Accuracy for Single Layer Neural Network – Celeb Face Data

```
Training set Accuracy:85.8104265403%

Validation set Accuracy:84.8405253283%

Test set Accuracy:86.8281604845%

Obtained time:112.23500895500183
```

As we can see from the above screenshot, when we run the facennScript, and copy our functions from nnScript to facennScript, we get the aforementioned accuracies, with a test accuracy **of 86.82%, and this runs in 112.235 s.**

Accuracy for Deep Neural Network – Celeb Face Data

In this case, we vary the no. of hidden layers between the values : 2,3,5 and 7.

The other parameters considered are :
n_hidden = 256, learning_rate = 0.0001, training_epochs = 100, batch_size = 100

The results for each of them are shown below :

No. of Hidden Layers	Test Accuracy (%)	Run-time (s)
2	80.5829	116.154
3	79.0689	124.786
5	74.8675	164.668
7	75.2839	227.138

Here, we can observe that as we increase the number of hidden layers, the run-time increases – this is intuitive because there will be more computation. The accuracy is dropping as we increase the no. of hidden layers, and we this is due to overfitting performed by the Deep Neural Network.

The accuracy as well as the run-time is marginally better when we compare the single layer Neural Network with the Deep Neural Network. This is because it takes lesser time due to just one hidden layer, and the accuracy is better because we aren't overfitting the data.

Convolution Neural Network Experiment

In this experiment, we set the dataset size as follows:

- Training-set: 55000 rows
- Test-set: 10000 rows
- Validation-set: 5000 rows

Shown below is the output of the CNN script.

Accuracy on Test-Set: 8.7% (873 / 10000)

Optimization Iteration: 1, Training Accuracy: 10.9%

Time usage: 0:00:00

Accuracy on Test-Set: 9.4% (941 / 10000)

Time usage: 0:00:05

Accuracy on Test-Set: 74.8% (7476 / 10000)

Optimization Iteration: 101, Training Accuracy: 73.4%

Optimization Iteration: 201, Training Accuracy: 85.9%

Optimization Iteration: 301, Training Accuracy: 84.4%

Optimization Iteration: 401, Training Accuracy: 87.5%

Optimization Iteration: 501, Training Accuracy: 81.2%

Optimization Iteration: 601, Training Accuracy: 84.4%

Optimization Iteration: 701, Training Accuracy: 90.6%

Optimization Iteration: 801, Training Accuracy: 87.5%

Optimization Iteration: 901, Training Accuracy: 89.1%

Time usage: 0:00:45

Accuracy on Test-Set: 93.3% (9327 / 10000)

