

Indian Institute of Science

Neural Networks and Learning Systems-I

Instructor: Shayan Srinivasa Garani

Homework #3, Fall 2021

Late submission policy: Points scored = Correct points scored $\times e^{-d}$, $d = \#$ days late

Assigned date: Oct. 30th, 2021

Due date: Nov. 12th, 2021, 11:59 pm

PROBLEM 1: Prove that the conditional mean estimator in equation (5.52) is also a minimum mean square estimator. (5 pts.)

PROBLEM 2: Solve problems 5.1 and 5.9 from Haykin's book, 3rd edition. (10 pts.)

PROBLEM 3: Derive the dual problem from first principles for the SVM classifier that is not linearly separable with consideration to the ϵ -insensitive loss function. We stated the result in the class. I would like to see the entire derivation worked out. (10 pts.)

PROBLEM 4: Consider the Iris data set <https://archive.ics.uci.edu/ml/datasets/iris>. We are interested in constructing classifiers for this data based on RBF and SVM. You may decide on a 70% training set and 30% test set.

- (1) Assume that there is no label information available. Obtain the clusters using the K-means technique. Plot the misclassification rate as a function of number of clusters since you know the label information. Also, plot the distortion function as a function of the number of clusters. How do you decide the optimal number of clusters to choose? Once you have chosen the right number of clusters, run the RBF hybrid algorithm with the labeled information. Obtain the classification results. Comment on the accuracy of the approach.
- (2) Obtain an SVM classifier for this data set. How do your results compare w.r.t the perceptron. Comment on the accuracy of the approach.

(35 pts.)