UE21CS342BA2 - Algorithms for Information Retrieval and Intelligence Web

Mini Project Report

"Information Retrieval Using Audio File"

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Abstract

Music genre classification is a fundamental task in music information retrieval, facilitating various applications such as music recommen- dation and content organization. This project explores the use of machine learning and deep learning techniques to classify music genres based on audio features extracted from music samples. The dataset consists of audio features such as chroma features, spectral centroid, and zero-crossing rate, extracted using the librosa library. Two models are trained and evaluated: an XGBoost classifier and a deep neural network implemented using Keras. The XGBoost model demonstrates high accuracy and efficiency, while the deep learning model offers flexibility and potential for further optimization. Through spectrogram analysis and feature visualization, the project provides insights into the frequency content and characteristics of music samples across different genres. Overall, the project showcases the effectiveness of machine learning techniques in music genre classification tasks and provides a foundation for future research in the field.

1 Introduction

The project aims to classify music genres based on audio features using machine learning tech- niques. Music genre classification is a signifi- cant task in the field of music information re- trieval, aiding in music recommendation sys- tems, playlist generation, and content organi- zation. This project utilizes a dataset contain- ing audio features extracted from music samples across various genres. By training machine learning models on this dataset, we can predict the genre of a given music sample.

2 Code Explanation

Data Preprocessing:

1. **Encoding Categorical Labels:** The genre labels are extracted from the DataFrame final data using iloc[:, -1]. These labels are then encoded into numeri- cal values using LabelEncoder().

2. **Target Variable (y):**

   The encoded genre labels (y) are utilized as the target variable during model training.

Feature Extraction and Visualization:

Various audio features are extracted from the music samples using the librosa library, includ- ing chroma features, spectral centroid, and zero- crossing rate. Spectrogram analysis is performed to visualize the frequency content of the audio signals.

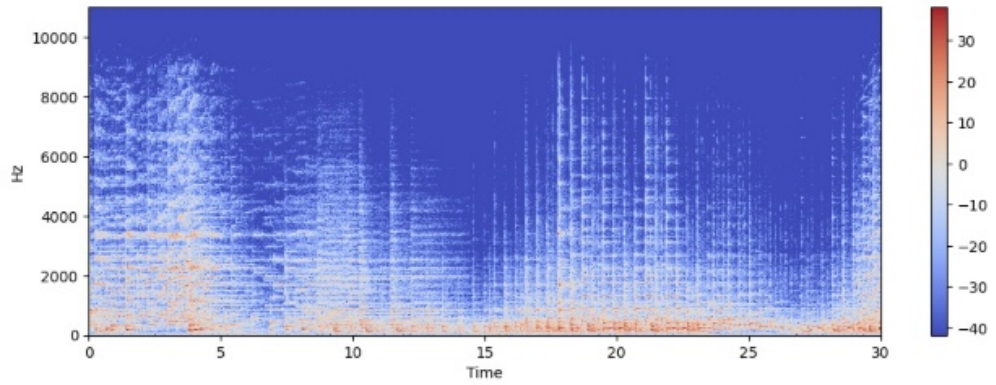
Model Training and Evaluation:

Two types of models are trained: an XGBoost classifier and a deep neural network using Keras. The XGBoost classifier is trained with hyperpa- rameter tuning using the Hyperopt library. The deep neural network consists of several dense layers with ReLU activation and dropout for reg- ularization. Training progress and model evalu- ation metrics such as accuracy, precision, recall, and F1-score are monitored.

