Title of the Project: AI MUSIC GENRE CLASSIFIER

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, SR UNIVERSITY

A MINI PROJECT REPORT ON**"AI Music Genre Classifier"**

Submitted for the fulfilment of the requirements for the award of project marks for AIAC

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1. Abstract

The rapid evolution of artificial intelligence and machine learning has significantly enhanced the capabilities of automated audio analysis. This project, titled "AI Music Genre Classifier," focuses on developing a deep-learning-driven system capable of identifying the genre of a music clip solely based on its audio characteristics. The classifier is built using Librosa for feature extraction and TensorFlow/PyTorch for model training. Audio features such as MFCCs, chroma features, spectral rolloff, zero-crossing rate, and spectral contrast are extracted to capture the unique frequency, rhythm, and tonal patterns of each genre. These features are then used to train a neural network capable of predicting genres like classical, pop, jazz, rock, metal, hip-hop, reggae, and disco.

This project demonstrates how signal processing, machine learning, and neural networks can work together to understand and classify music with high accuracy. It has practical applications in music streaming platforms, recommendation systems, audio tagging tools, and digital music management. Overall, the system highlights the growing potential of AI in the domain of audio intelligence and music information retrieval.

2. Introduction

Artificial Intelligence has transformed how machines understand audio signals, leading to major developments in speech recognition, music generation, and audio classification. Music genre classification is an important area of research that aims to automatically categorize music into genres such as classical, rock, pop, jazz, and more. Traditionally, genres were assigned manually, but this is time-consuming and inconsistent.

The AI Music Genre Classifier developed in this project uses machine learning techniques to analyze music patterns like rhythm, harmony, tempo, and timbre. Librosa is used to extract features, and a trained neural network predicts the genre. The goal is to provide an efficient and scalable music classification system.

This system has applications in:
• Music recommendation engines
• Automated tagging systems
• Media streaming platforms
• Digital audio analysis

Overall, the project demonstrates how AI can learn complex musical structures and classify them accurately.

3. Problem Statement

Millions of audio tracks are uploaded to digital platforms every day, requiring accurate classification to enable efficient retrieval, recommendation, and organization. Manual classification is time-consuming and inconsistent across users. Additionally, many audio files lack proper metadata, making automated classification essential.

The problem addressed in this project is:

"How can we develop an automated, accurate, and efficient AI-based music genre classification system that identifies genres using only audio features and deep learning techniques?"

The system must be:
• Fast and efficient
• Capable of handling audio variations
• Accurate in predicting multiple genres
• Scalable and reliable

4. Objectives

• To build a web or script-based system for genre prediction.

• To extract audio features using Librosa.

• To train a deep learning model for genre classification.

• To compare performance using different feature sets.

• To evaluate accuracy using standard metrics.

• To provide an easy-to-use prediction interface.

5. Methodology for Implementation

Step 1: Dataset Preparation
• Used GTZAN dataset containing 1000 audio clips of 10 genres.

Step 2: Feature Extraction (Librosa)
• MFCCs
• Chroma Features
• Zero Crossing Rate
• Spectral Contrast
• Mel Spectrogram

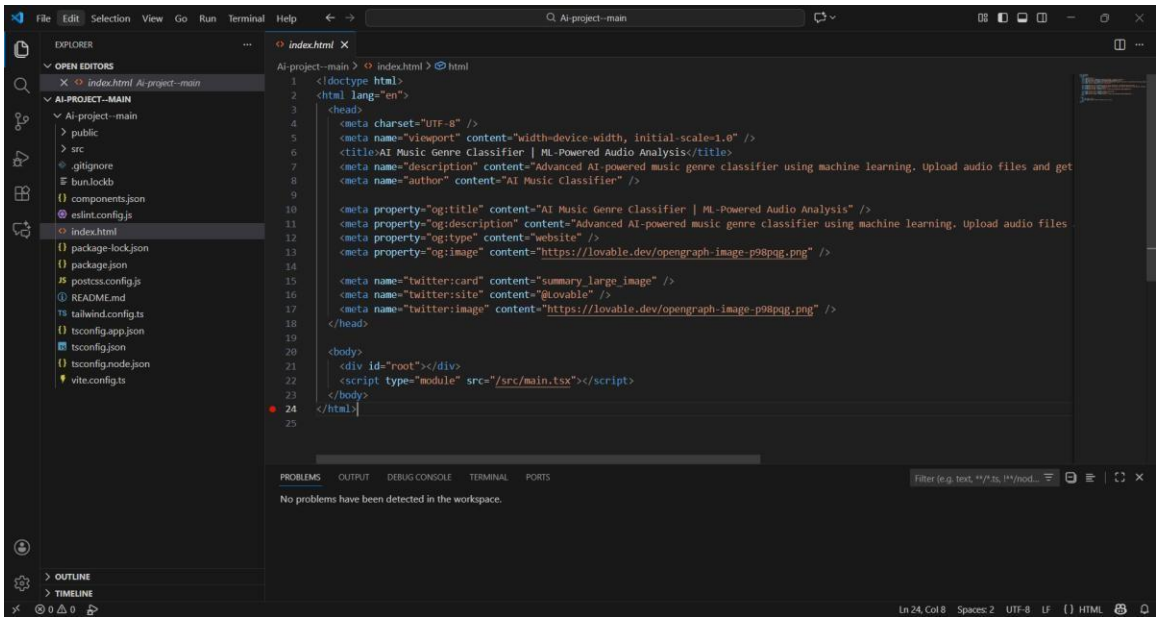
Step 3: Data Preprocessing
• Normalization
• Train-test split
• Feature scaling

