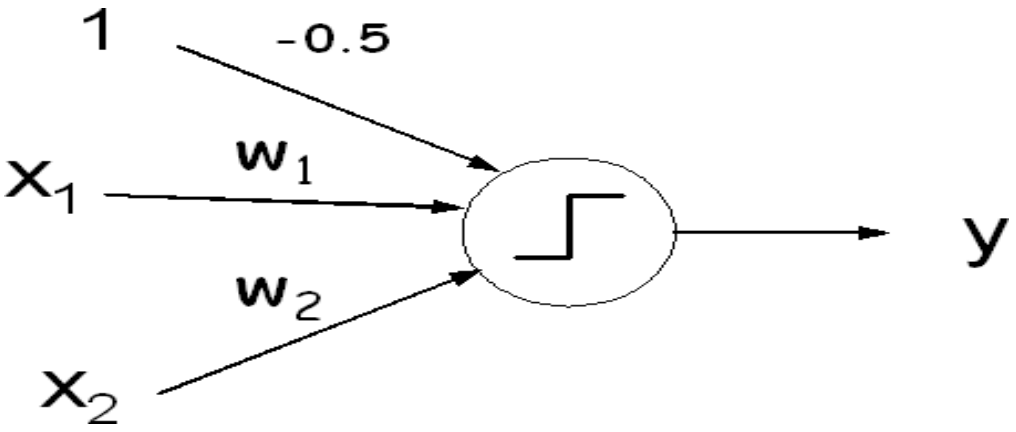
Perceptron model : Given is the following single neuron perceptron. In this one-layer perceptron model, the neuron calculates a weighted sum of inputs. Then, it applies a threshold to the result: if the sum is larger than zero, the output is 1. Otherwise, the output is zero.



Consider the following examples, where Z is the *desired* output (indeed, this is the OR function).

X_1	X_2	Z
0	0	0
0	1	1
1	0	1
1	1	1

Apply the Perceptron update algorithm to automatically learn the network's weights, so that it classifies correctly all the training examples. The algorithm is simple: Iterate through the training examples, one by one (if the last example was used, and the algorithm hasn't converged yet, start again from the first example, and so forth.).

For every example i:

• Calculate the net's output Yi.

• Multiply the error (Zi − Yi) by the learning rate . Add this correction to any weight for which the input in the example was non-zero.

That is, if for the current example i $X_1 = 1$, then update $W^{\mathrm{j}} \rightarrow W_1 + \eta(Z_i - Y_i)$, etc.

• If the network outputs the correct result for all of the training set examples, conclude.

X_1	X_2	W_1	W_2	Z	Y	Error	W_1	W_2
0	0	0.1	0.3					
0	1							
1	0							
1	1							
0	0							
0	1							
1	0							
1	1							
...								

Table 2: Results format

1. Apply the algorithm for the given training examples. Use learning rate η = 0.2. Assign the the initial weights values W_1 = 0.1, W_2 = 0.3.Give your results as specified in Table 2.

2. In practice, the training example may be noisy. Suppose that there are *contradicting* examples in the training set: for example, an additional example, where X_1 = 1, X_2 = 1, Z = 0. How do you think this will affect the algorithm's behavior?

X_1	X_2	W_1	W_2	Z	Y	Error	W_1	W_2
0	0	0.1	0.3	0	(-0.5) 0	0	0.1	0.3
0	1	0.1	0.3	1	(-0.2) 0	1	0.1	0.5
1	0	0.1	0.5	1	(-0.4) 0	1	0.3	0.5
1	1	0.3	0.5	1	(0.3) 1	0	0.3	0.5
0	0	0.3	0.5	0	(-0.5) 0	0	0.3	0.5
0	1	0.3	0.5	1	(0) 0	1	0.3	0.7
1	0	0.3	0.7	1	(-0.2) 0	1	0.5	0.7
1	1	0.5	0.7	1	(0.7) 1	0	0.5	0.7
0	0	0.5	0.7	0	(-0.5) 0	0	0.5	0.7
0	1	0.5	0.7	1	(0.2) 1	0	0.5	0.7
1	0	0.5	0.7	1	(0) 0	1	0.7	0.7
1	1	0.7	0.7	1	(0.9) 1	0	0.7	0.7
0	0	0.7	0.7	0	(-0.5) 0	0	0.7	0.7
0	1	0.7	0.7	1	(0.2) 1	0	0.7	0.7
1	0	0.7	0.7	0	(0.2) 0	0	0.7	0.7
1	1	0.7	0.7	1	(0.9) 1	0	0.7	0.7

2 When $X_1 = 1$, $X_2 = 1$, $Z = 0$, in this case, the examples are not separable, the weights will oscillate rather than converge