SUPERVISED LEARNING AND NEURAL NETWORKS

COMP3611: Coursework 1

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1) THE DATASET

Class 1
x-range = [2,5]
y-range = [1,4]
rotation = 75 degrees
colour = red

Class 2
x-range = [1, 3]
y-range = [-5, -1]
rotation = 75 degrees
colour = blue

Class 3
mean = (-2, -3)
covariance = [[0.5, 0], [0, 3]]
colour = green

Class 4
mean = (-4, -1)
covariance = [[3, 0.5], [0.5, 0.5]]
colour = cyan

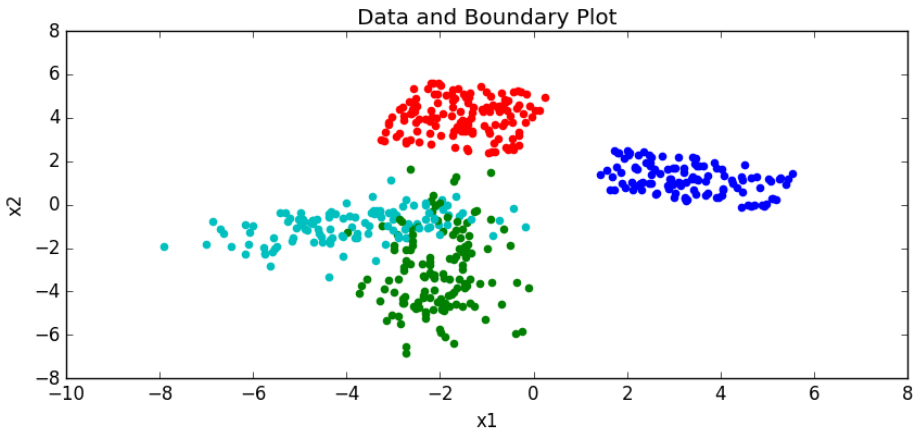


Figure 1. Plot of the data instances.

2) THE SINGLE-LAYER PERCEPTRON

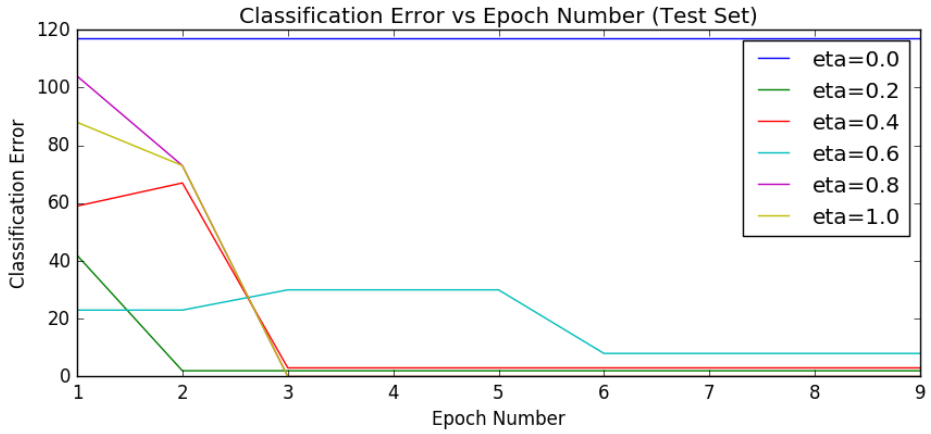
Classes Chosen: Class 2 (blue) and all other classes treated as a single class (red, green, cyan).

