Predicting Top 10 Songs on Billboard Hot 100 Chart

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Billboard Charts

- Billboard publishes musical charts of the most popular (highest sales, streams, etc.) songs & artists
- Charts are released on a weekly and/or yearly basis
- Great way to look at how trends and pop culture changes and evolves

The Hot 100

- *The Hot 100* is a popular Billboard chart
- Publishes 100 songs at end of year
- Songs are listed in ascending order– most popular at #1

Top 10 songs in 2010’s Hot 100 Chart

1	TiK ToK	Ke$ha
2	Need You Now	Lady Antebellum
3	Hey, Soul Sister	Train
4	California Gurls	Katy Perry Featuring Snoop Dogg
5	OMG	Usher Featuring will.i.am
6	Airplanes	B.o.B Featuring Hayley Williams
7	Love The Way You Lie	Eminem Featuring Rihanna
8	Bad Romance	Lady Gaga
9	Dynamite	Taio Cruz
10	Break Your Heart	Taio Cruz Featuring Ludacris

The Dataset

Hot 100 songs from 2010-2020 yearly charts

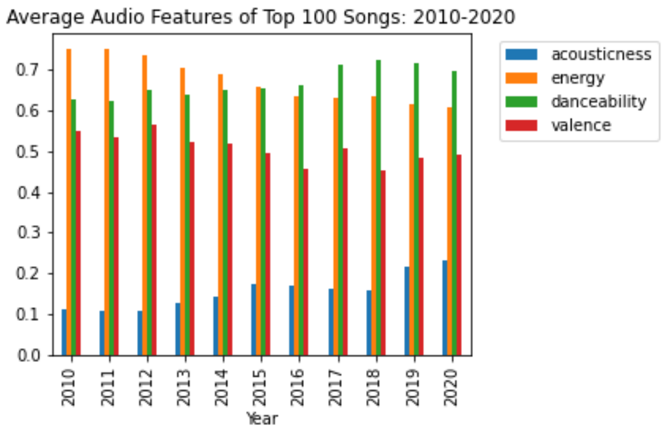
- **1100 songs** in total

Split data into 3 sets

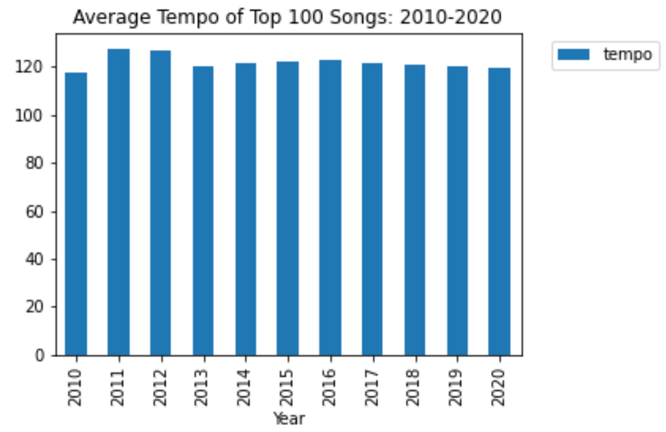
- Train: 2010-2015
- Validate: 2016-2017
- Test: 2018-2020

Spotify API Features:

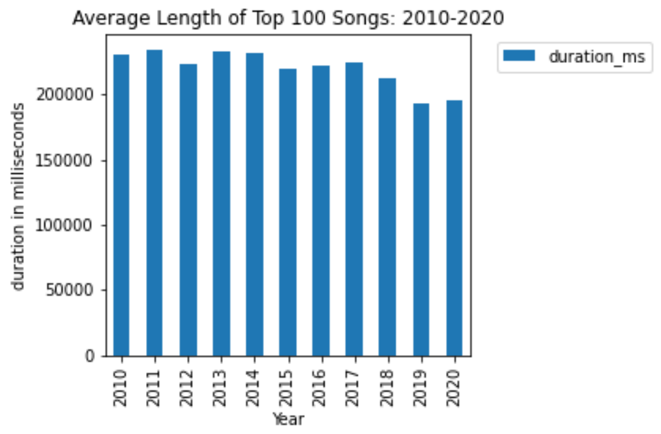
- Accousticness
- Danceability
- Duration
- Energy
- Instramentalness
- Key
- Liveness
- Loudness
- Speechiness
- Tempo
- Time signature
- Valence
- Artist popularity
- Artist genre



