Machine Learning
Exercise 6: Perceptron: Learning rule and implementation

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Abstract

This exercise focuses on the *perceptron* and its ability to solve linearly separable problems as well as the learning process that helps it reach its goal. You will start off by manually calculating the latter before implementing it in python during the last task.

Task 1: Sketching

- Task 1 has to be performed by hand!

- Additional information about the *perceptron* can be found in the course material.

- Draw a detailled and correctly labeled sketch of a perceptron with 3 input nodes.

- Write down the learning rule for the perceptron and explain it in a few sentences.

- Create binary AND and XOR tables for two input variables each.

- Create one scatterplot each for the AND and XOR tables and try to separate the data with a single line.

Task 2: Manual Calculations

- Task 2 also has to be performed by hand!

- Take your two tables and calculate the learning process for both of them, given the following parameters:

  - Learning rate (AND,XOR): 0.1
  - AND initial values: w_1: 0.6, w_2: 1, bias: 0.2
  - XOR initial values: w_1: -0.5, w_2: 0.6, bias: 0.2

- You can stop after 5 epochs or whenever your accuracy reaches 1, whatever comes first.

- What do you notice? How can you explain it when looking at the scatterplots from task 1?

Task 3: Implementation in python

- Now you are finally allowed to use your computer again.

- Please download the Jupyter notebook for this exercise from here as it contains useful information, code snippets, help and some directions for the following tasks.

- Follow the instructions in the notebook.