ENSC 474

Assignement 4

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Question 1:

To find the average of every subject's photo, I just read the 64 illuminated images of each person, summed them, then divided by 64.

Each person's face came out looking exactly like the files provided on the website, just cropped, since that was the file we downloaded. Using the getpgmraw function, I was able to load each of the pgm files, and simply average them and display them using a for loop. Below you may see the resulting images that this returned.

Figure 1: Averaged photos for each of the 28 subjects

The original images and the averaged images were saved in 3D and 2D matrices, respectively. For the 3D, the number of rows were MxN, representing every pixel in the images, the columns were each of the 64 images, and each plane was in respect to the subject number. For the 2D, number of rows was MxN, and columns were the subject number.

Once these were loaded, each of the averages were displayed, using the reshape and imshow functions. Subplot was used to fit the images onto one figure, so that we don't have to have an image for each subject.

With these values loaded, we then called the function to calculate and plot the penrose distance and Euclidian distance.

This was done simply by combining the columns of the average and All_images matrices. Once these were calculated, each point (one for each illuminated image of a subject) was plotted onto its own coordinates, the x value being the Euclidian distance, and the y being the Penrose.

In the end, the best way to observe the data was to log the number, as the penrose distance even when divided by the 255 to create a range of [0,1], it was still a very large number. When logged, we see that a lot of the images have a linear relationship, resembling a positive correlation graph.

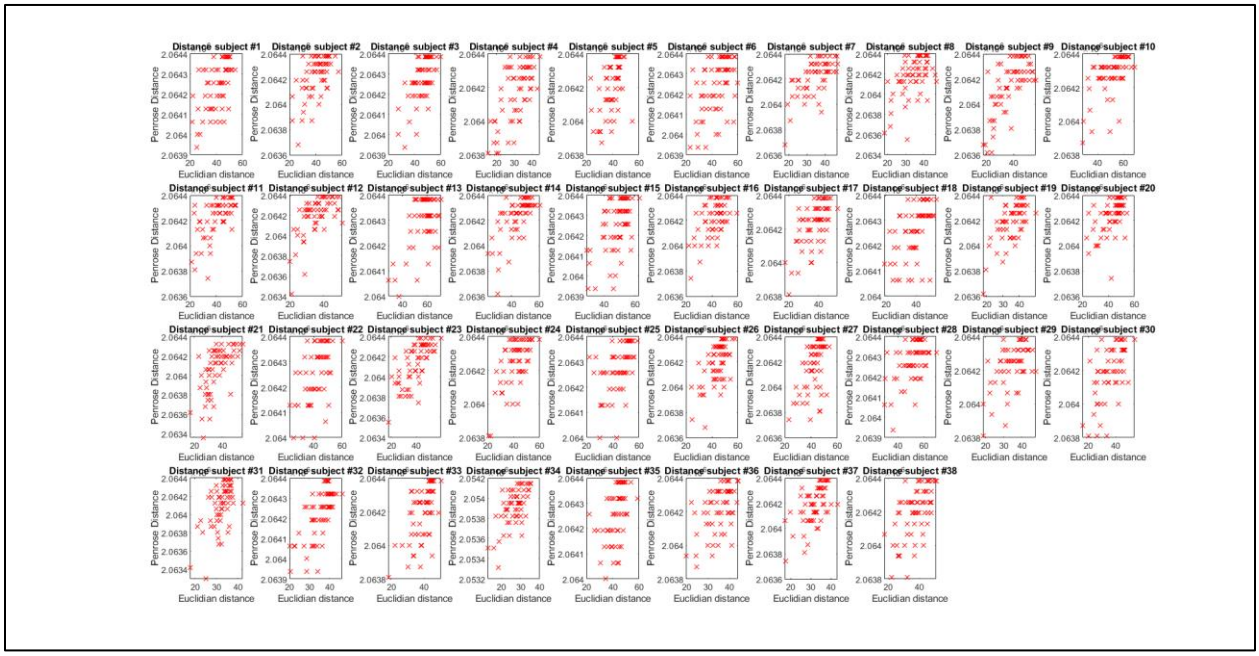

Figure 2: 38 plotted graphs of Euclidian distance vs. Penrose distance

Here, we can see the 38 plots, and every single one has a positive linear relation, and there seem to be a heavier presence in the top region of the graph vs. the bottom.

This portion of the lab was very interesting, since most people never really thought that there are tangible “distances” between every pixel in every in this assignment.

2) Bonus Problem:

Using the original, uncropped images, 9 images from one illumination were chosen and loaded as basis images. I chose the images from the yaleB11 folder, with the 00 illuminations. I chose a frontal image from yaleB12, and with the 9 basis images, I tried to recreate it with the basis images.

