PDF Exercises Neural Networks

Exercise 1

What are the values of weights w0, w1 and w2 for the perceptron with decision boundary illustrated in figure below? Assume the surface crosses the x1 axis at -1 and the x2 axis at 2.

$w_0 = 2$
$w_1 = 1$
$w_2 = 2$

Exercise 2

(a) Design a two-input perceptron that implements the Boolean function A AND (NOT B).

This is logically displayed as follows:

$A \cap \neg B$

x_1	x_2	$A \wedge \neg B$
0	0	0
1	0	1
0	1	0
1	1	0

With $\theta_0 + \theta_1 x_1 + \theta_2 x_2$ and picking $\theta_0 = -20,\ \theta_1 = 30,\ \theta_2 = -20$, the hypothesis will be:

$h_\theta(x) = \begin{Bmatrix} 1\ if\ \theta_0 + \theta_1 x_1 + \theta_2 x_2 > 0 \\ -1\ otherwise \end{Bmatrix}$

(b) Design a two-layer network of perceptrons that implements A XOR B.

This is logically displayed as follows:

$A \oplus B = (A \cap \neg B) \cup (\neg A \cap B)$

Or, alternatively:

$A \oplus B = (A \cup B) \cap \neg(A \cap B)$

x_1	x_2	$A \oplus B$
0	0	0
1	0	1
0	1	1
1	1	0

Thus, it requires the input of two different two-input perceptrons to implement: either one of the options mentioned above. Since we already completed the part of the first option, let's continue with this:

With $\theta_0 + \theta_1 x_1 + \theta_2 x_2$ and picking $\theta_0 = 0,\ \theta_1 = 10,\ \theta_2 = 20$, the hypothesis will be:

$h_\theta(x) = \begin{Bmatrix} 1\ if\ \theta_0 + \theta_1 x_1 < \theta_2 x_2\ OR\ \theta_0 + \theta_2 x_2 < \theta_1 x_1 \\ -1\ otherwise \end{Bmatrix}$