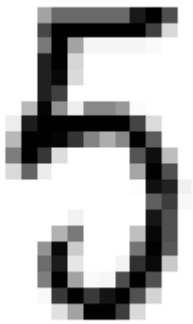
```
Python 3.6.2 |Anaconda custom (64-bit)| (default, Sep 19 2017, 08:03:39) [MSC
v.1900 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 6.1.0 -- An enhanced Interactive Python.

Restarting kernel...
```

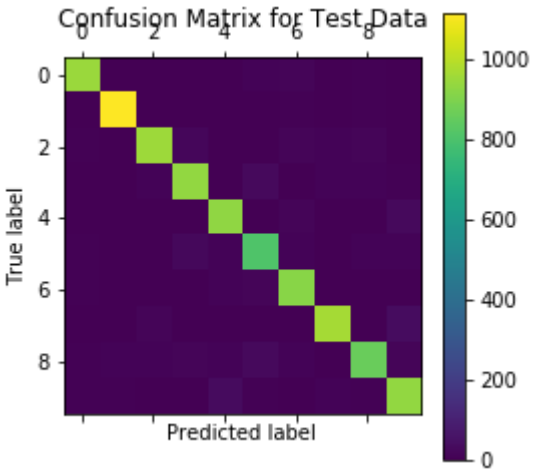
```
In [1]: runfile('C:/Users/raven/Google Drive/MSEE/EE 258/Projects/Project 1/MLP-3
hidden layer.py', wdir='C:/Users/raven/Google Drive/MSEE/EE 258/Projects/Project
1')
Iteration 1, loss = 1.69348429
Iteration 2, loss = 0.89516054
Iteration 3, loss = 0.61434847
Iteration 4, loss = 0.47542687
Iteration 5, loss = 0.40023837
Iteration 6, loss = 0.35329584
Iteration 7, loss = 0.31899334
Iteration 8, loss = 0.30524711
Iteration 9, loss = 0.27880520
Iteration 10, loss = 0.27638374
Iteration 11, loss = 0.25870060
Iteration 12, loss = 0.25124759
Iteration 13, loss = 0.24304772
Iteration 14, loss = 0.23491740
Iteration 15, loss = 0.24070534
Iteration 16, loss = 0.23149600
Iteration 17, loss = 0.22165858
Iteration 18, loss = 0.22562373
Iteration 19, loss = 0.21884933
Iteration 20, loss = 0.21044303
C:\Users\raven\Anaconda3\lib\site-
packages\sklearn\neural_network\multilayer_perceptron.py:564: ConvergenceWarning:
Stochastic Optimizer: Maximum iterations (20) reached and the optimization hasn't
converged yet.
  % self.max_iter, ConvergenceWarning)
```



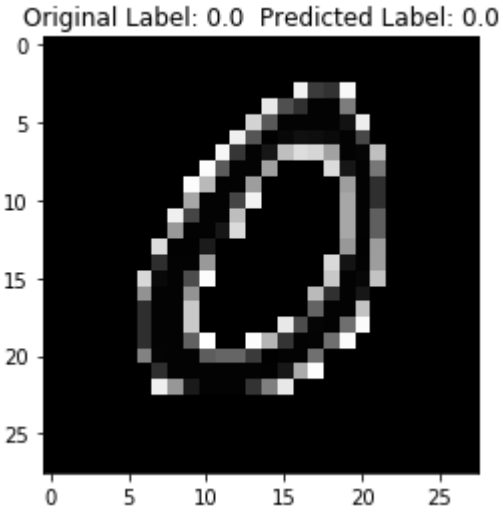
```
prediction is [ 5.]
label is 5.0

Predicted Labels for Test Images:  [ 7.  7.  7. ...,  9.  1.  4.]
Iteration 1, loss = 1.90118950
Iteration 2, loss = 1.13664507
Iteration 3, loss = 0.78871324
Iteration 4, loss = 0.62723938
Iteration 5, loss = 0.52099157
Iteration 6, loss = 0.44245232
Iteration 7, loss = 0.39725968
Iteration 8, loss = 0.36434199
Iteration 9, loss = 0.35332015
Iteration 10, loss = 0.32267133
Iteration 11, loss = 0.31028087
Iteration 12, loss = 0.29712658
Iteration 13, loss = 0.28446613
Iteration 14, loss = 0.27150106
Iteration 15, loss = 0.26618766
Iteration 16, loss = 0.26708386
Iteration 17, loss = 0.25581393
Iteration 18, loss = 0.25000069
Iteration 19, loss = 0.24957623
Iteration 20, loss = 0.23923577
C:\Users\raven\Anaconda3\lib\site-
packages\sklearn\neural_network\multilayer_perceptron.py:564: ConvergenceWarning:
Stochastic Optimizer: Maximum iterations (20) reached and the optimization hasn't
converged yet.
  % self.max_iter, ConvergenceWarning)
Iteration 1, loss = 1.90669004
Iteration 2, loss = 1.16745920
Iteration 3, loss = 0.82113416
Iteration 4, loss = 0.64233148
Iteration 5, loss = 0.53276643
Iteration 6, loss = 0.45087807
Iteration 7, loss = 0.39720715
Iteration 8, loss = 0.37950954
Iteration 9, loss = 0.34299510
```

