Hit or miss?

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Motivation and Reasoning

Motivation:
Can song features and lyrics of a song predict hits?

Why is predicting hit songs valuable?
- Artists
- Listeners
- Labels
- Streaming Platforms
- Marketing

What “hit” means in your project?
- Popularity, from Spotify API $\geq$ 45 cutoff

Guess whether it's a hit or miss!

Dataset & Features

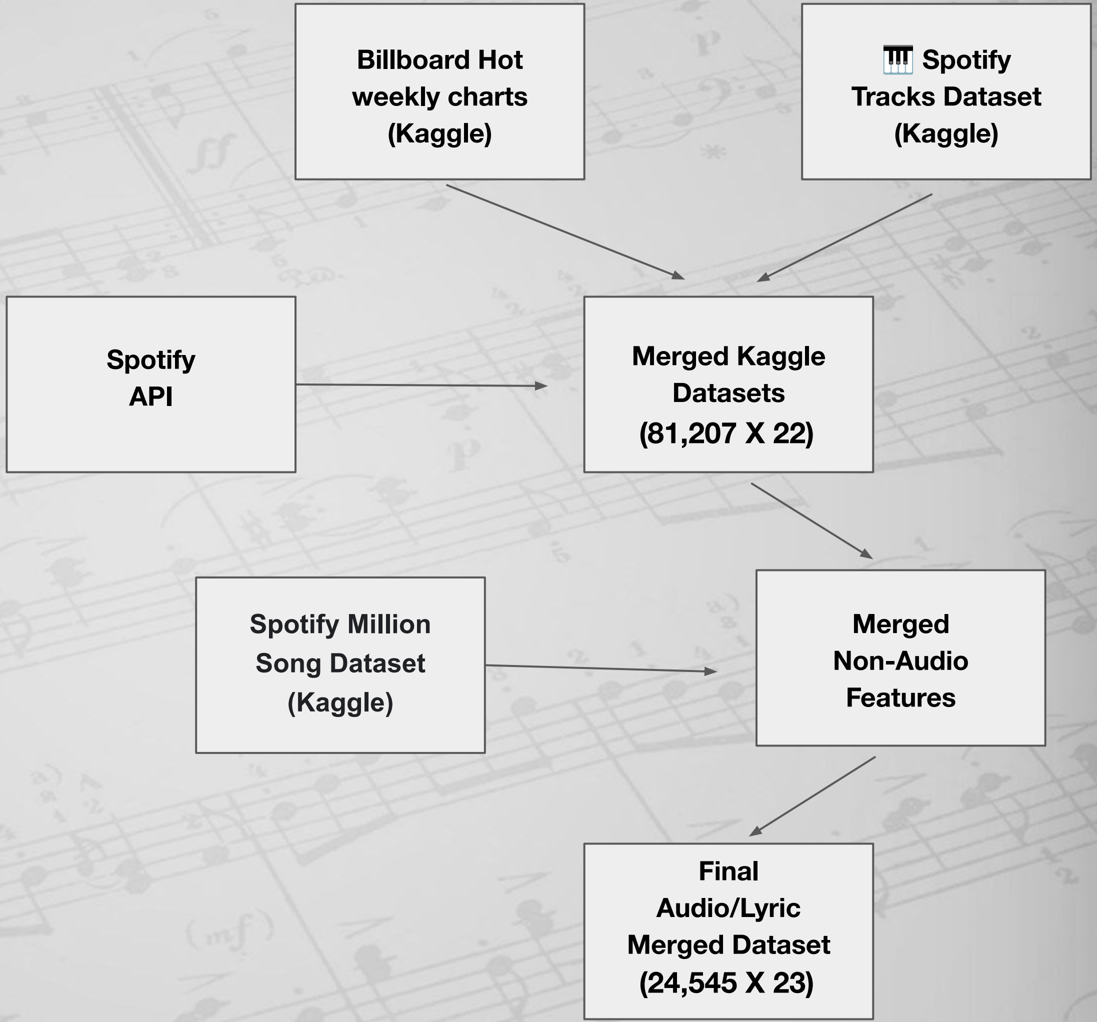
Numeric Features:

- **Audio:**
  Danceability, Energy, Speechiness, Tempo, Liveness, Loudness, Instrumentalness, Valence

