Report - Assignment 2

Foundations of Machine Learning

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Deliverables:

1. I have submitted answers of question 1, 2 and 3 in a hand-written pdf format – Assign2_1_2_3.pdf
2. I have submitted two jupyter notebooks – Assign2_4.ipynb and Assign2_5.ipnyb as a solution of question 4th and 5th.
3. And Report.pdf

4th –

a. *When we use the complete training dataset –*
   i. Accuracy: 97.87735849056604 %
   ii. No. of Support Vectors: [14 14]
b. *Training using only first [50, 100, 200, 800] points of training dataset*

   i. Accuracy for first 50 points is: 98.11320754716981 %
      No. of Support Vectors: [1 1]
   ii. Accuracy for first 100 points is: 98.11320754716981 %
      No. of Support Vectors: [2 2]
   iii. Accuracy for first 200 points is: 98.11320754716981 %
      No. of Support Vectors: [4 4]
   iv. Accuracy for first 800 points is: 98.11320754716981 %
      No. of Support Vectors: [7 7]
c. *Below*

   i. False,
      Train Error at Q= 2 is: 0.008968609865470878
      Train Error at Q= 5 is: 0.004484304932735439

   ii. True,
      Support Vectors at Q= 2 is: [38 38]
      Support Vectors at Q= 5 is: [12 13]

   iii. False,
      Train Error at Q= 2 is: 0.004484304932735439
      Train Error at Q= 5 is: 0.0038436899423446302
   iv. False,
      Test Error at Q= 2 is: 0.018867924528301883
      Test Error at Q= 5 is: 0.02122641509433964

d. For c in [0.01, 1, 100, 10000, 1000000], train error and test error is as follows-

Train Error at C= 0.01 is: 0.0038436899423446302
Test Error at C= 0.01 is: 0.02358490566037741

Train Error at C= 1 is: 0.004484304932735439
Test Error at C= 1 is: 0.021226415094339646

Train Error at C= 100 is: 0.0032030749519538215
Test Error at C= 100 is: 0.018867924528301883

Train Error at C= 10000 is: 0.002562459961563124
Test Error at C= 10000 is: 0.02358490566037741

Train Error at C= 1000000 is: 0.0006406149903908087
Test Error at C= 1000000 is: 0.02358490566037741

Test Error is lowest at C=100
Train Error is lowest at C=10^6

5th –
a. For Linear Kernel
  Training Error: 0.0
  Test Error: 0.02400000000000002
  No. of Support Vectors: [542 542]
b. For RBF Kernel
  Training Error: 0.0
  Test Error: 0.5
  No. of Support Vectors: [3000 3000]
  For Polynomial Kernel
  Training Error: 0.0004999999999999449
  Test Error: 0.020000000000000018
  No. of Support Vectors: [641 691]

Linear and RBF Kernel yields the lowest training error which is 0.0