

## Question - 5

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- a) Kernel Used = Linear Kernel  
Tolerance =  $10e-3$   
Train Accuracy = 1.0  
Test Accuracy = 0.976

We are trying to do a binary classification between two numbers 4, 9. The train accuracy is at its highest, this maybe because the data used to train was completely linearly separable and the SVM was able to find a margin to separate the data.

But the Test accuracy is not 100%. This maybe because there were some points which were one the other side of the margin but coming from another class. The decision boundary we learned wasn't able to classify that point correctly

- b) All the three kernels yielded same train accuracy. But the test accuracies were different

Training Error is zero for all the kernels for given data

- Tolerance =  $10^{-3}$

### Linear Kernel

- Support Vectors = 1084
- Training set accuracy = 100 %
- Validation set accuracy = 97.6 %

### Radial Basis Kernel ( $\gamma = 0.001$ )

- Support Vectors = 6000
- Training Set accuracy = 100 %
- Validation Set accuracy = 50 %

### Polynomial Kernel ( $C = 1.0$ , degree = 2 )

- Support Vectors = 1755
- Training Set accuracy = 100 %
- Validation Set accuracy = 97.9 %

It looks like RBF kernel overfitted the data, and hence its training accuracy is very high while its test accuracy is very low.

Next comes the Linear Kernel. It looks like it was able to separate the data by finding an optimum margin for the data, hence it generalised a bit well

Then comes the polynomial Kernel, which looks like generalised well when compared to other two kernels with the given data and mentioned parameters