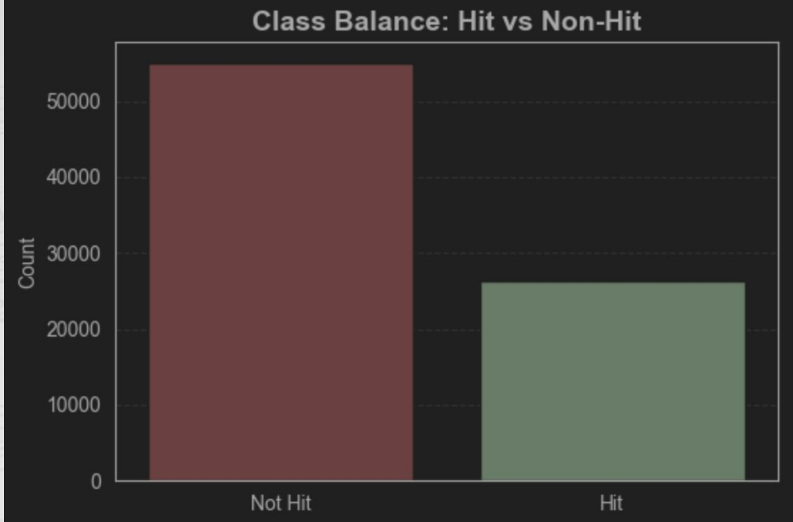
- **Non-Audio:**
  Tracks in Album, Artist Popularity,
  Artist Followers

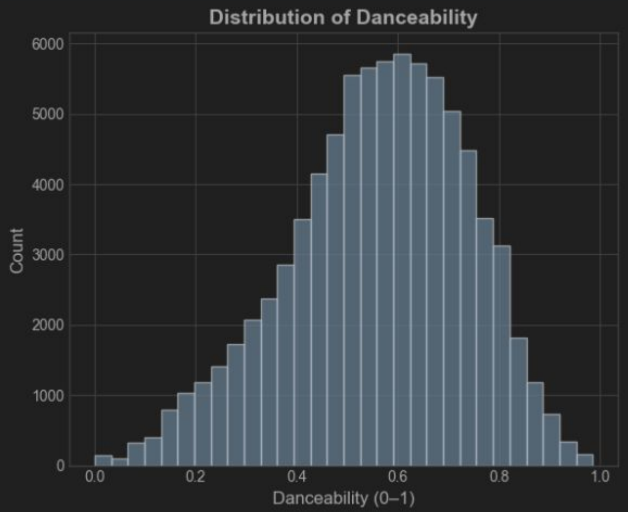
Categorical Features:

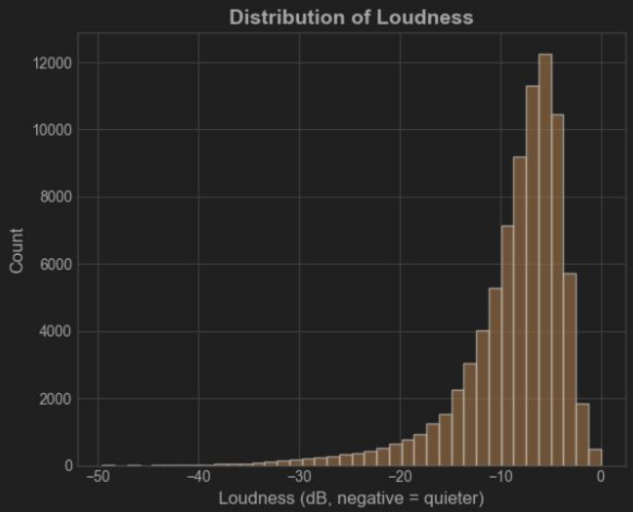
- Explicit, Mode, Album Type, Label Group, Artist Genre, Track Genre, Lyrics

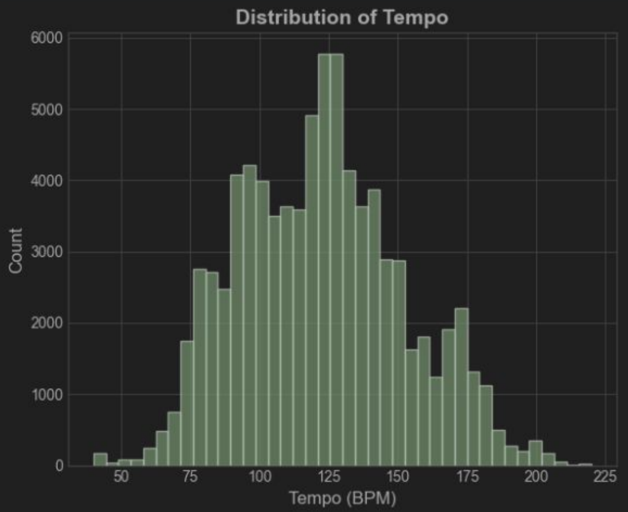


Exploratory Data Analysis









Challenges and Featured Engineering

Challenges in the Data

- Missing values
- Inconsistent formats in Genres and Labels
- Key stored as numbers, instead of musical notes
- Imbalanced target: only ~19% of songs are “hits”

