Final Year Projects

## 2.6. Conclusions

# 3. System Design

## 3.1. Introduction

## 3.2. Software Methodology

## 3.3. Overview of System

## 3.X. Other Sections

## 3.X. Conclusions

# 4. Testing and Evaluation

## 4.1. Introduction

## 4.2. Plan for Testing

## 4.3. Plan for Evaluation

## 4.4. Conclusions

# 5. Prototype Development

**As least 2 pages, but as many as you like (but lots of code samples).**

## 5.1. Introduction

## 5.2. Prototype Development

## 5.3. Other Sections

## 5.4. Conclusions

# 6. Issues and Future Work

## 6.1. Introduction

## 6.2. Issues and Risks

## 6.3. Plans and Future Work

### 6.3.1. GANTT Chart

# Bibliography

1. Statista [Internet]. [cited 2023 Oct 31]. Music streaming services subscribers market shares 2022. Available from: https://www.statista.com/statistics/653926/music-streaming-service-subscriber-share/

2. Dachs P. Hear what I’ve found — A survey on music discovery [Internet]. The Sound of AI. 2019 [cited 2023 Oct 31]. Available from: https://medium.com/the-sound-of-ai/hear-what-ive-found-a-survey-on-music-discovery-3869b6b6cbe4

3. Ding Y, Liu C. Exploring drawbacks in music recommender systems : the Spotify case [Internet]. 2015 [cited 2023 Oct 31]. Available from: https://urn.kb.se/resolve?urn=urn:nbn:se:hb:diva-8690

4. Leight E. It Started as a College Project. Now It’s the Music Industry’s Hottest Recommendation Tool [Internet]. Rolling Stone. 2022 [cited 2023 Nov 1]. Available from: https://www.rollingstone.com/music/music-features/discz-tiktok-recommendation-app-1324785/