Initial Plan - Automatic Analysis of Music Performance Style

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Project Description

A key problem in computational processing of music, is the need to create a models that can capture major features of particular performance styles, and then utilising these models to analyse and classify a given piece of music.
For example, different professional musicians will have contrasting styles of playing the same piece, so would it be possible to computationally analyse a given piece of music and determine which musician is playing it?

Another problem is to find ways of quantifying what makes a good musical performance, and from this quantification then automatically identify a professional musical performance.

Building up to these problems, can we produce reliable ways to extract relevant data from musical pieces in order to improve our knowledge of their performance styles?
Calling these techniques 'reliable' means that it is required that other variables (such as noise quality, reverberation etc.) do not affect the measurement of these features.

This work builds off previous work that worked on aligning musical performances, which compensates for any asynchronies between two renditions of the same piece, and identifying variations in tempo.

So from this work, my approach will be investigating further what other performance features can be reliably extracted from a musical piece (i.e. dynamics/loudness variations, rhythm etc.). And then exploring which of these features are relevant to the perception of a musician's performance

style, for example does the editing of one feature drastically alter the overall style of the music?

Another interesting area to look into is applying operations to particular styles, one example is interpolation between different musicians. So given two performers with renditions of the same piece, can we extract a particular feature (for example dynamics variations) from both, and then mix their two styles together.

The motivating thoughts for these aims are, if we can extract the common specific features from a particular musician's performance style, we could then create a model for that musician, and then use that model to determine who the performer is for a given unknown piece of music.

Additionally, identifying what performance features vary amongst different performers could show which of the features are integral to identifying a 'good musical performance?. As a professional musician would add variation and style to a performance whereas an amateur performance would be comparably blander.

Another thought is, if we can compare features of different musicians performing the same piece, then we could potentially quantify what exactly are the differences between their performance style.

Project Aims and Objectives

- **Reliable extraction of performance features from a musical piece**
  Work has previously been done on identifying variations in tempo, so this aim looks to further find ways of extracting more performance features.
  This may include (but not be limited to):
  - Variations in dynamics
  - Timbre
- **Investigation into which features are relevant to the perception of performance style**
  This aim is to deduce which features are essential for a piece to continue to follow a particular musician?s performance style.
  This could identify common features that a particular musician utilises.

- **Investigate what operations can be applied to styles**
  Here we look into manipulating certain styles to see where they differ compared to others.
  This could involve the interpolation of two musician styles, for example by taking their different renditions of the same piece and mixing together a specific performance feature.

- **Research into quantifiably identifying a good musical performance**
  This aim builds from the others, given common performance features shown by professional musicians, can we identify if a certain piece contains these features.
  And if the piece does contain these features, does that mean we can state it is a good musical performance?

Work Plan

There are 13 weeks until the final report deadline, however I will aim to complete implementation by the Easter period (Week 11).

Week 1 - 1st Feb

- Learning of MATLAB skills and digital signal processing techniques (as I have no previous experience with these things)
- Familiarization of the code base from previous work that this project will build upon.

Week 2 - 8th Feb

- Investigation into identifying performance features of a musical piece through digital signal processing
- Researching/investigating techniques to then extract these features

Week 3 - 15th Feb

- Further learning of digital signal processing techniques
- Further investigation into using digital signal processing to extract performance features

Week 4 - 22nd Feb
SCHEDULED REVIEW MEETING
MILESTONE - Success in reliable extraction of at least 1 performance feature

- Investigation into applying operations between different styles

Week 5 - 29th Feb

- Work on interpolation of different styles
- Searching for ways in which certain features of a musical piece can be edited/manipulated

Week 6 - 7th March

- Continuing work from week 5 ? finding techniques for altering musical features

Week 7 - 14th March
MILESTONE - success in applying operations to different performance styles

- Work on identifying common/relevant features to a musician?s performance style
- Research into how this work can be applied to identify good musical performances

Week 8 - 21st March
SCHEDULED REVIEW MEETING

- Work on identifying common/relevant features to a musician?s performance style
- Research into how this work can be applied to identify good musical performances

Week 9 - 28th March
MILESTONE - success in identifying important features of at least one musician performance style

- Final error testing and include commented out unfinished code
- Documentation of software functionality

Week 10 - 4th April
MILESTONE - Implementation to be completed/wrapped up during this week
DELIVERABLE - Final software/code base should be ready for submission
Week 11 - 11th April

- Accumulation of all research conducted during the project

- Summary and finalisation of software documentation

Week 12 - 18th April
DELIVERABLE - Software documentation should be completed, detailing the functionality

- Final report writing, including but limited to:
  - Summary of techniques found and used to complete the project
  - Outline of findings and successes
  - Identification of potential applications to future work

Week 13 - 25th April
MILESTONE - Final report completed
DELIVERABLE - Final report outlining the project findings and conclusions

FINAL REPORT DEADLINE - 6TH MAY