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EE 550 Artificial Neural Networks
Homework 3

At this project, the perceptron model is implemented using Matlab.

Firstly, I determine a max value and generate random data matrix(30x3), the numbers are between -max and max. The first 30 3D points are at the first quadrant and its label +1; the second 30 3D points are at the eighth quadrant and its label -1. I plot these two classes in a 3D space.

Secondly, I seperate this data as training data(40 points) - test data(20 points) and implement the perceptron learning algorithm(PLA). The weight vector is updated and cost value is calculated at each iteration for the misallocated points. After all points are allocated correctly and cost value is 0, I add the decision boundary to the previous 3D plot using the final weight vector, which makes the cost value zero.

Thirdly, I plot the cost function vs iteration index.

Lastly, I tested the perceptron model using the final weight vector and test data created at the beginning. I plot these test points with decision plane and the number of misestimated points can be seen at the plot title.

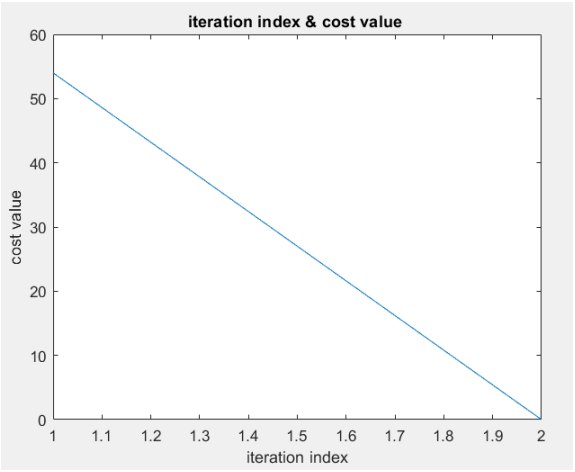
Evaluation:

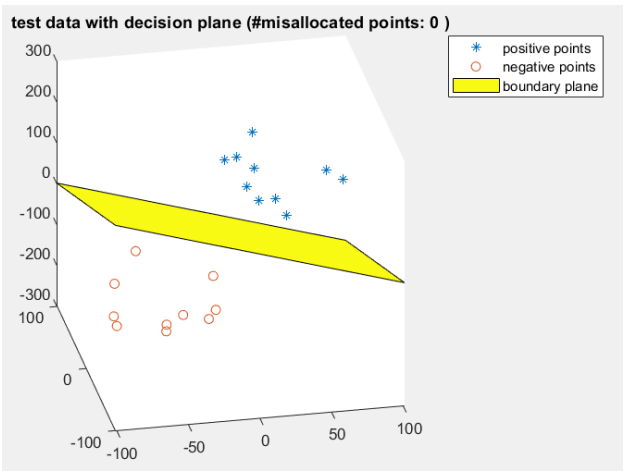
There are two critial points at this project: the threshold(line 31) and the max value(line 6) for the data.

1)threshold < max value

If threshold is lower than max value, there are too few iteration (about 3, at some cases there is not any iteration because the initial weight vector makes the cost value zero.) The accuracy values are generally 1.0.

example case: max = 101 , threshold = 100





The number of iteration is 2 and the accuracy is 1.0.

