EE E6887 Statistical Pattern Recognition

Homework #6

Due Date: Nov. 16th 2005 Wed.

Please complete all problems.

P.1 (Dual Problem of SVM)

In the lecture note (slide 14-6), we have formulated the unconstrained Lagrangean as follows

$$L_p = \frac{1}{2}\|\mathbf{w}\|^2 - \sum_{i=1}^{l} \alpha_i (y_i(\mathbf{w}^t \mathbf{x}_i + b) - 1)$$

subject to $\alpha_i \geq 0$. This is called the primal form.

Take the derivatives of the above with respect to **w** and *b*. By making the derivatives vanish, show that you can derive the following "dual form"

$$L_D = \sum_{i=1}^{l} \alpha_i - \frac{1}{2} \sum_{i=1}^{l} \sum_{j=1}^{l} \alpha_i \alpha_j y_i y_j \mathbf{x}_i \cdot \mathbf{x}_j$$

P.2 (SVM)

Problem 34 of Chap 5.

Note you need to find the Lagrange multipliers α_i, point out which samples are support vectors, derive the discriminant function, and derive the equation of classification hyperplane in the higher-dimensional space. Though it is not mandatory, you are encouraged to plot the decision hyperplane and the hyperplanes crossing the support vectors in the original space (x_1, x_2).