Emotion Detection in Music and Emotion-Based Music Recommendation System

Aditi Roy
University of Illinois Urbana-Champaign
Champaign, United States
aditir5@illinois.edu

Kinjal Chaudhari
University of Illinois at Urbana-Champaign
Champaign, United States
kchaud9@illinois.edu

Linnea Marsh
University of Illinois at Urbana-Champaign
Champaign, United States
linneam2@illinois.edu

Manasi Mangalvedhe
University of Illinois at Urbana-Champaign
Champaign, United States
manasim2@illinois.edu

Abstract

This project aims to develop a system that detects emotions in music by analyzing song lyrics and audio features and then recommends songs to users based on their emotional preferences. By leveraging natural language processing (NLP) techniques for lyrics and audio analysis methods, the system will classify songs into emotional categories such as joy, sadness, anger, and calm. The emotion detection component will be integrated into a recommendation engine that suggests music aligned with the user's emotional state or historical listening patterns. This project combines multi-modal emotion recognition with machine learning-based recommendation systems to enhance personalized music experiences.

1 Introduction

Emotion plays a significant role in the way individuals interact with music. People often select songs that resonate with their current mood or seek music to evoke a desired emotional state. Existing music recommendation systems primarily rely on user interactions, genres, and historical data but often lack a deeper understanding of the emotional content within the songs themselves. This project proposes a novel approach by incorporating emotion detection in both lyrics and audio features to create a more emotionally intelligent recommendation system. By analyzing the emotional tones of music, we aim to provide users with personalized recommendations that not only match their listening preferences but also align with their emotional needs.

2 Description of Intended Work

The project will be divided into two main components: *Emotion Detection* and *Recommendation System.*

2.1 Emotion Detection

Data Collection: Collect song lyrics from sources such as Genius Lyrics API and audio data from public datasets like the Million Song Dataset (MSD) and EmoMusic Dataset. Obtain emotion labels for songs using pre-existing datasets or through manual annotation where necessary.

Preprocessing:

- *Lyrics Preprocessing:* Clean the text data by removing special characters, normalizing the text, and tokenizing.
- *Audio Feature Extraction:* Use libraries to extract relevant audio features.

Feature Extraction:

- Apply NLP techniques like TF-IDF, Word2Vec, or transformer-based embeddings (e.g., BERT) to extract meaningful features from the lyrics.
- Extract audio features to complement text-based emotion detection.

Emotion Classification:

- Develop supervised learning models such as SVM, Random Forest, or Neural Networks to classify songs based on their emotional content.

2.2 Recommendation System

Content-Based Filtering: Develop a content-based recommendation approach that uses the emotional classification of songs to suggest music with similar emotional tones.

2.3 Evaluation

Emotion Classification: Evaluate the accuracy and robustness of the emotion detection models using metrics like precision, recall, F1-score, and confusion matrices.

Recommendation System: Assess the quality of the recommendations using metrics such as precision and recall.

3 Project Milestones

- **Data Collection and Preprocessing (5 hours) :** Collect and preprocess lyrics and audio data. Extract relevant features for both text and audio components.
- **Emotion Classification Model Development (15 hours):** Build and train emotion classification models using supervised and deep learning techniques. Evaluate and fine-tune the models to achieve optimal performance.
- **Recommendation System Development (10 hours):** Implement collaborative and content-based filtering approaches. Integrate the emotion detection models with the recommendation system.
- **Evaluation and Optimization (5 hours) :** Evaluate the performance of both the emotion detection models and the recommendation system. Optimize based on evaluation metrics and user feedback.

- **Testing, Documentation, and Final Presentation (5 hours) :** Conduct thorough testing of the system. Document the system architecture, code, and evaluation results. Prepare a final presentation of the project.