**ASSIGNMENT -2 PATTERN RECOGNITION ECE 766**

**OCTOBER 29** 2014 **; DUE NOVEMBER 12 2014**

**PLEASE USE MATLAB FOR ALL YOUR EXERCISES**

1. From the previous assignment's software generate data which is separable. You may choose any reasonable mean and covariance to achieve separation.

a. Choose 30-35 data points from each class. Plot the data and verify that they are separable. Write M- code for perceptron algorithm for single sample input. Hold $\rho_k = 1$ constant

b. Repeat for the same data: use variable $\rho_k \alpha \frac{1}{k}$; Here symbol (α stands for proportional to )What happens to the number of iterations before the algorithm converges. Repeat the data and run the algorithm till all data is correctly classified.

c. Write M-code for pocket algorithm based on Gallant's pseudo code. Figure 1 from the Gallant et al. paper.

2.

a .Apply mean square error algorithm to a part of the data which is separable. The data size will be limited to the matrix inversion capability of the software (number of data/pattern can be anywhere from 5-10). Plot the data and discriminant. Now the algorithm should separate because the data is separable.

b. move a part of the data (N=2 to 4) from class 1 to class 2 to make the data inseparable and run the algorithm. Plot the discriminant and compute the accuracy of classification.

**3.** Given data sets for two classes

X= {(4,1), (2,4), (2,3), (3,6), (4,4)}

Y= {(9,10), (6,8), (9,5), (8,7), (10,8)}

a. Plot the classes and determine if they are separable by visual inspection.

b. Calculate the mean/ covariance matrix for each class, within class scatter and between class scatter.

c. Fisher's Linear Discriminant to optimally separate the two classes.

d. Plot the discriminant and show how the separation of classes occurs. Take a printout of all plots.

4. For the following data compute means, covariance matrices and the Fisher's linear discriminant function.

   CLASS 1: {(1,2), (2,3), (3,3), (4,5), (5,5)}
   CLASS 2: {(1,0), (2,1), (3,1), (3,2), (5,3), (6,5)}

   e. Plot the classes and determine if they are separable by visual inspection.
   f. Calculate the mean/ covariance matrix for each class, within class scatter and between class scatter.
   g. Calculate Fisher's Linear Discriminant to optimally separate the two classes.
   h. Plot the discriminant and show how the separation of classes occurs. Take a printout of all plots.

5. Generate 1000 points from problem 6(b) in the previous assignment. And discard them to overcome seed bias. Next generate 10000 points and use them for the designing following classifiers; distance metric can be Euclidean distance metric. Plot all data sets and classification boundaries.

   a. Perform k-NN classification of the data with 0% noise and 50% noise for following parameters. Keep k=1; compute the classification accuracy.
   b. Repeat k =2,5 and 10 and take majority voting for distance metric.
   c. Prepare a table for various 'k ' and corresponding classification accuracy.
   d. Run the section 5.a for condensed nearest neighbour algorithm, for k=1. Now plot the data and the decision boundaries (i.e. patterns classified inaccurately).