Heinrich Heine Universität Düsseldorf

HEIDERLAB

Exercise 7 on Machine Learning WS 2023/24
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Submission: Until 13.12.2023, 23:59 on Ilias

Task 1. Support Vector Machine (5 points)

For this task, use the dataset svm_data.csv.

a) Calculate w and b for the support vectors. The Lagrange multipliers are already calculated: (3.5 P.)

x_i	a_i
x1	0.0437
x2	0.2162
x4	0.1427
x13	0.3589
x14	0.0437

b) Draw the coordinate system with the margins and the hyperplane. (1 P.)

c) Which points are misclassified by the present hyperplane? (0.5 P.)

Task 2. Support Vector Machine (5 points)

The file *generator.py* contains a data generator that produces two-dimensional linear-separable data in the range ([0, 1], [0, 1]).

a) Generate datasets of size 100 for the following (*intercept, slope*) values: (0.5 P.)

$$(-0.1, 0.7), (0.1, 2), (0.75, -0.2), (1, -1)$$

b) Create a class that can learn a separating hyperplane. Use the formulas for the SVM for this purpose. Use the *minimize* function from SciPy for optimization. For the minimization function, the important parameters are *fun*, *x0*, and *constraints* (3.5 P.)

c) Plot the data and the separating line. Mark the points according to their labels. (1 P.)