Predicting Hit Songs on Spotify

A combination of Lyrics and Audio Features

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Abstract

In this research, we are using lyrics, audio features, and producer / songwriter information to predict music's popularity before a song is released.

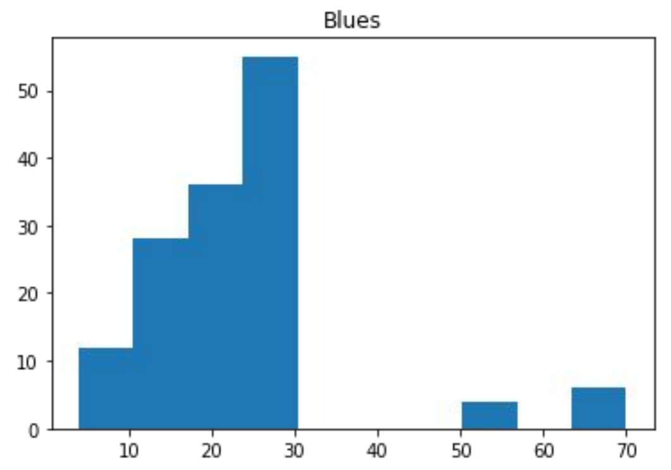
Introduction

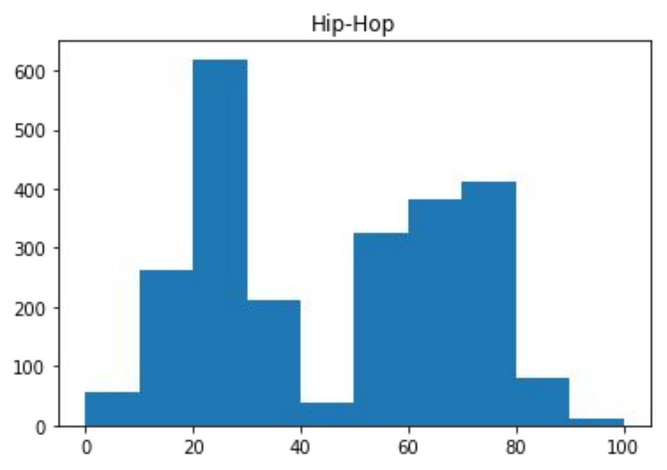
Problem statement

Given a track before it is released to public, how do we know if it would be a "hit" song on Spotify, which is the biggest music streaming platform that has 170 million worldwide users. Without any marketing strategy or promotion, only from the track attributes: title, artist, producers, lyrics, melodies, is it sufficient to predict its success?

Challenges

- Industry AUC score doesn't go above <u>60</u>
- Strict copyright from obtaining a large dataset
- Spotify doesn't share with WMG information except their own productions
- Highly Imbalanced Data (6% Hit Song) and different distributions by genre





