APL - Assignment 4

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1 How to run the code

- I have submitted a zip file, which contains Python Notebook, and two layout python scrips, "layout.py" and "split_keyboard.py". Download all three and make sure they are in the same directory before running the code.
- Instructions on how to run the notebook are given in detail at the beginning of the file, please read and follow those instructions before running the code.
- To change the input text, modify the text in the "input_string" variable and run the code again.
- I generate 2 keyboards per layout, one where the fill is "discrete" and one where it is continuous.
- For explanation on the functionality of the code, please refer to the comments in the code.
- Under the generated keyboard images, I print the input string for reference and the distance travelled.

2 Assumptions made

- I have assumed that the size of the key will remain the same irrespective of the coordinate system, since maybe placing them far apart might make a more optimised layout (we dont know that yet), so I have made the size of the key not depend on the distance between keys and so on.
- I have also assumed that the distance calculations is one way, as given in the problem statement pdf.
- I don't change the dimensions of the special keys, as in the case of different split keyboard configurations, these may behave unpredictably, so I have left them alone.
- I have not dropped the space bar, since the space bar is a very important part of finding the optimal solution. So even through it may skew the heatmap at higher frequencies, I have not dropped them.

3 Approach

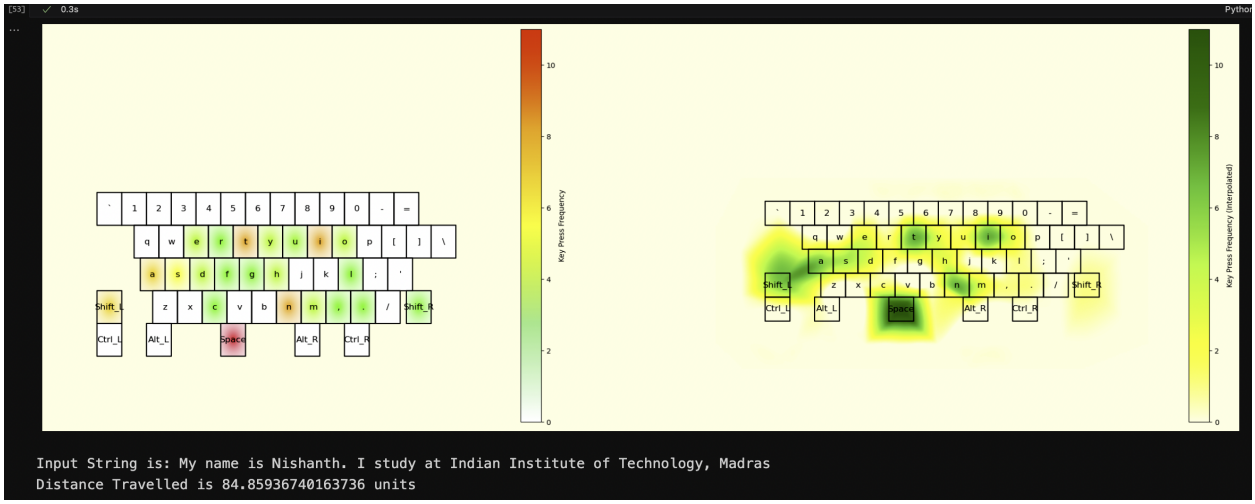
- I generate 2 keyboard images. The first one is just filling the squares of the keys with a color that symbolises the frequency with which it is pressed.
- I collect all the frequencies in a dictionary, then I use a color map given by matplotlib called gist_rainbow, and I only use the bottom section of the colormap.
- So I normalise the frequency of the characters between 0 and 0.4 and decide a color in the spectrum for it.
- I plot the keyboard using patches class of matplotlib and apply the colors at the same coordinates as the keys using "imshow".
- To make it look slightly better, I try to blend the color with white ("which is the background color of the keyboard") as one goes away from the centre of they keys. I use a Gaussian function to do this and blend it with white.
- For the second keyboard, I try to blend it with the neighbouring keys using interpolation.
- I basically plot the keyboard, that is my base layer, and plot the colors on top of that, corresponding to the keys, and make them blend using interpolation.
- I use griddata from SciPy, which is used to interpolate scattered data.
- The distance calculations related things were quite easy, and I did them the same way I did the programming quiz.
- I display the input string and the distance covered along with the keyboard images.
- I have also made a split keyboard layout, and have also demonstrated the functionality of my code with that.
- One problem with the interpolation was that since i had defined the key coordinates at the points in the color plot, it would abruptly stop coloring at the boundary of the keyboard. To fix this, I put a bunch of dummy characters around the border of the keyboard, and this fixed the abrupt endings of the colors.

4 Some Observations

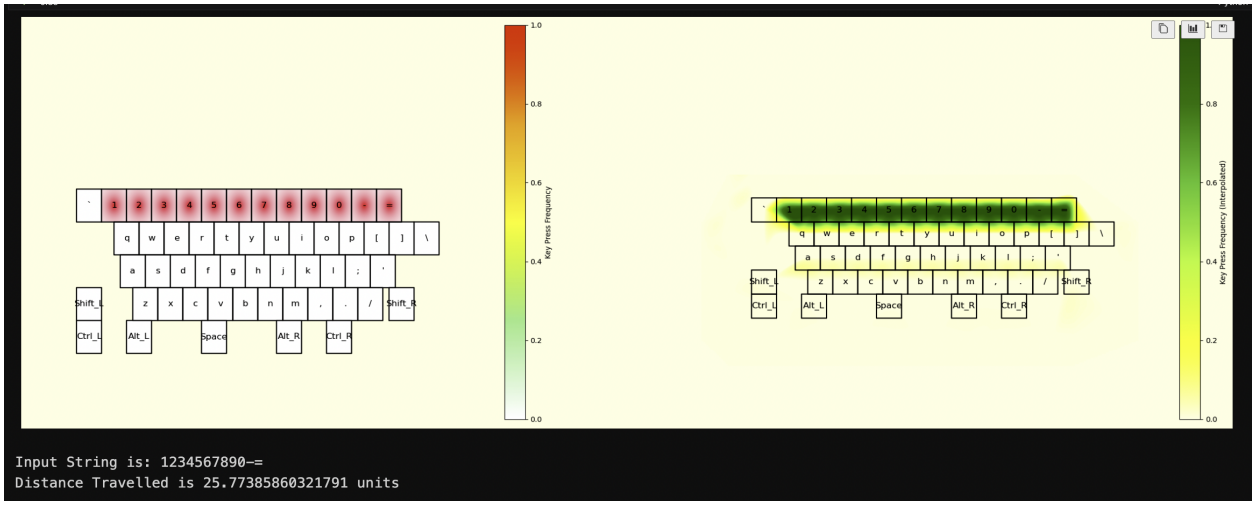
- The blending keyboard does not always give you accurate results, especially in the case of the split keyboard, performs very bad due to the interpolation, hence I have displayed both the keyboards.
- This is a personal opinion, but the blending effect might make it "look better", but does not add much to the functionality. Sure it may seek to track finger movement in a more accurate way than discrete color fills, but this may be at the sacrifice of not being able to differentiate the frequencies of different keys.

5 Sample Outputs

Note : All these output images are attached in the zip file.
Input : "My name is Nishanth. I study at Indian Institute of Technology, Madras".



Input :"1234567890-="



This is a split keyboard
Input : "The quick brown fox jumped over the lazy dogs"