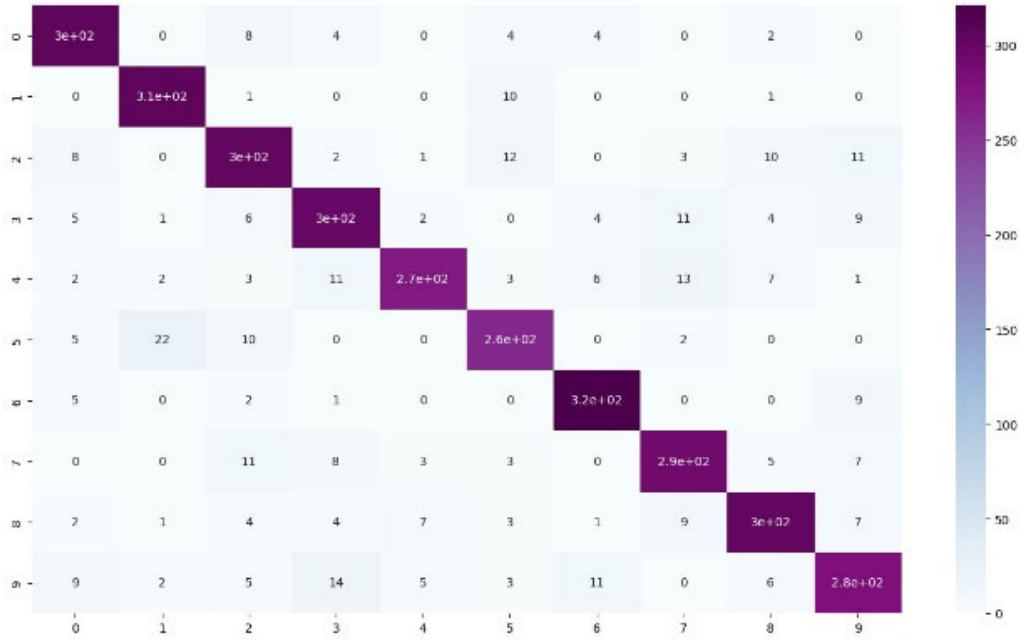
3 Output

Spectrogram Visualization: The code gener- ates spectrograms to visualize the frequency

con- tent and characteristics of music samples across various genres. Spectrograms provide a detailed representation of the audio signals, capturing in- formation about pitch, intensity, and timbre.



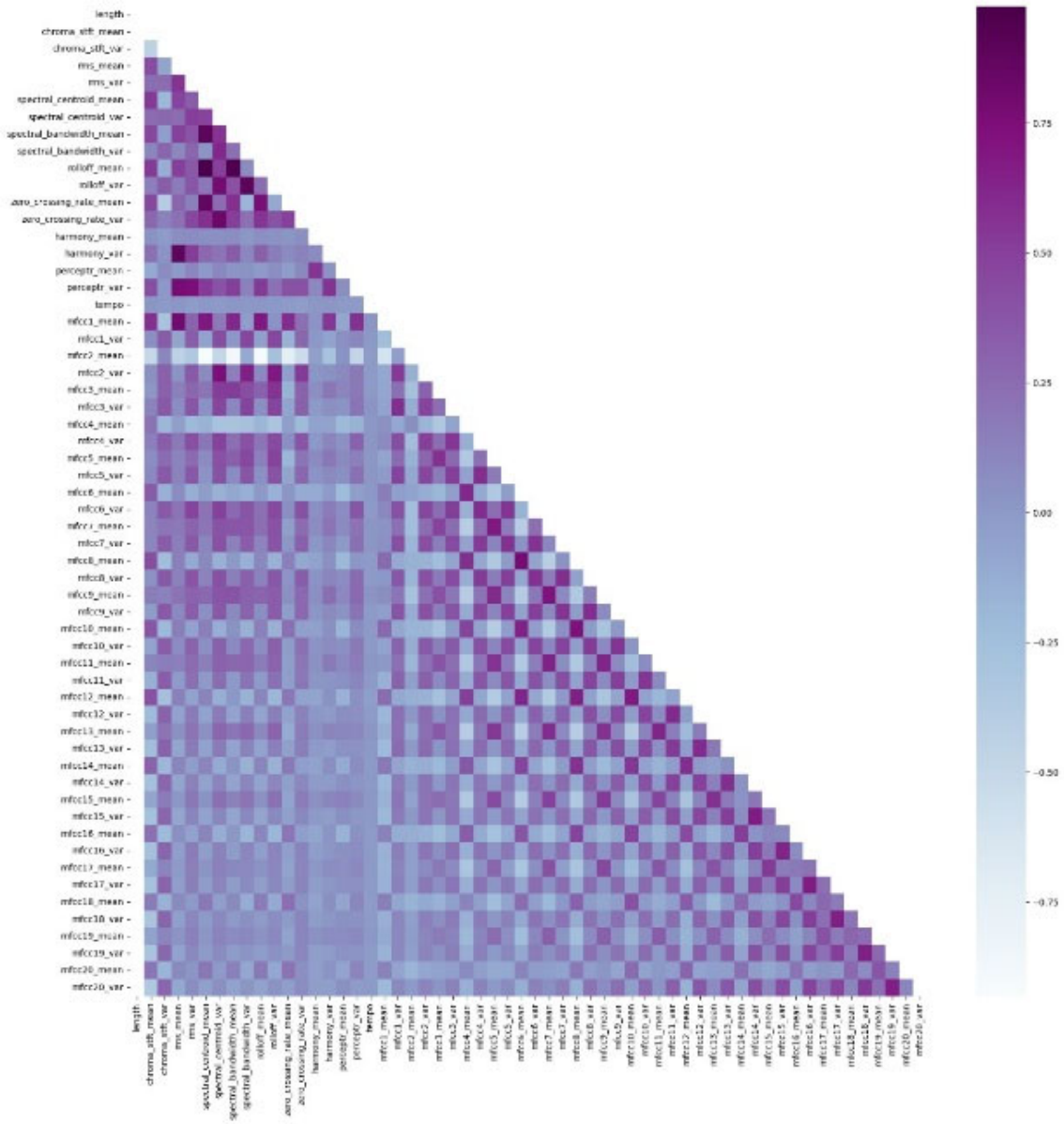
Confusion Matrix: The model's predictions are evaluated using a confusion matrix, which tabulates the number of correct and incorrect predictions for each class (genre). This matrix enables a comprehensive analysis of the model's classification performance, highlighting areas of confusion and misclassifications.



