Task 2: Hand-written Digit Classification using nearest subspace

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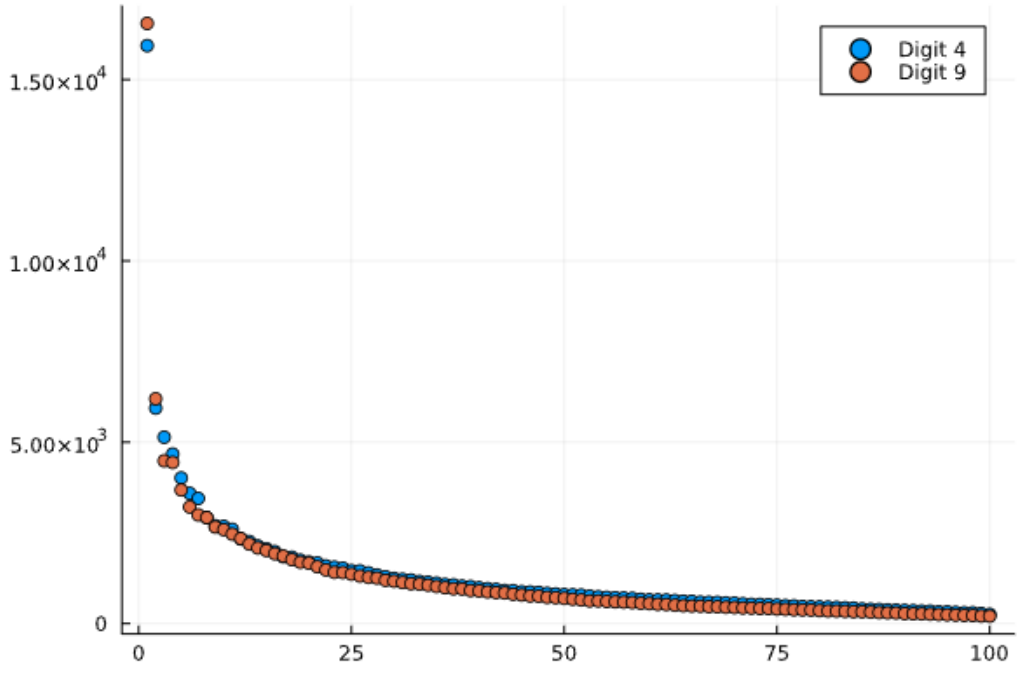
Part 1

Scree plot:



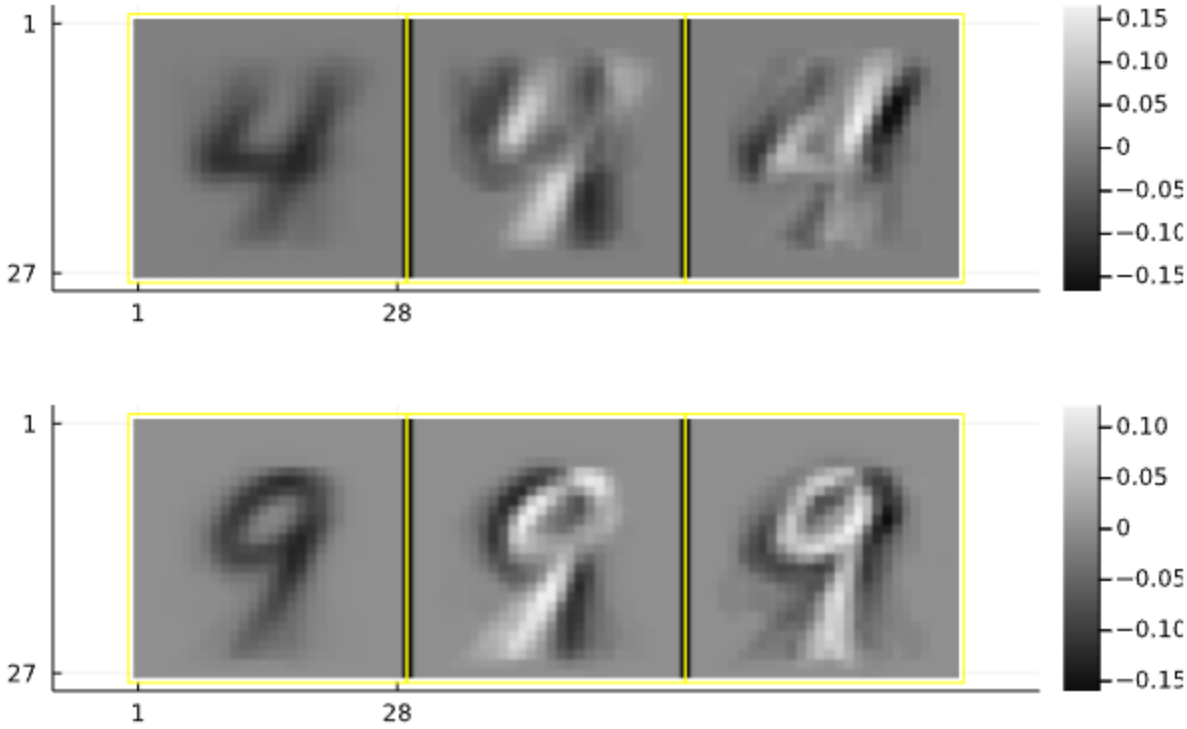
Where do you think the knee is in the scree plot? (1-2 sentences. You will get full credit for many different numbers here as long as you show you understand what the knee is.)

