

Vishwakarma Institute of Technology

Data Science

Course Project

Song Recommendation Engine

SY - CHA

A.Y. 2020-2021

Guide: Prof. Prashant Shevgaonkar

Group details:

SY\_CH Dept | DIV\_A | Batch\_B1| Group\_1

Group members:

1. Aayush Bhadani [01] [11910834]
2. Pratik Aher [04] [11910473]
3. Rohan Bedke [06] [11910997]
4. Vaishnavi Biradar [08] [11910319]

ABSTRACT

In this paper, we present a personalized music recommendation system (PMRS) based on the Reverse K Nearest Neighbor (R-KNN) approach. The R-KNN approach classifies the music based on the characteristics of the audio of the music into different genres by grouping or clustering the data of same attributes or characteristics.

In PMRS, we propose a content-based filtering (CBF) recommendation algorithm to combine the interactions of the user with the log files to recommend music to the user. We use the 1.3 Lakhs song dataset from Kaggle to evaluate the PMRS. It is a dataset of Spotify which includes all the genres present over the world as well as multi-linguistic in nature.

The key to a recommendation system is the prediction of users’ preferences. Personalized recommendation for many online music applications depends on the prediction of both long-term as well as the short-term preferences. We propose the system about the automatic management of the user preferences and genre classification in the personalized music system.

1. INTRODUCTION

The term **Machine Learning** (**ML**) was first used by Arthur Samuel, one of the pioneers of Artificial Intelligence at IBM, in 1959. The name came from researchers who observed computers recognizing patterns and developed the theory that computers could learn without being programmed to perform specific tasks.

Machine Learning is all about developing computer programs that can receive various types of data as input (images, text, signals, numeric tables, etc), and then recognize patterns in the data and make insights and predictions based on those patterns. One of the most important features of ML is self-learning. ML algorithms usually require the user to supply some function to be optimized by the algorithm and this function is a key part of the success or failure of such algorithms. If the function is appropriate but the data is messy or biased or incomplete, we can also expect the algorithm to perform badly. Making sure inputs are reasonable and representative of the world, deciding on the appropriate optimization function, choosing the best algorithm to perform a specific task, and choosing good hyperparameters to the algorithms are all still human tasks.

# 

**Artificial Intelligence** is not a new word and not a new technology for researchers. This technology is much older than you would imagine

* **Year 1943:** The first work which is now recognized as AI was done by Warren McCulloch and Walter pits in 1943. They proposed a model of **artificial neurons**.
* **Year 1955:** An Allen Newell and Herbert A. Simon created the "first artificial intelligence program". Which was named as **"Logic Theorist"**. This program had proved 38 of 52 Mathematics theorems, and find new and more elegant proofs for some theorems.
* **Year 1997:** In the year 1997, IBM Deep Blue beats world chess champion, Gary Kasparov, and became the first computer to beat a world chess champion.
* **Year 2002:** for the first time, AI entered the home in the form of Roomba, a vacuum cleaner.
* **Year 2006:** AI came in the Business world till the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI.

There is an ever-growing number of streaming music services available over the Web and mobile Internet. Searching for the favorite song from a music library that best fits your need has become an increasingly difficult task over every service platform.

Personalized music recommendation is a challenging task in the field of music information retrieval (MIR) . A personalized music recommendation algorithm recommends new music to a user is similar to the previously/current music listened by the user. Researchers in the field of MIR generally use two recommendation algorithms: collaborative filtering (CF) and content based (CB) . The CF algorithm recommends new music which is not available in the active user’s history and which is available in the other users with similar history as the active user. The CB algorithm recommends music to a user based on the similar music available in the user’s history.

[Above para is take from “A personalized music recomm system”]

One typical category of CF methods known as neighbourhood

methods, has a focus on identifying the relationship

between items and users, where new items are recommended

based on the similarity values. Neighbourhood

methods recommend items that are appreciated by users

who share the same preferences. Another category

of CF models employ machine learning models, such as

Bayesian models and matrix factorization, to perform the recommendation task.

*•* The content-based methods recommend items that are similar to those that a user preferred in the past.

The similarity of items is calculated using the features

associated with the compared items.