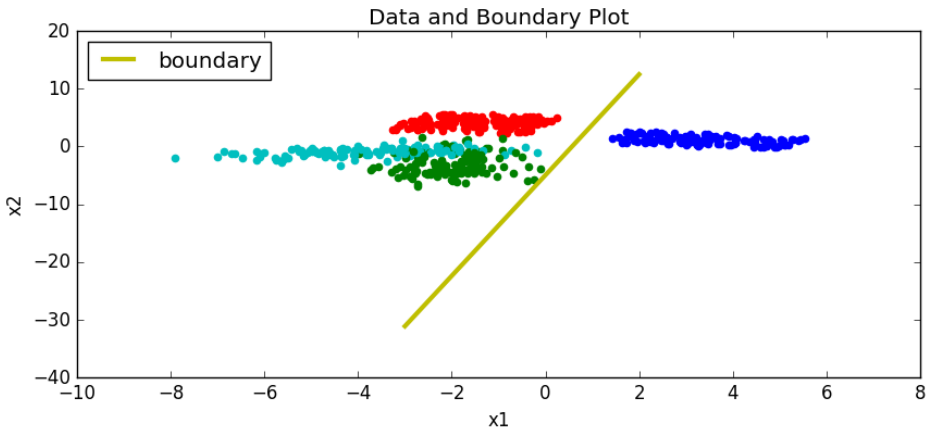
Reason: The two classes as shown above are linearly separable hence the single perceptron will be able to linearly distinguish them.

On the other hand, if classes, say, Class 3 (cyan) and Class 4 (green) were chosen, then the single-layer perceptron would perform poorly as they are not linearly separable.

Training Parameters

epoch = 10
batch = 10
eta (optimal) = 0.2 (since it reaches near 0 error the first and has the least errors after the epoch=1)
accuracy = 1.0 = 100% (see the hyperplane below separator below correctly classifying all instances)



