Initial Plan

CM3203 Deep Learning Guitar Tunings

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Project Description

Guitars can be tuned to a variety of tunings. This is especially common in certain genres of music, notably folk music and heavy metal. The idea here is to use a database of known tunings and respective recordings as test data, and to then use deep learning methods to firstly learn tunings from input test audio and then predict the guitar tuning of new unknown songs.

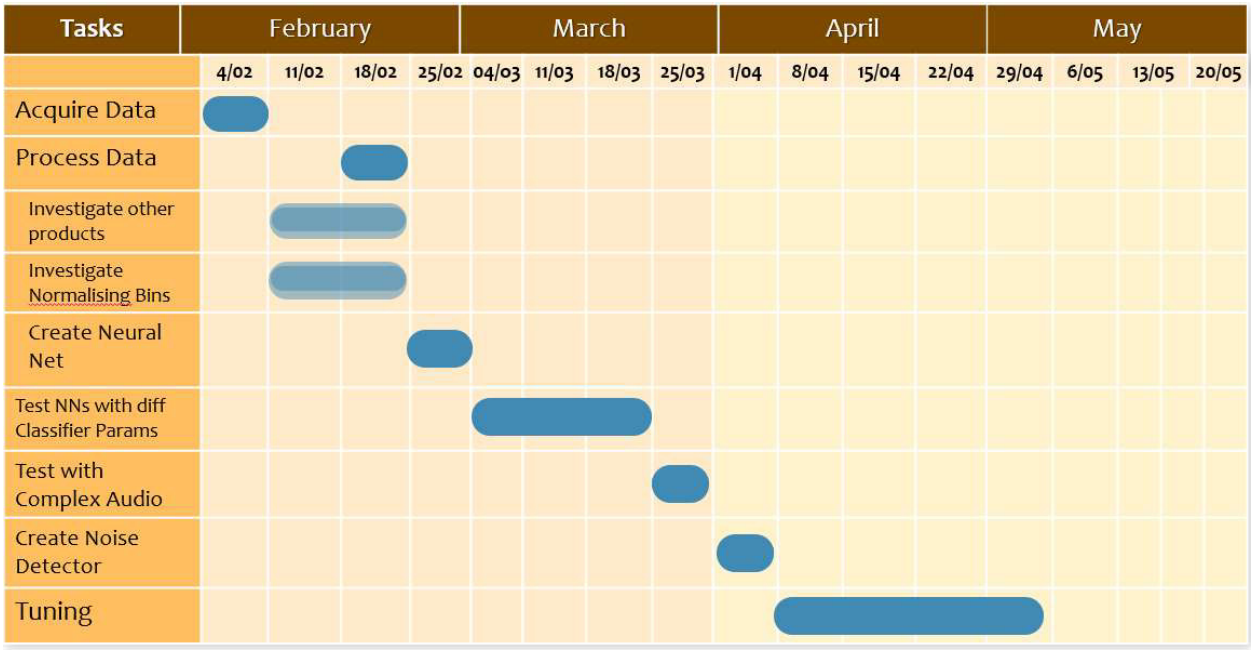
A deep learning system can be trained with input samples (many short “grains” from every recording) to classify the tunings. The grains will be transformed into some time-frequency representation, such as STFT or constant Q transformations, before being used as input into the neural net.

The project will investigate the following: what the best format for the input audio is; the transformations on the grains that give us the most appropriate results; which configuration of neural network is best; how to format the class labels (an n-class classifier for a set number of n tunings, or a classifier could be trained for each string).

Aims and Objectives

- Create a system that takes audio and splits it up into many short “grains” to be ready for processing
- Apply transformations to audio before being used as input for the neural network, that allow the detection of notes played. E.g. STFT, Constant Q, Dynamic Q.
- Create a Deep-Learning network model that can detect the tunings of a guitar within a song, even with some noise/unwanted audio (e.g. vocals) over the top.
- Investigate what type of classifier would be best to use: n-class for each standard tuning or a classifier for each string note.

Time Plan:



Acquiring Data:
During this stage I will acquire recordings of music with guitar in that have the tunings available (ideally with a low amount of other instruments/vocals). My primary resource will most likely be Joni Mitchell's recordings due to the wide variety of tunings she uses and the detailed songbook describing musical structure.

Investigate Other Products/Normalising Bins:
I will investigate similar products that have been used to transcribe piano music, such as Maestro and Anthem Score. I will study the methods used to divide frequencies into normalised bins to extract notes played. I will primarily be researching STFT, Constant Q and Dynamic Q transforms into the Frequency-Time space.

Process Data:
In this stage I will tag audio data with it's tuning and with how many other instruments it has in it (voice/drums/bass etc.). Tagging the data with other instruments means I will be able to test distinct categories – solo guitar, guitar+voice, guitar+bass etc. I will also split the audio up into grains, using the appropriate transform found in earlier investigations.

Create Neural Net Basis:
I will be setting up a keras environment (based on TensorFlow) to log data and train models, designing it so that I can easily change the network parameters for model optimisation.

Test NNs with Different Classifiers:
I will test different neural network structures with different classifier approaches. This involves testing different class models for various types of NN structure. Possible changes to NN structure include: hidden layer size, batch size, buffer size and how many previous states are taken into account. Class models include: a classifier for each popular tuning, one for each string, or individual classifiers for significant strings with a separate classifier for the sub strings in-between.

Testing with Complex Audio:
Using the NN and classifiers decided on, I will train the data on some audio containing multiple instruments or gaps in guitar playing. By testing how well the current solution performs when listening to a more complex piece, I will decide if a detector is needed to isolate parts of audio that throw the most false-positives/negatives.

Create Noise Detector:
Based on previous tests, I will need to create an appropriate detector that can be used to subtract the most damaging noise from the audio. If this was voice for example, then it would need to be a voice detector that I could use to extract the voice parts of the audio out, before putting through my neural net.

Tuning:
After all previous tasks are completed the rest of the time will be used to tune the NN params and train it on more data to make it more effective.

Meetings:
Meetings are scheduled for every Monday at 12:10PM. On March 8th we will have a longer length meeting. The other longer length meeting date is TBC.

School of Computer Science and Informatics

Coursework Submission Cover Sheet

Please use Adobe Reader to complete this form. Other applications may cause incompatibility issues.

Student Number	C1672949
Module Code	CM3203
Submission date	03/02/2019
Hours spent on this exercise	3
Special Provision	

(Please place an x is the box above if you have provided appropriate evidence of need to the Disability & Dyslexia Service and have requested this adjustment).

Group Submission

For group submissions, *each member of the group must submit a copy of the coversheet.* Please include the student number of the group member tasked with submitting the assignment.

Student number of submitting group member	

By submitting this cover sheet you are confirming that the submission has been checked, and that the submitted files are final and complete.

Declaration

By submitting this cover sheet you are accepting the terms of the following declaration.

I hereby declare that the attached submission (or my contribution to it in the case of group submissions) is all my own work, that it has not previously been submitted for assessment and that I have not knowingly allowed it to be copied by another student. I understand that deceiving or attempting to deceive examiners by passing off the work of another writer, as one's own is plagiarism. I also understand that plagiarising another's work or knowingly allowing another student to plagiarise from my work is against the University regulations and that doing so will result in loss of marks and possible disciplinary proceedings.