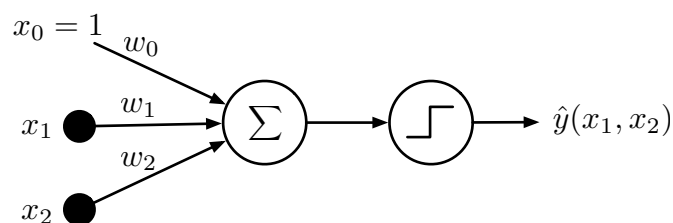


Exercise Sheet

Learning Goals

- Perceptron
- Logistic Regression

1. ●○○ For a single perceptron, find an assignment to the parameters w_0, w_1, w_2 such that the perceptron implements the boolean function $y(x_1, x_2) = x_1 \wedge \neg x_2$ for binary variables x_1 and x_2 . (Use the Heaviside step function $\varphi(x) = \max(\text{sign}(x), 0)$ as activation function.)



2. ●●○ Apply the perceptron training algorithm, as described in the lecture notes, on the following four data points to learn the parameters of a perceptron (use the heaviside step function as defined in 1).

Normally, the algorithm would pick a data point randomly, update the parameters and repeat until convergence. Here, go through the data points in the given order only once. The learning rate is $\eta = 0.4$ and the weights are initialized with $\mathbf{w} = (w_0, w_1, w_2) = (0.5, 1, -1)$. In each iteration (parameter update from a data point) list: $\mathbf{w}^T \mathbf{x}$, $\varphi(\mathbf{w}^T \mathbf{x})$, error, $\Delta \mathbf{w}$ and the new parameter vector \mathbf{w} .

x_1	x_2	$y(x_1, x_2)$
0	0	0
0	1	0
1	0	1
1	1	0

3. Implement a Logistic Regression Classifier. The jupyter notebook attached to this exercise sheet contains a skeleton implementation of a LogReg Classifier. Complete the implementations of the functions `fit(...)` and `predict(...)`.