[Last two points are from Song\_RS]

In order to recommend a music to a user, first step is to classify the music according to the user’s inputs. Traditional classifiers such as the support vector machine and linear regression classify the music by extracting the mel-frequency cepstral coefficients (MFCC) from the audio signal of the music. As the structural complexity of the music is more, the efficiency of traditional classifiers reduces in classifying the music from different genres.

[Above para is taken from PMRC]

We have included the concept of mood which will recommend the music according to the user’s mood. These categories include Happy, Sad, Workout, Gaming, Depressive and much more.

In this paper, we investigate a personalized music recommendation system (PMRS) which is based on the reverse k nearest number approach and a CBF recommendation algorithm. The reverse k nearest number approach classifies the music based on the characteristics of the audio that is present in the music. The reverse k nearest number extracts the hidden features or the characteristics of the audio of the music and classifies the music accordingly. In PMRS, we propose a CB algorithm to extract the user’s input and the output of reverse k nearest number for recommending music under different music categories and genres. To do so we are using a data set from Kaggle containing about 1.3 Lakh music.

The data-set consists of all genres present on this globe and so it is a multi-linguistic song data-set.

1. RELATED WORK
2. *OBJECTIVE*

The objective of the Song Recommendation System is to recommend the songs to the user; according to user’s mood or input. In the project our algorithm recommends a total of 6 songs for each interaction. We have introduced various categories of mood which will suggest the songs according to the user’s mood while using the following. To achieve the mentioned objectives, we have used the concept of reverse k nearest number.

1. *METHODOLOGY*

*Data Set and It’s Cleaning*

To begin data analysis on what so ever topic the first and foremost thing required is a data set and it’s cleaning. The data set used in the project is taken from Kaggle and it consists of around 1.3 lakh music present on Spotify. The dimension of the raw data set is 1,31,580 x 20

The had tsv extention (.tsv) which we converted to excel sheet (.xlsx). Most of the cleaning was performed in the Excel sheet only which includes improper/noisy data with help of Filter. Duplicates were removed with the help of R using ‘duplicated’ function.

*library(tidyverse)*

*S\_Seg = Songs %>% select(Name,ID,Danceability,Energy,Valence,Tempo,Round\_Dance,Genre,URL\_features)*

*Songs\_Seg <-S\_Seg[!duplicated(S\_Seg$Name),]*

*Songs\_Seg*

*nrow(Songs\_Seg)*

We used pipelining to fetch the required features of the data with help of ‘select’ function. Required data is stored in ‘Songs\_Seg’ after the removing the duplicates.

*S\_Seg = Songs %>% select(Name,ID,Danceability,Energy,Valence,Tempo,Round\_Dance,Genre,URL\_features)*

*Data Visualization*

Data visualizations make big and small data easier for the human brain to understand, and visualization also makes it easier to detect patterns, trends, and outliers in groups of data. Good data visualizations should place meaning into complicated datasets so that their message is clear and concise.

Data Visualization was used to monitor the categories of mood. It has major contribution for setting the limits of features that are required to decide the genre.

We have used scatter plot, splom plot, geom point and geom smooth.

*#ploting matrix of graphs of Songs\_Seg*

*library(lattice)*

*splom(Songs\_Seg[c(3,4,5,6)],main="Music")*

The above plots were used to note the relation between the features of the data set, outliers and precision of the data classification. These plots helped to increase accuracy for segregating the mood categories.

*Data Classification*

Data classification is the process of organizing data into categories that make it is easy to retrieve, sort and store for future use. A well-planned data classification system makes essential data easy to find and retrieve. Keeping the above points in mind data classification is implemented in the project to categorize the mood. To do so, we have further performed data reduction to have minimal data which is important for analysis. We categorized the data according to mood then all the categories are to be bind in same data set which is as ‘Final\_DB’ in the project. This data set contains the music related to moods of user and parallelly we have another data set (‘Songs\_Seg’) wiz. used for music recommendation on the basis of genre.

*Final\_DB <- rbind(Happy,Sad,Workout,Depression,Energetic,Calm,Frantic,Gaming) Final\_DB nrow(Final\_DB)*

We have performed data visualization of data for the analysis of data classification’s efficiency and the plot was very good and accuracy was very high of the random sample selected from the database ‘Final\_DB’.