Heatmap Representation:

A heatmap is constructed from the confusion matrix, offering a visual depiction of the classi- fication results. The heatmap enhances the in- terpretability of the confusion matrix

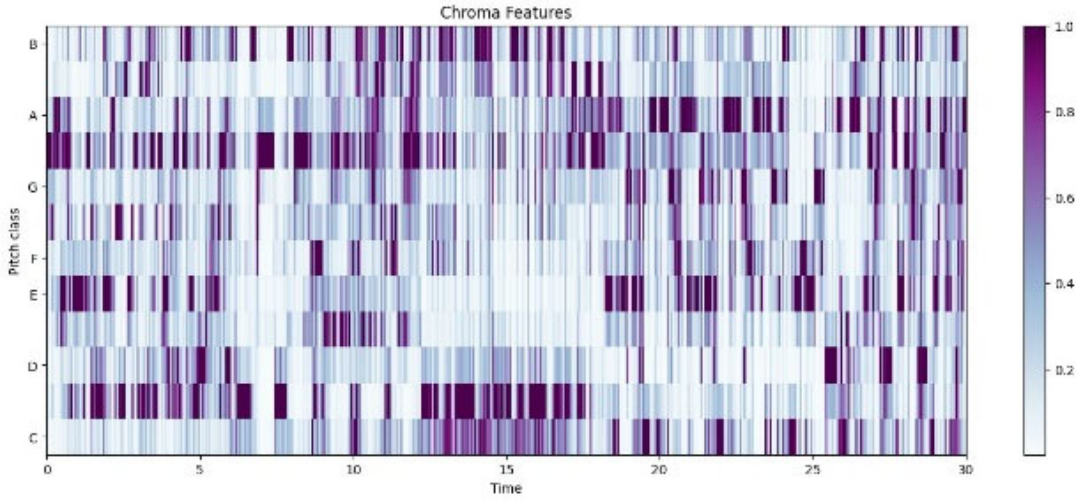
by using color gradients to represent the frequency and magnitude of correct and incorrect predictions across different genres.



Chroma Features Analysis:

The code incorporates chroma features ex- tracted from the audio signals, contributing to the classification of music genres. Chroma fea- tures capture the pitch content of the music

sam- ples, providing valuable information about the harmonic structure and tonality of the music, which influences genre classification accuracy.



Conclusions

In conclusion, the project successfully demon- strates the application of machine learning and deep learning techniques for music genre classifi- cation. By extracting meaningful features from audio signals and training robust models, we can accurately predict the genre of music samples. This project contributes to the broader domain of music information retrieval and offers valu- able insights into the analysis and classification of audio data. Further enhancements and opti- mizations can be explored to improve the mod- els' performance and scalability in real-world ap- plications.