Machine Learning

Assignment Report (2A)

Team members:

Nipun Wahi Hrithik Kulkarni Mir Ameen Mohideen

2018A7PS0966H 2018A7PS0278H 2018A7PS0487H

Logistic Regression:

The data was divided into training and testing data set with a 70:30 split. Then a weight vector was created and initialised to zeros. The last element in the weight vector represents the bias.

Then Gradient descent and Stochastic Gradient descent functions were called.

The only difference between the two was in terms of the error function which was computed with respect to one random element in SGD and all elements in case of GD

Results:

The most important feature was feature 1 which had the maximum absolute weight in SGD as well as GD with all learning rates.

GD with 10 independent random splits:

Weights:

```
[[-4.3066789 ]
 [-2.27748499]
 [-2.85149757]
 [-0.22494296]
 [ 3.9865394 ]]

Training Stats

Accuracy =  0.9896961498439125
Precision =  0.9962192816635159
Recall =  0.9924670433145011
Loss =  27.258281230021755
Fscore =  0.9943396226415094

Test Stats :

Accuracy =  0.9854014598540145
Precision =  0.9787234042553191
Recall =  0.9956709956709956
Loss =  15.767876281412578
Fscore =  0.9871244635193133
```

SGD with 10 independent random splits:

Weights:

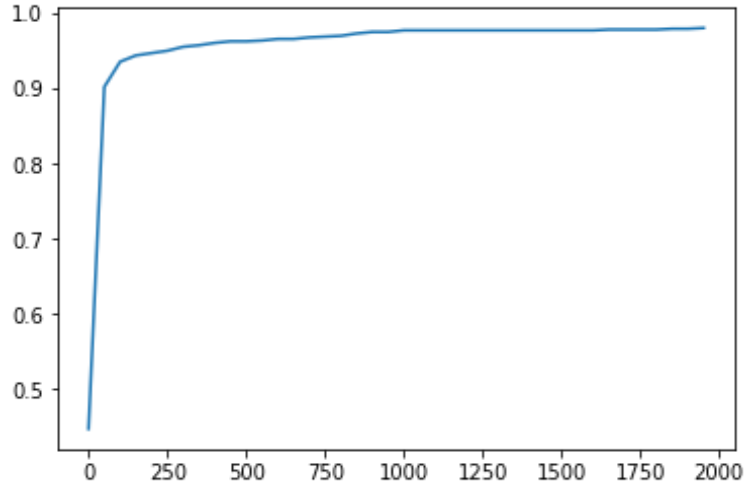
```
[[-0.68105689]
 [-0.31800028]
 [-0.27639552]
 [-0.14857716]
 [ 0.09813082]]


Training Stats

Accuracy =  0.9025062434963579
Precision =  0.9251561218222154
Recall =  0.9822975517890773
Loss =  271.97328569825464
Fscore =  0.9528675318878553
Test Stats :

Accuracy =  0.9479318734793185
Precision =  0.9215785081529309
Recall =  0.991774891774891
Loss =  120.18821340807922
Fscore =  0.9553842736293967
```

Gradient Descent:

Learning rate=0.00001

```
[[-1.44042871]
 [-0.77531945]
 [-0.84329198]
 [-0.25605462]
 [ 0.85423847]]

Training Stats

Accuracy =  0.9646706555671176
Precision =  0.9794007490636704
Recall =  0.9849340866290018
Loss =  10.438668029973066
Fscore =  0.9821596244131456

Test Stats :

Accuracy =  0.9781021897810219
Precision =  0.9703389830508474
Recall =  0.9913419913419913
Loss =  47.199074591349826
Fscore =  0.9807280513918629
```

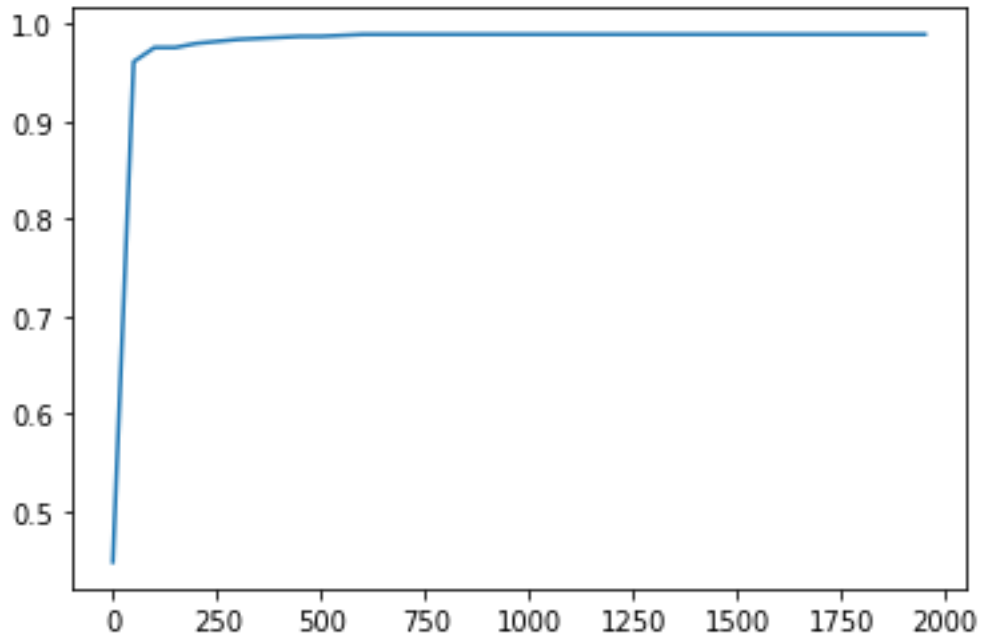
Accuracy vs epochs :