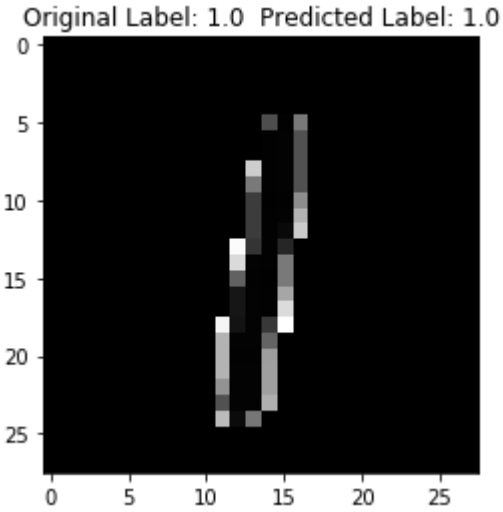
```
Iteration 10, loss = 0.32215030
Iteration 11, loss = 0.32155694
Iteration 12, loss = 0.30452824
Iteration 13, loss = 0.29323398
Iteration 14, loss = 0.28516066
Iteration 15, loss = 0.27982840
Iteration 16, loss = 0.27085117
Iteration 17, loss = 0.26411686
Iteration 18, loss = 0.25379553
Iteration 19, loss = 0.24891180
Iteration 20, loss = 0.23705698
C:\Users\raven\Anaconda3\lib\site-
packages\sklearn\neural_network\multilayer_perceptron.py:564: ConvergenceWarning:
Stochastic Optimizer: Maximum iterations (20) reached and the optimization hasn't
converged yet.
  % self.max_iter, ConvergenceWarning)
Iteration 1, loss = 1.91602361
Iteration 2, loss = 1.17246939
Iteration 3, loss = 0.83297968
Iteration 4, loss = 0.63854764
Iteration 5, loss = 0.53052332
Iteration 6, loss = 0.46753790
Iteration 7, loss = 0.41560980
Iteration 8, loss = 0.38792408
Iteration 9, loss = 0.37273068
Iteration 10, loss = 0.34459678
Iteration 11, loss = 0.34124594
Iteration 12, loss = 0.33400958
Iteration 13, loss = 0.31861830
Iteration 14, loss = 0.29750140
Iteration 15, loss = 0.28525892
Iteration 16, loss = 0.27753765
Iteration 17, loss = 0.26917469
Iteration 18, loss = 0.26623251
Iteration 19, loss = 0.26458903
Iteration 20, loss = 0.25129100
C:\Users\raven\Anaconda3\lib\site-
packages\sklearn\neural_network\multilayer_perceptron.py:564: ConvergenceWarning:
Stochastic Optimizer: Maximum iterations (20) reached and the optimization hasn't
converged yet.
  % self.max_iter, ConvergenceWarning)

The Cross-Validation score is [ 0.92631474  0.91954598  0.92448867]

The Confusion Matrix for Test Data:
 [[ 949    0    0    2    0    9   14    1    5    0]
 [   0 1116    2    4    0    1    5    1    6    0]
 [   7    4  954   18    4    1   14   12   16    2]
 [   1    1   13  933    0   29    1   12   13    7]
 [   1    0    2    1  929    0   15    1    4   29]
 [   8    2    1   23   12  809   13    1   12   11]
```

```
[   6    3    0    2   11   15  919    0    2    0]
[   1    4   14    2    3    0    1  965    2   36]
[   7    9    9   14   12   27   13    4  863   16]
[   8    6    1    4   33    6    1   10    7  933]]
```

