PANDIT DEENDAYAL ENERGY UNIVERSITY
SCHOOL OF TECHNOLOGY

Course: Machine Learning

Project Report on

SONG RECOMMENDATION SYSTEM

B.Tech. (Computer Science and Engineering)

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Submitted To

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Song Recommendation System

Abstract

Digital music is now more readily available than in the past due to commercial music streaming services that may be accessed via mobile devices. It takes a long time to filter through all of this digital music, and it leaves you feeling overwhelmed by information. As a result, creating a music recommendation system that can automatically search through music archives and offer acceptable songs to users is quite beneficial. By adopting a music recommender system, the music provider may predict and then present to its users the appropriate songs based on the characteristics of the music that has already been listened to. In the current study, we offer a Spotify dataset-based music recommendation system based on K-Means Clustering and machine learning algorithms that can suggest ten songs based on songs the user has already heard. We provide a collaborative filtering process in this system for recommending music to the user. In this paper, we present a Spotify dataset-based music recommendation system based on K-Means Clustering and machine learning algorithms that can propose 10 songs based on songs the user has previously heard. In this approach, we propose music to the user through a collaborative filtering process.

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1. Introduction

Online music listening is growing more popular. Music fans may now listen to music anytime they wish. Online music subscription services are becoming increasingly popular in the current age of computers. Users may now access an endless number of music more easily. Users may listen to songs that are only available to premium customers on websites such as Spotify, YouTube Music, Jio Saavan, and Amazon Music. It is critical for these businesses to give a positive user experience to their consumers. The playlist is a feature that distinguishes these streaming apps. Making a play list from a large number of songs may be tedious for certain people. Users usually select the following song based on a recommendation. So, it essential to use a good suggestion method. Many methods for song recommendation have been created.

Spotify exemplifies how popular music streaming services have grown. The user experience that an app provides to its users has a significant influence on the app's success. The goal of a streaming application's recommendation system is to provide a favorable user experience. As a result, we can infer that the Spotify recommendation system provides a very good user experience, which has contributed to Spotify's success.
The Spotify recommendation system employs collaborative filtering to recommend songs and podcasts to users. Collaborative filtering analyzes similarities between users and linked or services to provide recommendations. In this project, we'll show how to build a recommendation system using machine learning.

2. Literature Review

Multiple researches and approaches have been done in the field of music recommendation system in the past two decades. An overview of such works has been shown in this section.

- Diego Sanchez-Moreno, Ana B. Gil Gonzalez, M. Dolores Vincete F. Lopez Batista, Maria N. Moreno Garcia made a collaborative filtering-based song recommendation system using coefficients for artists and users in 2016. In this work the sparsity problem of recommendation system without requiring user attributes and content data was solved.

- In 2019 Adiyansjah, Alexander A S Gunawan and Derwin Suhartono proposed Music recommendation system based on genre using convolutional recurrent neural networks which gave out recommended music based on similarity of features of audio signal. The proposed work gave out precision of 0.712 and recall of 0.804. The Receiver operator Characteristic came out to be 0.944 and F1 score was 0.749.

- Wang Wenzhen proposed Personalised music recommendation system based on hybrid collaborative filtering technology in 2019. He created a hybrid recommendation model by adding association rules and music genes to collaborative filtering. The research was helpful to give music recommendation in the field of emotional regulation and psychotherapy.

- In 2010 Dmitry Bogdanov, Martin Haro, Ferdinand Furhamn, Emilia Gomez, Perfecto Herrera proposed content-based music recommendation system based on user preference examples in which they presented three content-based approaches and concluded that the content-based approach to recommend music did not succeed to surpass the success of music recommendation system based on collaborative filtering.
- Affective Music recommendation system reflecting the mood of input image was proposed by Shoto Sasaki, Tatsunori Hirai, Hyato Ohya and Shigeo Morishima in the year of 2013. In the presented work they proposed music suggestion based on the emotions of the user which were decided by machine by processing the image of user via digital image processing. They concluded that along with the presented system it was necessary to implement functionality with which if the user decided to skip the song the system can suggest a song based on previous songs played.

