Indian Institute of Technology, Guwahati

EE657: Pattern Recognition and Machine Learning

Assignment 5: Perceptron and Support Vector Machines

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0.1 Observation and Inferences

0.1.1 Task 1 :

1. By using the features contained in Pattern1.mat and Pattern2.mat, design a batch-mode perceptron classifier for the classes 1 and 2. How many iterations are required for convergence. Evaluate the performance on the test data Test1.mat and Test2.mat and report the accuracy.

Solutions :
We plotted the objective function for 1500 iterations and found out that it converges around 1300 iteration. **We do not get perfect convergence,which essentially implies that our data is not linearly separable. Here is the plot describing same**:

Figure 1: Plot depicting convergence of Perceptron Criterion
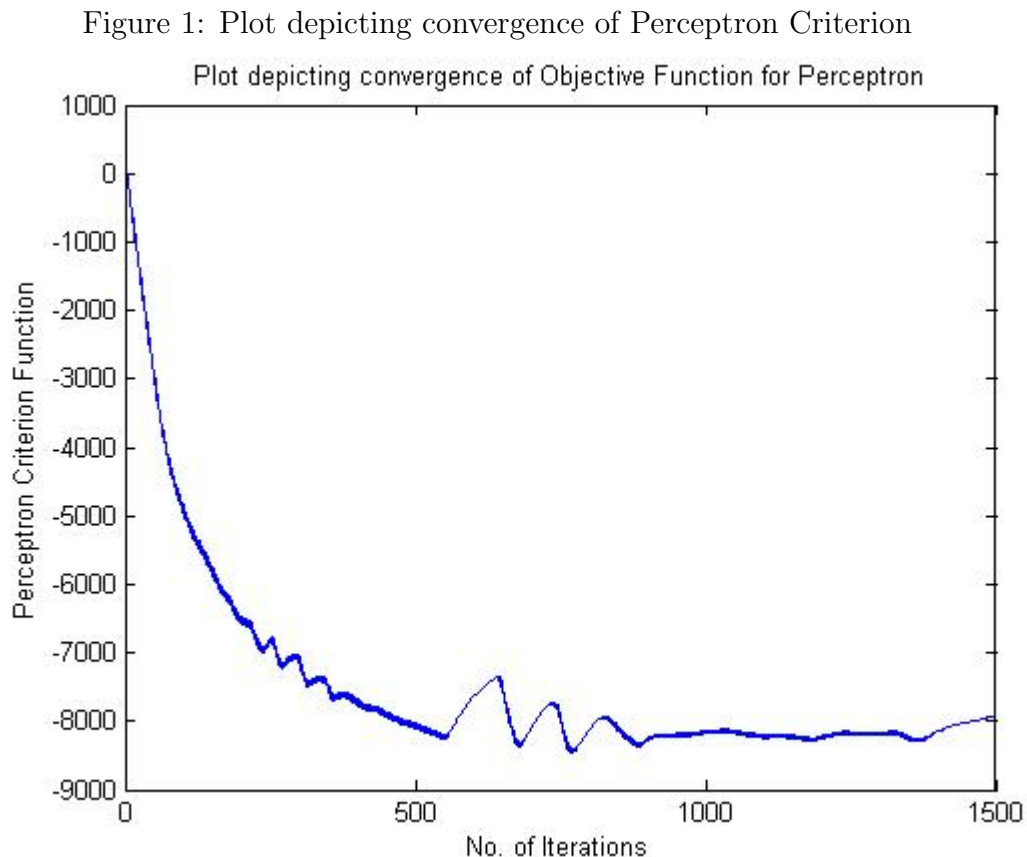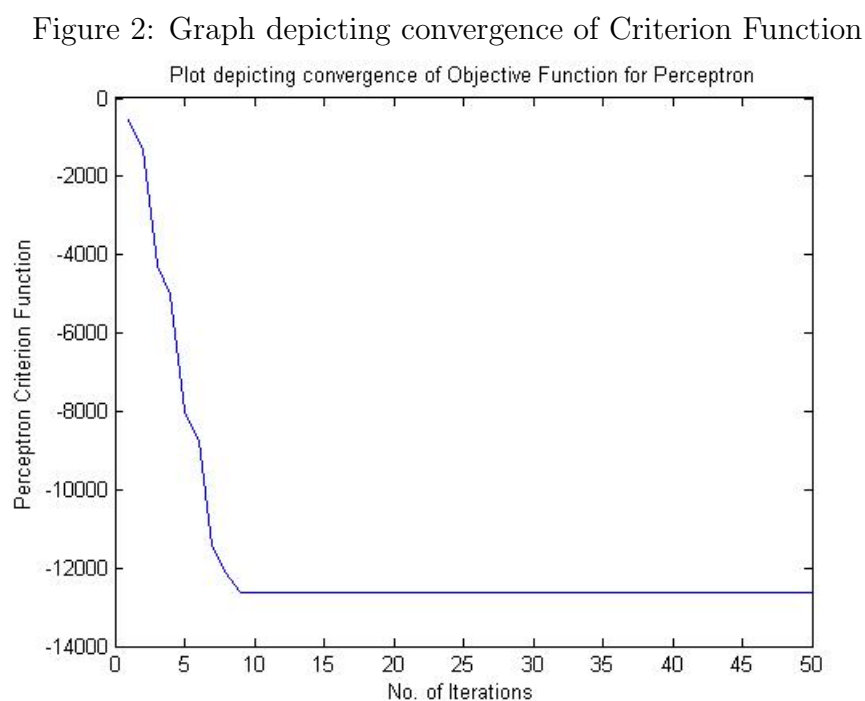
Accuracies :

