Homework No.3

Machine Learning 2021

Classification

1. Given the 10 points in following table along with their classes and their Lagrangian multipliers (α_i), answer the following questions:

   (a) What is the equation of the SVM hyperplane $h(\mathbf{x})$?

   (b) What is the distance of $\mathbf{x}_6$ from the hyperplane? Is it within the margin of the classifier?

   (c) Classify the point $\mathbf{z} = (3, 3)^T$ using $h(\mathbf{x})$ from above.

x_{i1}	x_{i2}	y_i	α_i
4	2.9	1	0.414
4	4	1	0
1	2.5	−1	0
2.5	1	−1	0.018
4.9	4.5	1	0
1.9	1.9	−1	0
3.5	4	1	0.018
0.5	1.5	−1	0
2	2.1	−1	0.414
4.5	2.5	1	0

2. Find the dual of the following version of the SVM method:

$$\min_{\mathbf{w},b,\xi_i} \frac{\|\mathbf{w}\|^2}{2} + C \sum_{i=1}^{n} \xi_i$$
$$s.t$$
$$y_i \left(\mathbf{w}^T \mathbf{x}_i + b \right) \geq 1 - \xi_i,$$
$$\xi_i \geq 0$$

By having the optimal dual solutions find the optimal solution of the primal problem(find the hyperplane).