Machine Learning 15-681/781
Tom Mitchell, Fall 1998

Homework Assignment 5
Due Friday Dec 4, 1998 (turn in to Jean Harpley, Wean 5313)

We have covered the material you need to answer questions 1,2, and 3, in previous lectures.

1. Radial Basis Function networks[1]. Consider a variant of the distance-weighted k nearest neighbor algorithm defined in the text. In particular, consider a variant which we will call Gaussian distance weighted nearest neighbor (GDWNN), in which (1) the classification for a query instance is calculated using equation 8.2 from the textbook, (2) k is set equal to the number of training examples, and (3) the distance weight of equation 8.3 is redefined as follows:

$$w_i \equiv e^{-\frac{1}{2}d^2(x_q,x_i)}$$

   True or false? For every possible set of training examples D, it is possible to construct a Radial Basis Function network that is equivalent to the GDWNN classifier for D. (here "equivalent to" means that the two classifiers agree on the classification of every possible query instance). If true, describe precisely your procedure for constructing the RBF network. If false, explain why this is impossible. (to convert your RBF network output to a boolean value, interpret outputs greater than or equal to zero as True, and outputs less than zero as False.

2. Exercise 8.3 from the textbook.

3. Exercise 9.4

4. Exercise 13.2

[1]Important: Please note the equation on line three of page 239 is in error. A minus sign should be added to the exponent. A full set of errata for the textbook is available at www.cs.cmu.edu/~tom/mlbook.html