Using Classification Models to Predict Song Popularity

Presented by: Gabby Amparo

Objectives

- The objective of this analysis was to build classifying models that could predict a song's popularity given various audio features in hopes of helping artists gain popularity.

HELLO!

I am Gabby Amparo

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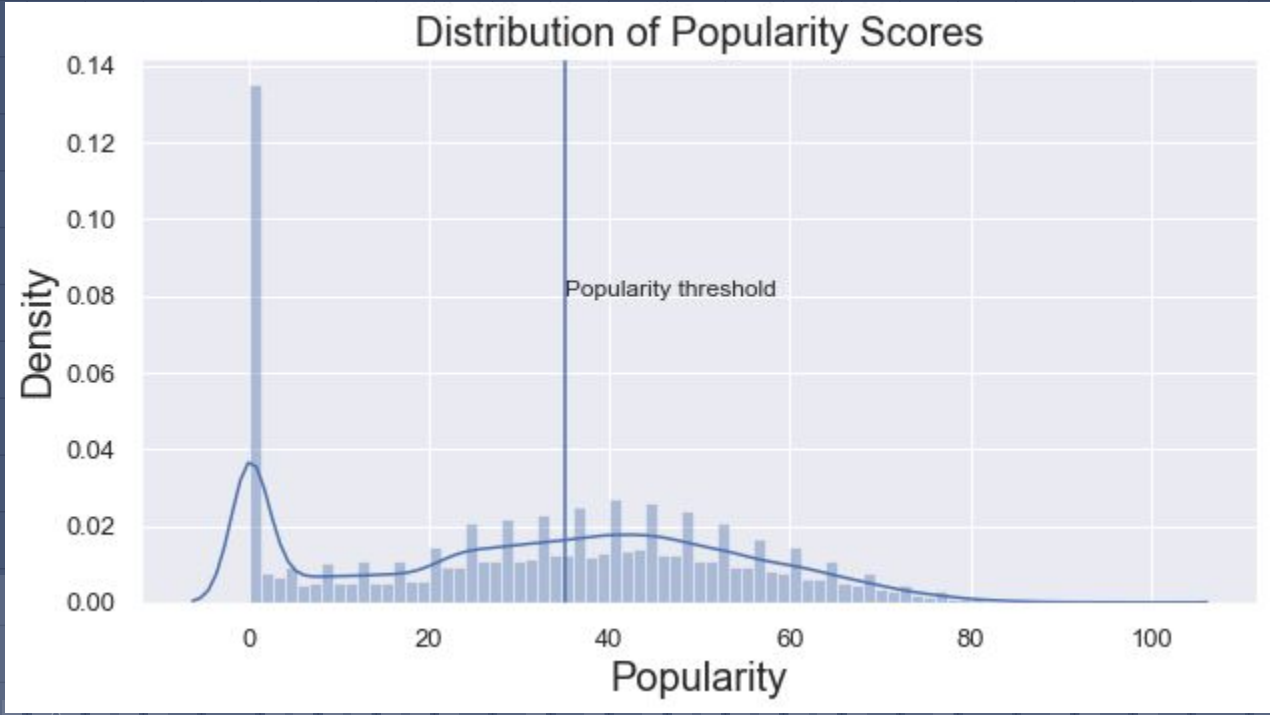
Overview of the Data

- Spotify is a popular music streaming service
- Data was obtained from the Spotify API and a dataset from the kaggle website
- The dataset contained:
  - 170,000+ tracks
  - About 30,000+ artists
  - Tracks dating back to 1921
  - Audio features