*Algorithm*

Algorithms are very important in computer science. The best-chosen algorithm makes sure computer will do the given task at best possible manner. To make sure our algo has same trait as of mentioned in above lines, henceforth we preferred for; reverse k nearest number. The algorithm here is that; we searched for KNN to the user input. The algo is same for recommendation with respect to mood as well as recommendation with respect to genre. Category of the music is fetched from the data given by the user after searching the data-set. Then with the help of category the mood categories are decided and the nearest neighbors around selected mood category are searched. The same is with recommendation on the basis of genre just instead of category this time its genre.

The main algorithm is in “decategorize” and “recomm” function. The decategorize function finds the category of the user input and returns the corresponding mood of user. This function is called in the brain function in which the k nearest numbers is searched out of which 3 songs are displayed randomly for each mood based and genre based recommendation.

‘Recomm’ is then called in the main function. The veery strong feature of the main function is that it accepts the input in any form irrespective of the case of the input given by the user.

1. RESULTS AND DISCUSSION

To confirm validity of our system, we repeatedly conducted

experimentation about **30** times in music recommendation,

users' evaluation and updating the system. It was conducted

based on the above algorithm on the condition where music

contents consisted of **625 Genre** and **8 categories of mood** the system had learned nothing *so* that any parametric values of the Evaluation Record (including Fit and Unfit Records) were randomized uniformly. In addition, it was assumed that users could evaluate 10 pieces of music every time the system made

recommendation.

With this much comes some drawbacks of the project. One of the flaws is that sometimes the input given by user comes in the recommendation too. The input should either have no spaces between the words or should have space between the input.

Coming to the future scope there’s a lot of features / operations that can be added in the project. Some of them are adding a database of user’s input which stores the inputs given by the user and with the help of which the recommendation system can be made stronger i.e. leads to increase in efficiency. Further recommendation based on KNN can also be added; but adding KNN will deduce the music having multiple categories. Smart search (search recommendation) would help the user to get the song easily.

We would like to extract the user’s information (like geographical location, time, ambience, emotions, etc.) to provide a better music recommendation that match with user’s preference.

IV CONCLUSION

The Music Recommendation system is the personalized music services based on input and automatic genre and mood classification. This system can be applied to various audio devices, apps and services. It was confirmed through experimentation that the system had a capability to recommend pieces of music properly according to users' mood by means of learning their preferences.

The recommendation on the basis of music has almost 45% songs repeated in multiple categories of mood as one song may have multiple category traits for e.g. A chunk of ‘happy songs’ maybe a part of ‘workout songs’ and this duplication is purposely not disturbed, for user to have best experience out of it.

We would like to work on; increasing the quantity of songs in our database (viz. Final\_DB) as it has 27% songs of the cleaned data-set (Songs\_Seg).

Our engine is a very good recommendation engine by keeping it accuracy in mind; though it can be taken to next level by adding a database as well as an UI. We didn’t added UI as the link in the dataset were just dummy links.

REFERENCES

References

Artificial intelligence. (2001, October 8). Wikipedia, the free encyclopedia. Retrieved December 25, 2020, from <https://en.wikipedia.org/wiki/Artificial_intelligence>

Machine learning. (2003, May 25). Wikipedia, the free encyclopedia. Retrieved December 25, 2020, from <https://en.wikipedia.org/wiki/Machine_learning>

A music recommendation system - IEEE conference publication. (n.d.). IEEE Xplore. <https://ieeexplore.ieee.org/document/1429796>

Music recommendation system based on usage history and automatic genre classification - IEEE conference publication. (n.d.). IEEE Xplore. <https://ieeexplore.ieee.org/document/7066352>

A personalized music recommendation system using convolutional neural networks approach - IEEE conference publication. (n.d.). IEEE Xplore. <https://ieeexplore.ieee.org/document/8394293>

A personalized next-song recommendation system using community detection and Markov model - IEEE conference publication. (n.d.). IEEE Xplore. <https://ieeexplore.ieee.org/document/8005464>