

PROJECT REPORT

CS 487/519 APPLIED MACHINE LEARNING I

Project 1: Single-layer Linear Neural Networks

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CS519

Objective:

The objectives of the project is to implement single-layer linear neural networks such as Perceptron Binary Classifier, Adaline Binary Classifier, Stochastic Gradient Descent(SGD) Binary Classifier using IRIS dataset and another dataset to check the accuracy of prediction and the costs for each iterations and plot the figures.

Description:

The Perceptron, Adaline and Stochastic Gradient Descent has been implemented and the IRIS data is used to find the percentage of accuracy using the three binary classifiers. A python program called main was created to call the different classifiers for proper error checking.

Implementation Of Perceptron Binary Classifier:

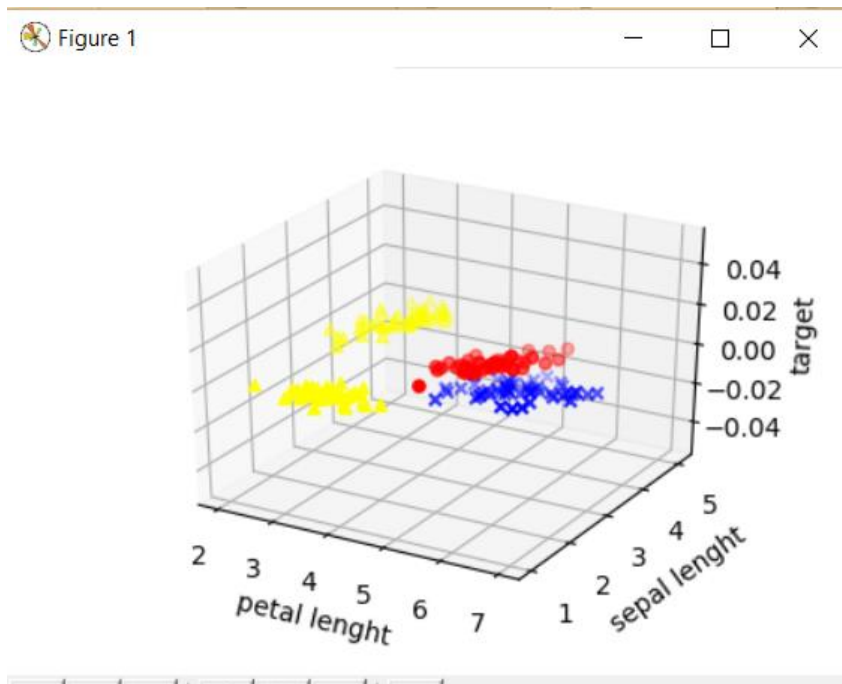


Fig: 1.1 This is the 3D plotting of perceptron using the iris data set

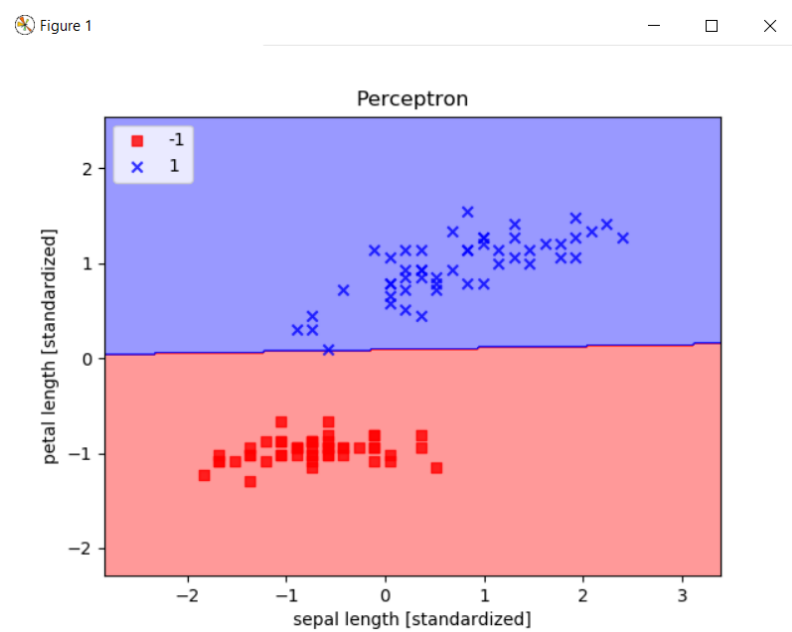


Fig 1.2: The graph for Perceptron measuring the sepal length and the petal length as attributes for plotting