Data Source

WARNER MUSIC GROUP

GENIUS

Spotify

Audio

Lyrics

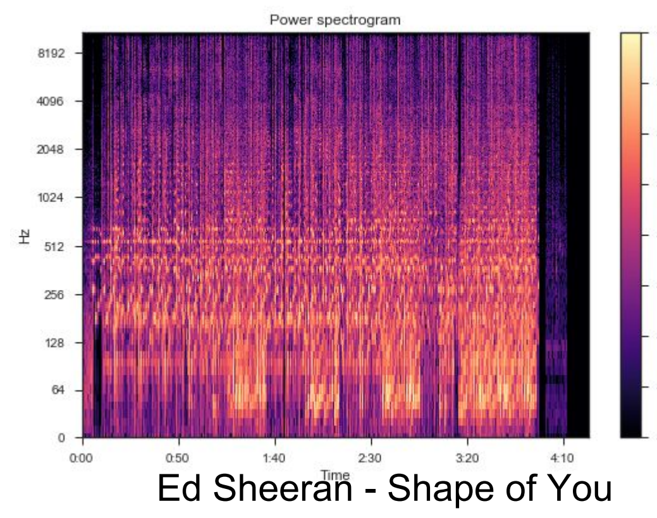
Producer Songwriter

Genre

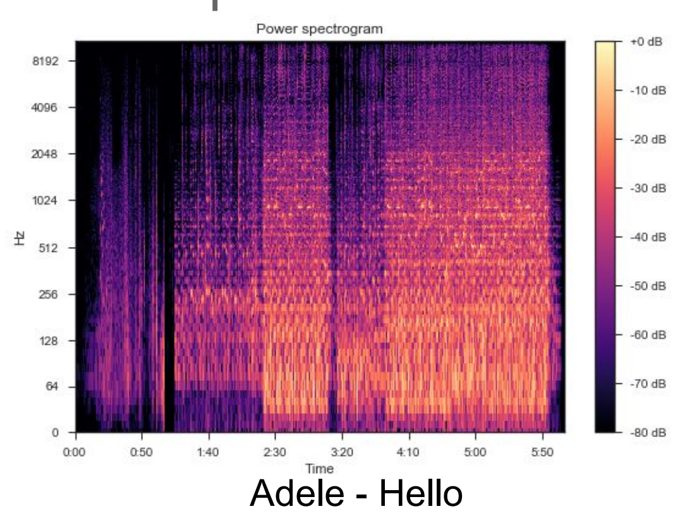
Data Processing

Audio

Melspectrogram Loud & Repetitiveness



Ed Sheeran - Shape of You



Adele - Hello