Learning rate=0.0001

```
[[-2.67005971]
 [-1.47583862]
 [-1.78289737]
 [-0.14389337]
 [ 2.62778512]]

Training Stats

Accuracy =  0.9864089490114464
Precision =  0.9961904761904762
Recall =  0.9849340866290018
Loss =  40.12560760209089
Fscore =  0.990530303030303

Test Stats :

Accuracy =  0.9854014598540146
Precision =  0.982832618025751
Recall =  0.9913419913419913
Loss =  19.018831560117324
Fscore =  0.9870689655172413
```

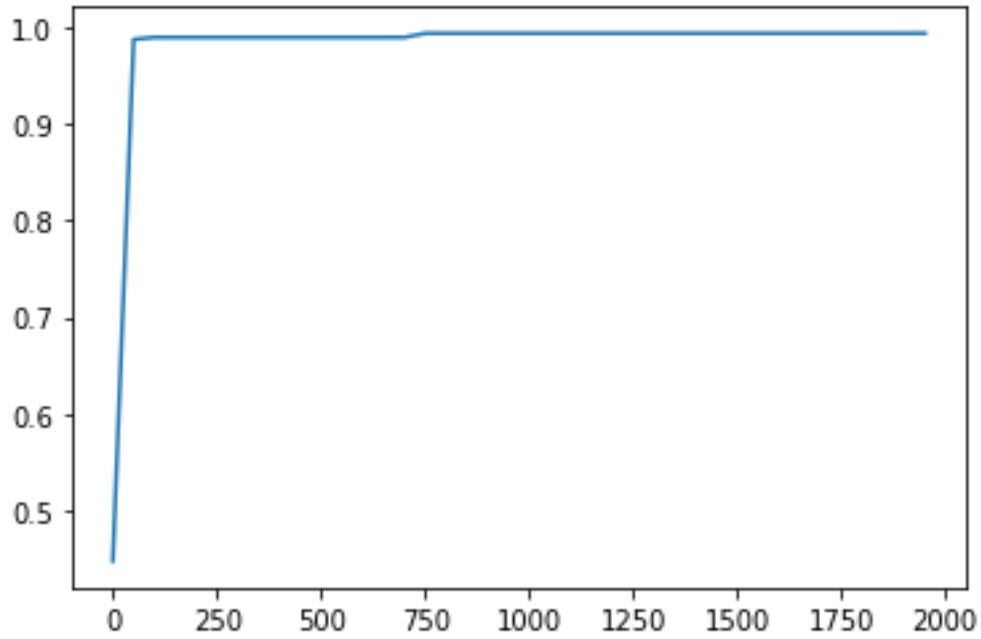
Accuracy vs epochs



Learning Rate=0.001

```
[[-5.28860649]
 [-2.77051614]
 [-3.49635806]
 [-0.33452235]
 [ 4.70634546]]
```

```
Training Stats

Accuracy =  0.9917315296566076
Precision =  0.996219281663516
Recall =  0.992467043314501
Loss =  24.111983684310894
Fscore =  0.9943396226415094

Test Stats :

Accuracy =  0.9854014598540146
Precision =  0.9787234042553192
Recall =  0.9956709956709957
Loss =  15.842389845079894
Fscore =  0.9871244635193133
```

