Basic Neural Networks

Hebb, Perceptron & Adaline

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The percentage of error in the best case with the threshold limit theta =2.5 is 23.80% for training data and 38.09% for test data.

It is worth mentioning that the learning rate is 0.5 and the limit is 2.5

Bias	Weight	Training error	Test error	Epoch number
0	0	0	0	6
1	0	0	4.76%	6
0	0.1	0	٪ 14.28	8
0.1	0.1	0	٪ 19.04	8
0	0.2	0	14.28 %	5
0.5	0.2	0	٪ 9.52	6
0	0.3	0	4.86%	5
0	0.5	0	19.04%	6
0	0.7	0	٪ 28.57	5
0	.09	0	19.04%	5
0	1	0	9.52%	6
1	1	0	14.28%	4

The best result for the program that has the least errors in the test phase is zero for initial values.

It is worth mentioning that the learning rate is equal to 0.5 and the initial weights are considered to be zero.

Threshold value	Training error in percent	Test error in percent	Epoch number
0	0	4.76	6
0.5	0	14.28	6
1	0	19.04	6
1.5	0	9.52	6
2	0	9.52	6

2.5 and3	0	0	6
3.5	0	4.76	6
4	0	9.52	6

The best threshold value for the test data is in the range of ۲.۵ to ۳ and has an error of ۰. It) can be seen that the number of rounds does not change for a fixed alpha 0.5.

In this part, the best answers were obtained with zero theta.

Learning rate	Training error rate	Test error rate	Epoch number
0.02	0	4.76	6
0.1	0	4.76	6
0.3	0	4.76	6
0.5	0	4.76	6

All learning rates with zero theta give the same results. But by increasing theta to 0.5 and the learning rate to 0.02 the test error rate reaches 28.57. By increasing the learning rate to 0.1 and theta to 0.5 the error in the test reaches zero.

Adaline is trained with bias 1, initial values of 0.1, theta orthreshold value of 0.5, and alpha values are halved every 5 epochs.

Initial learning rate	Training error in percent	Test error in percent	Epoch number
0.9	0	9.52	5

The point is that after a few rounds, the output values become the same as the corresponding target values, and the weight does not change, and the program stops.

Algorithm	theta	Learning rate	Training error	Test error	Epoch number
Heb	0	1	23.80	38.09	1
Perceptron	to ۳ 2.5	0.5	0	0	6
Adaline	0	0.9	0	0	6

It seems that in the case of this training data, the greatest effect is the setting of the learning rate and the threshold values.

In testNetwork function, for the output vectors that have more than one 1 in the output and algorithm recognizes more than one character, the distance of the generated output to the target is measured and the y_ins that are in the greatest distance are selected.