3. Methodology and implementation details

3.1 Dataset Description

For this project we have used Spotify dataset that contain over 175,000 songs and 19 attributes. Dataset have following attributes.

```
 #   Column            Non-Null Count   Dtype
---  ------            --------------   -----
 0   acousticness      174389 non-null  float64
 1   artists           174389 non-null  object
 2   danceability      174389 non-null  float64
 3   duration_ms       174389 non-null  int64
 4   energy            174389 non-null  float64
 5   explicit          174389 non-null  int64
 6   id                174389 non-null  object
 7   instrumentalness  174389 non-null  float64
 8   key               174389 non-null  int64
 9   liveness          174389 non-null  float64
 10  loudness          174389 non-null  float64
 11  mode              174389 non-null  int64
 12  name              174389 non-null  object
 13  popularity        174389 non-null  int64
 14  release_date      174389 non-null  object
 15  speechiness       174389 non-null  float64
 16  tempo             174389 non-null  float64
 17  valence           174389 non-null  float64
 18  year              174389 non-null  int64
dtypes: float64(9), int64(6), object(4)
```

Fig-3.1

3.2 Data Exploration

First, we'll see if the dataset has any null values. So, because our dataset contains no null values, there is no need to fill it. Some columns, such as "id," "name," "artists," "release date," and "year," are unimportant and can be removed. We will examine the features correlation with the dependent variable using the Yellowbrick package (Yellowbrick is frequently used to visualize data).