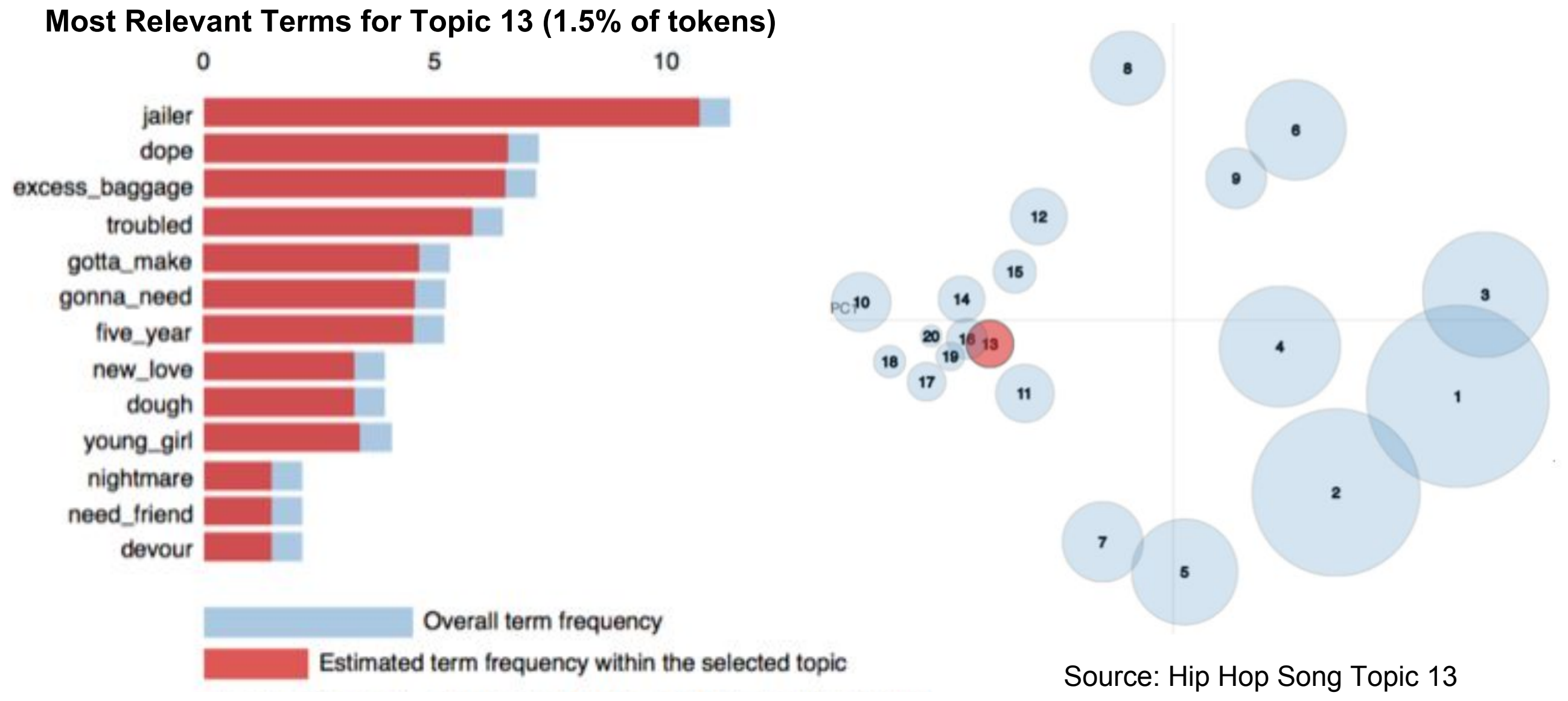
Song Tags Vocal & Instrument feature

🎸 🎹 👩‍🎤 & 47 other features

Lyrics

Topic Modeling (LDA) from Gensim

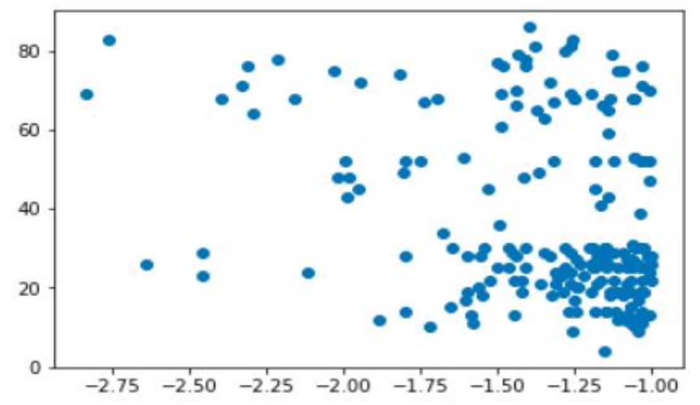
This hip hop topic 13 can inferred to be drug/crime related from the words associated



