

Exercise Sheet #11

Problem 1 (*Analytic Calculation of Maximal Margins*) 10 Pts

Given the following classification problem:

- The positively classified ($l = 1$) training vectors are:
 $\mathbf{x}_1 = (1, 1)$, $\mathbf{x}_2 = (-1, -1)$.
- The negatively classified ($l = -1$) training vectors are:
 $\mathbf{x}_3 = (1, -1)$

Determine the maximum-margin line analytically, i.e. find \mathbf{w} and b that solves $\mathbf{w} \cdot \mathbf{x} = b$ with maximum margins.

You can solve this problem by maximizing the dual Lagrangian with constraints with respect to $\{a_1, a_2, a_3\}$:

$$L = \sum_i a_i - \frac{1}{2} \sum_{ij} a_i H_{ij} a_j, \quad a_i \geq 0, \quad \underbrace{\sum_i a_i l_i = 0}_{\text{constraints}}$$
$$H_{ij} = (l_i \mathbf{x}_i) \cdot (l_j \mathbf{x}_j)$$

(Hint: Check if the inequality constraint is fulfilled after you have found the maximum on the hyperplane.)

Use the SVM code given in the lecture to verify your analytic result.

Problem 2 (*System commands*) 10 Pts

Finding specific files in a directory is a basic necessity for any big project. Write code that returns the `.dat` file with the most recent modification date in a directory. Use the `system()` function with the `ls` command to get the names of all files in the folder. Use string manipulation to print out the name of the latest `.dat` file edited. Remember `ls` can receive additional parameters.