

Machine Learning - Homework 3

Spring 2018

Exercise 1 (5 pts)

As usual we assume that our separating line is given by the equation

$$x_2 = -\frac{w_0}{w_2} - \frac{w_1}{w_2}x_1.$$

Assume that $w_0, w_2 > 0$ and $w_1 < 0$. Recall from class that the vector (w_1, w_2) is always perpendicular to the separating line.

1. Draw an exemplary graph for this setting (by choosing some suitable values for w_0, w_1, w_2).
2. In the same plot, draw the vector (w_1, w_2) . If it does not intersect the separating line, extend the vector to a line.
3. What happens to the line if we increase w_0 and let w_1, w_2 unchanged?
4. What happens to the line if we increase w_1 and let w_0, w_2 unchanged?
5. What happens to the line if we increase w_2 and let w_0, w_1 unchanged?

Exercise 2 (3 pts)

Write a Perceptron algorithm for $n = 3$ features in R. You can simply change your existing algorithm from the last homework, or use the sample solution algorithm uploaded (soon) on StudyNet. Use it to find a separating plane for the XOR-problem, embedded in \mathbb{R}^3 :

	D_1	D_2	D_3	D_4
x_1	1	1	-1	-1
x_2	1	-1	1	-1
x_3	1	-1	-1	1
y	1	-1	-1	1

Submit your algorithm and the solution weights.

Exercise 3 (2 pts)

Use the commands `plot3d`, `points3d`, `planes3d` to plot the four points and the separating plane found in Exercise 2. For this you need the package `rgl`. Save the plot as a graphic and submit this as solution. (You may also use other commands if you like.)