	0	1	2	3	4
0	5.1	3.5	1.4	0.2	Iris-setosa
1	4.9	3.0	1.4	0.2	Iris-setosa
2	4.7	3.2	1.3	0.2	Iris-setosa
3	4.6	3.1	1.5	0.2	Iris-setosa
4	5.0	3.6	1.4	0.2	Iris-setosa
Accuracy of perceptron					
98.0 %					

Fig: 1.3: The Accuracy of Perceptron Binary Classifier has been found to be 98.0%

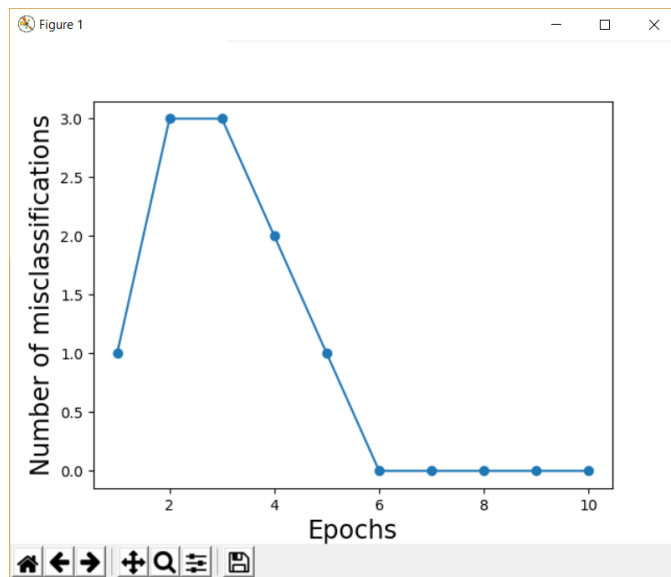


Fig: 1.4 This is the Error plot of perceptron where the error is at its peak when the epoch is 2 and 4

Implementation Of Adaline Binary Classifier

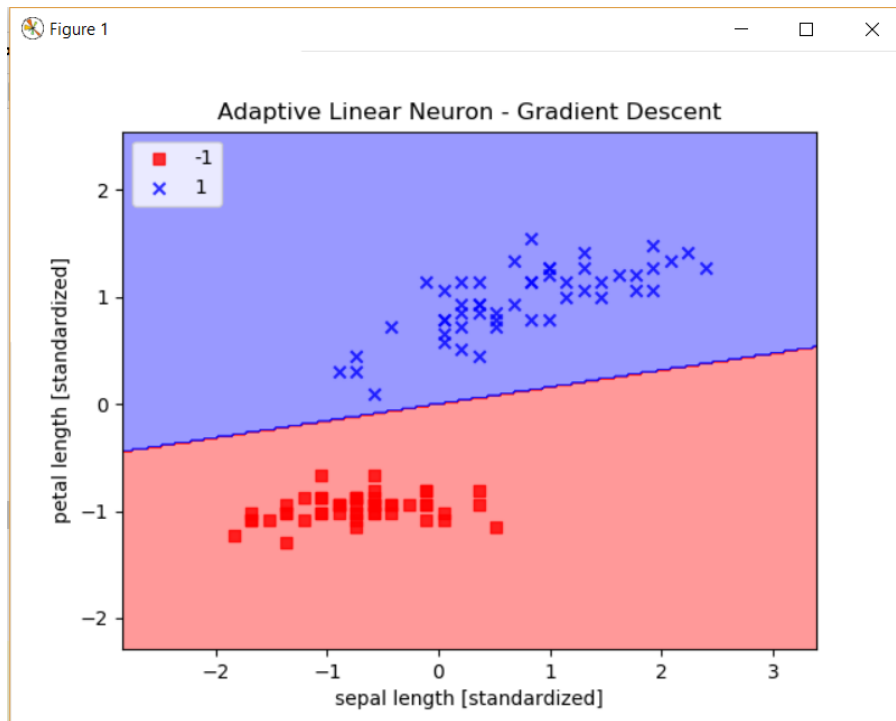


Fig: 2.1 The two values of the iris data are separated into two and its plotted in the graph with sepal length along the X axis and Petal length along the Y axis