Optimization Iteration: 1001, Training Accuracy: 92.2%

Optimization Iteration: 1101, Training Accuracy: 95.3%

Optimization Iteration: 1201, Training Accuracy: 98.4%

Optimization Iteration: 1301, Training Accuracy: 96.9%

Optimization Iteration: 1401, Training Accuracy: 95.3%

Optimization Iteration: 1501, Training Accuracy: 95.3%

Optimization Iteration: 1601, Training Accuracy: 92.2%

Optimization Iteration: 1701, Training Accuracy: 93.8%

Optimization Iteration: 1801, Training Accuracy: 95.3%

Optimization Iteration: 1901, Training Accuracy: 98.4%

Optimization Iteration: 2001, Training Accuracy: 98.4%

Optimization Iteration: 2101, Training Accuracy: 98.4%

Optimization Iteration: 2201, Training Accuracy: 93.8%

Optimization Iteration: 2301, Training Accuracy: 92.2%

Optimization Iteration: 2401, Training Accuracy: 93.8%

Optimization Iteration: 2501, Training Accuracy: 93.8%

Optimization Iteration: 2601, Training Accuracy: 95.3%

Optimization Iteration: 2701, Training Accuracy: 98.4%

Optimization Iteration: 2801, Training Accuracy: 93.8%

Optimization Iteration: 2901, Training Accuracy: 95.3%

Optimization Iteration: 3001, Training Accuracy: 93.8%

Optimization Iteration: 3101, Training Accuracy: 100.0%

Optimization Iteration: 3201, Training Accuracy: 96.9%

Optimization Iteration: 3301, Training Accuracy: 95.3%

Optimization Iteration: 3401, Training Accuracy: 98.4%

Optimization Iteration: 3501, Training Accuracy: 96.9%

Optimization Iteration: 3601, Training Accuracy: 98.4%

Optimization Iteration: 3701, Training Accuracy: 95.3%

Optimization Iteration: 3801, Training Accuracy: 96.9%

Optimization Iteration: 3901, Training Accuracy: 100.0%

Optimization Iteration: 4001, Training Accuracy: 96.9%

Optimization Iteration: 4101, Training Accuracy: 98.4%

Optimization Iteration: 4201, Training Accuracy: 100.0%

Optimization Iteration: 4301, Training Accuracy: 95.3%

Optimization Iteration: 4401, Training Accuracy: 98.4%

Optimization Iteration: 4501, Training Accuracy: 98.4%

Optimization Iteration: 4601, Training Accuracy: 95.3%

Optimization Iteration: 4701, Training Accuracy: 100.0%

Optimization Iteration: 4801, Training Accuracy: 96.9%

Optimization Iteration: 4901, Training Accuracy: 98.4%

Optimization Iteration: 5001, Training Accuracy: 98.4%

Optimization Iteration: 5101, Training Accuracy: 96.9%

Optimization Iteration: 5201, Training Accuracy: 98.4%

Optimization Iteration: 5301, Training Accuracy: 100.0%

Optimization Iteration: 5401, Training Accuracy: 98.4%

Optimization Iteration: 5501, Training Accuracy: 98.4%

Optimization Iteration: 5601, Training Accuracy: 98.4%

Optimization Iteration: 5701, Training Accuracy: 100.0%

Optimization Iteration: 5801, Training Accuracy: 100.0%

