

SMAI Spring-2019 Quiz-3

Full marks: 30

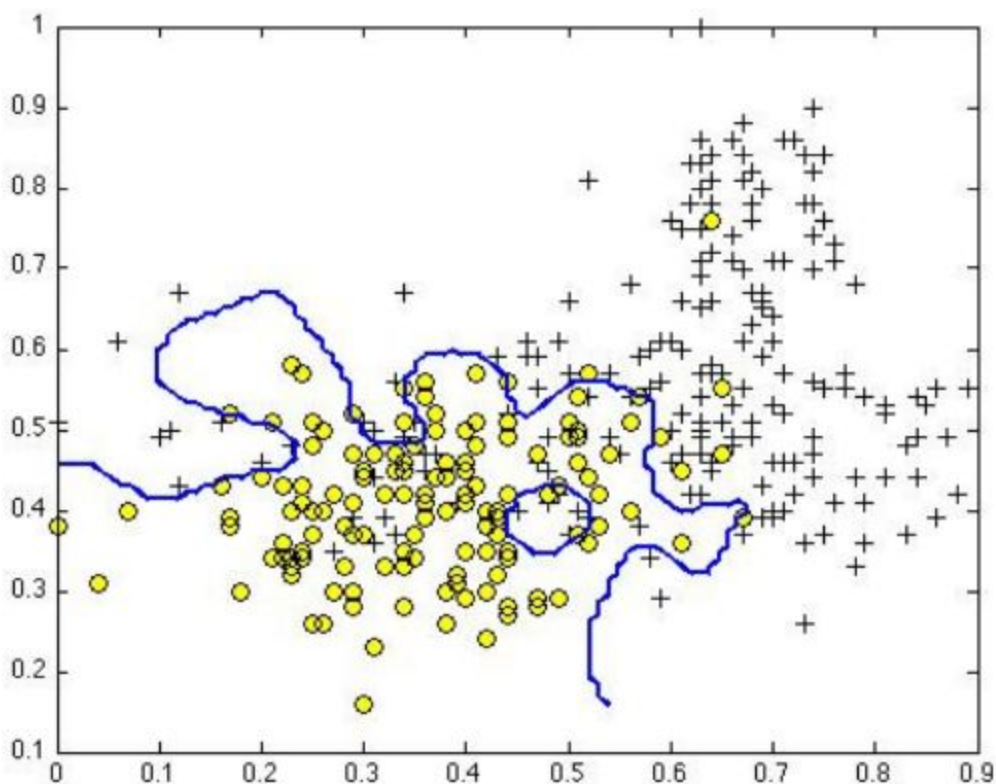
Time: 50 Mins

1. Given the hyperplane defined by the line $y = (1, -2)^T x = w^T x$. What is the minimal adjustment to w to make a new point $y = 1$, $x = (1, 1)$ be correctly classified?
[5]

2. Which of the following is/are true regarding an SVM? Give explanation:
 - (a) For two dimensional data points, the separating hyperplane learnt by a linear SVM will be a straight line.
 - (b) In theory, a Gaussian kernel SVM can model any complex separating hyperplane.
 - (c) For every kernel function used in a SVM, one can obtain a equivalent closed form basis expansion.
 - (d) Overfitting in an SVM is a function of number of support vectors**[5]**

3. Suppose a support vector machine for separating pluses from minuses finds a plus support vector at the point $x_1 = (1, 0)$, a minus support vector at $x_2 = (0, 1)$. You are to determine values for the classification vector **W** and the threshold value **b** . Your expression for w may contain x_1 and x_2 .
Hint: Think about the values produced by the decision rule for the support vectors, x_1 and x_2 **[5]**

4. Suppose you have trained an SVM classifier with a Gaussian kernel and it learned the following decision boundary on training set:



When you measure the SVM's performance on cross validation set it performs poorly. Should you increase/ decrease the value of σ^2 . Give explanation. **[5]**

5. State True/ False with proper justification:
- A. If a learning algorithm is suffering from high bias only adding more training samples may not improve the test error significantly
 - B. A model with more parameters is more prone to overfitting and typically has higher variance
 - C. When debugging learning algorithms it is useful to plot a learning curve to understand if there is high bias or high variance problem
 - D. If a neural network has much lower training error than test error then adding more layers would help bring the test error down as we can fit the test set better. **[10]**