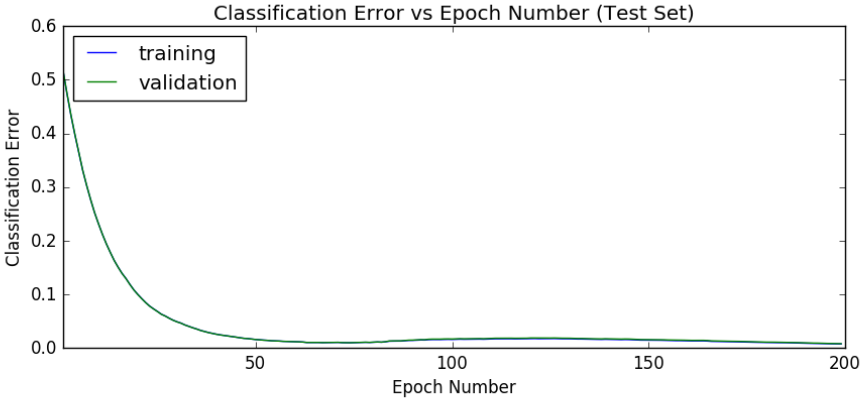


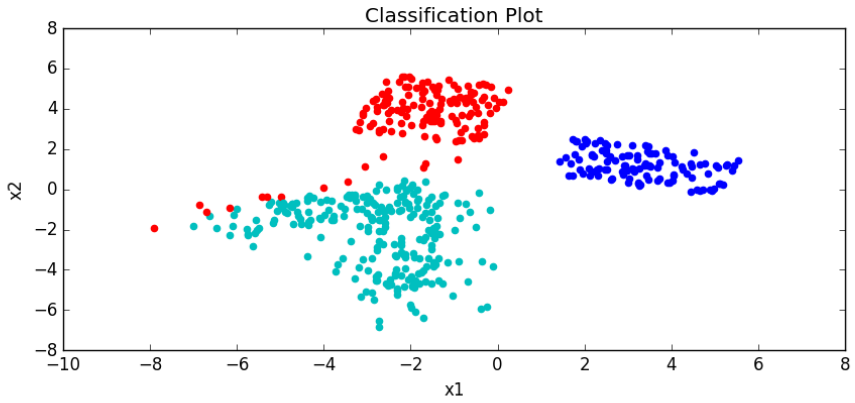
2) THE MULTI-LAYER PERCEPTRON

Training Parameters

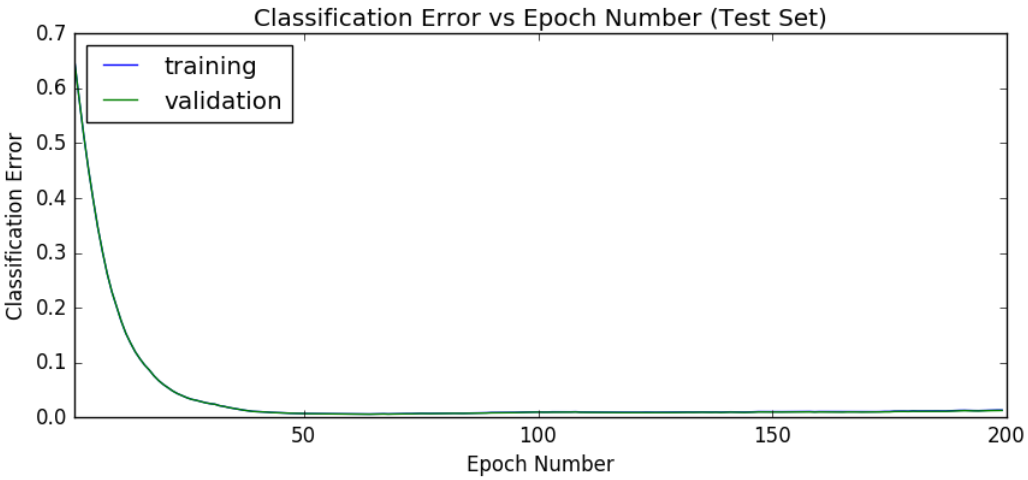
epoch = 200
batch = 5
eta = 0.1

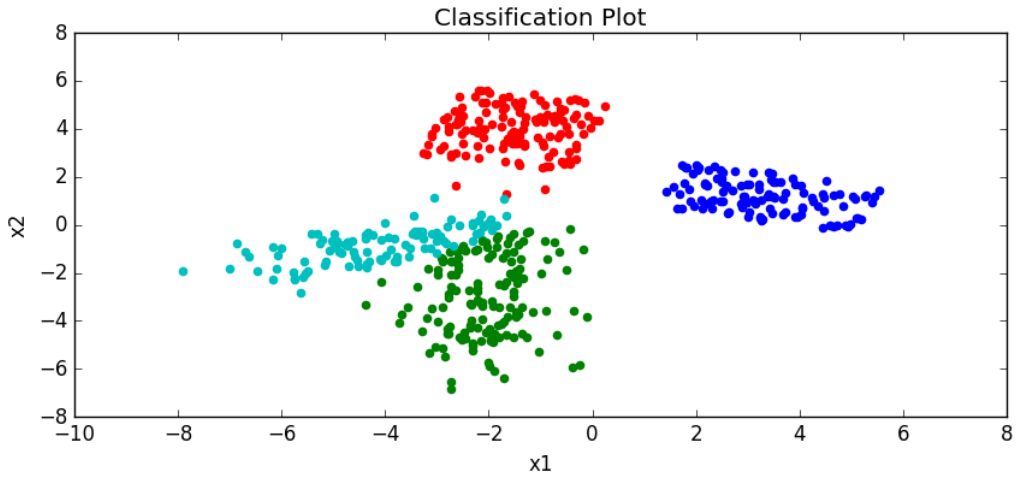
hidden nodes = 2
confusion matrix:
[[132 0 0 0]
[0 116 0 0]
[4 0 0 129]
[10 0 0 109]]





hidden nodes = 5 **(BEST PERFORMANCE (see matrix and plot below))**
confusion matrix:
[[132 0 0 0]
[0 116 0 0]
[3 0 120 10]
[0 0 26 93]]





hidden nodes = 20
confusion matrix:
[[132 0 0 0]
[0 116 0 0]
[4 0 119 10]
[2 0 24 93]]