ELEC5305 Project Proposal

Due: 7/09/2025

1. Project Title

Music Analyser GUI

2. Student Information

- Full Name: **Matt Starr**
- Student ID: **510453253**
- GitHub Username: **matt-starr**
- GitHub Project Link: **https://github.com/matt-starr/elec5305-project-510453253**
- GitHub Pages Link: **https://matt-starr.github.io/elec5305-project-510453253/**

3. Project Overview

The goal of this project is to develop a simple GUI application to analyse musical features in a song file. Features like a song's key, bpm, verse/chorus sectioning and instruments will be extracted and presented to the user.

For a musician to learn a song from an audio recording, they typically need to listen to it back with an instrument, playing different scales until they land on the correct key. Also, whilst a musician may be able to determine the makeup of a song's instrument lineup, a novice may not be able to successively discern an instrument's use from its timbral qualities.

My proposed solution is to develop an easy to use application, which will require the user to input a file containing a song (MP3/WAV). The program will analyse the song to extract as many features as possible to return to the user.

4. Background and Motivation

In researching this project, a similar project was found to exist called sonoteller (https://sonoteller.ai/). The goals for this project would be to implement some of the features that this program does, but do it on local hardware and open source.

I chose this topic as I have previously attempted to transcribe music for songs, and the starting point is to find out what key it is, which has until this point been a manual process of trial and error.

5. Proposed Methodology

Python will be used for this project as I have more experience in it and it is easier to develop a responsive and interactive program than in MATLAB. QT will be used for the GUI app as there are plenty of available libraries.

Digital signal processing techniques will be applied to extract musical features like key, BPM, and instrument identification from audio files. Key detection will utilize chromagram analysis, while BPM will be derived from onset detection and tempo estimation. Instrument identification will use Mell Frequency coefficients and spectral features alongside machine learning models for classification.

Songs that will be used for the training and validation of this program will be downloaded from sources of free to use music files such as soundcloud and youtube.

6. Expected Outcomes

The first goal of this project will be to make the application return basic musical information about a song such as key, bpm and identify a small set of instruments. A key advantage of this project is that it is extendable, so other types of feature identification can be added based on the actual workload.

Version control for this project will be tracked in this GitHub repository, and instructions will be provided in the project's README to run it locally.

7. Timeline (Weeks 6-13)

Week	Task
6-7	Literature review Dataset collection GUI design GUI basic implementation
8-9	Implementation of basic musical feature extraction - Key - Bmp - 4-piece rock band instruments Exploration into implementation of more complicated feature extraction
10-11	Optimisation of basic musical feature extraction Implementation of complicated feature extraction
12-13	Finalisation of Report Testing and validation Presentation or results Demo development

8. References

[1] Yongwei Zhu, M. S. Kankanhalli and Sheng Gao. 2005. "Music Key Detection for Musical Audio"

[2] Namunu C. Maddage, Changsheng Xu, Mohan S. Kankanhalli and Xi Shao. 2004. "Content-based music structure analysis with applications to music semantics understanding."

[3] Blaszke, M., & Kostek, B. 2022. "Musical Instrument Identification Using Deep Learning Approach."

[4] Jouni Paulus and Anssi Klapuri. 2006. "Music structure analysis by finding repeated parts."