A STATISTICAL ANALYSIS OF TIMBRE DESCRIPTORS FOR MUSICAL INSTRUMENT CLASSIFICATION

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ABSTRACT

Timbre is highly informative of the acoustical nature of sound source vibration patterns and the way they are excited. It should therefore be quite useful in the classification of musical instruments. Most automatic classification algorithms use various sound features, including many that model dimensions of timbre. Even though researchers are aware of the fact that including bad features leads to bad classification performance, there has been no large-scale assessment of each descriptor’s performance.

This paper presents a statistical analysis of the 70 timbre descriptors collected at IRCAM. The goal is to judge each descriptor’s effectiveness in three classification settings: according to musical instrument families, excitation types and the wind instruments’ reed types. Eighty-two stimuli from six well-known timbre studies were considered.

Correlation analysis revealed clusters of features that are similar to the nine groups listed in Rioux et al. (2006). A simple k-means clustering on the values from each descriptor yielded a range of moderate classification rates from 33% to 79%. Wind instruments seem to be easier to classify than others. Of the nine descriptor groups, Spectral Centroid group was rather consistent and Attack Time more varied in intra-group performance. For the reed type classification, the Spectral Deviation group is superior to the other groups in terms of mean group performance and intra-group variance. While the classification performance may not be excellent, it showed a promising result with only one classifier and a simple classification algorithm. The performance is expected to improve with combinations of two or more descriptors.