

ALEC MANDERS  
C1228303  
SUPERVISOR: PROF DAVID MARSHALL

# INITIAL REPORT

---

SAMPLE BASED GUITAR TRANSCRIPTION

# PROJECT DESCRIPTION

---

## SAMPLE BASED GUITAR TRANSCRIPTION

---

There are a wide range of sample libraries that exist that contain large numbers of guitar samples from different types and models of guitar, these samples libraries also exist with other musical instruments however this project will focus solely on guitar samples.

The basic idea of this project is to machine learn playing styles and types of guitar being played using banks of guitar samples. Playing styles can range from the articulation of a note that is being played, for example if it is being muted or where on the neck the note is being played to how hard strings are being plucked. Other information such as whether the guitar is electric or acoustic and even the gauge of the string that producing the sound can also be learnt.

Once different playing styles/types have been learnt the aim is to be able to record a piece of your own guitar playing in the form of audio input that can then be accurately transcribed

# AIMS AND OBJECTIVES

---

## INITIAL TARGETS AND GOALS

---

This project has been split into a task of two main halves, each containing several sub-problems; the first is the classification of already known guitar samples, this is the machine learning aspect of the project where I intended to use a classification library called LibSVM. Once enough data has been derived from known contextual information of guitar samples, for example which string and fret the note is being played on; it should be possible to then use these classifiers to categorize recorded notes that lack sufficient contextual information.

Other information that can be represented in the frequency domain can also potentially be analyzed for example different thicknesses (gauge) of strings vibrate differently and produce different tones, acoustic and electric guitar often have different types of strings such as an acoustics nylon set of strings compared an electric guitars steel wound and nickel strings. Another thing that must be considered is plucked intensity whereby the amount of pressure that is applied to the string when its being plucked can alter the sound of the note despite the note being of the same frequency, this will have to be taken into account when classifying notes. The intention is to also be able to recognize chords that are being played based on locating the largest harmonic components of the chords in the frequency domain and using a collection of those frequencies to realize the name of the chord that is being played.

The second part of the project is the transcription of a selection of known notes in a piece of audio to a human readable format, most probably tablature. There are limitations to this in that there will have to be no other music present on the audio file so creating tablature for a typical pop song won't be effective. Because of this, the program is intended as a method of easily remembering and noting down pieces of music that an individual creates, as long as they record themselves while they are practicing guitar.

It is my intention to use Matlab to complete this project as it has excellent facilities for digital signal processing and I have experience of using Matlab to view and edit information in the frequency domain through use of the Fourier transform.

During the early stages of this project a certain amount of research will have to be conducted in several different areas including the physics of a vibrating string to better understand how sound is actually produced and how altering the length of through fretting causes changes in the vibrations of different lengths of string. Other areas such as machine learning will needed to be studied in as much depth as possible given the time I allocate to the task as I currently have very vague knowledge of the subject, this will include learning how to use the LibSVM library.

## ADDITIONAL AIMS AND OBJECTIVES

---

### POTENTIAL TARGETS AND GOALS

---

There is scope at the end of the project to include recognition of play styles outside of different note articulations, I do not intended to include this in my initial design however depending on how project progression goes other styles such as hammer-ons, vibrato, bends and slides could be learnt and then transcribed. It doesn't seem outside of the realms of possibility that these styles could be machine learnt and transcribed from recorded audio however it is a secondary feature that I would like to include in my project and as I am limited by time these features are not guaranteed.

## WORK PLAN

---

Here is a breakdown of my expected week by week work plan, as with all projects of this nature it is subject to extreme change depending on how long it takes to solve unexpected problems, and how long individual tasks take.

### Week 1:

- Initial report writing.
- Research into different types of machine learning to decide which would be best for the current task
- Meeting with project supervisor ( to continue on a weekly basis)

### **Week 2-3:**

- Research into physics of a vibrating string, how sound is created, how different lengths and gauges of string effect vibration and which of these aspects can be exploited in the frequency domain to achieve sufficient classification.
- Learn LibSVM, get to grips with how its different features work, learn basic classification methods
- Begin to collect and sort guitar sample libraries

### **Weeks 3-7:**

- Develop classification techniques
- Develop machine learning

### **Weeks 7-10:**

- Develop transcription methods
- Begin development on addition features, time allowing

### **Weeks 10-12:**

- Continue developing additional features
- Create final report

