Hit Song Prediction for Indian Popular Music

Shreya Kale Rameshwari Joshi Aparna Dhaygude Vaishnavi Ingole Makarand Velankar

MKSSS's Cummins College of Engineering For Women, Pune

Introduction

Predicting the popularity of a song before its release based on features that define its qualities.

Hit song prediction for Indian origin music using machine learning Models based on audio features of the song before its release.Music is also known as food for the soul. Thus, good music makes people happy and gives them peace. Hit song prediction system can help identify songs that people will like.

What makes Song Hit

Not a lot of work is done on Indian origin music so, various ML algorithms are analyzed based on dataset of Indian music.

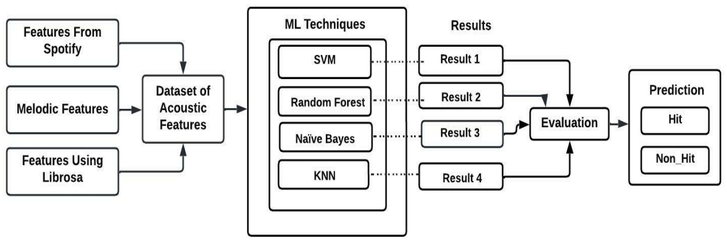
- **Unique Streamers** A song is considered a hit when it has many unique streamers on music streaming services
- **Significant Features** Hit songs generally have a set of characteristics which are common and usually always present in hit songs. Eg.: Hit songs mostly have high danceability energy but low acoustic ness.

Factors Affecting

- **Internal Factors** In the field of hit song prediction, several researches have been conducted of which many focus on predicting hit songs using internal factors such as composition of music and frequency, loudness, acousticness, danceability, tempo, spechiness, etc. Internal factors also include artist features, genre, lyrics, video, etc. In some findings it is observed that lyrics-based prediction is used to classify songs as well.
- **External Factors** Whereas, other researches on prediction use external factors such as social media impact, view counts on various platforms, release dates, promotional campaigns and teasers conducted before the song release, release dates (such as important holidays or release of songs on themes of certain days), etc. Sometimes unpleasant songs get more popularity because of social media impact or more pleasant songs can't get that much popularity because of low social media impact, less promotion campaign, wrong release date,etc. So the effect of external factors is unpredictable on the success of a song.

Audio features alone do not make a song popular, popularity of a song is driven by social forces, time periods, etc. Along with internal and external factors audio features of hit songs differ over the decades.

Architecture



Architecture Diagram.

Methodology

1. **Data Extraction**, Data Extraction from spotipy library, librosa and wav files and filtering for spotify based on popularity and genre.Data extraction from librosa python library and melodic features from wav files.
2. **Data Cleaning** .Data Cleaning by removal of null and duplicate values and assigned class labels.Any duplicate entries or rows containing any NULL values are dropped as well and any special characters present in the data are removed to facilitate easy execution of the algorithms.
3. **Class Labeling** .Class labels are assigned to the data on the basis of popularity value obtained from Spotify. To decide a range of popularity to assign class labels, YouTube view counts per month of a song are calculated. For popularity value 0 - 58 class label assigned is "Hit" and for 59 - 100 class label is "Non-Hit".
4. **Feature Classification**. Similarly the features with which the highness and lowness of sound associated are grouped under Pitch feature classification which has chroma features along with Z-rate in it. Then one more grouping is performed based on energy level and song's rhythmic properties, we simply call it as Rhythmic and Energetic features in these classification. And then we grouped all melodious features into a feature classification group under which patterns of note and its diagrams are included.

Feature Type	Features Included	Feature Count
Timbral	acousticness, instrumentalness, mfcc	28
Pitch	chroma-mean, chroma-std, zrate mean, zrate-skew, key, mode	29
Rhythmic	danceability, loudness, tempo, time_signature, intensity, spectral centroid, contrast, rolloff	31
Melodic	Valance, speechiness, ref_ note, bi-grams and tri-grams patterns	62

Feature Classification Table

6. **Model Building**. After labeling, the final dataset is fed to various machine learning algorithms.The model is tested on four datasets, i.e., from spotify, librosa, melodic data and combined dataset of all three. Machine Learning algorithms namely Support Vector Machines (SVM), Random Forest (RF), Naïve Bayes and k-Nearest Neighbors (kNN). All algorithms are tested for 10 fold cross validation on the dataset.
7. **Evaluation** . After feeding each dataset to machine learning algorithms, each model is evaluated based on the various metrics like accuracy, precision, recall, f-measure etc.

About Dataset

- An in-house dataset which contains 297 audio files and two feature sets is used:
  - One is obtained from Spotify Web API with attributes.
  - Second one is Librosa python library 76 attributes.
  - Then we also tried to add some melodic features to test whether it makes some value addition to conclude some useful results with 62 attributes.
- There are 157 instances of Hit songs.
- There are 139 instances of Non-Hit songs.

Datset Result

Algorithms	Accuracy(in %)			
	Spotify API	Librosa	Melodic	Combined
SVM	55.85	48.64	52.03	60.13
Random Forest	55.85	58.55	49.66	56.76
Naive Bayes	61.26	58.55	51.69	55.06
KNN	48.64	52.25	55.07	61.49

(i) Accuracies of Algorithms for Dataset Obtained from Spotify API, Librosa and Melodic Features

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(ii) Performance metrics on combined dataset

Feature Selection Results

2*Algorithms	Accuracy(in %)			
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Feature Selection Results

Conclusion

Among all algorithms tested KNN gives highest accuracy of 61.49Timbral features which have MFCC and acousticness combinedly generate 64.87Maximum accuracy which can be obtained using acoustic features of a song is 60-70Features like danceability, speechinesss, loudness and intensity are found to influence the popularity of a song over other features in the dataset