In The Name of God, The Compassionate, The Merciful

Name: .....

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Statistical Pattern Recognition (CE-725)
Department of Computer Engineering
Quiz #7 solution - Spring 2010

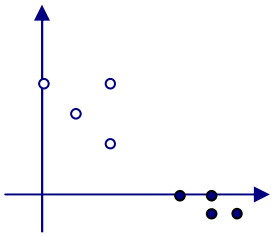
Assume that the training set for two classes are:

S1: {(2, 2), (1, 3), (2, 4), (0, 4)}
S2: {(4, 0), (5, 0), (5, -0.5), (6, -0.5)}

Find the optimum line that SVM finds for the case of no training set error. Find the support vectors and margin of the optimal SVM (Justify carefully why it is the optimum line).

Hint: Do not try to solve the SVM quadratic optimization!

Sol : The points are marked in the coordinate plane as below :



There are a number of possibilities for the support vectors of the first and the second class. (2, 2) and (2, 4) are the candidate SVs from the 1st class. (4, 0) and (5, 0) are the candidate SVs from the 2nd class.

Now we consider each possibility:

- (2, 2) – (4, 0): All points will be classified correctly and the margin will be $||(4, 0) – (2, 2)|| = 2\sqrt{2}$.
- (2, 2), (2, 4) – (4, 0): All points will be classified correctly and the margin will be 2.
- (2, 2) – (4, 0), (5, 0): All points will be classified correctly and the margin will be 2.

Therefore the SVs are (2, 2) and (4, 0). The separating hyperplane normal vector is (2, 2) - (4, 0) = (-2, 2). The point ((2, 2) + (4, 0))/2 = (3, 1) is on the hyperplane. The equation of hyperplane will be : ((x, y) – (3, 1)). (-2, 2) = 0. That is -2x+2y=-4 which is –x+y=-2.