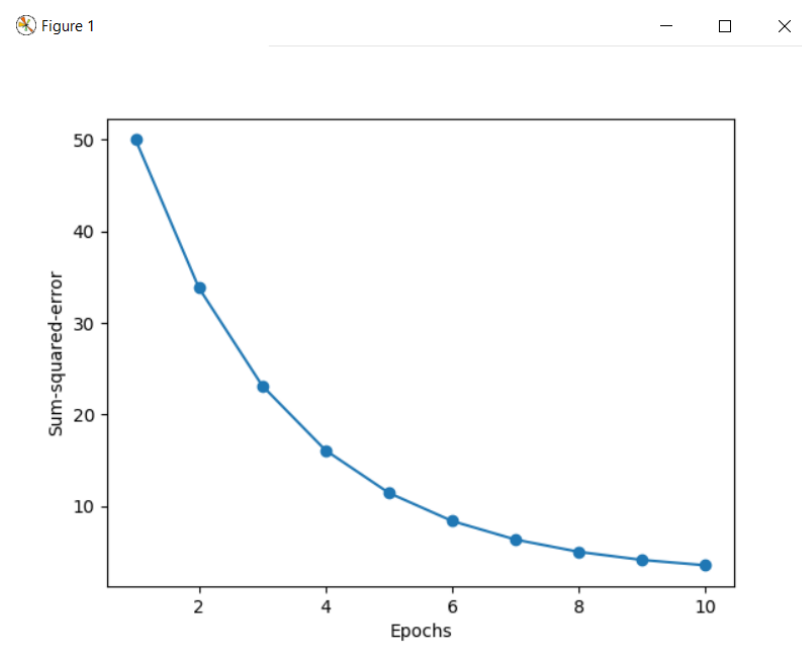


Fig 2.2: The error plot of Adaline Binary Classifier

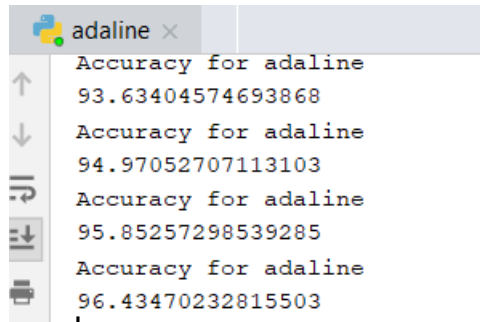


Fig 2.3: The Accuracy of Adaline Binary Classifier is found to be 96.43%

