Introduction

This proposal outlines a project to use music information retrieval (MIR) algorithms and develop a tool for identifying and extracting musical patterns from MIDI files.

The core of this project is to build upon the capabilities of existing music datasets, such as the ComMU dataset. ComMU dataset consists only of a limited range of musical genres, which restricts its applicability for diverse music production needs. Our proposed tool addresses this limitation by establishing a versatile pipeline that expands such datasets. It allows music producers to train personalized music generation systems tailored to their unique styles and preferences.

This project explores a systematic approach for processing and examining MIDI data using the LakhMIDI dataset as a source of MIDI files. The outlined framework analyzes each MIDI track, identifies musical structures within segments, recognizes recurring patterns, and extracts musical samples and features. This framework allows music producers to compile diverse samples to customize and enhance their musical datasets.

Project Objectives

The primary goal of this project is to develop a tool that utilizes MIR algorithms to identify and extract musical patterns from MIDI files. It aims to enhance the capabilities of existing music datasets like the ComMU dataset by broadening the musical genres and styles they cover. This tool will enable music producers to create personalized sample libraries that reflect their unique artistic styles, streamline their production workflows by automating pattern extraction and feature analysis, and serve as a valuable resource for music education and research. By leveraging the Lakh MIDI dataset for testing, the project aims to ensure the tool's effectiveness and adaptability to real-world music production scenarios.

Background

A critical component of our approach involves using the Music Structure Analysis Framework (MSAF), an open-source software designed to automatically decompose music into its structural components. MSAF facilitates understanding and segmenting audio and symbolic (MIDI) music, which is key for our objective of pattern extraction. Alongside MSAF, the `sf_segmenter` Python library will be employed to refine the segmentation process further, ensuring that each identified segment is accurately represented and useful for subsequent analysis. For processing MIDI files, we will utilize the `pretty_midi` and `MidiToolkits` libraries that provide a straightforward and efficient way to handle MIDI data, offering functionalities to parse, manipulate, and synthesize MIDI sounds.

Project Description

This project aims to develop a tool that utilizes advanced MIR techniques to analyze, segment, and extract patterns from MIDI files. This tool would facilitate the creation of music datasets and personalized sample libraries. The project will be executed in several structured steps, each contributing to the overall functionality and effectiveness of the tool.

The initial literature study involves a review of the ComMU dataset and its accompanying GitHub repository to understand the dataset's structure and previous applications. The FMP Notebook will also be referenced to gain insights into music structure analysis and segmentation algorithms. The Lakh MIDI dataset will be used as the primary source of MIDI files for experimentation, providing a diverse range of music genres and styles for comprehensive testing and analysis.

The first technical step involves the initial processing of MIDI files using the `pretty_midi` and `MidiToolkits` libraries, which will parse and prepare the data for further analysis. Following this, the Music Structure Analysis Framework (MSAF) and `sf_segmenter` will be employed to perform automatic segmentation of the MIDI files into their structural components, such as verses, choruses, etc. Enhanced segmentation will be experimented with by adjusting various parameters and algorithm settings to achieve detailed segmentation within each musical segment.

Once the segments are defined, the next step focuses on pattern recognition. This process involves analyzing each segment to identify recurring musical patterns based on melodic, harmonic, and rhythmic elements. This step can be done using the same segmentation algorithm or other methods. Successful patterns will then be extracted as individual samples, ready to be utilized in music production.

Alongside pattern extraction, musical features similar to the ones in the ComMU dataset will be extracted using `pretty_midi` or `MidiToolkits.` These features are important for categorizing and organizing the samples effectively and can also be used to train machine learning models to enhance the tool's capabilities further.

The final step involves developing a user-friendly interface for uploading and managing MIDI files. A library of the extracted patterns and features will be created and made accessible through the tool's interface. Additionally, integration capabilities with digital audio workstations (DAW) and other music production software can be developed, allowing seamless incorporation of this tool into existing music production workflows.