Source: Hip Hop Song Topic 13

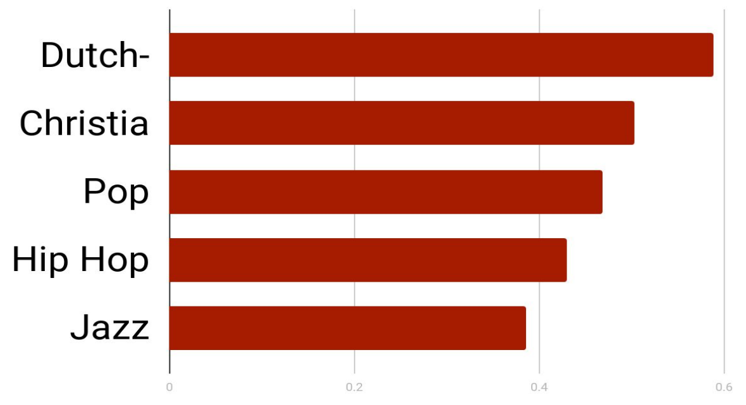
Sentiment Analysis from SentimentR

Negative sentiment is significantly correlated with the popularity score



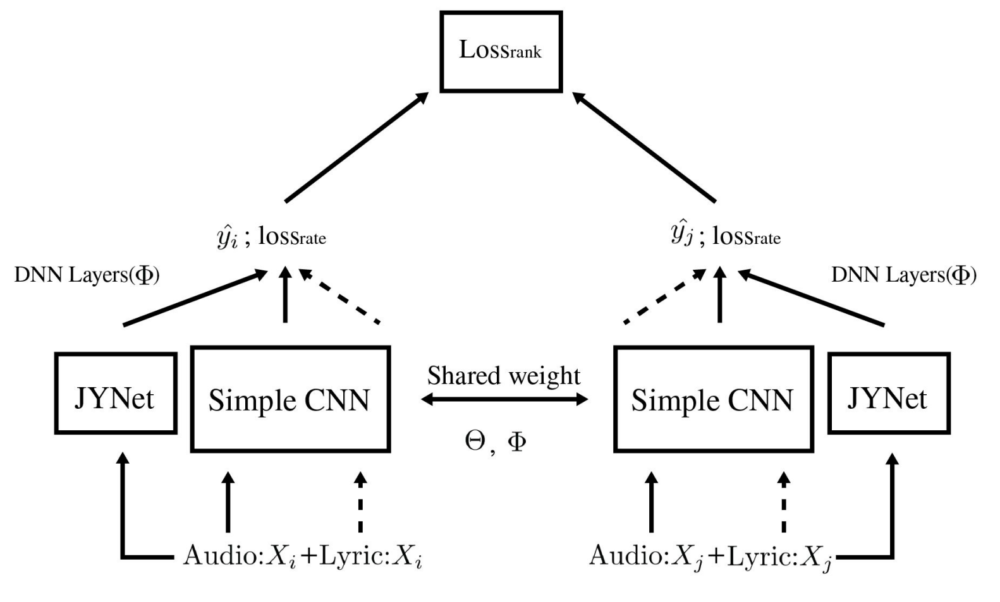
Repetition Analysis with Lempel-Ziv Algorithm