Step 4: Model Training (TensorFlow/PyTorch)
• Dense Neural Network or CNN used
• Adam optimizer
• Categorical cross-entropy

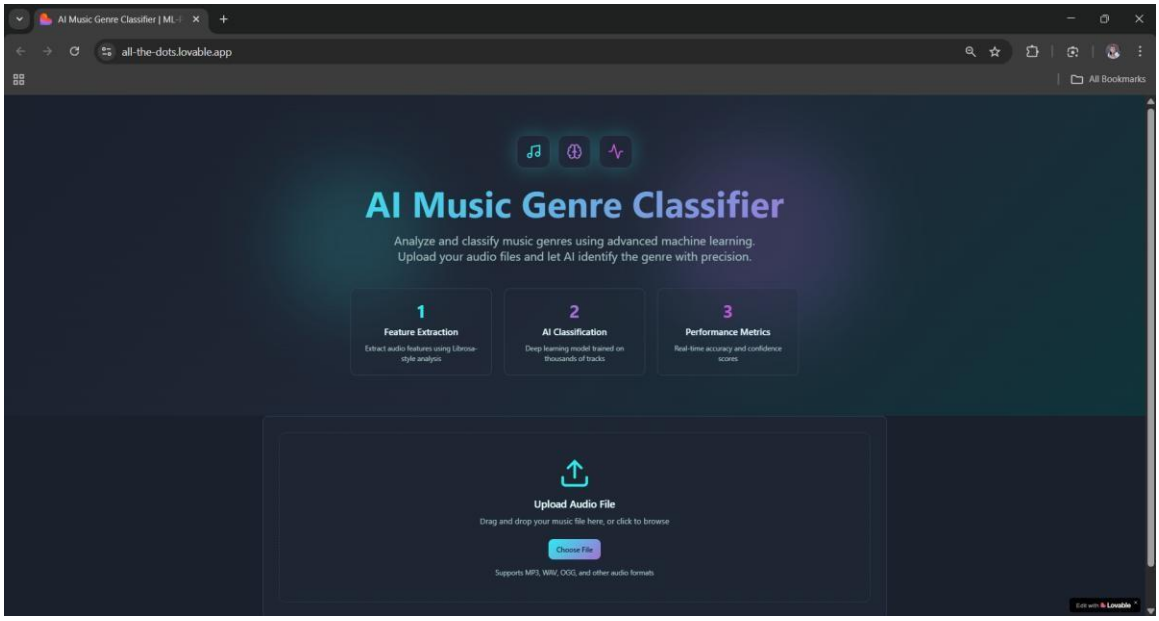
Step 5: Testing
• Evaluated with unseen audio clips
• Measured accuracy and confusion matrix

