Optical Music Recognition with Robotic Piano Player

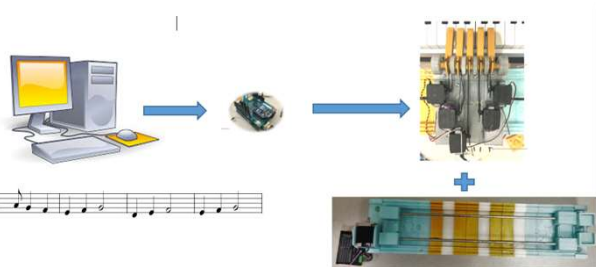Yedi Luo| EE/CSE 576| University of Washington

Background

- Optical Music recognition is also known as Music OCR; it is an application of computer vision to interpret the sheet of music. It performs image analysis on a well structured music score image with the conventional five staff lines, then give computer ability to directly play it through. Although OMR is related to OCR, the OCR techniques cannot be used in music score recognition. Two major differences made OMR much harder than the OCR. The first difference is that music sheet is a two-dimensional structure, while the text is one-dimensional structure. We need to keep track of pitches vertically and time horizontally. The second difference is that the notes on the sheet is always overlapped by the conventional five staff lines. It makes the situation much harder to extract object from the image. This project will introduce one solution to OMR and combine it with one of my other project "Robot Piano Player".
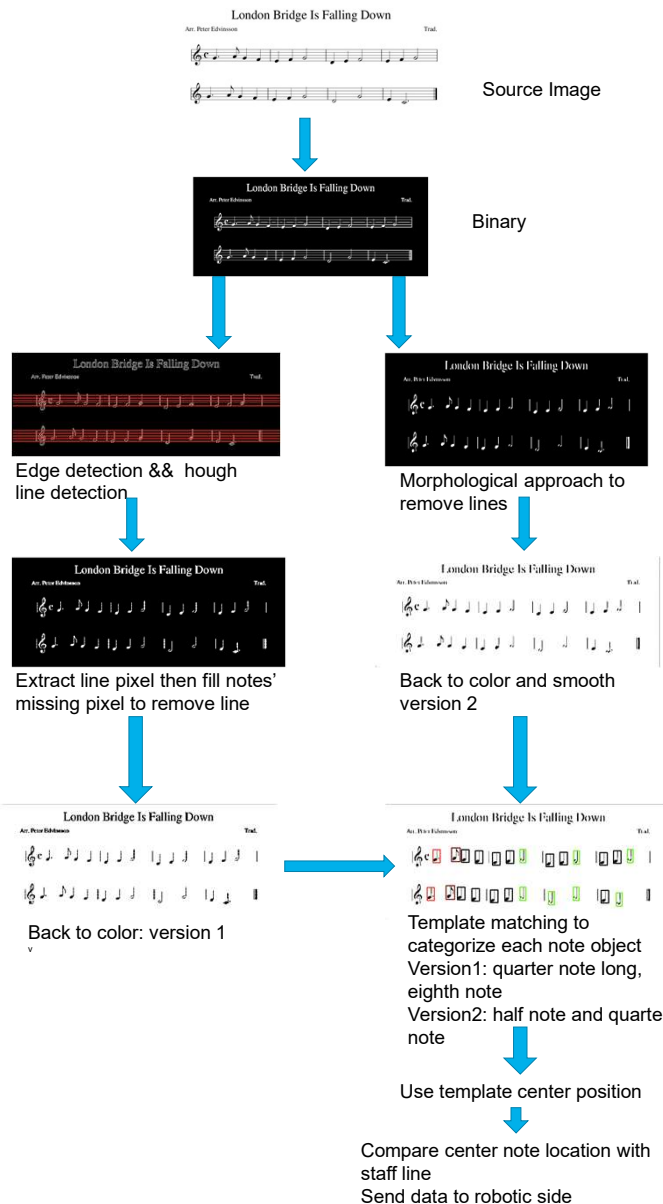
Goal

- The goal of this project is to be able to analyze sample music score image, then convert & send the information as data sample to the microcontroller of the robot piano player. Finally, let the robot piano player to perform it.
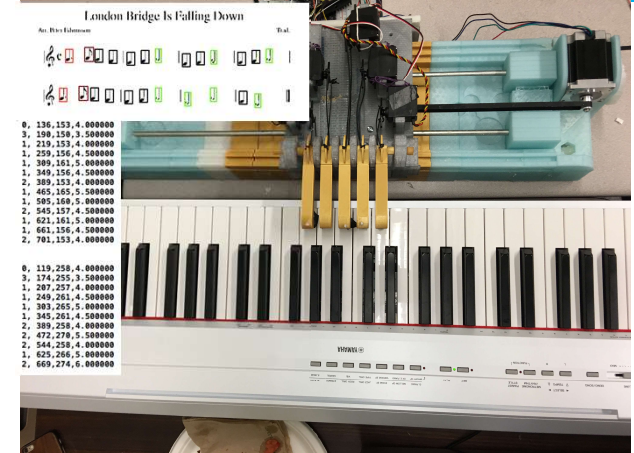
Objective

- Staff Line Identification
- Staff Line removal
- Music Symbol Location
- Music Symbol Identification
- Manage and Sort Relation of Music Notes
- Convert C++ data into robot embedded system data.
- New algorithm for Robot to Perform the play.

Solution

Source Image

Binary

Edge detection && hough line detection

Morphological approach to remove lines

Extract line pixel then fill notes' missing pixel to remove line

Back to color and smooth version 2

Back to color: version 1

Template matching to categorize each note object
Version1: quarter note long, eighth note
Version2: half note and quarter note

Use template center position

Compare center note location with staff line
Send data to robotic side

Results

- The entire system run done takes around 2 – 3 mins, overall. computer reads information correctly and piano playing robot works great.
- For working video: https://www.youtube.com/watch?v=RF2ShV4MP44

Future Work & Improvement

- Add more music object, currently, this system can only handle few types of music symbol. Be able to recognize more symbol can result in playing more complicated song.
- Add real time camera, Initially, I was planning to use a real time camera to do the image reading, but the staff line will never be straight and the notes are always distorted. It is very hard to use distorted image to do the analysis.

Works Cited

- **Wazir Zada Khan,:" Overview of Algorithms and Techniques for Optical Music Recognition" Available at: http://www.academia.edu/782397/Overview_of_Algorithms_and_Techniques_for_Optical_Music_Recognition**
- ***Robot Piano Player: 448-449ws2016.wikispaces.com/**