Individual Violin Identification using audio features and machine learning

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1. Introduction

Musical instruments classification is a Musical Information Retrieval (MIR) task which consists of determining the instruments present in a recording. This topic has been extensively studied in the literature, and for monophonic recordings (containing only one instrument), state-of-the-art models reach often almost 100%. However, few articles have addressed the issue of identifying individual instruments of the same type.

In Zhao, Fazekas, and Sandler (2022)

This paper is structured as follows: Section 2 presents the methodology of our experiment, describing data collection, features extraction, data exploration and finally classification using machine learning methods. Results of the experiments are discussed in Section 3. Finally, conlusions are drawn in Section 4, which also outlines possible future developments.

2. Methodology

2.1. Dataset

During the Bilbao Project, thirteen violins were built in order to relate their material and geometrical characteristics with their tonal quality (Fritz, Salvador, and Stoppani 2021). These violins have been played by twenty-three professional violinists, each of them having recorded a scale on each violin. The recordings were made under the same conditions in a large rehearsal room at the Bilbao conservatory, keeping the distance between the player and the microphone constant. Our dataset thus consists of 13×23 scales.

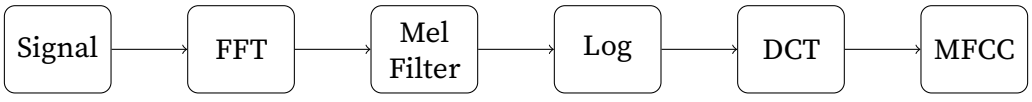
2.2. Features

The following features have been compared for the classification task :

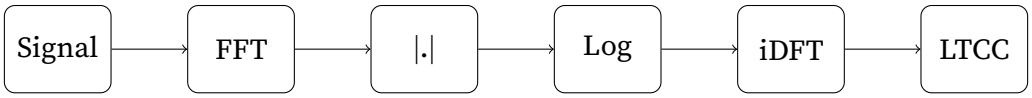
Long-Term Average Spectra (LTAS). Average Power Spectral Density (PSD) of a recording, obtained using a series of overlapping FFTs.

1/3-octave band LTAS (1/3-LTAS). LTAS, gaussian-smoothed to 1/3-octave resolution.

Mel-Frenquency Cepstral Coefficients (MFCC). MFCC are a set of features that has been extensively used for Automatic Speaker Reognition and for Instruments Classification.



Long-Term Cepstral Coefficients (LTCC). LTCC have been introduced in Lukasik (2010) for Indivudial Instrument Identification. Their calculation is similar to that of MFCCs, except that a Mel-filterbank is not applied and that the final step is given by an Inverse Discrete Fourier Transform.



2.3. Data exploration

2.4. Classification

3. Results

4. Conclusions

References

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