- Increase in acousticness & danceability
- Decrease in energy



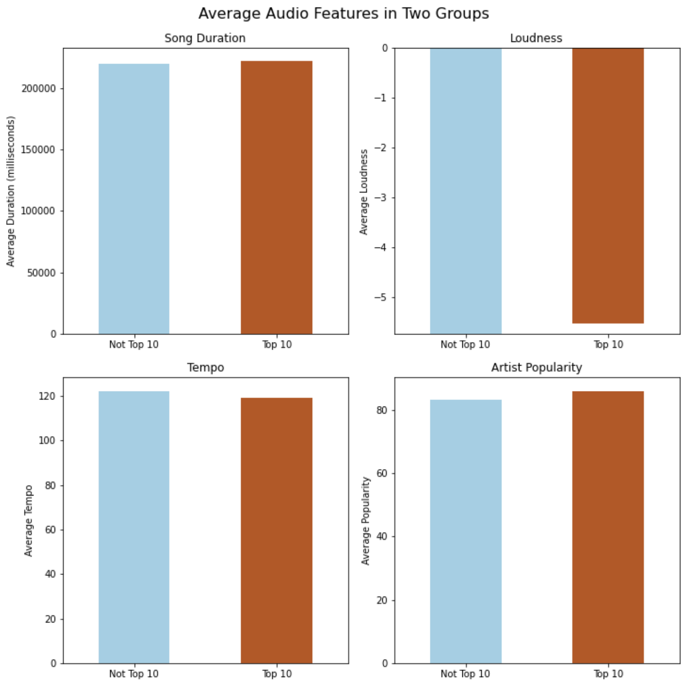
- Tempo is consistent

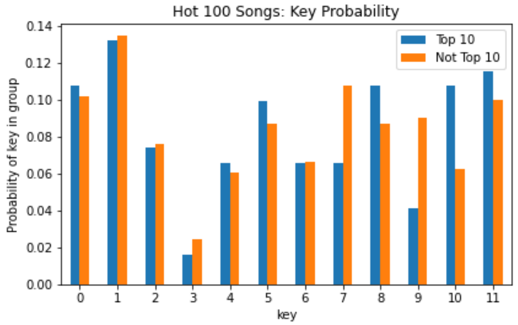


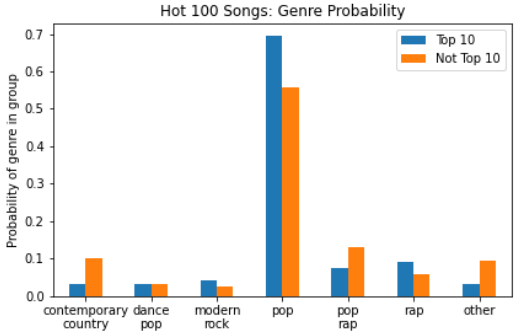
- Decrease in song length

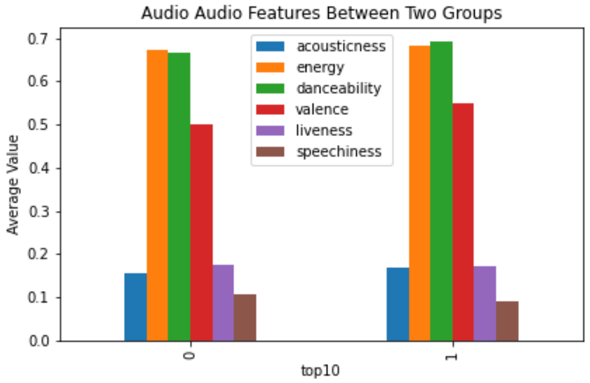
How has the Hot 100 changed over the past decade?

How do **Top 10** songs compare to the rest of the Hot 100?









- Higher valence and danceability
- Less loud, slower tempo
- More popular artists
- Pop and rap are most common

The Project

Which **features** best predict the **top 10** songs on Billboard Hot 100 charts?

