

Song Popularity Prediction

An Analysis Using Data Mining Techniques

Garcia Garcia, Bernat
Maria Montés, Iker
Rota, Davide
Tobella Jacomet, Pol

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Introduction

In this paper we will analyze data related to spotify tracks, with the objective of determining a way to predict a song/track popularity in the site through information related to that track. *Needs to be expanded a bit probably*

Motivation

...

Metadata

Our dataset consists of 13186 inputs of spotify tracks with 15 variables. From those, 3 are qualitative variables while 12 are quantitative variables.

Probably some more explanation needed

Data source

The data has been obtained from the file “*train.csv*”. This file contains information related to tracks of Spotify, openly shared on the net. The data originally comes from the platform Kaggle, specifically from the contest *Predictión de la Popularidad de Canciones*.

Disclaimer: This data will not be used to train machine learning or AI models, as per the Policy Note of Spotify.

Overview of the Data

Qualitative variables

- **Audio mode:** Mode 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. Example: 0
- **Key:** The key the track is in. Integers map to pitches using standard Pitch Class notation. E.g. 0 = C, 1 = C /D , 2 = D, and so on. If no key was detected, the value is -1. Range: -1..11 Example: 9
- **Time signature:** An estimated time signature. The time signature (meter) is a notational convention to specify how many beats are in each bar (or measure). The time signature ranges from 3 to 7 indicating time signatures of “3/4”, to “7/4”. Range: 3 - 7 Example: 4

Quantitative variables

Relative/Ratio variables (0..1)

- **Liveness:** Detects the presence of an audience in the recording. Higher liveness values represent an increased probability that the track was performed live. *A value above 0.8 provides strong likelihood that the track is live.* Example: 0.0866
- **Danceability:** Danceability describes how suitable a track is for dancing *based on a combination of musical elements including tempo, rhythm stability, beat strength, and overall regularity.* A value of 0.0 is least danceable and 1.0 is most danceable. Example: 0.585
- **Audio valence:** A measure from 0.0 to 1.0 describing 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). Example: 0.428
- **Energy:** Energy is a measure from 0.0 to 1.0 and 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. Perceptual features contributing to this attribute include dynamic range, perceived loudness, timbre, onset rate, and general entropy. Example: 0.842
- **Acousticness:** A confidence measure from 0.0 to 1.0 of whether the track is acoustic. *1.0 represents high confidence the track is acoustic.* Example: 0.00242
- **Speechiness:** Speechiness 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. *Values above 0.66 describe tracks that are probably made entirely of spoken words.* Values between 0.33 and 0.66 describe tracks that may contain both music and speech, either in sections or layered, including such cases as rap music. Values below 0.33 most likely represent music and other non-speech-like tracks. Example: 0.0556
- **Instrumentalness:** 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”. *The closer the instrumentalness value is to 1.0, the greater likelihood the track contains no vocal content.* Values above 0.5 are intended to represent instrumental tracks, but confidence is higher as the value approaches 1.0. Example: 0.00686
- **Song popularity:** Objective variable, which describes the popularity of the song. The popularity of a track is a value between 0 and 100, with 100 being the most popular. Example: 69

Absolute variables

- **ID:** A count, from 1 to 13186 *Not spotify ID*



- **Loudness:** 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. Loudness is the quality of a sound that is the primary psychological correlate of physical strength (amplitude). *Values typically range between -60 and 0 db.* Example: -5.883
- **Song duration (ms):** The duration of the track in milliseconds. Example: 237040
- **Tempo:** 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. Example: 118.211

The data

In this section we show a summary of our data

```
##          ID      liveness      loudness   danceability
##  Min.    : 1      Min.   :0.015      Min.   :-36.729      Min.   :0.000
##  1st Qu.: 3297    1st Qu.:0.093     1st Qu.: -9.095     1st Qu.:0.531
##  Median  : 6594    Median :0.121     Median : -6.587     Median :0.645
##  Mean    : 6594    Mean   :0.179     Mean   : -7.449     Mean   :0.634
##  3rd Qu.: 9890    3rd Qu.:0.221     3rd Qu.: -4.921     3rd Qu.:0.749
##  Max.    :13186    Max.   :0.986     Max.   :  1.342     Max.   :0.987
##           NA's    :3956       NA's   :3956       NA's   :3956
## song_duration_ms time_signature audio_valence      energy
##  Min.    : 26186    Min.   :0.000      Min.   :0.000      Min.   :0.002
##  1st Qu.: 184000   1st Qu.:4.000     1st Qu.:0.339     1st Qu.:0.510
##  Median  : 211233   Median :4.000     Median :0.530     Median :0.670
##  Mean    : 217955   Mean   :3.957     Mean   :0.531     Mean   :0.645
##  3rd Qu.: 242292   3rd Qu.:4.000     3rd Qu.:0.728     3rd Qu.:0.817
##  Max.    :1799346   Max.   :5.000     Max.   :0.982     Max.   :0.999
##           NA's    :3956       NA's   :3956       NA's   :3956
##           tempo      acousticness speechiness      key
##  Min.    : 0.00    Min.   :0.000      Min.   :0.000      Min.   : 0.000
##  1st Qu.: 99.01   1st Qu.:0.024     1st Qu.:0.038     1st Qu.: 2.000
##  Median  :120.27   Median :0.131     Median :0.056     Median : 5.000
##  Mean    :121.68   Mean   :0.258     Mean   :0.103     Mean   : 5.306
##  3rd Qu.:140.00   3rd Qu.:0.422     3rd Qu.:0.122     3rd Qu.: 8.000
##  Max.    :242.32   Max.   :0.996     Max.   :0.940     Max.   :11.000
##           NA's    :3956       NA's   :3956       NA's   :3956
## instrumentalness audio_mode      song_popularity
##  Min.    :0.000    Min.   :0.000      Min.   :  0.00
##  1st Qu.:0.000    1st Qu.:0.000     1st Qu.: 40.00
##  Median :0.000    Median :1.000     Median : 56.00
##  Mean   :0.075    Mean   :0.624     Mean   : 52.94
##  3rd Qu.:0.002    3rd Qu.:1.000     3rd Qu.: 69.00
##  Max.   :0.997    Max.   :1.000     Max.   :100.00
##           NA's    :3956       NA's   :3956
```

““