

# CS 4803A/8803A: Pattern Recognition

## Problem Set 5

**Date: April 1, 2003**

**Due: April 10, 2003**

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In this short problem set you will build some perceptrons. Use any of the techniques described in class (in terms of optimization functions and iteration techniques).

To do this PS you'll need the data on the class web site. The two files, **percept2.mat** and **percept3.mat** contain data from two and three classes respectively. The classes for the three class problem are `class1`, `class2` and `class3`. They are each matrices of 30 rows of two dimensional data. For the two class set, the names are `classA` and `classB` (don't forget the capitals).

1. Using the classes from the 3 class set, build a simple linear perceptron using an augmented vector of  $[1 \ x_1 \ x_2]$  to separate `class1` from `class3`. These classes are linearly separable.
2. For the two class set, build a perceptron-like decision function that separates the two classes `classA` and `classB` as best as possible. Use a completely linear machine, that is using an augmented vector of  $[1 \ x_1 \ x_2]$ . On a plot, show where the boundary is. (This machine will not work very well.)
3. Continuing with the two class problem, try using a quadratic system where the augmented vector is now  $[1 \ x_1 \ x_2 \ x_1^2 \ x_2^2]$ . Does this work better? Show the results by either a curve or a shaded area in the original  $\langle x_1, x_2 \rangle$  space.
4. Now for the three class case go back to building linear machines, building 3 class-X vs. not-class-X machines. What does this tell you about the considering how to build classifiers given training data and a particular set of methods for constructing classifiers.