Project Use & Intentions:

- Artists wanting to reach larger audiences can know what to focus on
- Music companies seek out songs that meet these features
- Predicting trends

Project Overview

Use neural networks to solve binary classification problem

- Class 0: Not top 10 song (90% of dataset)
- Class 1: Top 10 song (10% of dataset)

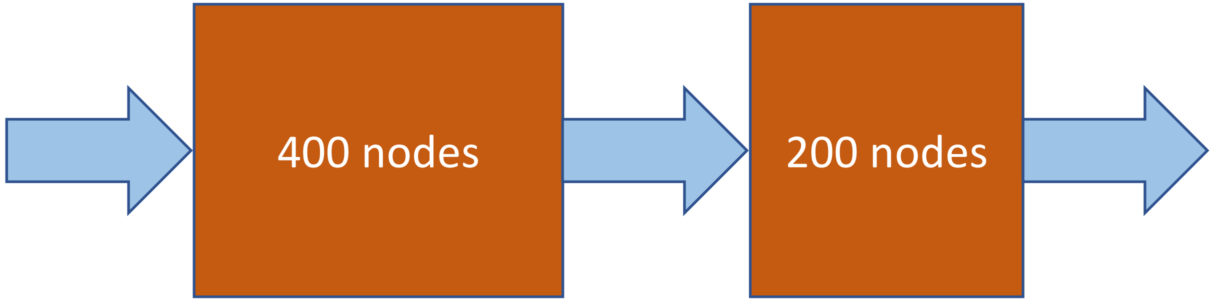
Reduce dataset by using **feature selection** techniques

- Irrelevant features can impact the accuracy of our model
- Which features yield the best predictive model?

Classification with Neural Networks

Input

Matrix $(n \times m)$
- n songs
- m features



Output

Vector $(n \times 1)$
- n labels

1. Train network with training data
2. Use validation data to improve parameters
3. Feed network testing data
4. Use the network's output and compare with true classes of testing data

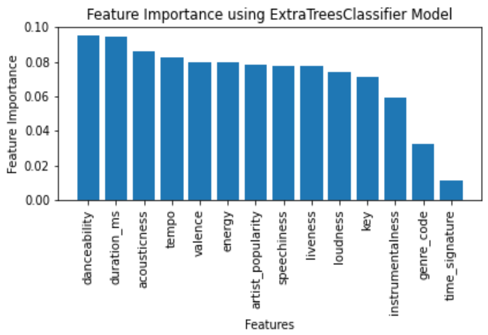
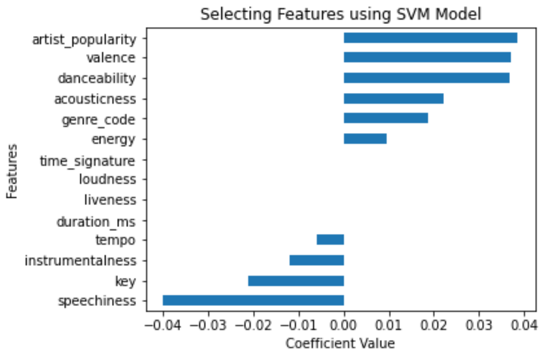
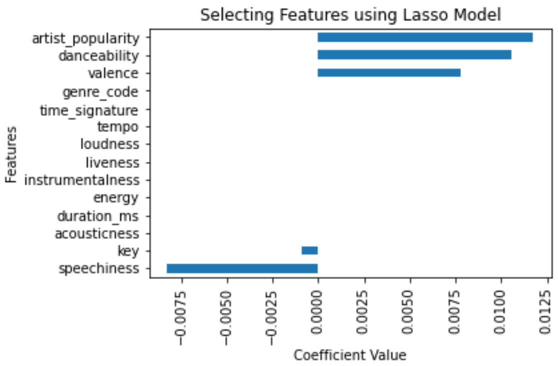
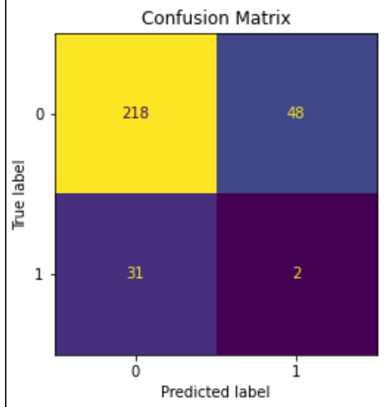
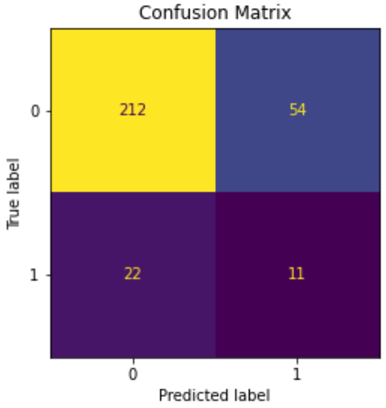
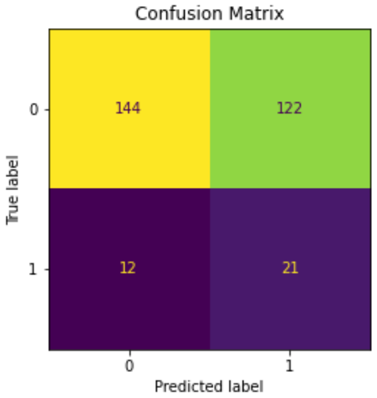
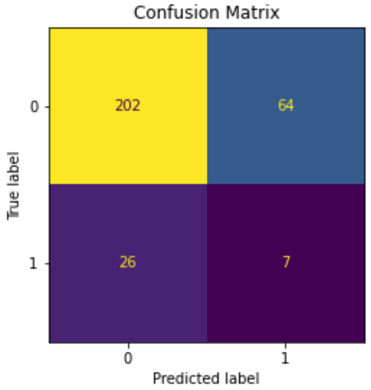
Applying Feature Selection to Neural Networks