I think the knees should be the points where the y-axis is greater than around 4*10^3 (meanwhile the x-axis is less than around 10)

Name of person answering part 1:
Yu Gan (Arkham)

Part 2

Images of the three left singular vectors for both classes:

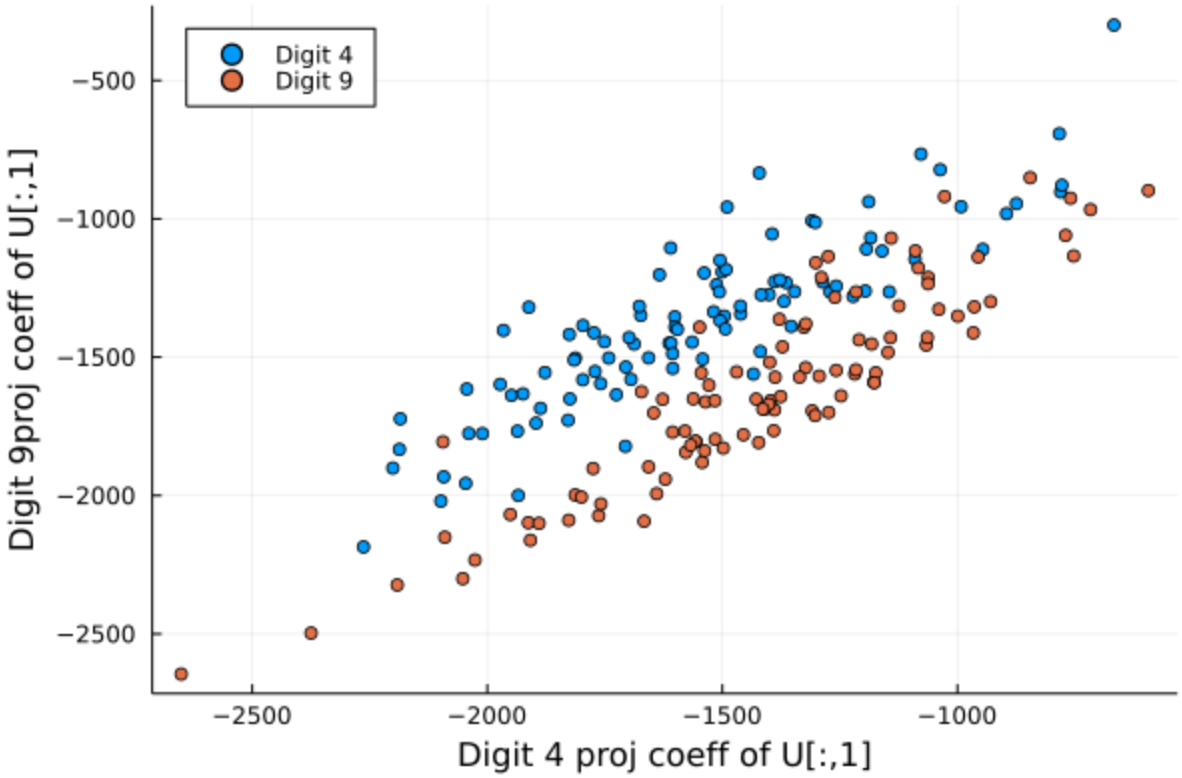


Do the left singular vectors look sensible? Why? (1-3 sentences)
Yes, the 1st left singular vector looks the most sensible while the other two vectors are less. And shadows of the other two vectors caused by combining multiple images are obvious to see.

