Amirkabir University of Technology

Neural Networks

HW1

In this exercise, we become familiar with the utilization of neurons in artificial neural networks, specifically the perceptron and Adaline, for data classification. To start, consider two artificial datasets as shown in Figure 1. Assume that all available data points are used to train the algorithm.

Q1)

Considering the properties of perceptron and Adaline neurons, in your opinion, which of these two neuron types do you think cannot achieve 100% accuracy in classifying dataset 1, which is linearly separable? Please explain the reason for this limitation.

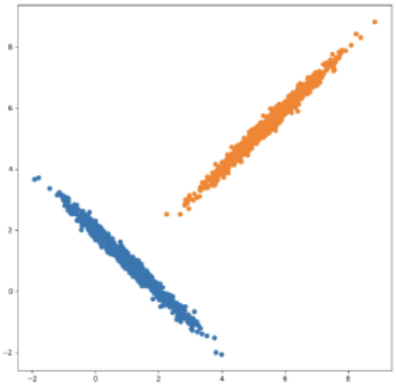


Figure 1

Answer:

Adaline neurons aim to optimize mean square error, while perceptrons strive to find a linear boundary that accurately classifies datasets. Therefore, Adaline may not always achieve 100% accuracy when the data shapes resemble those in Figure 1.

Q2)

We have uploaded the two datasets mentioned (Figure 1,2) into a folder, along with this document. For each of these datasets, we will train a perceptron neuron. Before training, we'll divide the data into two sets: a training set and an evaluation set, with an 80-20 ratio.

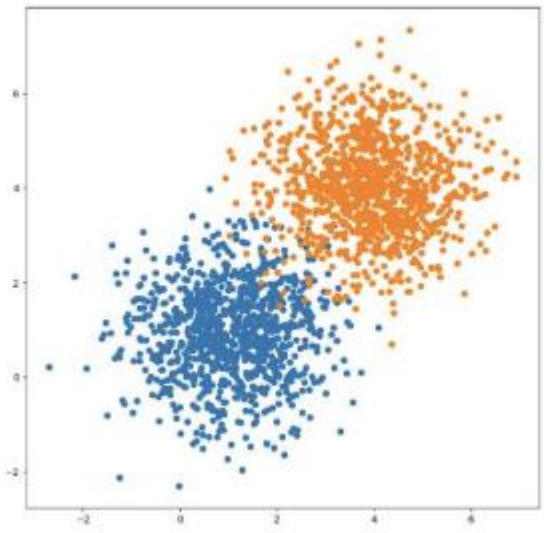
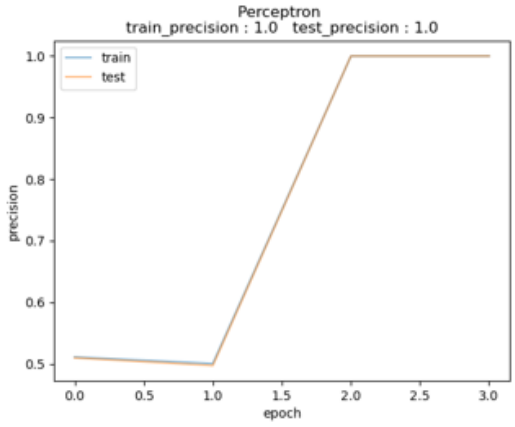
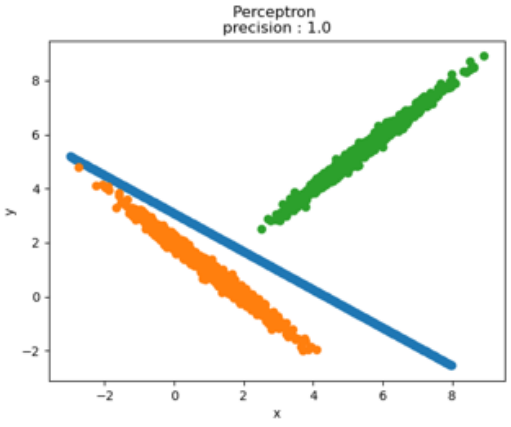
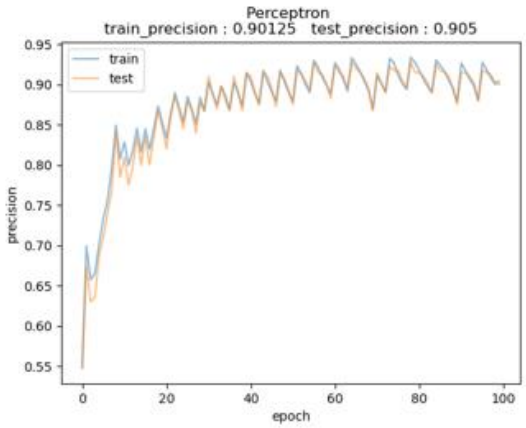


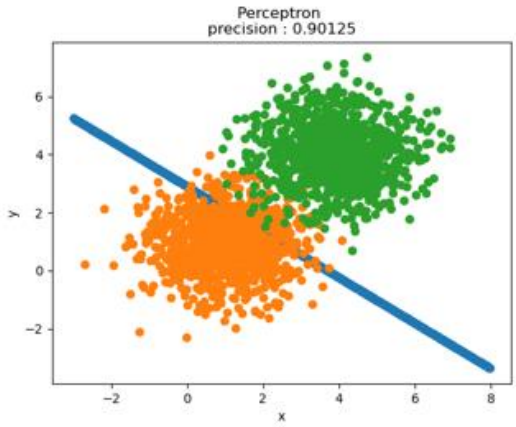
Figure 2

Answer:





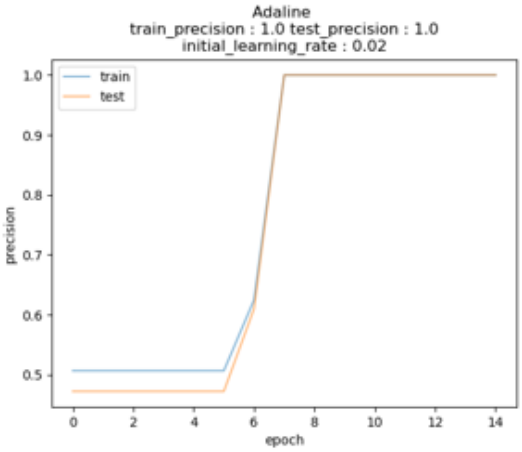


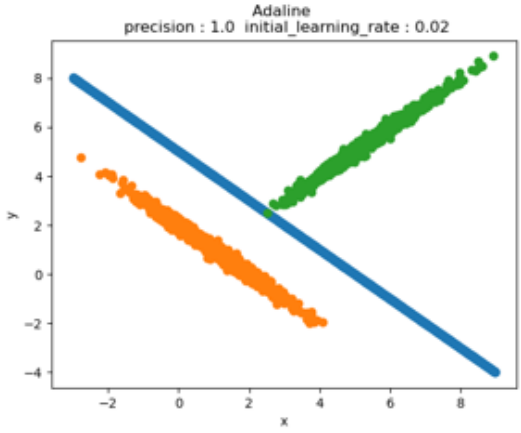


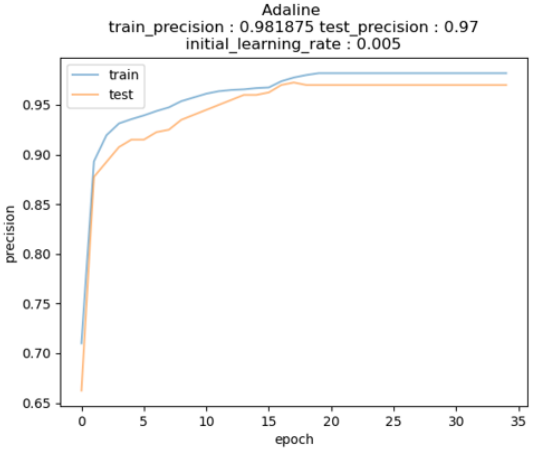
Q3)

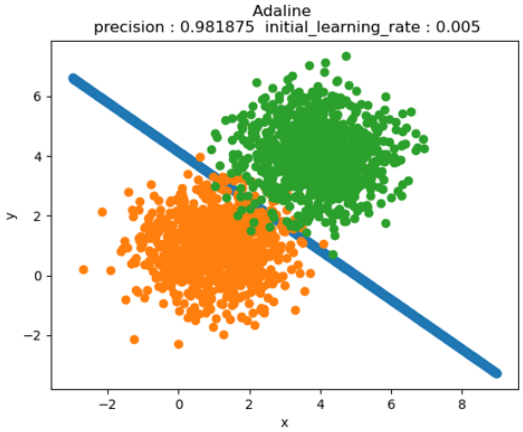
To repeat the previous step for the Adaline neuron, before training the neuron, you need to transform the labels of the data to 1 and -1.

Answer :






Adaline
train_precision : 0.981875 test_precision : 0.97
initial_learning_rate : 0.005
train
test
precision
epoch


Adaline
precision : 0.981875 initial_learning_rate : 0.005
y
x