Train and test the neural network using data that contains:

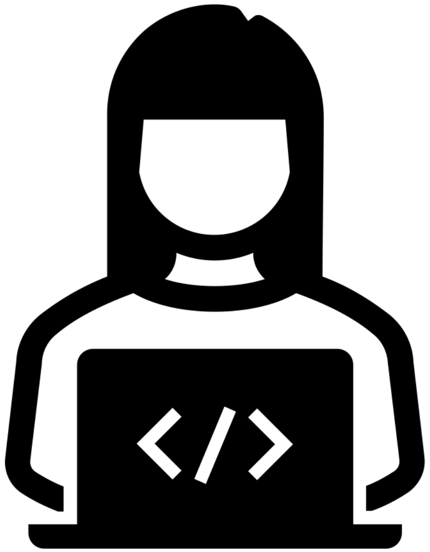
All features	Features selected by **ExtraTreesClassifier**	Features selected by **Lasso**	Features selected by **SVM**

The model with the highest accuracy contains the features most useful with identifying top 10 songs

Results

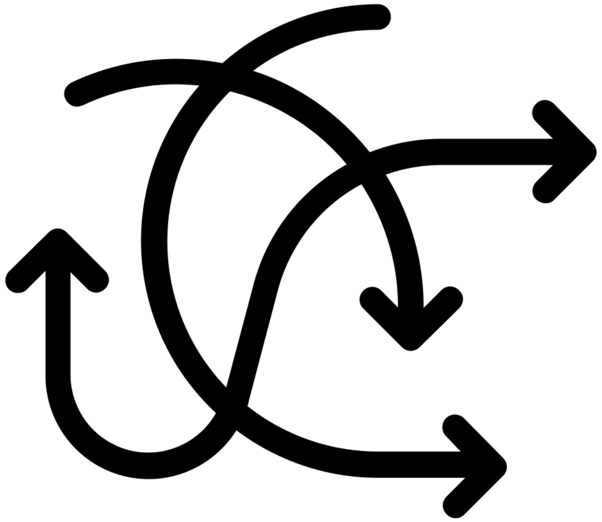
<table>
<tr><th>Method</th><th>ExtraTreesClassifier</th><th>SVM</th><th>Lasso</th><th>No Feature Selection</th></tr>
<tr><td></td><td>
</td><td>
</td><td>
</td><td></td></tr>
<tr><td># Features</td><td>10</td><td>10</td><td>5</td><td>14</td></tr>
<tr><td></td><td>
</td><td>
</td><td>
</td><td>
</td></tr>
<tr><td>Accuracy</td><td>74%</td><td>75%</td><td>55%</td><td>70%</td></tr>
</table>

The Team



- I worked alone on this project
- Skills: programming, machine learning, listens to music
- I collected the data and ran the analysis

Project Challenges & Limitations



- Spotify API was irritating
  - Features are only for songs in a playlist or on the same album
  - Had to manually create Spotify playlists for 1100 Billboard songs
- Limited Data
  - Unable to obtain artists net worth demographics
  - No database for this information

Conclusion

SVM performed the best with the following features:

Artist popularity

Danceability

Valence

Genre

Acousticness

Energy

Tempo

Instramentalness

Key

Speechiness

Lasso performed the worst

Had smallest # of features

Likely too much data reduction

It’d be interesting to consider additional features

artist net worth

artist demographics