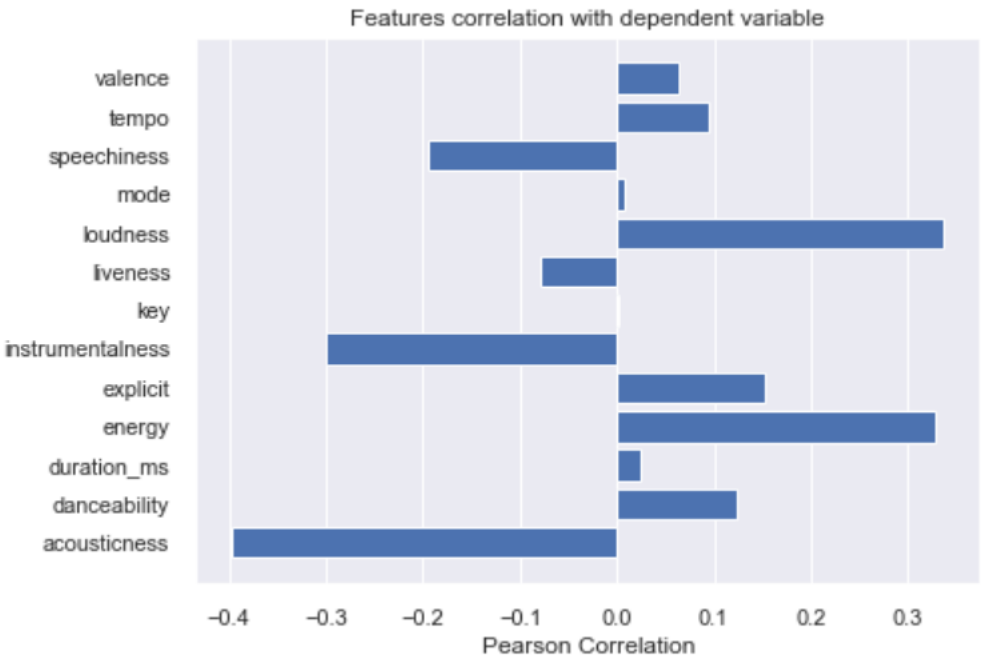

Fig-3.2

Then we'll see Feature Correlation using Heatmap

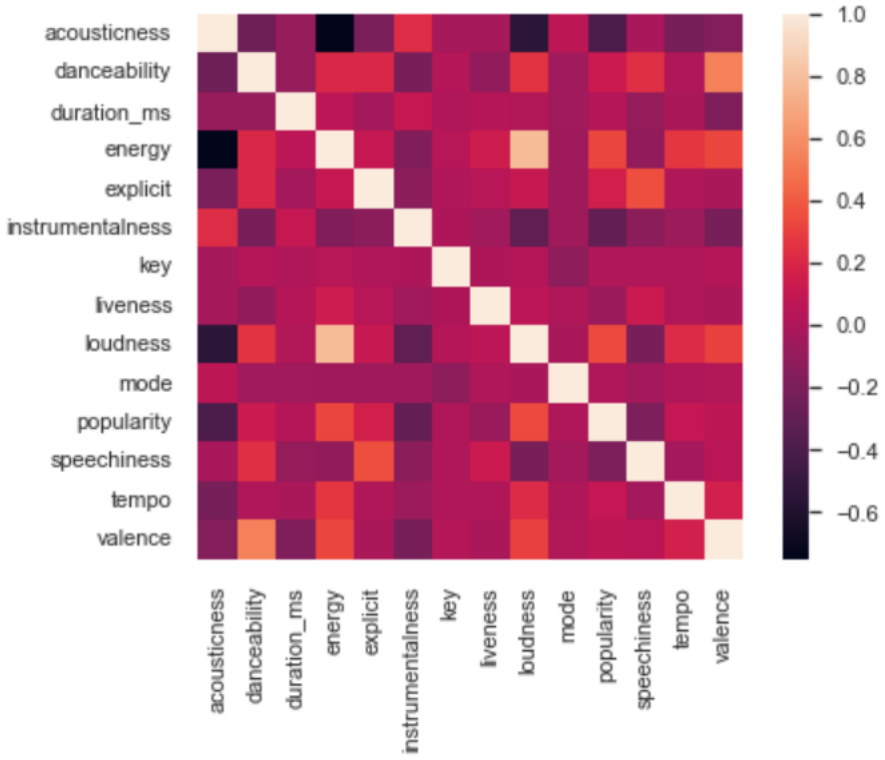

Fig-3.3

3.3 Data Transformation

The data will then be normalized using MinMaxScaler (MinMaxScaler transforms features by scaling each feature to a specific range.) All numerical columns will be normalized as a result of this. We'll use int and float datatypes for this.

Some songs from different genres may share characteristics that influence the recommendation system. We'll do this by using K-means clustering to create a new feature.

In order to find an optimal number of cluster, we'll be using Elbow method.

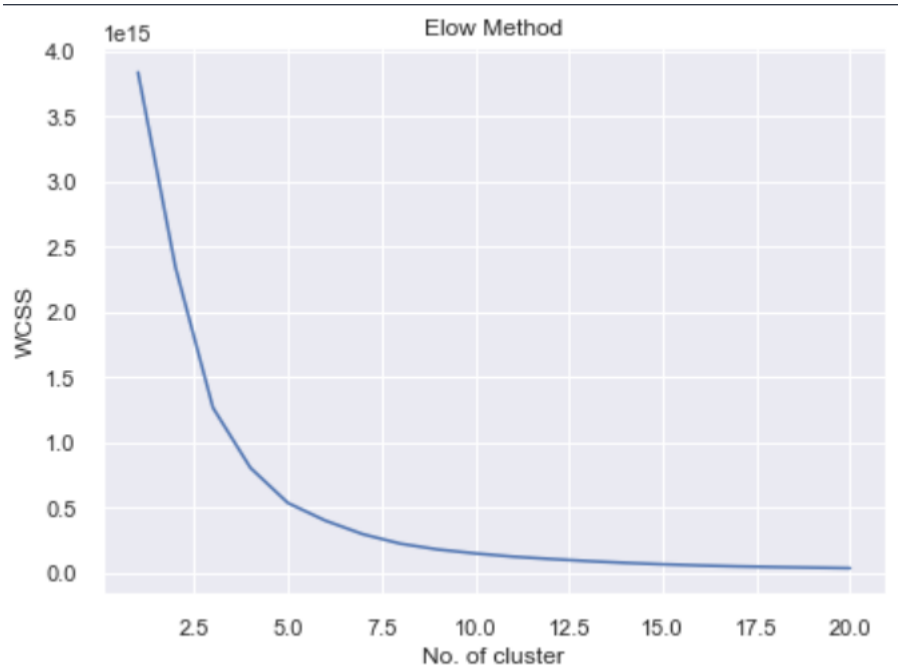

Fig-3.4

Cluster Visualization in 3D:

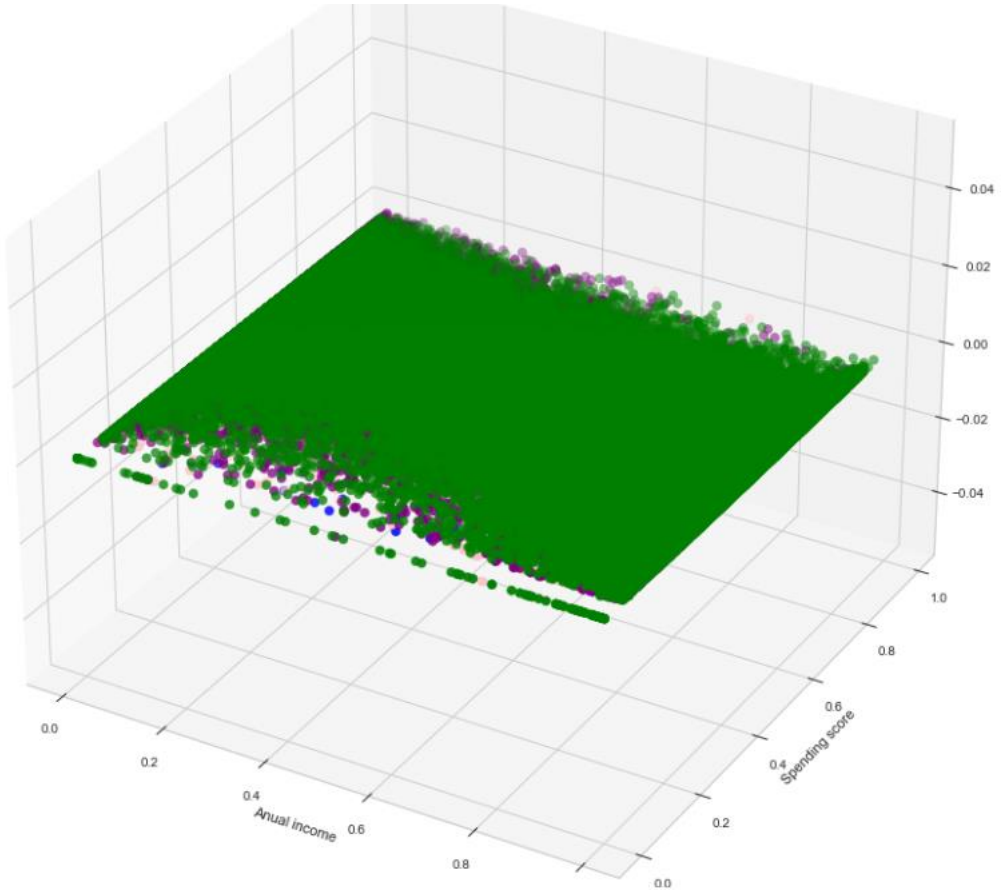

Fig-3.5

3.4 Recommendation System

After all the steps, we'll be predicting the songs to the user. In order to do that we'll take input one song and how many recommendations like that song from user wants predict similar songs to the user.

For example, if user give song "Lovers Rock" then user will get following

	artists	name
103171	['Barão Vermelho']	Bete Balanço
55318	['Shinedown']	Save Me
16385	['O-Zone']	Dragostea Din Tei
11168	['Bob Marley & The Wailers']	Positive Vibration
158441	["Olivia O'Brien"]	Love Myself
54226	['Naughty By Nature', 'Zhané']	Jamboree (feat. Zhané)
85047	['The Outlaws']	Song For You
50644	['The Alan Parsons Project']	Mammagamma - Instrumental
107163	['Britney Spears']	My Prerogative
35098	['Los Askis']	¡Ay! El Amor

Fig-3.5

4. Result & Analysis

By applying the models, we get a system with a frequency of similar genres with adjacent data points, and music or songs are grouped, which is the system's output. Music or songs from similar genres will sound similar and date from the same time period. The data point of a song that a user has already listened to is collected, and other matching data points adjacent to that data point are collected, and the specific song or music is displayed as output to the user. By doing so, the user obtains songs or music that are similar to the user's output. This idea is used to create a recommendation system.

Silhouette score is near 0.6 in case of k-mean clustering. The song recommendation system that we make take the input from the user and predict the 10 songs from related to those genres. And shows the output of that songs. And that output also contains song name and artist name.

5. Conclusion

We conclude from this recommendation system report that if the recommendation system provides a good user experience, user traffic will be high. It is extremely difficult to create a recommendation system that provides an excellent user experience. Spotify employs a recommendation system, which eliminates the need for users to search for songs or music of their choosing. It suggests very relevant search results and also provides a list of songs that are similar to that song. This provides a positive user experience and encourages the greatest number of people to use it. To implement this type of recommendation system.

Spotify recommends other songs using various types of machine learning models. Spotify employs algorithms for collaborative filtering. Then, these models receive user input as the name of a song or piece of music, and the model predicts the song and informs the user of other songs or pieces of music that are related to the search. Spotify has grown in popularity as a result of this. So, if this type of song recommendation system is used, attracting new users will be simple, and current users will continue to use the Spotify app.

Future work

In future we can make web API that makes it easy to make web app and implement in it using python library Spotify. And recommend songs to user. By focusing on personalization, embracing new technologies, and maintaining a commitment to user privacy and sustainability, we can create a music and song discovery platform that continues to resonate with users and shape the future of music consumption.

6. References

1. https://www.sciencedirect.com/science/article/pii/S1877050919310646

2. https://ieeexplore.ieee.org/abstract/document/8901416/authors#authors

3. https://repositori.upf.edu/handle/10230/47004

4. https://link.springer.com/chapter/10.1007/978-3-540-72079-9_10

5. https://www.sciencedirect.com/science/article/abs/pii/S0957417416304973

6. https://cyanite.ai/2021/09/02/how-do-ai-music-recommendation-systems-work/

7. https://www.scikit-yb.org/en/latest/index.html

8. https://www.kaggle.com/code/vatsalmavani/music-recommendation-system-using-spotify-dataset/notebook