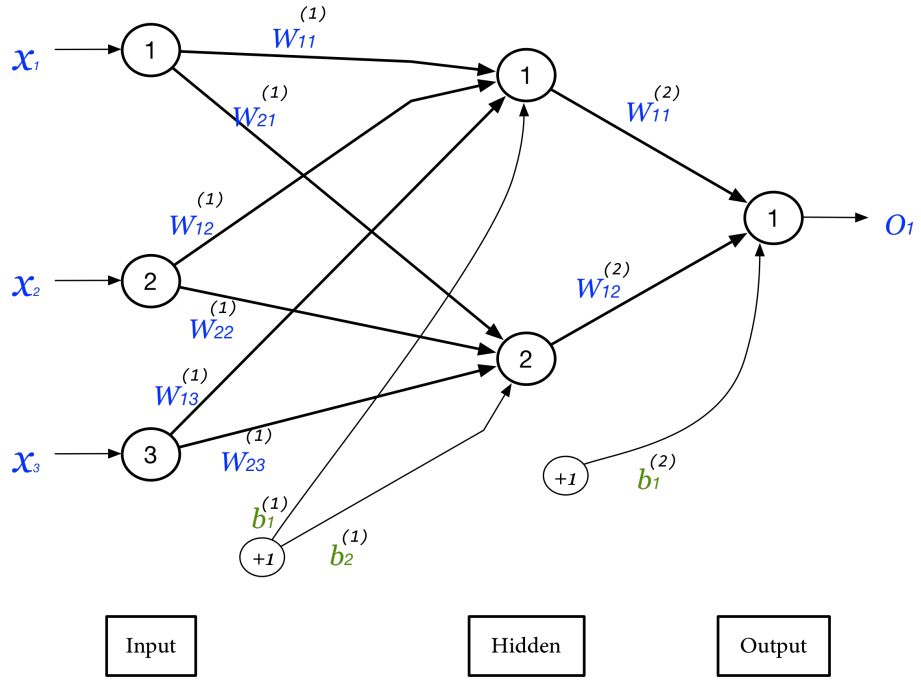
TD1 - Back Propagation Algorithm

1 The algorithm

A Back Propagation network learns by example. Back Propagation is the algorithm used to train the network by changing the network's weights in order to minimize a predefined loss function.

2 Working example

In this section we show all the calculations for a full sized network with 3 inputs, 2 hidden layer neurons and 1 output neuron as shown in fig. 2.



Assume that the Sigmoid activation function is applied to hidden layer and output layer. Assume that the network has the following initial weights (η is the learning rate)

$$\eta = \begin{pmatrix} 0.9 \end{pmatrix}$$

$$w1 = \begin{pmatrix} w_{11} & w_{21} \\ w_{12} & w_{22} \\ w_{13} & w_{23} \end{pmatrix} = \begin{pmatrix} 0.2 & -0.3 \\ 0.4 & 0.1 \\ -0.5 & 0.2 \end{pmatrix}$$

$$w2 = \begin{pmatrix} w_{11} \\ w_{12} \end{pmatrix} = \begin{pmatrix} -0.3 \\ -0.2 \end{pmatrix}$$

$$b1 = \begin{pmatrix} b_1 & b_2 \end{pmatrix} = \begin{pmatrix} -0.4 & 0.2 \end{pmatrix}$$

$$b2 = \begin{pmatrix} b_2 \end{pmatrix} = \begin{pmatrix} 0.1 \end{pmatrix}$$

Using the following first training example x = $[1 \ ; \ 0 \ ; \ 1]^T$ whose class label $y = 1$

1. Perform a forward pass on the network.
2. Perform a reverse pass (training) once using $(x_1; y_1)$.
3. Perform a further forward pass
4. Comment on the result.