

Music Analysis

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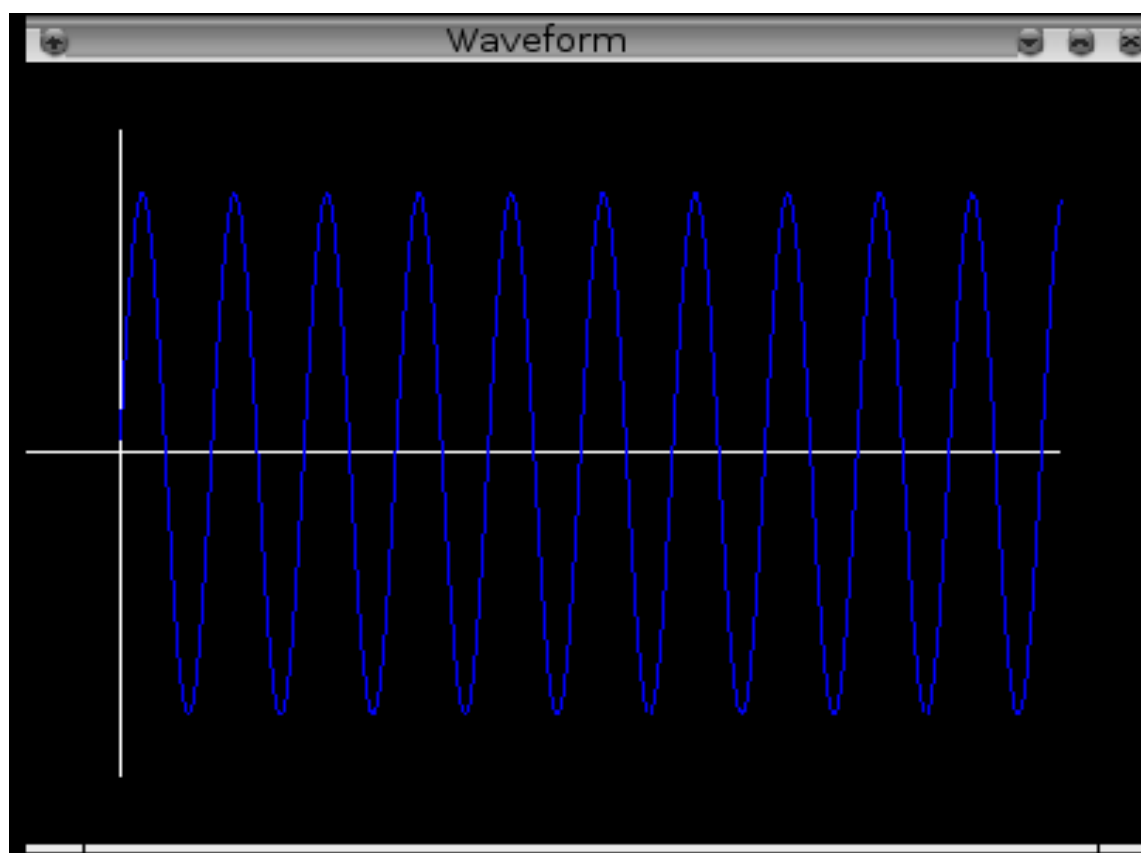
Abstract

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.

