Optical Music Recognition Implementation and Application

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Purpose

Using computer vision techniques, we design and implement an algorithm to automatically recognize musical notations on printed sheet music captured by the camera of a handheld mobile device, and convert such notations into MIDI (Musical Instrument Digital Interface) format for playback.

Abstract

The recognition of printed sheet music has been studied in the computer vision field since the late 1960s. In our project, we capture a piece of printed sheet music by a handheld mobile device (e.g. Android smartphone) and interpret the musical notations using various image segmentation and morphological filtering techniques. Upon successful recognition of individual notes, they can be presented by MIDI streams.

Implementation

Our project can be broken down into three main steps. First, we binarize the captured image because color does not present any necessary additional information for sheet music. As a preprocessing step, we perform adaptive thresholding and de-noising to the input image to improve its quality for analysis.

In order to correctly recognize the notations, we propose to employ line detection to localize the staff lines in the image and area detection to localize the solid and hollow note heads. By analyzing the location of the note heads in relation to the location of the staff lines, we can determine the identity of each note for further processing. For example, research by C. Raphael and J. Wang has demonstrated the identification of chords using grammatically-formulated top-down model-based methods.

For demonstration purposes, we plan to integrate the MIDI API into our system and present the detected musical notations by an audio stream. Beyond Version 1.0, Google no longer supports Android access to javax.sound.midi. We would need to either include APIs written by other developers, or otherwise upload chord information to existing online applications for conversion into MIDI.

Milestones

Timeline	Tasks
April 23	Study algorithms to recognize staff line, and simple symbol like solid note head. Research related algorithms and implement in Matlab.
April 30	Implement the algorithm to recognize open note head, and improve the classification accuracy between solid note and open note head.
May 7	Implement the algorithm in Android platform using sheet music captured by a mobile camera.
May 14	Integrating streaming MIDI API into our system.
May 21	Implement detection algorithm for single/double/triple flag up/down on Matlab and Android.
May 28	Implement algorithm to detect other notations such as 1/2/3/4 beam, treble clef, bass clef, and rest.
June	Work on write-up and prepare for project demonstration.

References

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Android Based

Yes.