

Exercise 14: The Traditional Perceptron

Summer Term 2024

This exercise covers *the* traditional one-layer perceptron.

Review: Questions:

1. How is the perceptron defined?
2. How can you represent the input/output behavior of a simple perceptron *graphically*?

To Do: Analyse the utility of the perceptron.

Tasks:

1. How does the decision line look like in case of a simple `and` and `or` function? Both functions may have two inputs.
2. We now turn to the classical `xor` case. How does the decision line look like? Is a simple, one-layer perceptron able to realize this function?

Show by symbolic representations that the simple one-layer perceptron with two inputs x_1 and x_2 as well as a threshold Θ *cannot* realize the `xor` function.

3. In the lecture, we have discussed two realizations of simple, one-layer perceptrons. The first one had a threshold Θ , whereas the other one had an additional bias link with a constant input value of “1”. “Suddenly”, the second realization has an additional input, and the inequality “ $\text{net}_i \geq 0$ ” means that the angle between the input and weight vector is between $-\pi/2$ and $\pi/2$. Why is this the case? Why may that be the same as a freely moving decision line?

Hint: This is a surprisingly difficult task, and stop this exercise if you have not succeed within five minutes.

Have fun, Theo and Ralf.