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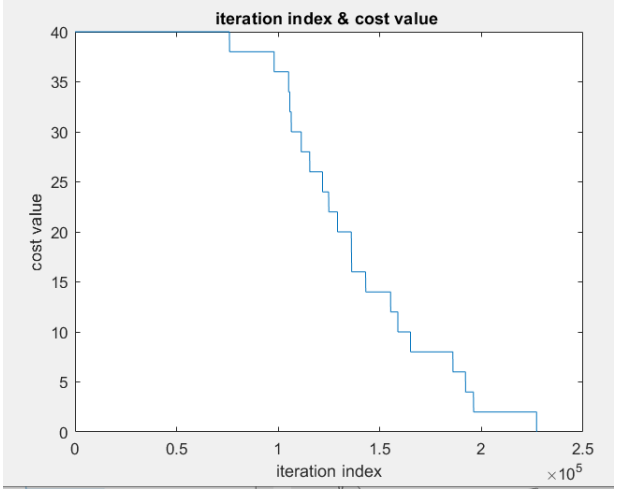
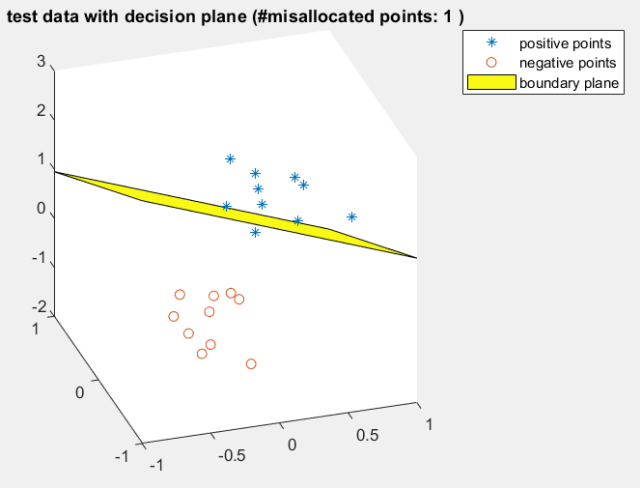
2) threshold >> max value

If threshold is much higher than max value, there may not any weight matrix which makes the cost value zero, so the program doesn't find proper weight vector and stop or it takes too long time.

example case: max:1, threshold = 100000



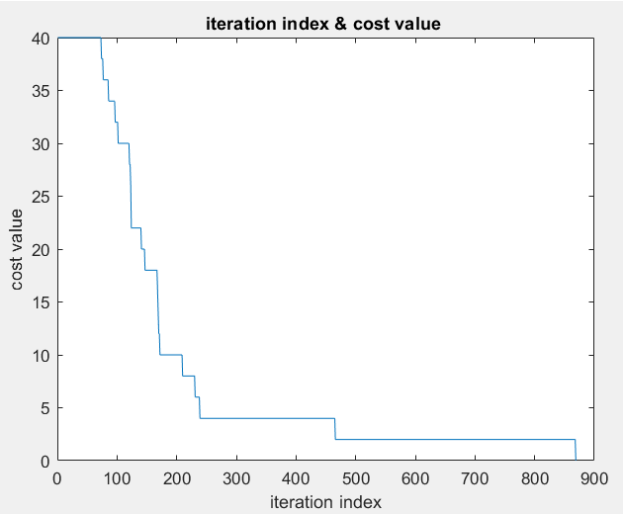


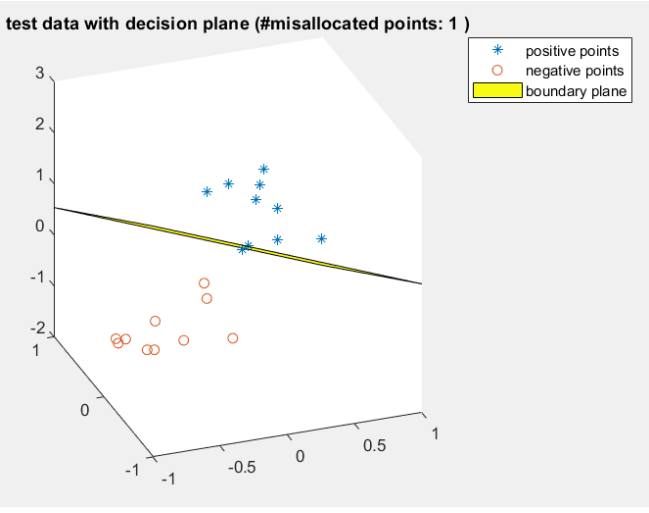
The number of iteration is 227127 and the accuracy is 0.95. The run time is about 1 minute.

3) threshold > max value

If threshold is higher than max value, there are enough iterations(1000) to test this model and this project. The accuracy values are generally 0.95. There are about 1 misallocated points at te test data.

example case: max = 1 , threshold = 100





The number of iteration is 869 and the accuracy is 0.95.