**Song Popularity prediction using machine learning algorithms with insights from unsupervised learning**

**Authors:**

Abhinav Lakhani(0769062)

**Supervisor:**

Savita Seharawat

# 

# Abstract

In a digital age where independent artists are trying to break through the barriers installed by putative gatekeepers of the music industry, the golden key to becoming a successful artist is data. Without data, successful campaigns cannot be recreated and the unsuccessful ones cannot be learned from. The Spotify Popularity Index is a 0-to-100 score that ranks how popular an artist is relative to other artists on Spotify. As your numbers grow, you’ll get placed in more editorial playlists and increase your reach on algorithmic playlists and recommendations. The Index can be used to monitor and influence the progress of new releases. Each track has its own SPI calculated influencing the artist’s overall index. Yet, while the Popularity Index is majorly determined by recent stream count, other factors like save rate, the number of playlists, skip rate, and share rate can indirectly bump up or push down a song’s popularity index. This project uses similar dataset where the songs are labeled popular(1) or unpopular(0).

The chosen themes for this project will be Exploratory data analysis using unsupervised learning and using the knowledge gained from the unsupervised learning to build Classification/Clustering and Predictive Analysis.

We aim to answer:

* What are the different factors affecting song popularity.
* Are there any clusters/groups of songs identifying audience demographic like people who like rock music or jazz music, etc. so as to align with the artists’ theme.
* Build a classification algorithm to help with classifying whether a song would be popular.
* Make suggestions to the artists about their song: whether it would be popular or not and the attributes of their song that needs improvement.

The dataset used for our analysis has 14 attributes within it, and there are described below.

|  |  |  |
| --- | --- | --- |
| **Attribute** | **Data Type** | **Description** |
| **song\_duration\_ms** | Numeric | Duration of song in milliseconds |
| **acousticness** | Numeric | A confidence measure from 0.0 to 1.0 of whether the track is acoustic. |
| **danceability** | Numeric | Describes how suitable a track is for dancing based on a combination of musical elements including tempo, rhythm stability, beat strength, and overall regularity. |
| **energy** | Numeric | Represents a perceptual measure of intensity and activity. Typically, energetic tracks feel fast, loud, and noisy. For example, death metal has high energy, while a Bach prelude scores low on the scale. |
| **instrumentalness** | Numeric | Predicts whether a track contains no vocals. “Ooh” and “aah” sounds are treated as instrumental in this context. Rap or spoken word tracks are clearly “vocal” |
| **Key** | Factor | The estimated overall key of the track. Integers map to pitches using standard Pitch Class notation . E.g. 0 = C, 1 = C♯/D♭, 2 = D, and so on. |
| **Liveness** | Numeric | Detects the presence of an audience in the recording. Higher liveness values represent an increased probability that the track was performed live. |
| **Loudness** | Numeric | The overall loudness of a track in decibels (dB). Loudness values are averaged across the entire track and are useful for comparing relative loudness of tracks. |
| **Audio\_mode** | Factor | Indicates the modality (major or minor) of a track, the type of scale from which its melodic content is derived. Major is represented by 1 and minor is 0. |
| **speechiness** | Numeric | This detects the presence of spoken words in a track. The more exclusively speech-like the recording (e.g. talk show, audio book, poetry), the closer to 1.0 the attribute value. |
| **tempo** | Numeric | The overall estimated tempo of a track in beats per minute (BPM). In musical terminology, tempo is the speed or pace of a given piece, and derives directly from the average beat duration. |
| **Time\_signature** | Factor | An estimated overall time signature of a track. The time signature (meter) is a notational convention to specify how many beats are in each bar (or measure). |
| **Audio\_valance** | Numeric | Describes the musical positiveness conveyed by a track. Tracks with high valence sound more positive (e.g. happy, cheerful, euphoric), while tracks with low valence sound more negative (e.g. sad, depressed, angry). |
| **Song\_popularity (Y)** | Factor | Whether the song is popular(1) or not(0) |

Keywords:

Non Negative Matrix Factorization(NMF), PCA, Manifold Learning with t-SNE, Logistic Regression, SVM, Decision trees, Clustering, Random Forests

GitHub Repository:

[abhinav3398/song-popularity: given features like acoustics, danceability, key, loudness, etc., predict the popularity of a song. (github.com)](https://github.com/abhinav3398/song-popularity)

References

“Song Popularity Prediction” *kaggle Dataset*.