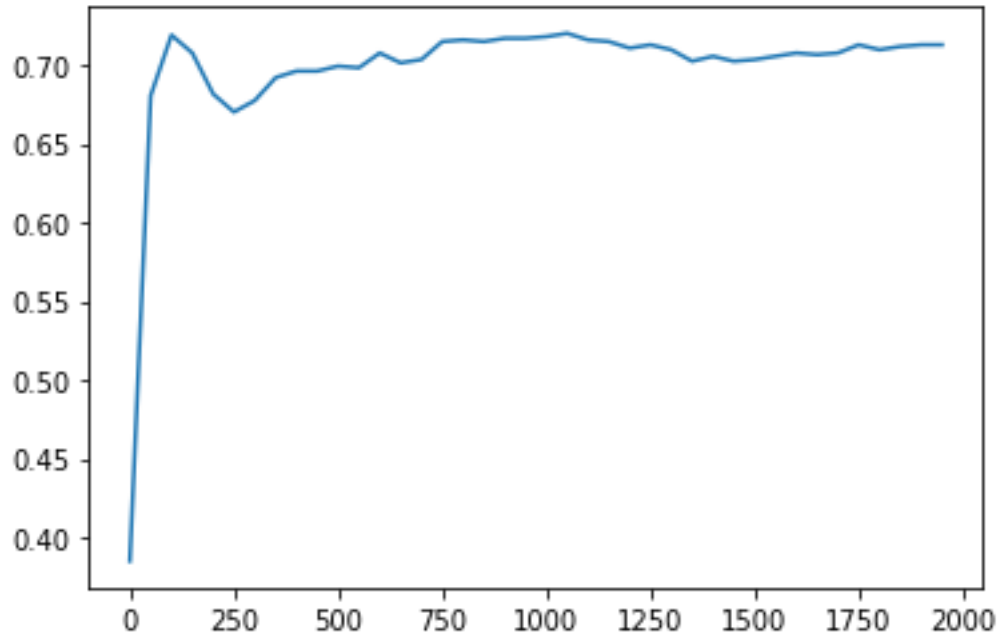


SGD

Learning rate=0.00001

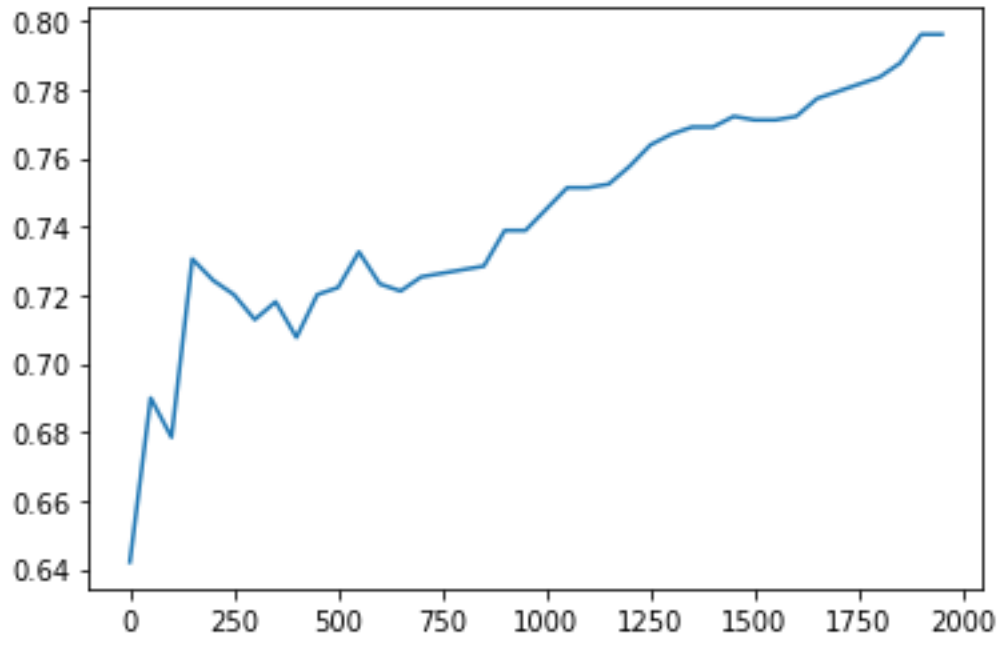
Weights:

```
[[-0.08589993]
 [-0.08546586]
 [-0.00641872]
 [-0.00490893]
 [-0.00216998]]

Training Stats

Accuracy =  0.7460978147762747
Precision =  0.7222222222222222
Recall =  0.8796992481203008
Loss =  744.0516689327236
Fscore =  0.7932203389830509


 Test stats


Accuracy =  0.8004866180048662
Precision =  0.7761194029850746
Recall =  0.9043478260869565
Loss =  308.6360343054742
Fscore =  0.8353413654618473
```



Learning Rate=0.0001

```
Weights
[[-0.16157106]
 [-0.13198572]
 [-0.00941518]
 [-0.02081083]
 [-0.00026101]]

Training Stats

Accuracy =  0.7458678459937566
Precision =  0.7775974025974026
Recall =  0.9020715630885122
Loss =  63.407708397728506
Fscore =  0.8352223190932868

Test Stats :

Accuracy =  0.8029197080291971
Precision =  0.7737226277372264
Recall =  0.9177489177489177
Loss =  27.231904005903157
Fscore =  0.8396039603960395
```



Learning rate=0.001

Weights:

```
[[-0.68294396]
 [-0.33670299]
 [-0.27966735]
 [-0.16135218]
 [ 0.09446525]]

Training Stats

Accuracy =  0.9034167533818939
Precision =  0.9253996447602132
Recall =  0.9811676082862524
Loss =  27.009093689870184
Fscore =  0.9524680073126143

Test Stats :

Accuracy =  0.9464720194647201
Precision =  0.9196787148594378
Recall =  0.9913419913419913
Loss =  11.917713988300948
Fscore =  0.9541666666666668
```