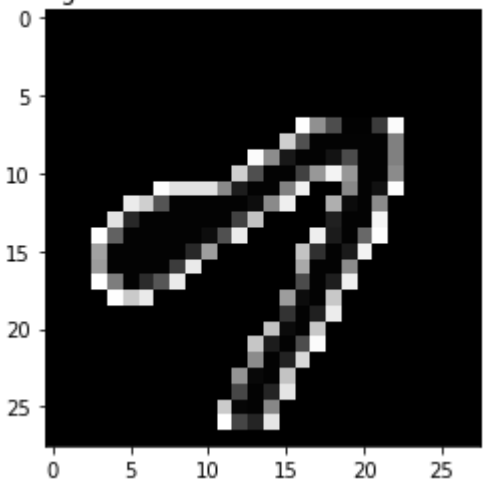


The test error for Linear Classifier is 10724.0

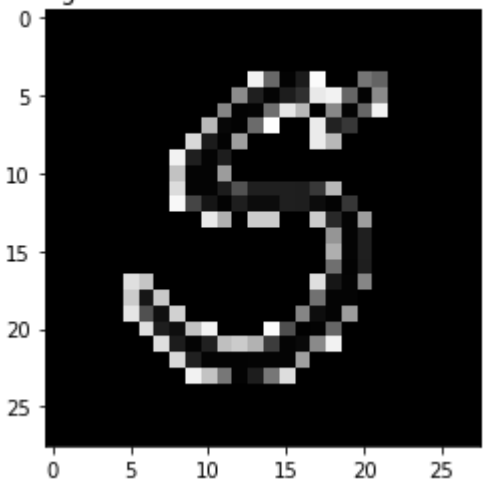




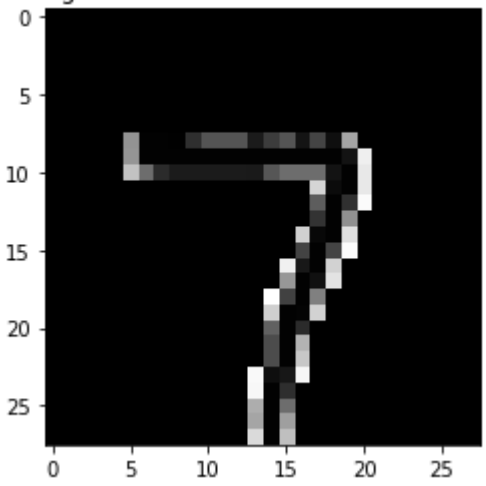
Original Label: 7.0 Predicted Label: 7.0

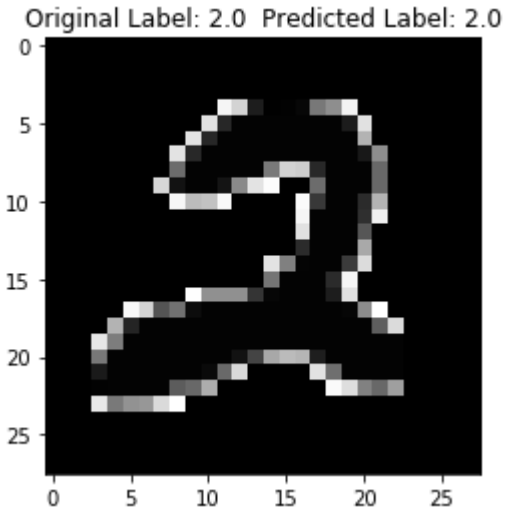


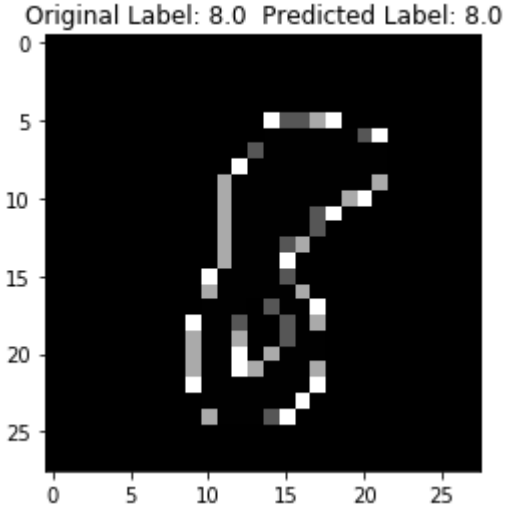
Original Label: 5.0 Predicted Label: 5.0