Overview of the Data: Summary of Audio Features

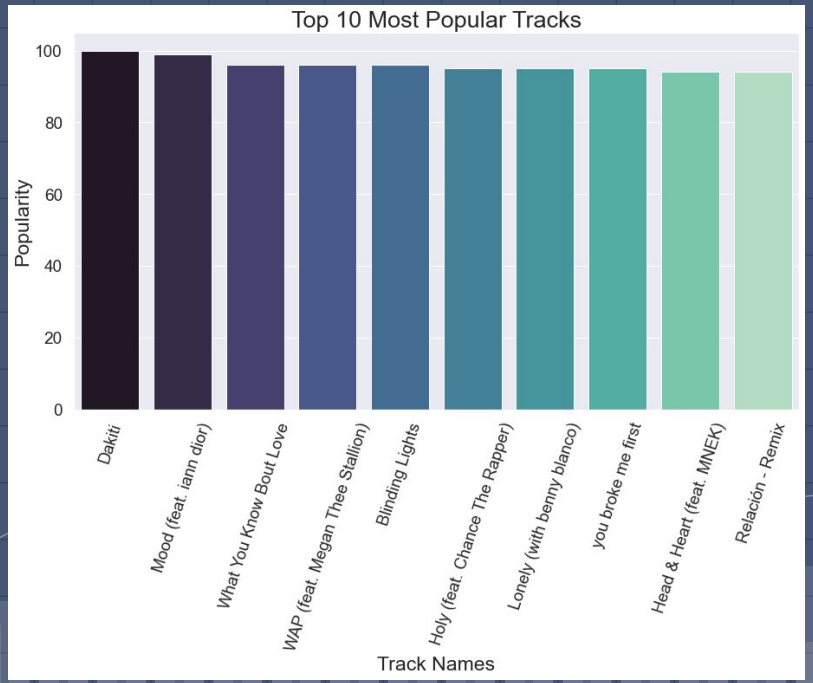
- Acousticness
  - Measure from 0.0 to 1.0 of whether the track is acoustic.
- Danceability
  - Measure from 0.0 to 1.0 how suitable a track is for dancing
- Duration_ms
  - Duration of the track in milliseconds.
- Energy
  - Measure from 0.0 to 1.0 and represents a perceptual measure of intensity and activity.
- Valence
  - Measure from 0.0 to 1.0 describing the musical positiveness conveyed by a track.
- Instrumentalness
  - Measure from 0.0 to 1.0 that predicts whether a track contains no vocals
- Liveness
  - Measure from 0.0 to 1.0 that detects the presence of an audience in the recording
- Loudness
  - The overall loudness of a track in decibels (dB) from -60 to 0
- Speechiness
  - Measure from 0.0 to 1.0 that detects the presence of spoken words in a track
- Key
  - The key the track is in
  - 0 = C, 1 = C♯/D ♭ , 2 = D, and so on.
- Tempo
  - The overall estimated tempo of a track in beats per minute (BPM).

