Course: DD2427 - Exercise Set 9

Exercise 1: *SVM problem*

Consider a Support Vector Machine and the following training data from two categories:

$$\omega_1 : (1,1)^T$$
$$\omega_2 : (-1,-1)^T, (1,0)^T, (0,1)^T$$

a) Plot these four points and construct by inspection the weight vector for the optimal hyper-plane and the optimal margin, that is compute $\mathbf{w}$ and b such that

$$\mathbf{w}^T\mathbf{x} + b = 0$$

is the optimal, the one with maximum margin, separating hyper-plane.

b) Which point(s) correspond to the support vectors?

c) In this case, write down the Lagrangian associated with the optimization problem which is solved by the SVM.

d) Using the dual formulation of the optimization problem, calculate the optimal value of $\mathbf{w}$ in terms of the Lagrange multipliers.

e) (*Optional / not hard but some algebra involved*) Construct the solution in the dual space by explicitly finding the Lagrange multipliers. (You can assume the Lagrange multipliers associated with the feature points that are not support vectors are zero.)

For the lecture: 2nd May

Bring your hand written solution to this exercise.