

Description:

The main purpose of this project is to make a program that can help a person play a piano song. The user will be playing a 44 key Casio SA76 keyboard. This keyboard will be fitted with camera(s) that observe the user playing. The program will output how the user's fingers are placed and what key needs to be pressed next so that the song is played correctly.

Approach:

1. Develop a MATLAB program that can see whether the user is playing the correct notes
 - a. The camera will be mounted above the piano and will record the small LCD screen see Figure 3 and 7.
 - b. The SA76 has an LCD screen that is linked to each key. So, when any key is pressed the appropriate symbol will show on the LCD screen. For example, Figure 2 shows the user playing notes on piano.
 - c. The piano can "play" songs itself. While it plays as song the notes will also be displayed on the LCD screen.
 - i. We will record this video and call it the "model" video
 - d. As the user plays a video will be recording their notes
 - i. We will call this is "user" video
 - e. The program will compare both videos and look for discrepancies by subtracting images
 - i. The program will need to locate the LCD screen
 1. Then it will have to focus on the dotted region in Figure 3
 - a. We will vary lighting and angle to see if the accuracy of the note recognition program degrades.
 - i. Of course, each key will be mapped to a location on the LCD screen to get the "ground truth" of what is being played. see Figure 1 and 4.
2. Develop a MATLAB program that can display the next key to be played
 - a. The next key will be highlighted so the user can see what needs to be played next the current key will be blue and the next key will be green
 - i. The program will reference the model video in part 1 (see figure 4) and high light the keys accordingly. See figure 5.
 1. The program will need to use edge detection to identify the pixel locations of the keys.
 2. The location and width of the keys will be inputs to an augmented reality program that projects the colored rectangles onto the keys.
 - a. Occlusion issues with the fingers being in the way will need to be addressed so that the fingers will not be "colored over" with the colored rectangles.
3. If time permits we will make a GUI that shows a layout shown in Figure 6

Appendix



Figure 1. Shows layout of keyboard. 26 white key, 18 Black Key, totaling 44 key piano will be used.



Figure 2 shows the user playing middle-C, E and G notes. The notes will update on the screen for every key pressed. The screen can display up to 8 notes simultaneously.

https://www.amazon.com/gp/product/B00416WHV4/ref=oh_aui_detailpage_o03_s00?ie=UTF8&pssc=1



Figure 3. The LCD screen that displays the notes the user is playing

<http://www.casio-intl.com/asia/en/emi/products/sa76/>

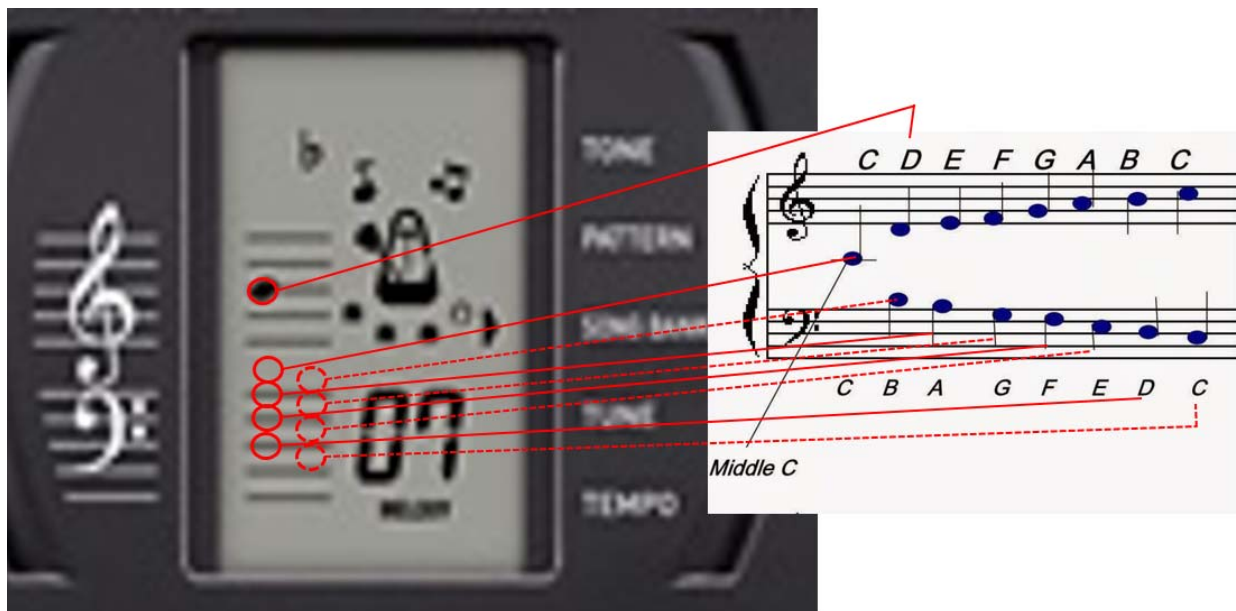


Figure 4 shows the “ground truth” of the 2nd D note being played on the key board. Each note has a musical mapping

<https://www.pinterest.com/pin/558868634982554713/>



Figure 5 Shows the current 3 keys being pressed with a blue coloration and the next key to be played is colored green. This video will be shown to the user on a computer screen along with the “model” video and the “user” video.



Figure 6. Shows the overall setup with GUI and piano set in front of a monitor



Figure 7 shows a flexible mount that holds a web camera over the piano. The location of the webcam will not be the same each time so the program needs to be able to account for the setup variation. The LCD screen face bezel may be painted white to add contrast on all 4 edges to help with the edge detection.

https://www.amazon.com/gp/product/B00K0NYSY6/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1