Exploratory Data Analysis

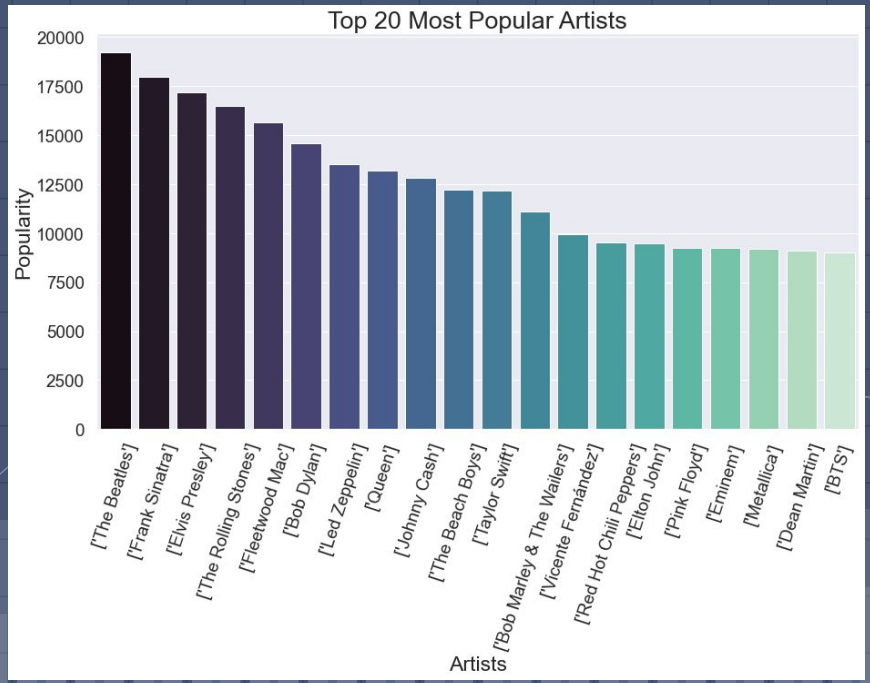


Exploratory Data Analysis

Top 10 Tracks



Top 20 Artists



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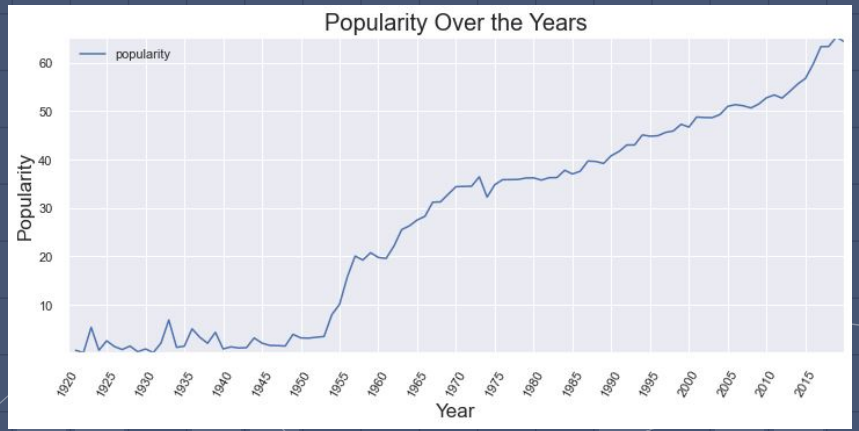
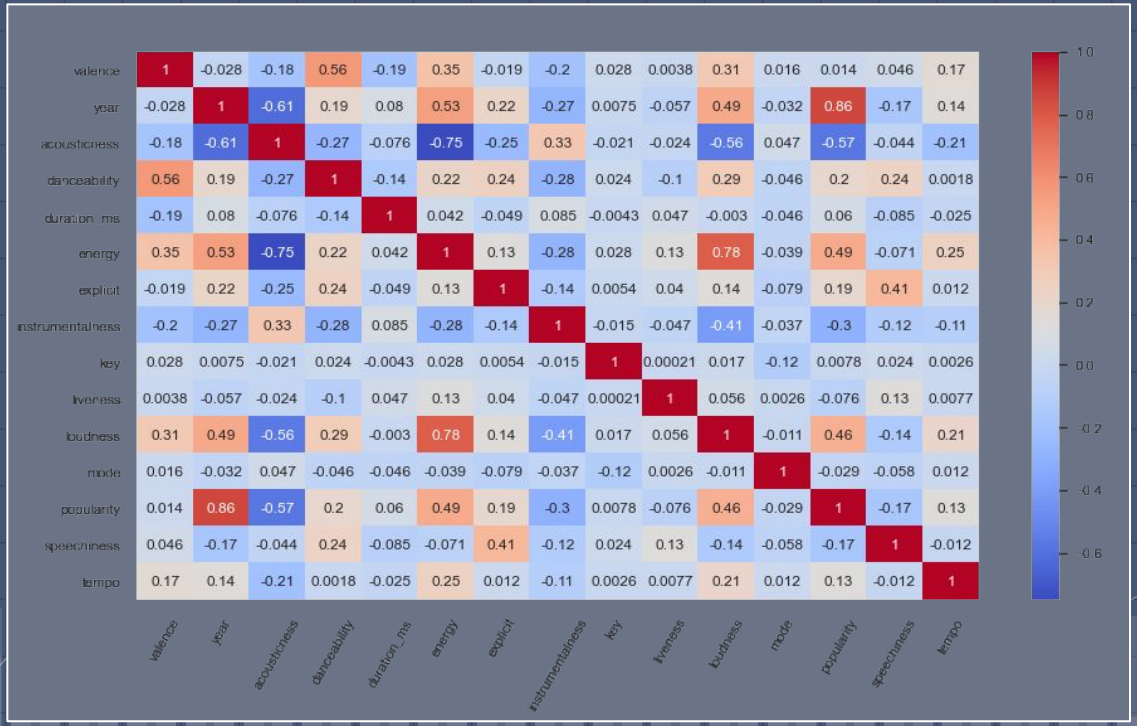