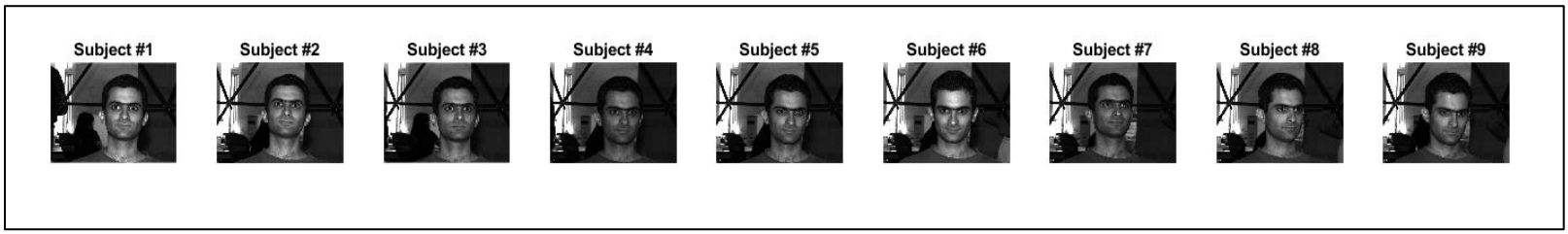

Figure 3: 9 basis images

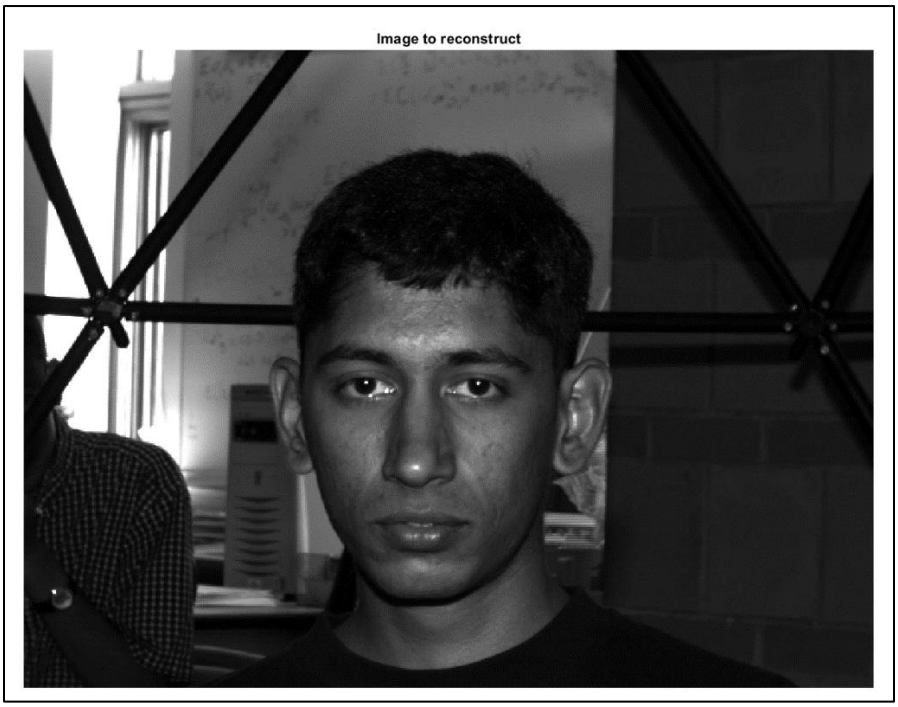

Figure 4: Image to be reconstructed

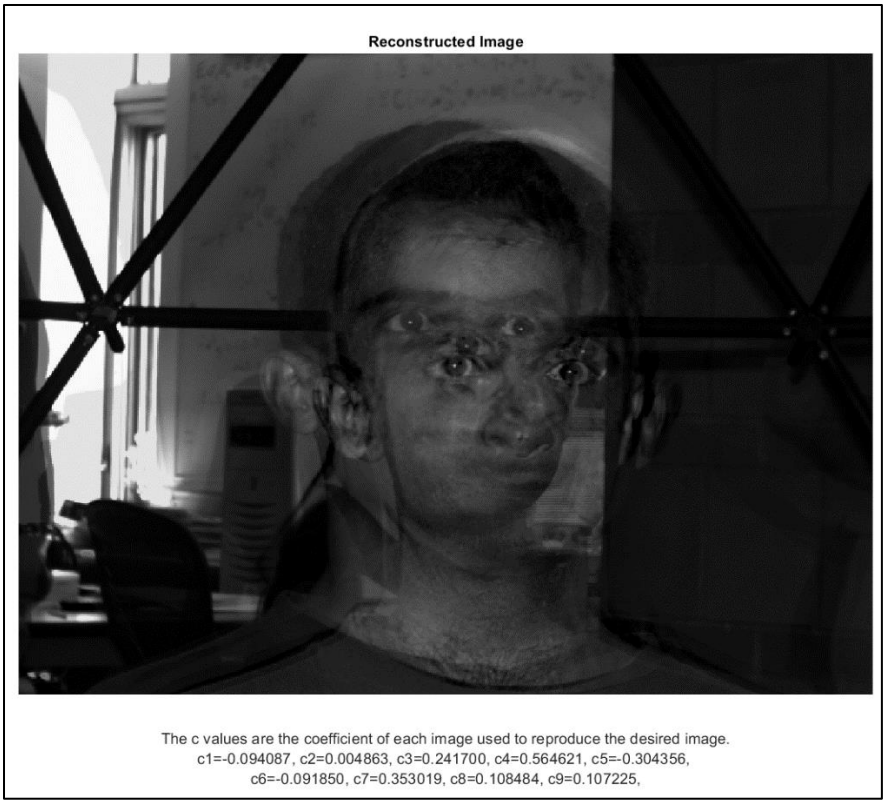

Figure 5: Reconstructed images, with coefficients of each image

As we can see, the most influential images in the recreation were images 3, 4, and 7. The most heavily used was 4, which makes sense since the subject in the basis images is looking at the camera, just as the person who is being reconstructed is.

The fourth and seventh images being used heavily makes sense since they are darker images, and the subject being recreated is darker, so to match the colour, darker images had to be used.

In the end, this was incredibly interesting, as we are now recreating people with image of other people. This is much better than assignment 2, as we now have more images as basis images, which produces much more accurate and realistic recreated images.