**Project Report: Music Genre Classification**

# Introduction

Music has become one of the most consumed forms of digital content. With millions of tracks available on streaming platforms, organizing and recommending music is an important task. Music genre classification helps in automating playlist generation, music recommendation, and digital library management. This project leverages deep learning and audio feature extraction to classify music into different genres.

# Abstract

The objective of this project is to predict the genre of an audio file using Convolutional Neural Networks (CNN). The project uses the GTZAN dataset, which contains 10 different genres of music. Librosa was used to extract MFCC and mel-spectrogram features from audio files. These features were used to train a CNN model implemented in TensorFlow/Keras. The model was trained on an 80/20 split of the dataset and later integrated into a Streamlit application for real-time predictions. The app allows users to upload audio files and view predicted genres along with confidence scores and visualizations.

# Tools Used

- Python: Programming language  
- Librosa: Audio analysis and MFCC feature extraction  
- TensorFlow/Keras: Deep learning framework for CNN model  
- Matplotlib: Data visualization  
- Streamlit: Web application for deployment  
- GTZAN Dataset: Standard dataset for music genre classification

# Steps Involved

1. Data Collection: The GTZAN dataset was used, containing 1000 audio files across 10 genres.  
2. Feature Extraction: Mel-Frequency Cepstral Coefficients (MFCCs) and mel-spectrograms were extracted from each audio file.  
3. Model Building: A CNN model was designed to learn from extracted audio features.  
4. Training & Validation: The dataset was split into 80% training and 20% validation for model evaluation.  
5. Model Evaluation: The model performance was analyzed using accuracy, confusion matrix, and classification report.  
6. Deployment: A Streamlit app was created to classify uploaded audio files and visualize predictions.

# Conclusion

The music genre classification project demonstrates the application of deep learning in audio signal processing. The CNN model trained on MFCC features achieved reasonable accuracy in classifying audio files into different genres. The deployment through a Streamlit app made the system interactive and user-friendly, allowing real-time classification with visual outputs. Future improvements can include expanding the dataset, optimizing CNN architectures, and experimenting with hybrid models such as CNN-LSTM to capture temporal features in audio.