Exploratory Data Analysis



Classification Models

Built Logistic Regression classification models to compare their accuracies

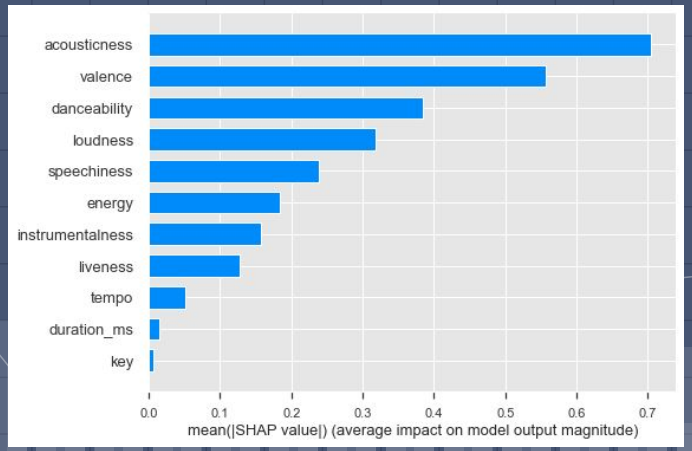
Performed GridSearchCV on each model to get the best parameters

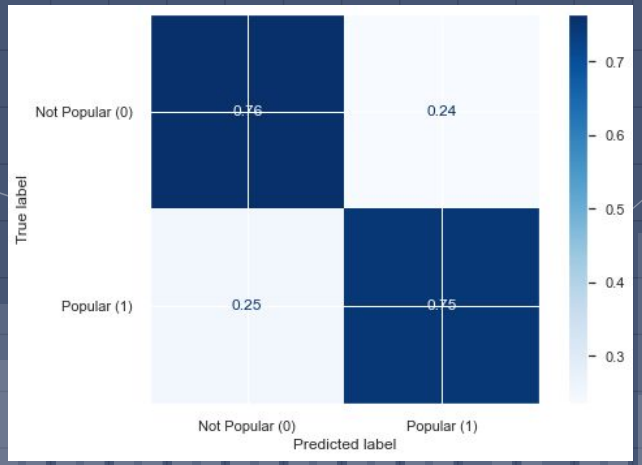
The models included were:

- Baseline LogisticRegression model
- LogisiticRegressionCV model

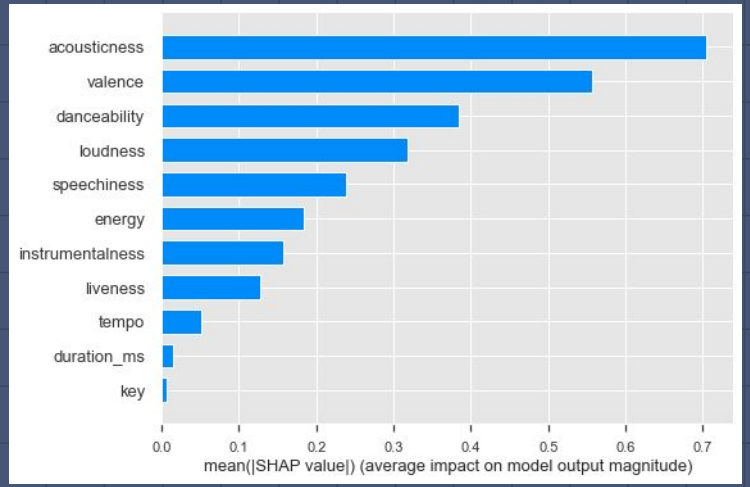
Logistic Regression Model

- The LogisticRegressionCV model performed the best
- The LogisticRegressionCV model had a performance accuracy of 75.7%
- Model has false positive and false negatives present
- Misclassification rate : 0.245