Optimization Iteration: 5901, Training Accuracy: 98.4%

Optimization Iteration: 6001, Training Accuracy: 98.4%

Optimization Iteration: 6101, Training Accuracy: 95.3%

Optimization Iteration: 6201, Training Accuracy: 98.4%

Optimization Iteration: 6301, Training Accuracy: 100.0%

Optimization Iteration: 6401, Training Accuracy: 98.4%

Optimization Iteration: 6501, Training Accuracy: 98.4%

Optimization Iteration: 6601, Training Accuracy: 98.4%

Optimization Iteration: 6701, Training Accuracy: 96.9%

Optimization Iteration: 6801, Training Accuracy: 100.0%

Optimization Iteration: 6901, Training Accuracy: 100.0%

Optimization Iteration: 7001, Training Accuracy: 98.4%

Optimization Iteration: 7101, Training Accuracy: 98.4%

Optimization Iteration: 7201, Training Accuracy: 100.0%

Optimization Iteration: 7301, Training Accuracy: 100.0%

Optimization Iteration: 7401, Training Accuracy: 100.0%

Optimization Iteration: 7501, Training Accuracy: 100.0%

Optimization Iteration: 7601, Training Accuracy: 100.0%

Optimization Iteration: 7701, Training Accuracy: 100.0%

Optimization Iteration: 7801, Training Accuracy: 98.4%

Optimization Iteration: 7901, Training Accuracy: 98.4%

Optimization Iteration: 8001, Training Accuracy: 100.0%

Optimization Iteration: 8101, Training Accuracy: 100.0%

Optimization Iteration: 8201, Training Accuracy: 98.4%

Optimization Iteration: 8301, Training Accuracy: 100.0%

Optimization Iteration: 8401, Training Accuracy: 95.3%

Optimization Iteration: 8501, Training Accuracy: 100.0%

Optimization Iteration: 8601, Training Accuracy: 98.4%

Optimization Iteration: 8701, Training Accuracy: 100.0%

Optimization Iteration: 8801, Training Accuracy: 96.9%

Optimization Iteration: 8901, Training Accuracy: 100.0%

Optimization Iteration: 9001, Training Accuracy: 98.4%

Optimization Iteration: 9101, Training Accuracy: 98.4%

Optimization Iteration: 9201, Training Accuracy: 98.4%

Optimization Iteration: 9301, Training Accuracy: 100.0%

Optimization Iteration: 9401, Training Accuracy: 98.4%

Optimization Iteration: 9501, Training Accuracy: 95.3%

Optimization Iteration: 9601, Training Accuracy: 100.0%

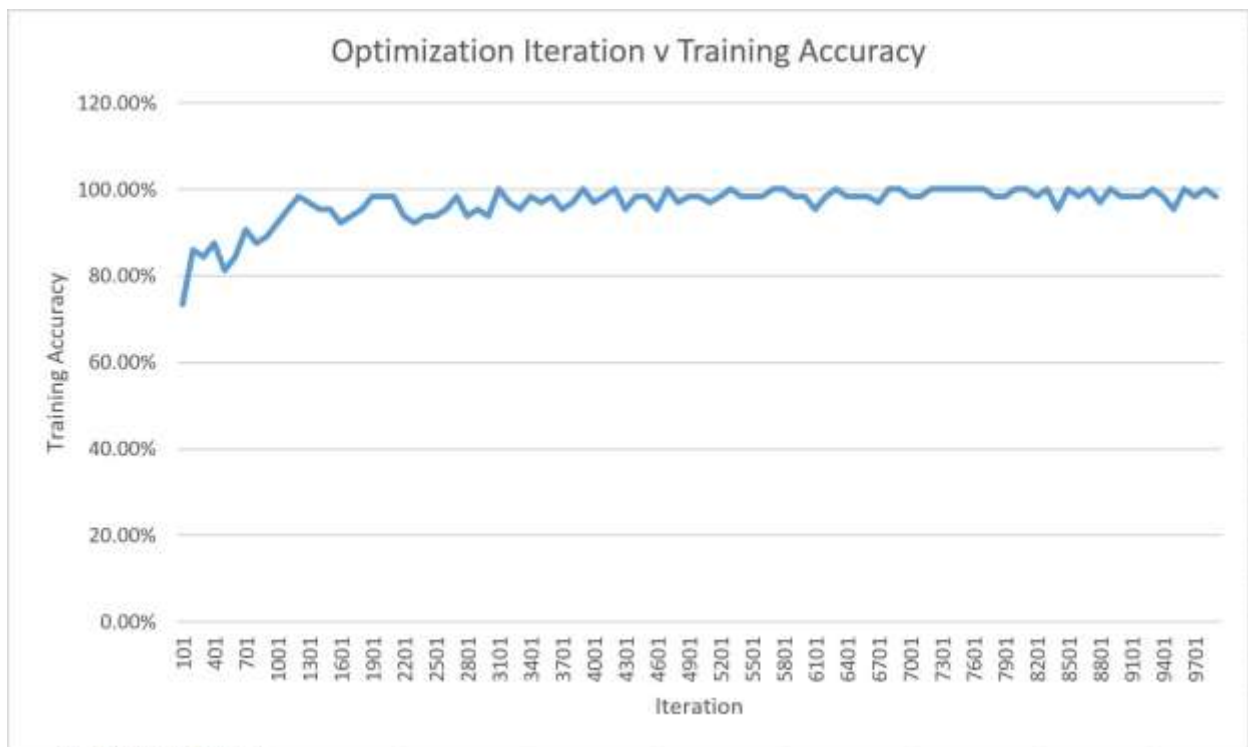Optimization Iteration: 9701, Training Accuracy: 98.4%

Optimization Iteration: 9801, Training Accuracy: 100.0%

Optimization Iteration: 9901, Training Accuracy: 98.4%

Time usage: 0:07:30

Accuracy on Test-Set: 98.9% (9888 / 10000)

We can make a graph depicting the optimization iteration and training accuracy, and it is shown below :

As we can see, as the iterations increases, the training accuracy hits close to 100%.

The final test accuracy obtained for this is: **98.9%,** which is quite exceptional performance by the convolution network.