A Machine Learning Approach to Melody Identification

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1 Summary

While many attempts at song identification have been pursued and done successfully, there is a lack of work done in the area of melody identification, where only the melody line is sung or hummed to identify the musical piece. My thesis will be an investigation into a machine-learning centric solution for melodic identification. The research will use MIDI files containing the melody lines to be analyzed and utilize Hidden Markov Models with varying structures to determine the name of the melody line being tested.

2 Data

The data used for this research is going to be primarily midi files of melodies either pre-existing or created during the course of the research. The use of midi files is primarily because they are already encoded so they are easier to input into the learning model. Additional data samples that may be used include live recordings of a melody being sung or played.

3 Features

The following features will be used during this thesis for the Hidden Markov Models to analyze:

- Intervals between notes: The intervals between notes is the primary feature in this thesis because the intervals between tones in a melody line are what differentiate melody lines from one another and define the melodic line.
- Rhythm: The rhythm, or relative length, of the notes in the melody is another primary way melodies are identified and although they are important to the identification of melodic lines they do not hold as much importance as the intervals do so they will not be considered with as much weight in this thesis project.

4 Learning Model

Hidden Markov Models will be used for this project due to the linear nature of the data being analyzed and Hidden Markov Models previous use in related projects having to do with musical melody lines.

Two main different structures of Hidden Markov Models will be explored. The first structure being where each melody has a single Hidden Markov Model representing it, where it can transition to any part of the model from the start vertex and then from any other vertex transition to a special end vertex, thus allowing the melody to start and end at any part of the melody allowing for the new melody to not need to be the full melody from start to end.

The second main structure to be tested is each melody having several Hidden Markov Models representing it with each model representing an overlapping segment of the melody. So when a melody is tested, it would depend on the success of multiple Hidden Markov Models to identify the melody line.

Each model has it's strengths and weaknesses the first one being better for longer continuous melodies but has the possibility of incorrectly starting at a different part of the melody line and being unable to correct itself. While the second representation removes the problem of starting in the incorrect place it could perform worse in regards to longer more continuous melody line samples.

5 Key Questions

Key questions that will be explored during my research will include the following. How many notes are necessary to identify the song? What if there are mistakes in the performance of the melody? What if there isn't an close match for any melodies in that database?

6 References

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