Logistic Regression Model



The Impact of Audio Features on the Model

	coef
acousticness	-0.767210
valence	-0.651481
danceability	0.469579
loudness	0.404460
speechiness	-0.360529
energy	0.214315
instrumentalness	-0.197915
liveness	-0.184105
tempo	0.064652
duration_ms	0.026815
key	0.006954

Direction of Impact

Impactful Audio Features:

- Acousticness
  - Negative correlation
- Valence
  - Negative correlation
- Danceability
  - Positive correlation
- Loudness
  - Positive correlation
- Speechiness
  - Negative correlation

Conclusions

Most Impactful Audio Features on Model

1. Acousticness
2. Valence
3. Danceability
4. Loudness
5. Speechiness

- Accuracy is 75.7%, could improve
- Misclassification rate = 0.245

Recommendations

For artists that want to create popular music I would recommend:

- Create songs with little to no acoustics, more electronic beats
  - Data shows that songs with a high acoustic levels are not popular
- Songs that are sad / gloomy tend to be more popular with listeners
  - Try creating songs about heartbreak or betrayal
- Listeners enjoy music that they can dance to
  - Create songs that have a fast tempo, strong beats, a stable rhythm
- Popular songs have lyrics, but not too many
  - Create songs with simple, repetitive lyrics
- Loud songs are more popular
  - Focus on electro-beats

Future Work

- Looking at the date and time when a song was uploaded to Spotify would improve the models.
- Use the same modeling techniques on a different popularity threshold
- Removing songs from 1920s - late 1940s

THANKS!

Any questions?

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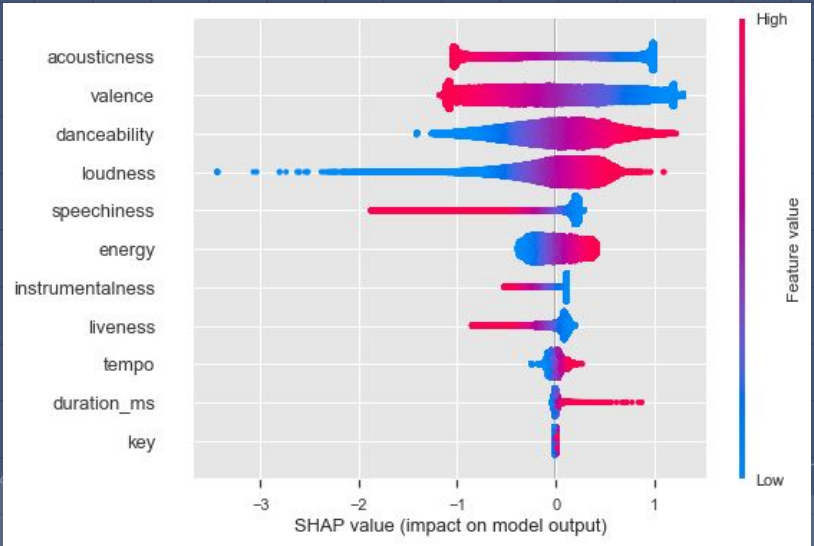
Appendix: Programs and Libraries

The following software libraries were used within Python to conduct data analysis:

- Numpy - for mathematical computation
- Pandas - allows for data organization & analysis
- Matplotlib - for data visualization
- Seaborn - works with Matplotlib to make clean graphics
- Sklearn - machine learning
- Shap - ML model interpretation

Appendix: Shap Summary Plot

Summary plot of Audio Features



The summary plot summarizes the following:

- When the level of acousticness of a track is low, it has a positive shap value and is more likely to be "popular"
- When the level of valence of a track is low, it has a positive shap value and is more likely to be "popular"
- When the level of danceability of a track is high, it has a positive shap value and is more likely to be "popular"
- When the level of loudness of a track is high, it has a positive shap value and is more likely to be "popular"
- When the level of speechiness of a track is high, it has a negative shap value and is less likely to be "popular"