Background

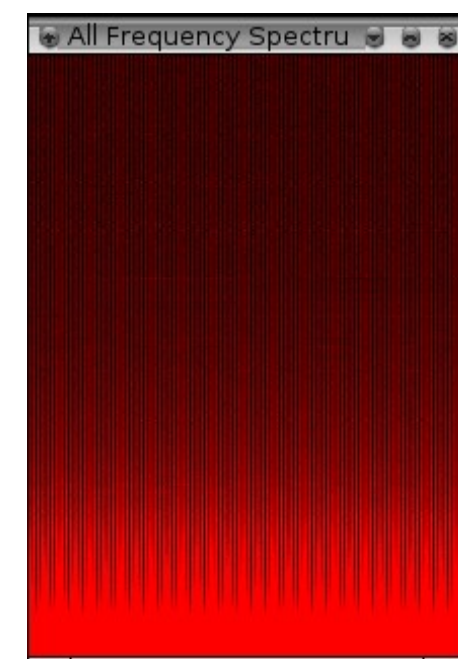
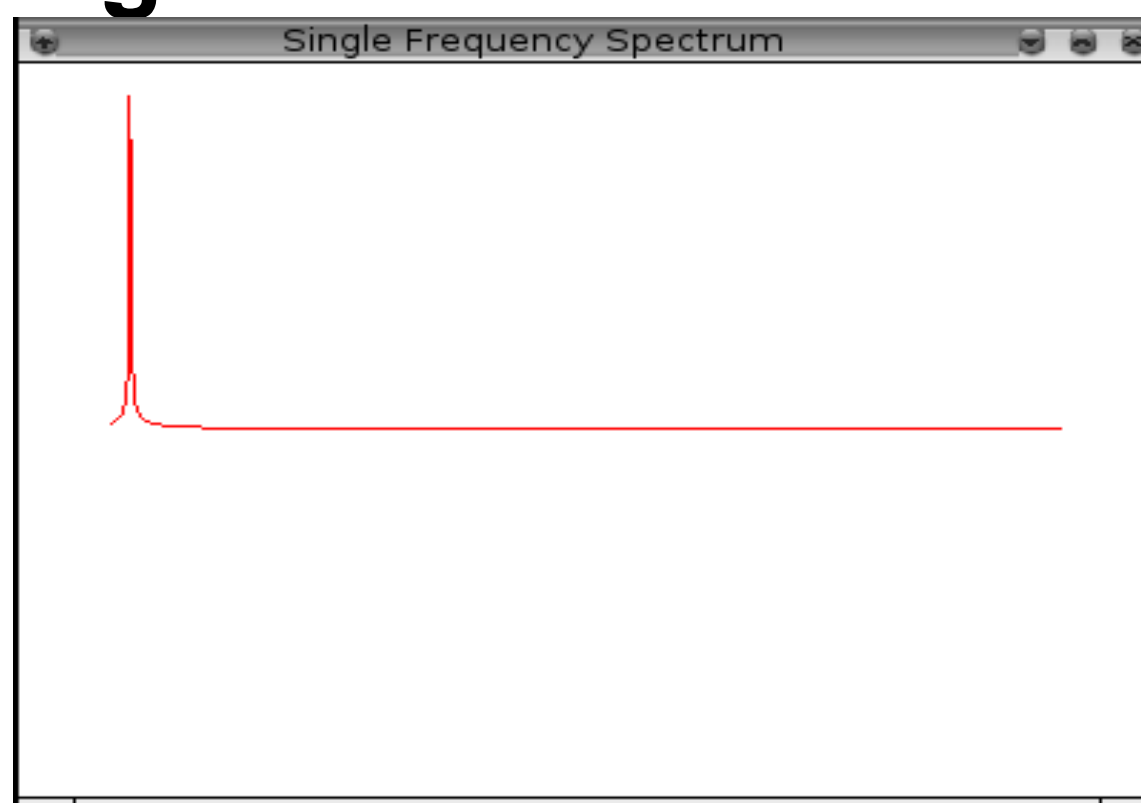
Computers have already been used to perform analysis of music. In 1999, Bigerelle and Iost determined that different genres of music could be distinguished by fractal dimension, and in 2004, Basili et al. showed that machine learning techniques could successfully identify musical genres[2][1]. Other 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.

Waveform



Multiple Fourier Transforms

Single Fourier Transform



Works Cited

- [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.
- [2] Bigerelle, M., and A. Iost. 2000. "Fractal Dimension and Classification of Music." *Chaos, Solitons & Fractals*. 11(14):2179-92.
- [3] Leach, Jeremy, and John Fitch. 1995. "Nature, Music, and Algorithmic Composition." *Computer Music Journal*. 19(2):22-23.