TJHSST Senior Research Project
Computer Music Analysis
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Abstract

Although music is one of the most universal aspects of human culture, it is very difficult to define. Most definitions of music have been dependent on attributes such as rhythm, melody, and harmony, which are extremely subjective, so the ability to identify music has been limited to humans. This project aims to better define "music" by applying machine learning techniques to music analysis and recognition, allowing computers to autonomously identify whether a given audio sample is musical in nature.

Keywords: music analysis, machine learning

1 Introduction

This project aims to unify machine learning and signal processing techniques in a program that will learn to distinguish between musical and non-musical audio recordings. The end product will be a program that will learn to identify audio samples of musical nature. The program will be "trained" on a number of audio samples typically agreed upon as "music" as well as a number of non-musical samples. After sufficient training, the program will be able to distinguish between musical and non-musical audio recordings.

2 Background

Computers have already been used to perform analysis of music. In 1999, Bigerelle and Iost determined that different genres of music could be distinguished by fractal dimension, and in 2004, Basili et al. showed that machine learning techniques could successfully indentify musical genres[2][1]. Other research has attempted to deconstruct music in terms of rhythmic and melodic patterns, and even looked at writing software to generate music conforming to such patterns[3]. However, as Bigerelle and Iost point out, each instrument has a different sound quality, and composers write music with these timbral differences in mind. Simply analyzing the notes on sheet music precludes the use of these differences in the analysis. Audio recordings, in contrast, allow analysis of exactly what the composer intended his audience to hear.

3 Procedure and Methodology

The program will be written in C. It will perform spectral and fractal analysis of the samples, and will use machine learning techniques, most likely neural networks, to detect correlations between these analyses and whether the samples are "musical" or not. Each portion of the program will be tested thoroughly as it is written to ensure proper functionality. The signal processing portion will be tested by comparing the output of my implementations to a known, correct value. The machine learning portion will be trained and tested with input samples that clearly are or are not music.

4 Conclusions

The program can currently read and successfully perform analysis of WAV audio files. The project is not as far advanced as expected, largely due to a language change several weeks into the project requiring translation and reimplimentation of a large portion of code. Now that all translation is complete, the project will begin to progress more quickly.

References

[1] Basili, Roberto, Alfredo Serafini, and Armando Stellato. 2004. "Classification of Musical Genre: A Machine Learning Approach." Presented at the 5th International Conference on Music Information Retrieval.

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[3] Leach, Jeremy, and John Fitch. 1995. "Nature, Music, and Algorithmic Composition." *Computer Music Journal.* 19(2):22-23.