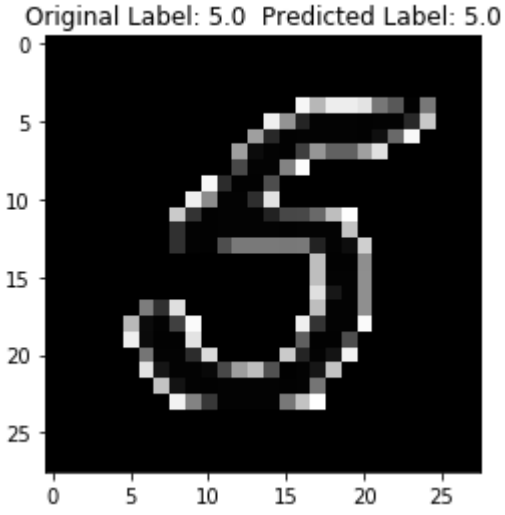


Original Label: 7.0 Predicted Label: 7.0

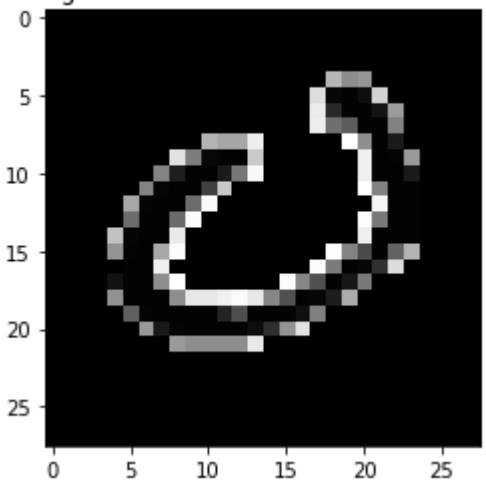



Original Label: 2.0 Predicted Label: 2.0
0
5
10
15
20
25
0
5
10
15
20
25

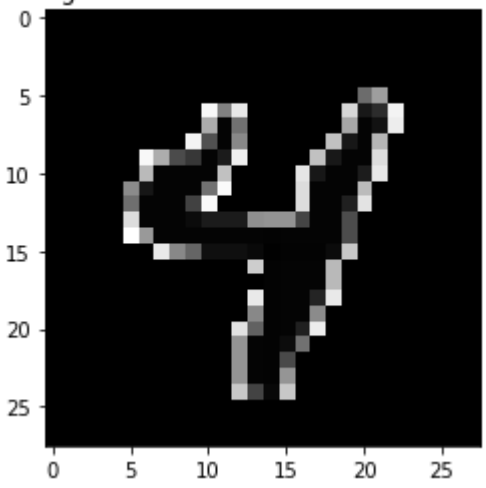

Original Label: 8.0 Predicted Label: 8.0
0
5
10
15
20
25
0
5
10
15
20
25


Original Label: 5.0 Predicted Label: 5.0
0
5
10
15
20
25
0
5
10
15
20
25

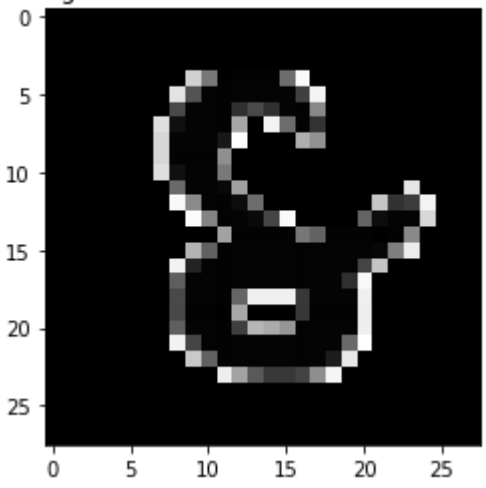
Original Label: 0.0 Predicted Label: 0.0

