The Johns Hopkins University

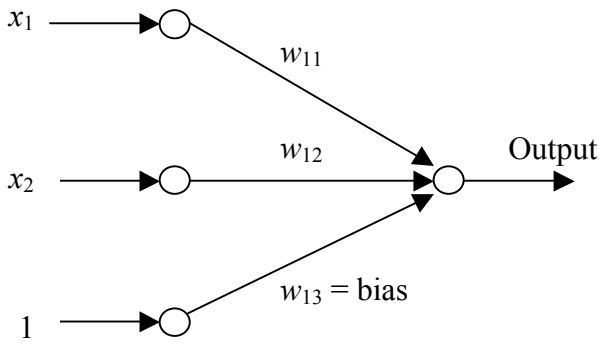
JHU ENGINEERING FOR PROFESSIONALS PROGRAM

NEURAL NETWORKS: 625-438/605-447

Problem Set #3

3.1 Determine a standard perceptron solution (*i.e.,* a set of weights w_{11}, w_{12}, and w_{13} = bias) which represents the Logical OR function.

Input		Output
x_1	x_2	
0	0	0
0	1	1
1	0	1
1	1	1



3.2 Consider a standard perceptron as illustrated above except with a threshold value of 0.6, *i.e.,* a function such that

$$f(x) \geq 0.6 \rightarrow 1$$
$$f(x) < 0.6 \rightarrow 0$$

(a) Show that if we don't allow a bias term there doesn't exist a solution (*i.e.,* w_{11} and w_{12}) for the following truth table:

Input		Output
x_1	x_2	
0	0	1
0	1	0
1	0	1
1	1	0

(b) Now allow a bias term and show that the problem is now solvable by providing a solution for each of the weights

3.3 Design (determine weights and bias) of a first-order perceptron that models the implication statement: $x_1 \Rightarrow x_2$.

3.4 Find fixed points (*i.e.,* $x = f(x)$) for the equation $f(x) = \ln(1 + ax)$ where $a = 3$. Indicate the two fixed point solutions.