Q1.

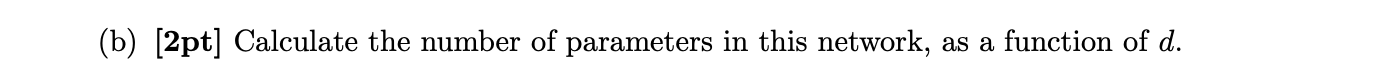
Diagram

Description automatically generated

Text, letter

Description automatically generated

W2 (1,d)



d^2 + d

Text

Description automatically generated

Text, letter

Description automatically generated

Text, letter

Description automatically generated

Text, letter

Description automatically generated

Text, letter

Description automatically generated

Text

Description automatically generated

Text, letter

Description automatically generated

Text, letter

Description automatically generated

Q3.0

A black and white checkered background

Description automatically generated with medium confidence

Figure 1. Means of each digit class in the training data represented by 8x8 2D images

Q3.1.1a

For K = 1:

train\_acc\_k1 = 100%

test\_acc\_k1 = 96.9%

Q3.1.1b

For K = 15:

train\_acc\_k15 = 95.7%

test\_acc\_k15 = 95.6%

Q3.1.2

In the event of a tie, to make a decision, we query the test point using an updated K value of K-1. If K is an even number, then using K-1 would help us break the tie by picking the majority.

Q3.1.3

train test K

0 1.000000 0.963143 1

1 0.964746 0.932286 2

2 0.980667 0.960429 3

3 0.969857 0.949286 4

4 0.973222 0.957714 5

5 0.965429 0.948857 6

6 0.969190 0.954714 7

7 0.962302 0.948571 8

8 0.964667 0.951286 9

9 0.960460 0.946857 10

10 0.960968 0.948571 11

11 0.957413 0.947429 12

12 0.957937 0.949000 13

13 0.954413 0.944857 14

14 0.955429 0.944857 15

Chart, line chart

Description automatically generated

X\_label = K

Y\_label = train (blue), test (orange)

Q3.2.1

MLP – Please see attached code.

Q3.2.2

SVM Classifier – Please see attached code.

Q3.2.3

AdaBoost Classifier – Please see attached code.

Q3.3. Model comparison