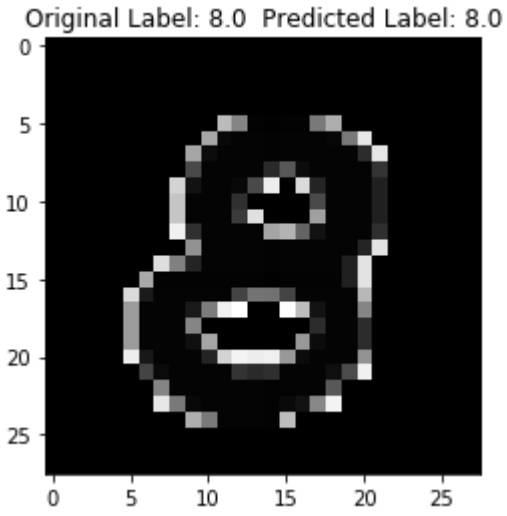


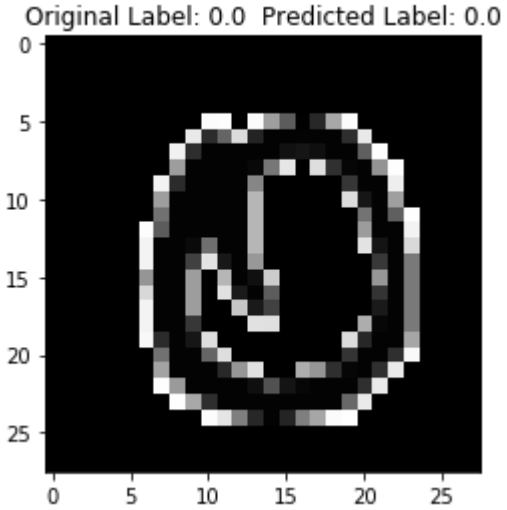
Original Label: 4.0 Predicted Label: 4.0