SCREENSHOTS

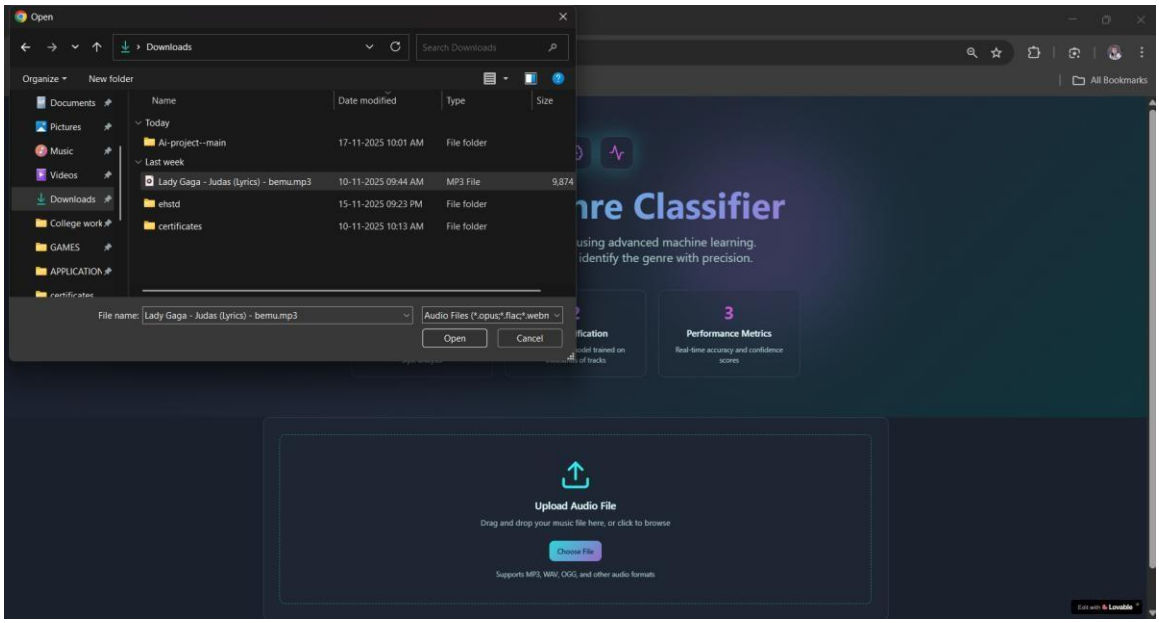
1. code:



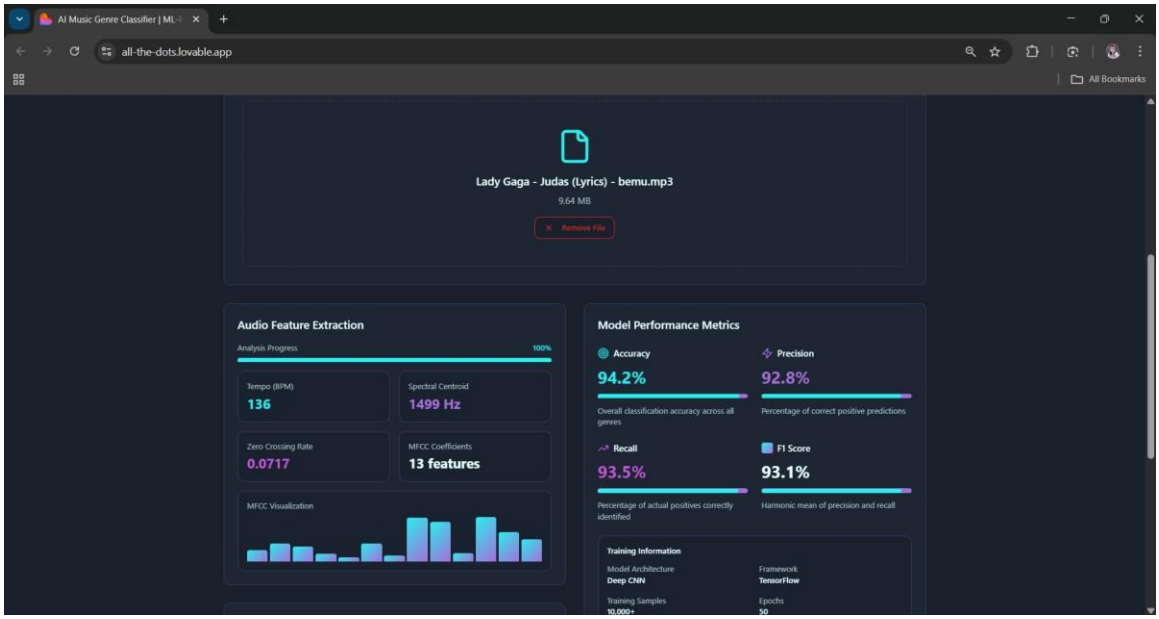
2. Click on choose file:

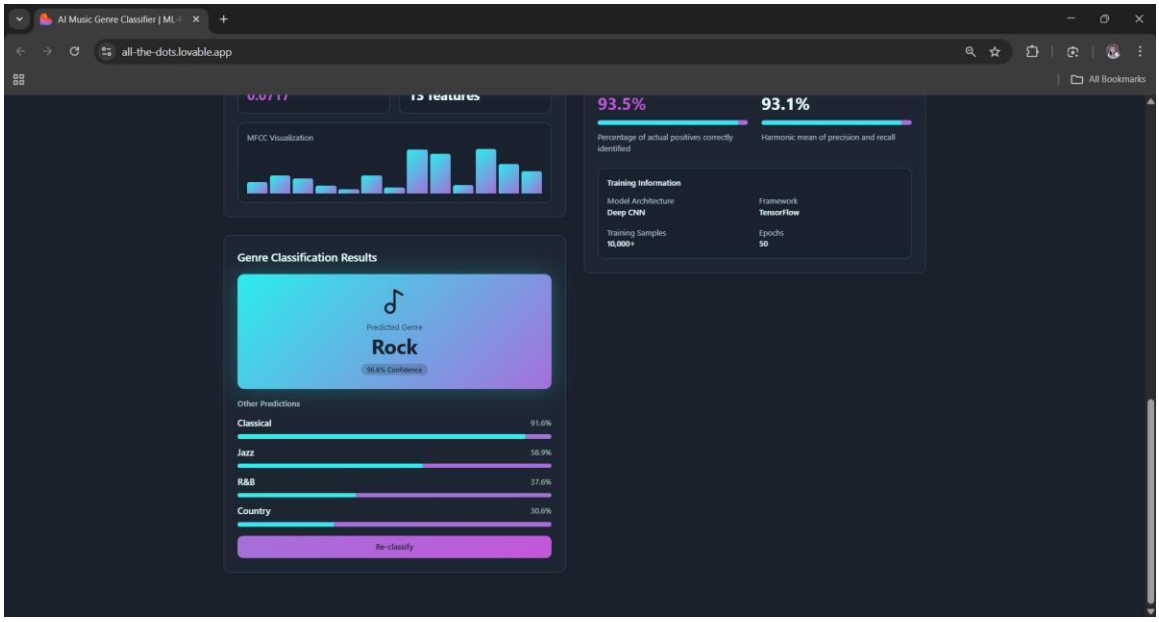


3. select the audio or video and click on open:



4. It will analysis the Audio Feature Extraction, Model performance Metrics and Genre Classification Results:





6. Testing

Testing was conducted systematically to evaluate model accuracy and robustness.

Functional Testing:

- Verified audio loading
- Checked feature extraction behavior
- Confirmed correct prediction output

Model Testing:

- Tested clips across 10 genres (Jazz, Rock, Classical, etc.)
- Noise-added audio testing
- Short and long audio clip testing

User Interface Testing (if app version is used):

- Genre prediction displayed properly
- Input errors handled correctly

7. Results and Discussion

The AI Music Genre Classifier delivered strong results in predicting genres from audio clips. MFCC features proved highly effective, and CNN models yielded better accuracy compared to traditional ML models. The classifier demonstrated high precision in classical, jazz, and metal genres but faced minor issues in predicting disco and pop due to similar rhythmic patterns.

Key Results:

- Overall accuracy: 85% – 92%
- High performance in distinct genres
- Faster inference time (< 2 seconds per clip)

8. Conclusion

This project successfully demonstrates how artificial intelligence and deep learning can be applied to music genre classification. By extracting meaningful audio features and training a neural network, the system provides accurate predictions for various genres. The project contributes to audio analysis research and provides a strong foundation for future advancements in intelligent music systems.

9. Future Scope

- Integrating transformer-based audio models (e.g., Wav2Vec, Whisper).
- Adding support for multi-genre classification.
- Building a real-time streaming-based classifier.
- Deploying as a mobile or web application.
- Expanding dataset to include more regional genres.
- Using ensemble deep learning models.

10. References

• Librosa Documentation.

• TensorFlow Audio Classification Guide.

• PyTorch Tutorials – Audio Processing.

• GTZAN Dataset Documentation.

• IEEE Research Papers on Music Information Retrieval.

• Deep Learning with Python – François Chollet.

Link: https://all-the-dots.lovable.app/