Stochastic Gradient Descent

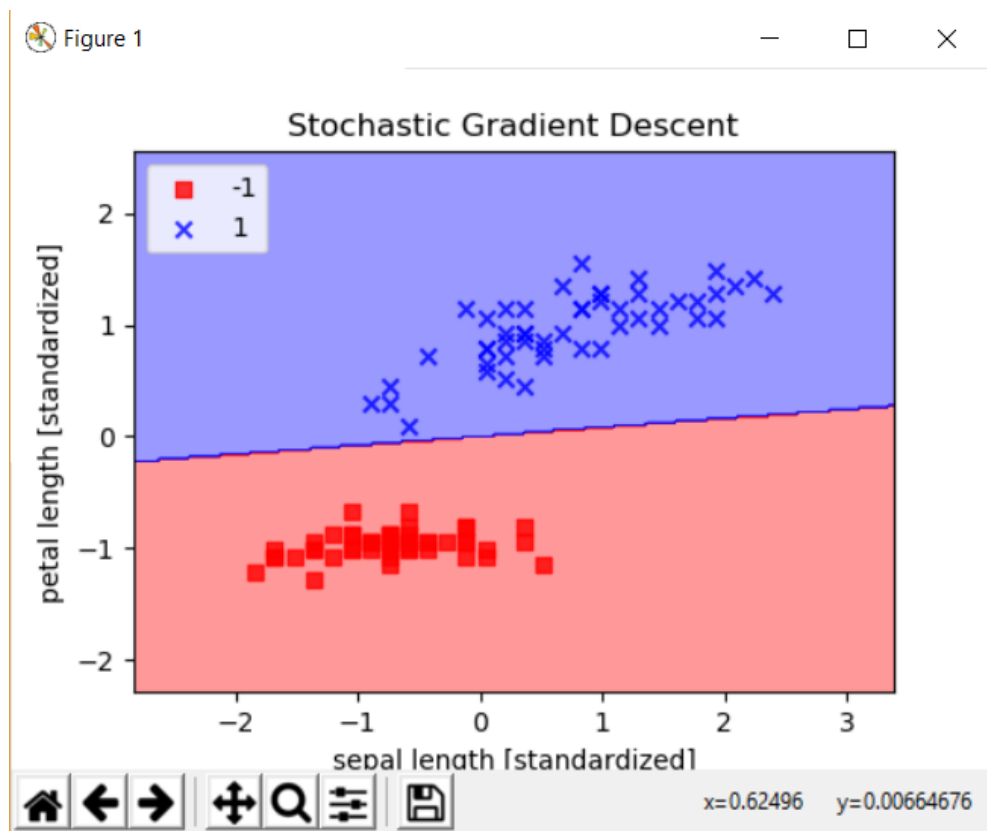


Fig 3.1: The Stochastic Gradient Descent is plotted for the dataset.

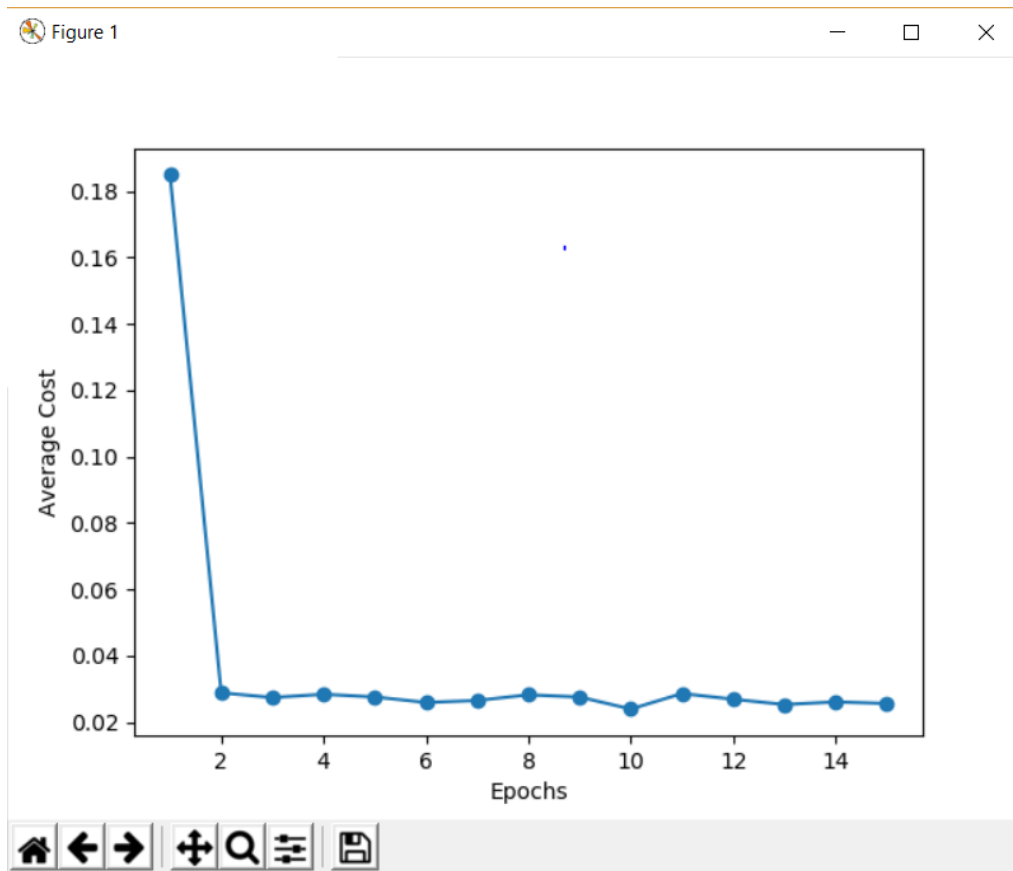
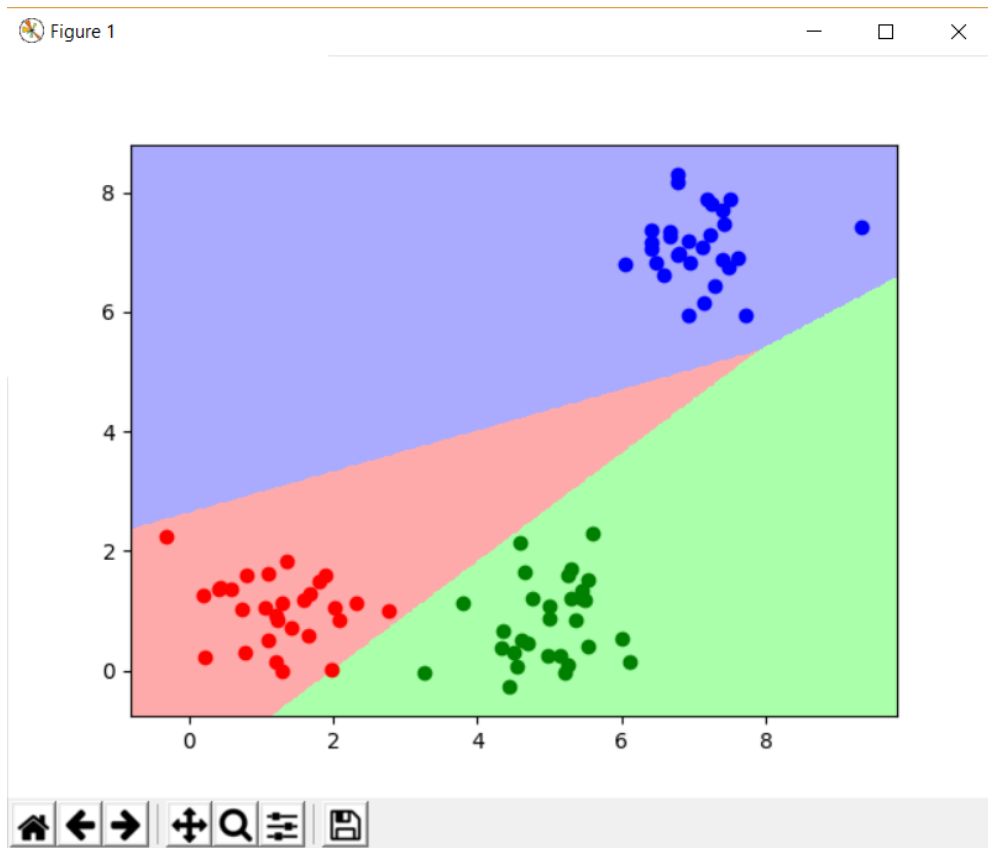