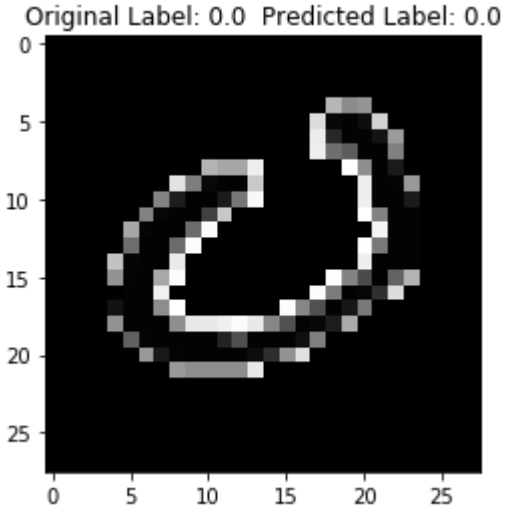


Original Label: 8.0 Predicted Label: 6.0

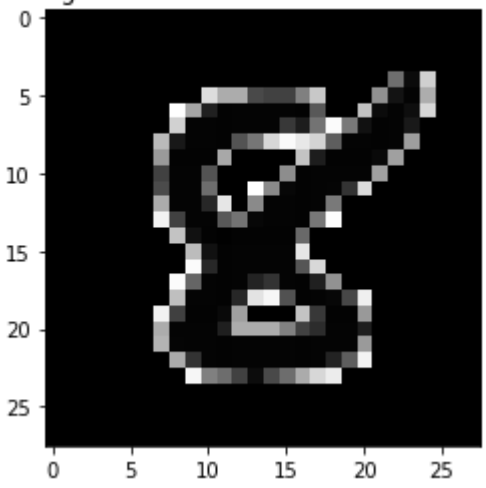



Original Label: 8.0 Predicted Label: 8.0
0
5
10
15
20
25
0
5
10
15
20
25

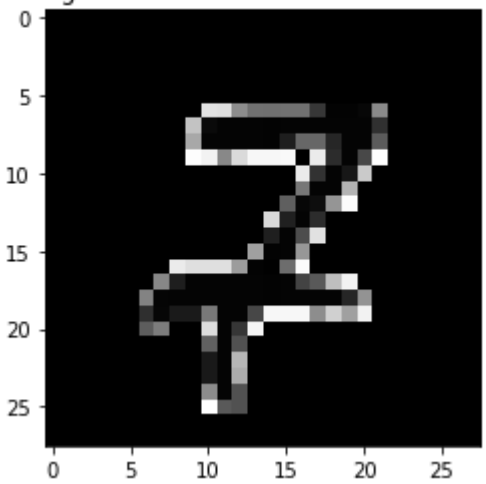

Original Label: 0.0 Predicted Label: 0.0
0
5
10
15
20
25
0
5
10
15
20
25


Original Label: 0.0 Predicted Label: 0.0
0
5
10
15
20
25
0
5
10
15
20
25

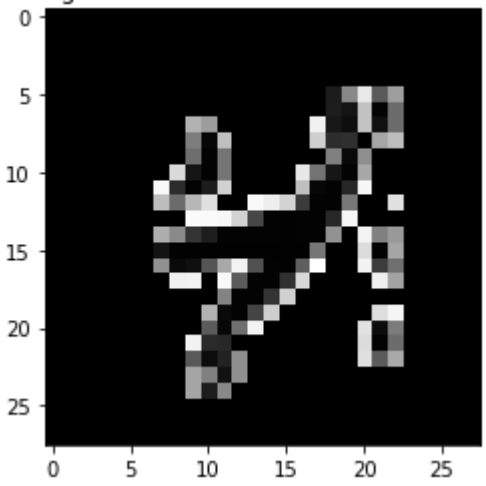
Original Label: 8.0 Predicted Label: 8.0

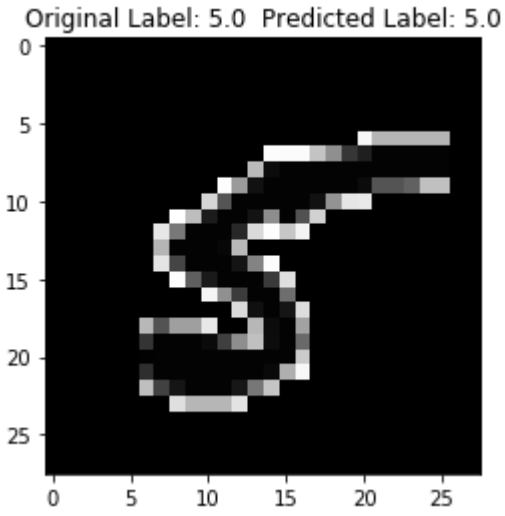


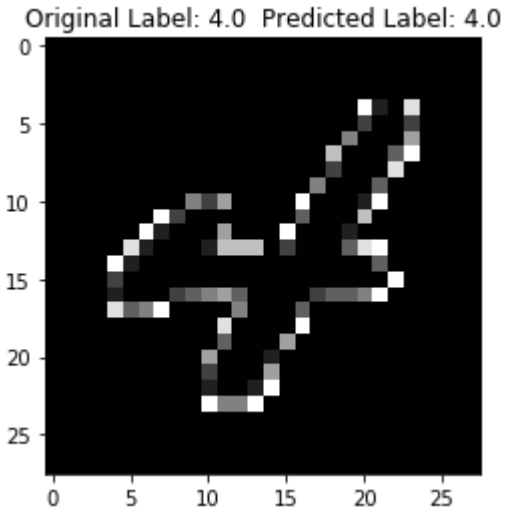
Original Label: 7.0 Predicted Label: 2.0

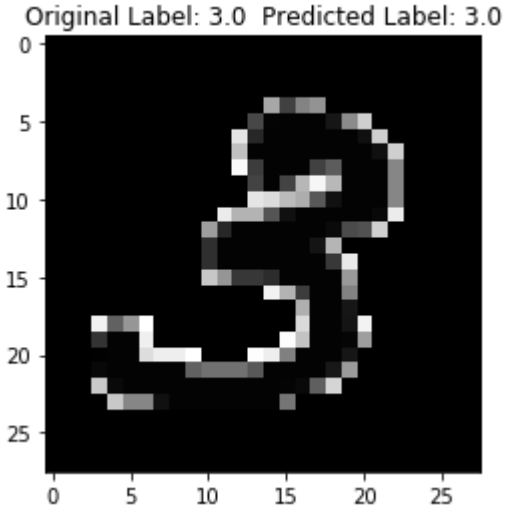


Original Label: 4.0 Predicted Label: 4.0










```
The Models Accuracy is 0.937
```

In [2]: