

Homework 1

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1 Perceptron Algorithm and Convergence Analysis

1. (a)

$$f(x_1, x_2) = \begin{cases} 0, & x_1 = 0, x_2 = 0 \\ 0, & x_1 = 0, x_2 = 1 \\ 1, & x_1 = 1, x_2 = 0 \\ 1, & x_1 = 1, x_2 = 1 \end{cases}$$

(b)

(c)

2 Programming Assignment

1. Please refer code in "perceptron.py"

(a) Epoch number is set to 100. The figure is shown below:

The accuracy increases drastically before $I \approx 15$. Then it rises shakingly and slowly.

By increasing/decreasing I the shape of the curve won't change but just reveals more/less of the curve in the figure.

(b) Epoch number is set to 100. The figure is shown below:

Red one is for training data, while blue one is for testing data.

For testing data, the result is even better. As the accuracy continues to rise(shakingly).

(c) accuracy: 0.9939728779507785

confusion matrix:

$$\begin{bmatrix} 1009 & 40 \\ 0 & 942 \end{bmatrix}$$

(d)

(e) $AUC(w') = 0.9877518533678995$

$AUC(w^*) = 0.9999666948582919$