Songs with more repetitive lyrics are more likely to become a hit song



Methodology

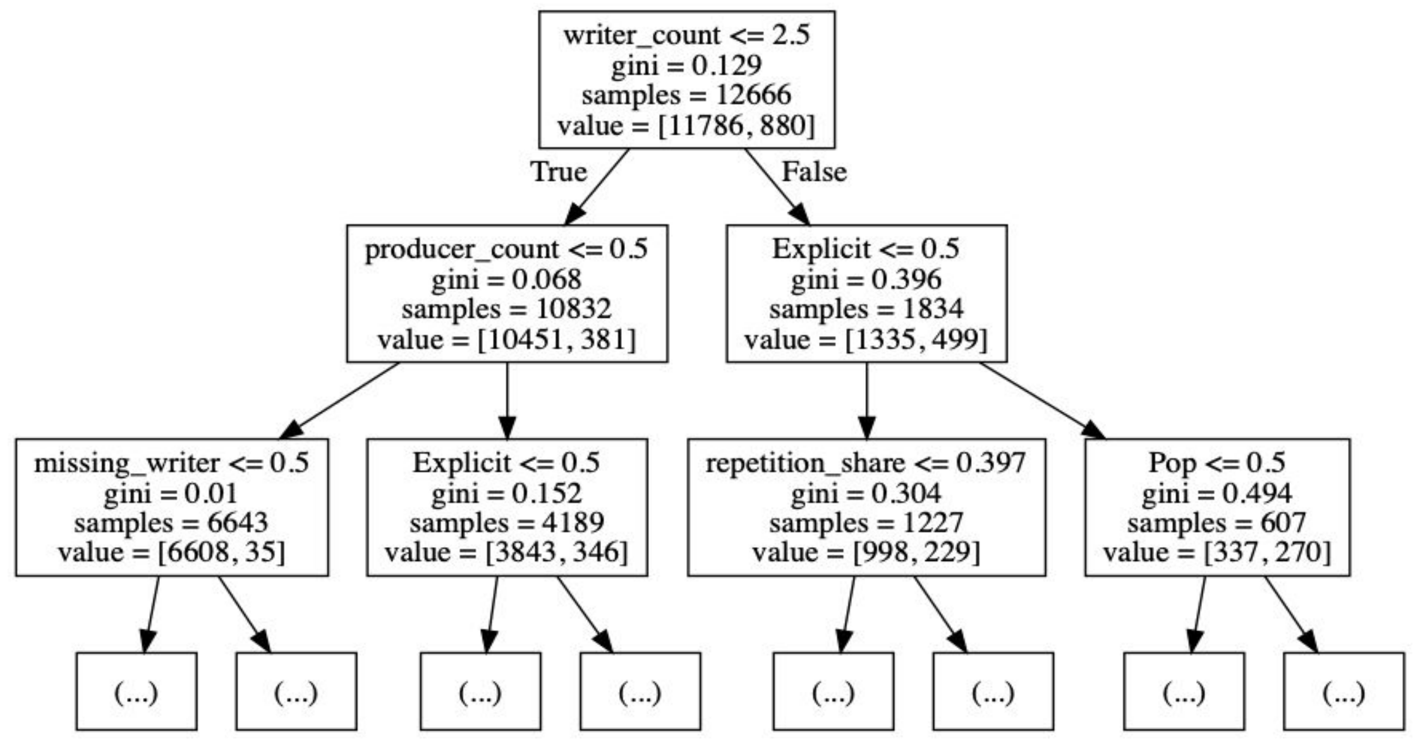
Siamese CNN



Siamese CNN with audio, lyric &tag features

Decision Tree

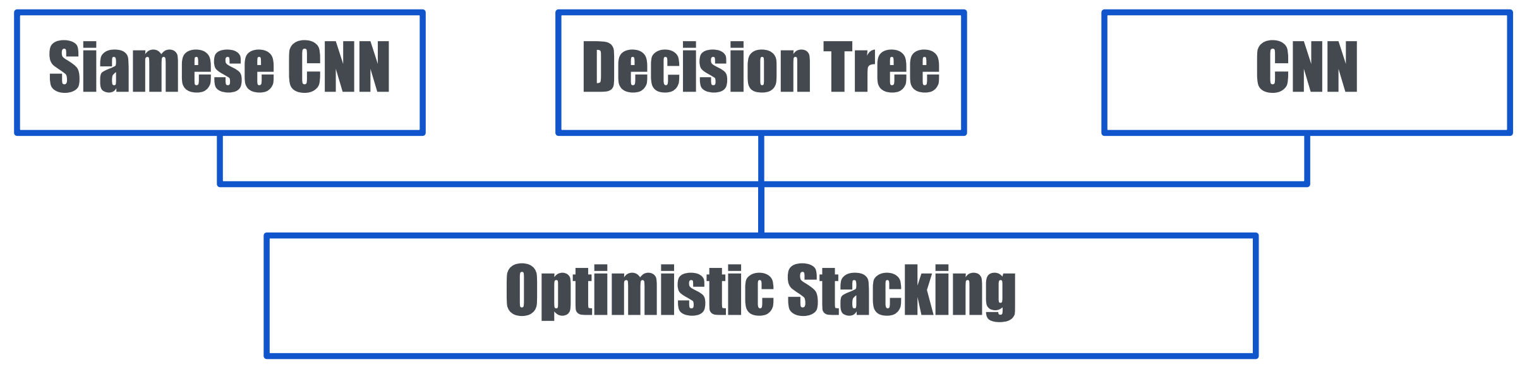
- Spotify Audio Features and Scraped Data
- 5 minimum leaf split and 20 maximum depth achieved maximum recall / F1 score



Convolutional Neural Network

- A pre-trained word embedding from FastText, the CNN takes the embedded lyrics and predict a binary class
- After running 20 epochs, training loss dropped from 0.26 to 0.008, and the model achieved a recall of 33%, which is much better than the baseline model
- Predictions on the test set is later being used in the final model.

Optimistic Stacking



Siamese CNN

Decision Tree

CNN

Optimistic Stacking

Result

Conclusion

- Audio features from Spotify are not predictive
- Number of songwriters and producers is correlated with popularity. The more songwriters and producers lead to higher score.
- More popular songs are more repetitive and they are often explicit
- Pop and hip-hop songs are more popular than blues and country
- Combining predictions from multiple models in "optimistic stacking" leads to the best results
- We achieved **<u>40% recall</u>** and **<u>25.7% F-1 score</u>** in the final model, improved from a baseline model Decision Tree with 5% recall and 8.9% F-1 score.

Forthcoming Research

In the future work, we would like to implement the embedded lyrics from CNN and audio features into a deep learning model, and integrated all other features and train the model with an attention mechanism.

Acknowledgments

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Reference

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