Feature Engineering Solutions

- Extracted release_year, release_month, added flags
- Simplified genres and grouped labels into groups
- Log transforms
- Interaction of features

```
BEFORE (original features)
   duration_ms   tempo  loudness  energy  valence  danceability
0     230666.0  87.917    -6.746   0.461    0.715         0.676

AFTER (engineered features added)
   log_duration  log_tempo  log_loudness  energy_valence  dance_tempo
0      12.34873   4.487703      2.047177        0.329615    59.431892
```

Methods

Modeling Approach

- Train/test split (80/20, stratified).
- Models tested: Logistic Regression, Random Forest, LightGBM, CatBoost, **XGBoost (tuned)**.
- Evaluation metrics: Accuracy, Precision, Recall, F1, ROC-AUC.

Model Comparison

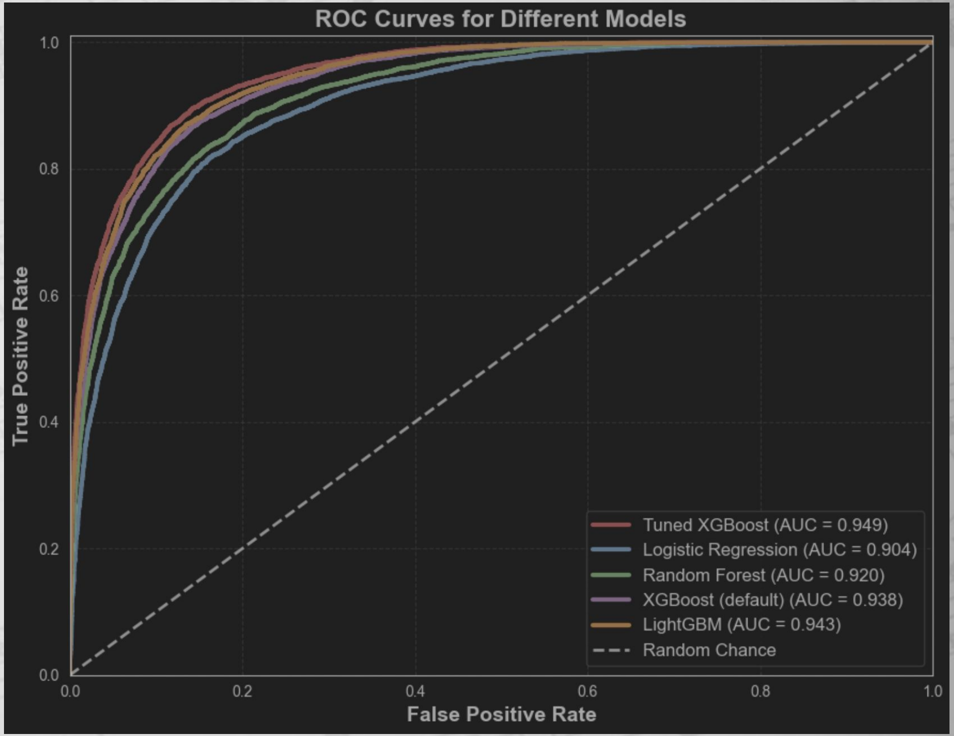
Model	*Accuracy (%)*
Tuned XGBoost	**88.2%**
LightGBM	88%
XGBoost (default)	87%
Random Forest	84%
Logistic Regression	82%

```
Tuned XGBoost (threshold=0.50)
             precision    recall  f1-score

          0      0.909     0.918     0.913
          1      0.824     0.807     0.815

   accuracy                          0.882
```

ROC-AUC Comparison



Methods pt. 2

Lyrical Analysis

- Standardized lyrics
- Converted lyrics into numeric features using term frequency-inverse document frequency (TF-IDF)
- Split and run logistic regression
- Extract top words
- WordCloud

The song was….

A HIT

Top 25 most common hit lyrics

Reflection

Positive:

- Importance of non-audio features
- Learned TF-IDF

Negative:

- Remove duplicates
- Limitations of Spotify API

Any questions?