- Accuracy for class-1 for classification b/w class 1 and 2 is : 86 Percent

- Accuracy for class-2 for classification b/w class 1 and 2 is : 83 Percent

2. Now consider building a perceptron for the classes 1 and 3. How many iterations are required for convergence in this case. Comment on the result. Evaluate the performance of this classifier on Test1.mat and Test3.mat

solutions :
Similarly, here we also plotted the perceptron criterion function for around 50 iterations and observed that we obtain a perfect convergence for around 10 iterations. It essentially implies that data is linearly separable. Below is the graph depicting the same :

Figure 2: Graph depicting convergence of Criterion Function

Accuracies :

- Accuracy for class-1 for classification b/w class 1 and 3 is : 99 Percent

- Accuracy for class-3 for classification b/w class 1 and 3 is : 100 Percent

0.1.2 Task 3:

Build a SVM Classifier for the classes 1 , 2 and 3 using a Radial Basis Function Kernel. Plot a graph depicting the recognition accuracy on the test data Test1.mat, Test2.mat and Test3.mat for different values of penalty factors C and precisions of the Radial Basis Function.

Solution :
Plots for individual accuracies as well as average accuracies are shown below : We observe that for reasonable values of C and Precision or Sigma , we
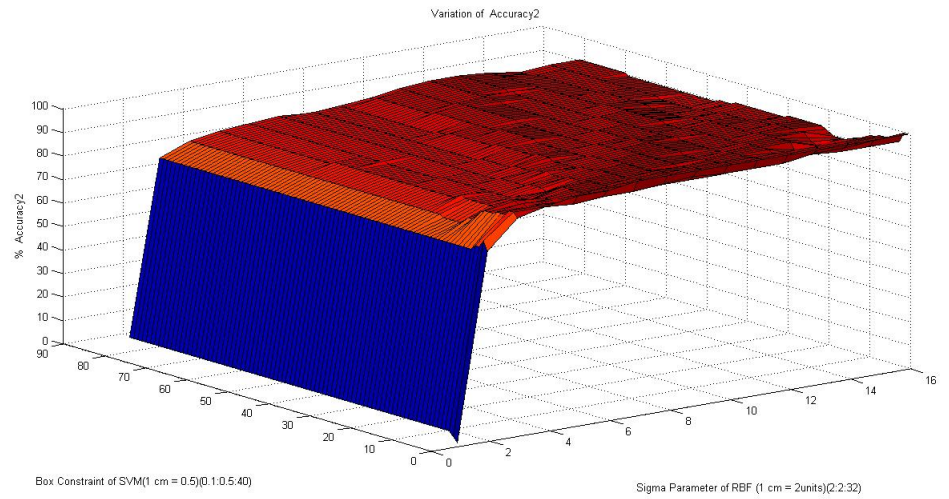
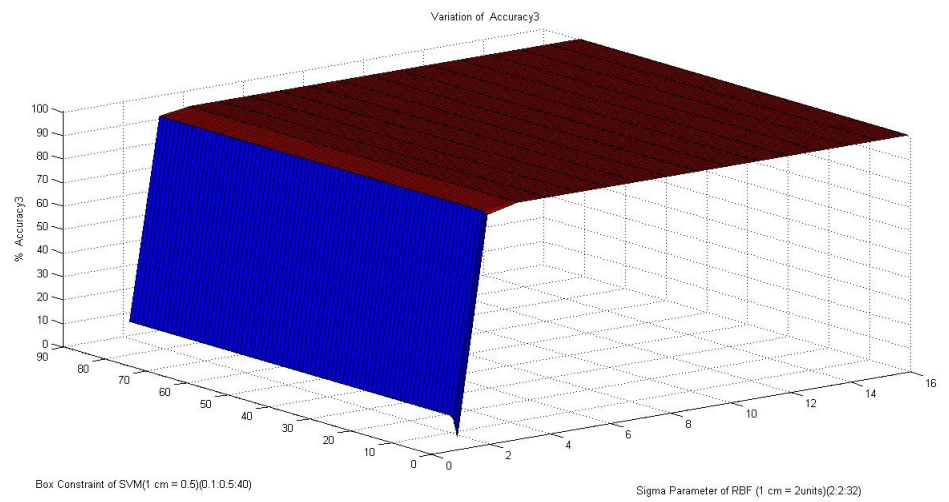Figure 3: Class -1 Accuracy Plot
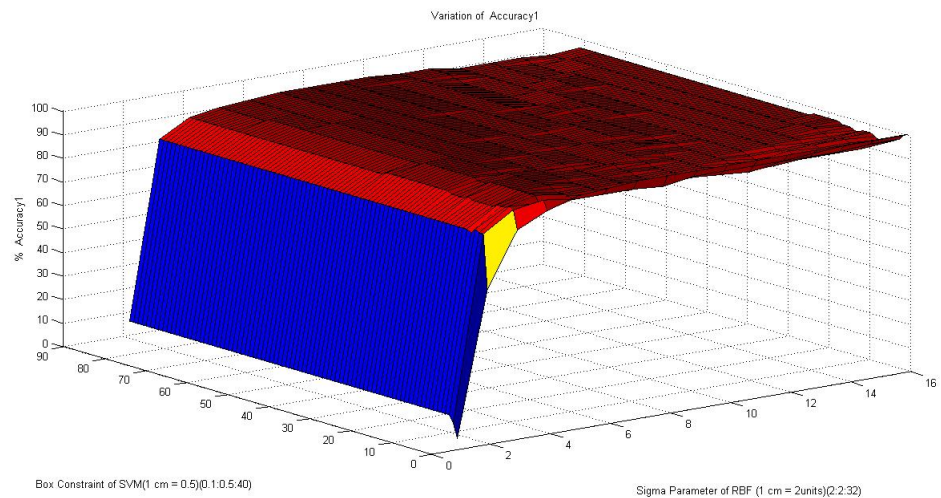
Output/1.jpg

get **Average Accuracy Around 92 Percent.**
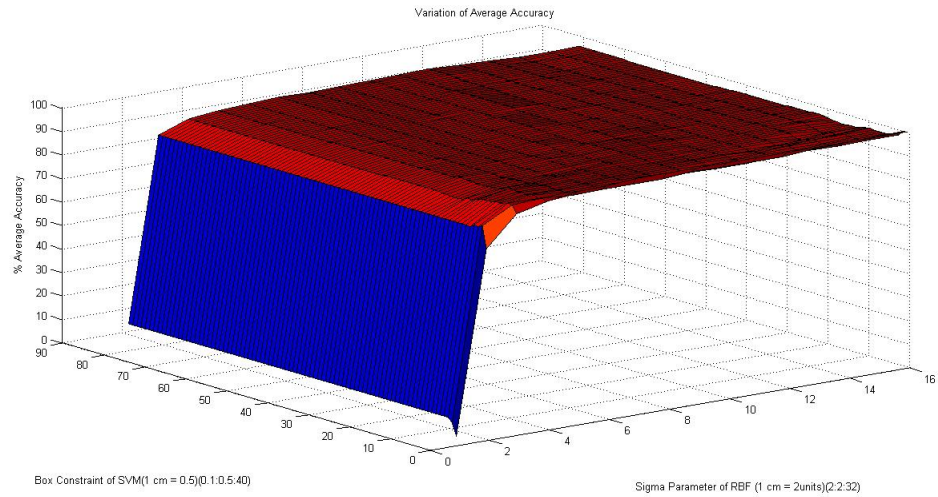
Figure 4: Class -2 Accuracy Plot

Output/2.jpg

Figure 5: Class -3 Accuracy Plot

Output/3.jpg

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Figure 6: Average Accuracy Plot

Output/Average.jpg

0.2   Bibliography

1. Bishop, Christopher M. Pattern recognition and machine learning. Vol. 1. New York: springer, 2006.

2. Alpaydin, E. (2004). Introduction to machine learning. MIT press.

3. Duda, Richard O., Peter E. Hart, and David G. Stork. "Pattern Classification."

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