Fig 3.2 This figure shows the error plot of stochastic Gradient Descent

```
sgd x
accuracy for SGD
99.97468739428483
accuracy for SGD
99.97389502855756
accuracy for SGD
99.97437244103608
[-0.08018822 -0.12623362 -0.34104253  0.53068833  0.29286388]
-1
>>
```

Fig 3.3: The accuracy value of the data used in Stochastic Gradient Descent is 99.97%

One Vs Rest



Findings:

1. Accuracy of the three Binary Classifiers are
 - Perceptron Binary Classifier - 98.0%
 - Adaline Binary Classifier – 96.43%
 - Stochastic Gradient Descent – 99.97%
2. The Errors have been found and plotted under the respective classifier names above.
3. Feature scaling is important as it is easier to find an approximate learning rate if the features are on the same scale. This is notable in Stochastic Gradient Descent. Perceptron implements this with the help of the “errors” attribute.

Prediction Accuracy:

The three types of Binary classifiers were implemented and tested with the datasets to find their respective accuracies

- Perceptron Classifier, labels={setosa-versicolor}, eta=0.01, n iter=10, accuracy=98%
- Adaline Classifier, labels={setosa-versicolor}, eta=0.01, n iter=10, accuracy=96.43%
- Stochastic Gradient Descent Classifier, labels={setosa-versicolor}, eta=0.01, n iter=10, accuracy=99.97%

Here, the accuracies of each type of Binary Classifiers were found to be close to each other and thus proving the analysis is true.