Neural Networking, Perceptron

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Abstract: The objective of this project is to determine what weights (in this case w1 and w2) lead to Target Result equaling to the results for all the vectors in the training data. Results are based on Epoch's. The events are iterated until the Error is reached 0.

Background: The perceptron is an algorithm of binary classifiers that can decide whether an input represented by a vector of numbers, belongs to some specific class or not. This project is the basic perceptron example. This experiment is not comparing between two algorithm rather it is using a very simple algorithm to look at the machine learning in a very basic level. Some algorithm used are WS: w1*x1+ w2*x2 and Wi =Learning Rate *Error* Xi + Wi. Given the fact, that the number of target condition for the given problem can be regarded as a constant, the overall complexity of O(n^2) equals O(1).

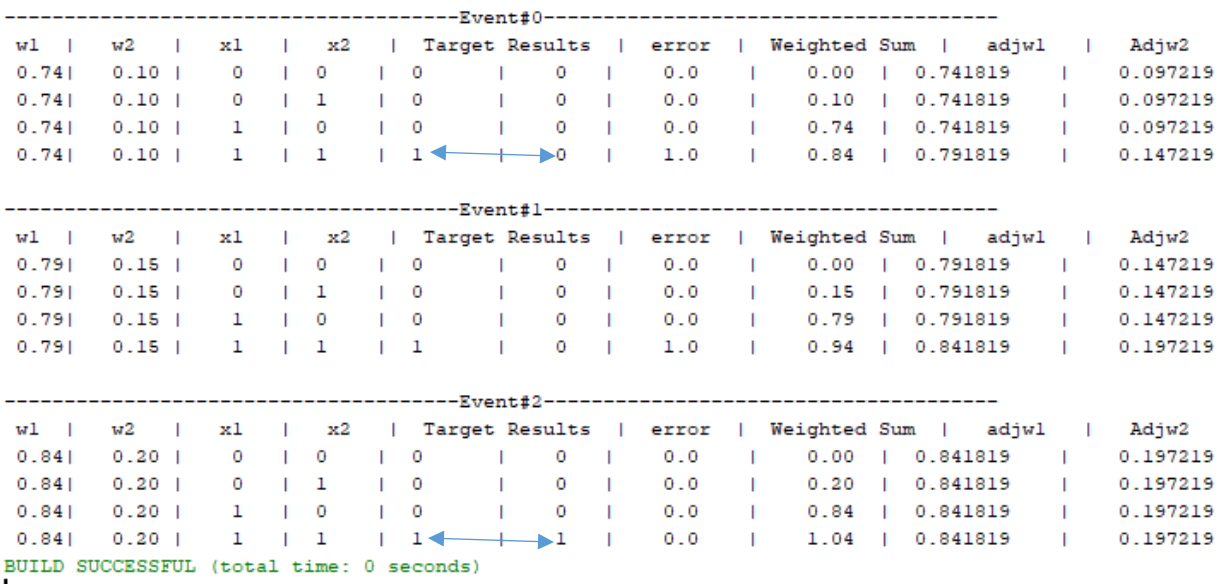
Experimental Setup:

We took a training Data:

X1	X2	Target Result
0	0	0
0	1	0
1	0	0
1	1	1

For this experiment, 0.05 is the value kept as the Learning rate. We start by randomly initializing the weights w1 and w2 and then we go into a loop where we calculate the weighted sum (WS): w1*x1+ w2*x2. After that, we apply the step function as an activation function. The condition being, if WS> 1 then result equals 1 or if WS<=1 then result equals 0. After that, we determined the error. For the error, we calculate it by Target Result – Result. Then we adjust the weights by multiplying Learning rate, error, Xi and sum of original adjust Weight (Wi). Then we repeat all the steps for all the vectors in the training data until all the event have 0 error.

Result:



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----------------------------------------Event#0----------------------------------------
 w1   |   w2    |   x1   |   x2   |  Target Results  |  error  |  Weighted Sum  |   adjw1   |   Adjw2
 0.74|   0.10 |    0   |   0    |  0       |    0   |    0.0    |    0.00   |  0.741819    |    0.097219
 0.74|   0.10 |    0   |   1    |  0       |    0   |    0.0    |    0.10   |  0.741819    |    0.097219
 0.74|   0.10 |    1   |   0    |  0       |    0   |    0.0    |    0.74   |  0.741819    |    0.097219
 0.74|   0.10 |    1   |   1    |  1       |    0   |    1.0    |    0.84   |  0.791819    |    0.147219

----------------------------------------Event#1----------------------------------------
 w1   |   w2    |   x1   |   x2   |  Target Results  |  error  |  Weighted Sum  |   adjw1   |   Adjw2
 0.79|   0.15 |    0   |   0    |  0       |    0   |    0.0    |    0.00   |  0.791819    |    0.147219
 0.79|   0.15 |    0   |   1    |  0       |    0   |    0.0    |    0.15   |  0.791819    |    0.147219
 0.79|   0.15 |    1   |   0    |  0       |    0   |    0.0    |    0.79   |  0.791819    |    0.147219
 0.79|   0.15 |    1   |   1    |  1       |    0   |    1.0    |    0.94   |  0.841819    |    0.197219

----------------------------------------Event#2----------------------------------------
 w1   |   w2    |   x1   |   x2   |  Target Results  |  error  |  Weighted Sum  |   adjw1   |   Adjw2
 0.84|   0.20 |    0   |   0    |  0       |    0   |    0.0    |    0.00   |  0.841819    |    0.197219
 0.84|   0.20 |    0   |   1    |  0       |    0   |    0.0    |    0.20   |  0.841819    |    0.197219
 0.84|   0.20 |    1   |   0    |  0       |    0   |    0.0    |    0.84   |  0.841819    |    0.197219
 0.84|   0.20 |    1   |   1    |  1       |    1   |    0.0    |    1.04   |  0.841819    |    0.197219
BUILD SUCCESSFUL (total time: 0 seconds)
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Fig: 01

Conclusion: So the output went from Event#0 to Event#2. Here in Event#0 the target is 1 which doesn't match with the Results value 0 due to which we get an error of 1. Likewise, when we are in event#2 we can see that the Target equals the Results so the total error we get is 0 and thus the program stops executing. Both w1 and w2 are generated randomly every time so every time we execute the program the event# can run n times, thus condition being the Target value must equal to the results providing 0% error.