Name of person answering part 2:
Yu Gan

Part 3

Plot of separation based on first left singular vector:



Explanation of what the `regress` function returns (1-3 sentences):

This regress function is to solve a LLS problem and it returns the projection coefficient of input data which is closer to the U'y where yi s given training samples. As the graph shows the data has been divided into two subspaces digit 4 and digit 9.

Name of person answering part 3:
Moyan Lyu

Part 4

Classification accuracy (make it clear which digit each classification accuracy is for - remember we are no longer classifying 0 and 1 digits!):

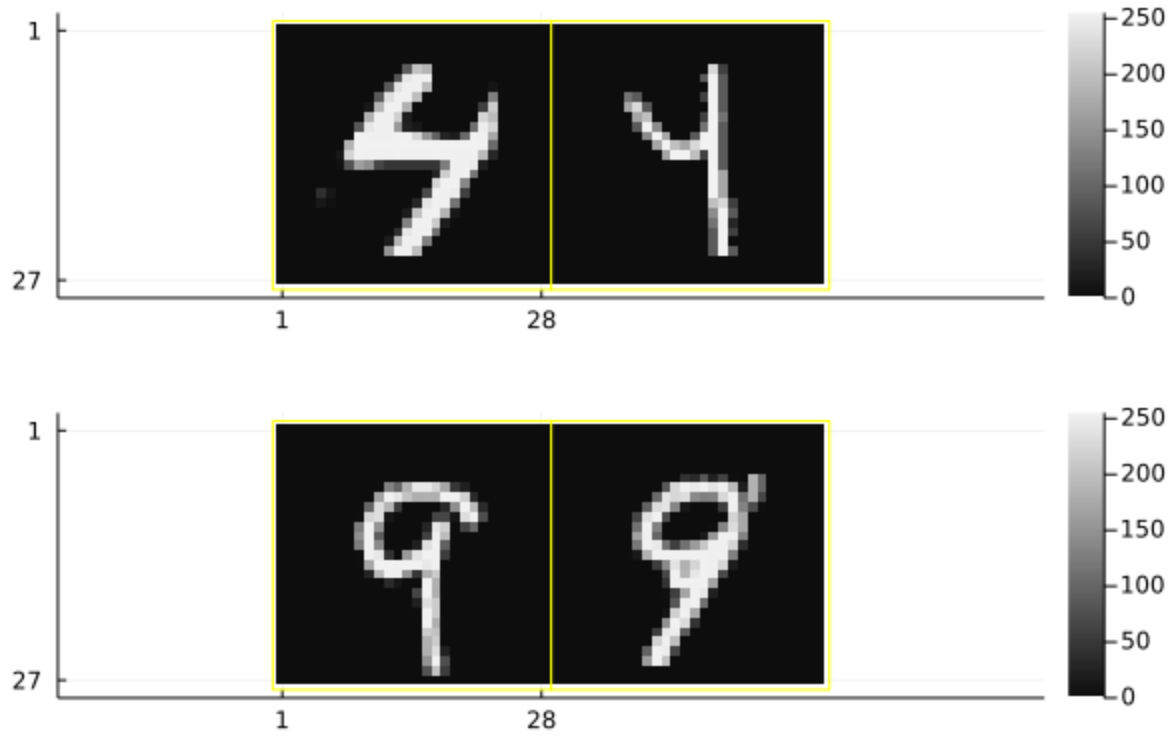
```
round(sum(correct0) / ntest, digits = 4) = 0.7722
round(sum(correct1) / ntest, digits = 4) = 0.9311
```

Comment on how good/bad the classifier is:
This classification accuracy for the 4's and the 9's is 0.7722 and 0.9311 which are roughly around 80% and 90%. It is good overall. However, classification for 9's has higher accuracy compared to classification for 4's.

Name of person answering part 4:
Yuzhan Jiang

Part 5

Pictures of the first two 4’s and 9’s that are misclassified:



The first two 4’s look like digital 9 at the first sight.

Name of person answering part 5:

Yuzhan Jiang