INTEGRATED COMPUTATIONAL GESTURAL AND TIMBRAL MAPPING FOR MUSICAL EXPRESSIONS

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Background & Significance

The ultimate artistic achievement for musical instrument performers is to obtain intuitive control and expression that seamlessly maps desired musical concepts into expressive sound. Such a mastery requires years of systematic training that would benefit from computational tools of pedagogical associations between gesture (e.g., hand placement and movement on musical instruments) with sonic features (overtones, harmony, texture, articulation, etc.) Our research collected a dataset for exploring the connection between musical gestures and sound, and then implemented computational analysis and visualization tools. The dataset currently includes synchronized piano performance in MIDI (Musical Instrument Digital Interface) and video format. We map the MIDI data (pitch/timing for individual notes and musical expressions) to the piano keyboard to synthesize the movement pattern for the hands. These patterns are then connected to synchronize video frames to compare with recorded hand positions and gestures. We also map each pattern to the synchronized sound. This analysis and visualization tool is useful as both a pedagogical tool for training musicians and as an analytical tool for computational musicology.

Objectives & Approach

Our approach utilizes MATLAB software and MIDIToolbox to analyze the MIDI data from recorded performances. Parameters such as pitch and dynamics are collected from the data and are used to create visualizations of the changes in these variables over the course of the performance. A gesture model was created by mapping out each black and white key on the piano keyboard, and labelling the point at which the fingers are most likely to strike the key based on video analysis. Through this, the distance travelled and movements required to make specific gestures can be noted and analyzed.

Outcomes & Future Directions

While the gestural analysis program has not been used to collect presentable data, as time was required for the performer to learn the baroque pieces which would be recorded and analyzed in this project, the resources and data created through this study can be used as tools for future computational musicology works, and can aid music teachers in better understanding the nature of practice and the similarities in a student's repertoire to maximize learning efficiency.

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