Xuening Wang (xw672), Lexi Yin (my528)
Oct 3rd, 2023

CS 5785: Applied Machine Learning
Project Proposal

Thank You, Next: Predicting Song Skips for Personalized Music Recommendations

Project Category: Application of machine learning to a practical problem

Motivation

Music streaming services have changed how we listen to music and have become a key part of today's music scene. Platforms like Spotify and Apple Music lead this digital change, making it normal to have personalized music easily available. A crucial aspect of augmenting user engagement on these platforms involves understanding the user's musical preferences, prominently reflected through their interaction with the "skip" button. This button serves as a window into the user's musical taste, providing immediate feedback on the current music. Consequently, predicting a song's likelihood of being skipped can substantially improve music recommendation systems, making them more user-oriented and adaptive.

Method

The core problem being addressed is the application of machine learning to predict the likelihood of song skips on Spotify, using user interaction data and acoustic features of the songs played. This issue holds relevance as it transcends towards a more personalized user experience, ensuring the users find their musical haven on streaming platforms. The sequential skip prediction model aimed to be developed will utilize the historical data of user interactions within a listening session, coupled with the acoustic attributes of the songs, to predict the "skip" or "not skip" outcome for upcoming tracks.

Experiments

For our project, we are utilizing Spotify API and the Spotify Sequential Skip Prediction dataset (https://www.aicrowd.com/challenges/spotify-sequential-skip-prediction-challenge) encompassing approximately 130 million listening sessions. A session comprises up to 20 music tracks. The dataset provides all user behavior attributes and track ids for the initial half of each session, while only the track ids are available for the latter half. These track ids are linked to the acoustic features of the tracks, which can be retrieved through the Spotify API. The user behavior attributes include actions such as pausing by the user, the hour of the day, among others, while the acoustic attributes cover aspects like danceability and tempo.

Model Development and Evaluation:

1. Construct and train various ML models (like GBTs, LSTMs, Bi-LSTMs, Transformers, or a RL-based model) using a dataset from Spotify, ensuring a fair comparison by using the same training and testing splits.

2. Evaluate models based on metrics like accuracy, precision, recall, F1 score, and Area Under the ROC Curve (AUC-ROC) in predicting song skips.
3. Analyze the models' ability to generalize across different user demographics and musical genres.

Feature Importance and Analysis:

1. Conduct a feature importance analysis using techniques like SHAP (SHapley Additive exPlanations) to understand which features (e.g., acoustic attributes, historical user interactions) are most predictive of skip behavior.
2. Investigate temporal data leakage and assess the impact of different feature sets on model performance.

Comparative Analysis:

1. Compare the performance of our models against existing state-of-the-art models in predicting song skips.
2. Explore the trade-off between model complexity, interpretability, and performance.

Conclusion

This project proposes a machine learning approach to predict song skips on Spotify, aiming to enhance user experience on music streaming platforms. By analyzing user interaction and acoustic features of songs, the developed model seeks to make music recommendations more personalized and responsive. The project also explores various machine learning models, providing insights into feature importance and model performance which could be invaluable for future developments in music recommendation system and streaming technology.