CS580 Assignment-5
Averm004@odu.edu

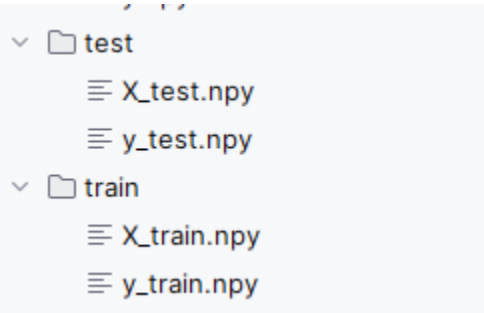
CS580 Assignment-5

Analysis Report:

Data

The original data is in the form of binary sequence of 0 and 1 representing each digit between 0 and 9. During the data processing phase the binary sequences are not converted to flattened array of 1797, 1024 shape where 1797 represent the number of rows in the dataset and 1024 are the features.

The dataset is then split into the ration of 80% train data and 20% test data and are saved under respective directories as .npy array objects. The whole processing is done by **DataProcessing.py** file



The final shapes of the train and test datasets are

X_train=(1437, 1024)

X_test=(360, 1024)

Y_train(1437,)

Y_test=(360,)

The code available in Git repo =>https://github.com/ashishodu2023/NeuralNetwork.

CS580 Assignment-5
Averm004@odu.edu

Model

The hyper parameters of the model are as hidden layers=16 number of epochs = 3000 and learning rate = 000.1. Execute **DigitPrediction.py**

Training Loss

Epoch 100, Training-Loss : 0.158819

Epoch 200, Training-Loss : 0.134327

Epoch 300, Training-Loss : 0.110114

Epoch 400, Training-Loss : 0.091878

Epoch 500, Training-Loss : 0.078680

Epoch 600, Training-Loss : 0.066190

Epoch 700, Training-Loss : 0.055023

Epoch 800, Training-Loss : 0.046809

Epoch 900, Training-Loss : 0.040010

Epoch 1000, Training-Loss : 0.034604

Epoch 1100, Training-Loss : 0.029889

Epoch 1200, Training-Loss : 0.026630

Epoch 1300, Training-Loss : 0.024381

Epoch 1400, Training-Loss : 0.022609

Epoch 1500, Training-Loss : 0.020716

Epoch 1600, Training-Loss : 0.019181

Epoch 1700, Training-Loss : 0.017998

Epoch 1800, Training-Loss : 0.017014

Epoch 1900, Training-Loss : 0.015997

Epoch 2000, Training-Loss : 0.015254

Epoch 2100, Training-Loss : 0.014703

Epoch 2200, Training-Loss : 0.014123

Epoch 2300, Training-Loss : 0.013677

Averm004@odu.edu

Epoch 2400, Training-Loss : 0.012964

Epoch 2500, Training-Loss : 0.012409

Epoch 2600, Training-Loss : 0.011968

Epoch 2700, Training-Loss : 0.011589

Epoch 2800, Training-Loss : 0.011133

Epoch 2900, Training-Loss : 0.010795.

Training Confusion Matrix

Predicted	0	1	2	3	4	5	6	7	8	9	All
Actual											
0	144	0	0	0	1	0	0	0	0	0	145
1	0	149	0	1	0	0	2	0	2	0	154
2	0	1	143	0	0	0	0	0	0	0	144
3	0	0	0	143	0	1	0	2	1	2	149
4	0	0	0	0	132	0	1	0	2	0	135
5	0	1	0	0	0	131	0	0	0	3	135
6	0	0	0	0	0	0	145	0	1	0	146
7	0	0	0	0	0	0	0	145	0	0	145
8	0	4	0	1	0	0	0	0	137	2	144
9	0	1	1	0	1	2	0	0	0	135	140
All	144	156	144	145	134	134	148	147	143	142	1437

The model train accuracy is =0.97704

The model train precision is =0.97712

The model train recall is =0.97704

Test Confusion Matrix

Predicted	0	1	2	3	4	5	6	7	8	9	All

CS580 Assignment-5

Averm004@odu.edu

Actual

0	30	0	1	0	1	0	1	0	0	0	33
1	0	24	3	0	0	0	0	0	1	0	28
2	0	1	30	0	0	1	0	1	0	0	33
3	1	0	1	27	0	1	0	2	2	0	34
4	0	6	0	0	37	0	0	3	0	0	46
5	0	0	2	1	0	38	1	1	1	3	47
6	0	0	0	1	1	0	32	0	0	1	35
7	0	1	0	0	0	0	0	32	0	1	34
8	0	3	1	0	0	0	0	1	21	4	30
9	1	0	0	3	0	1	0	1	4	30	40
All	32	35	38	32	39	41	34	41	29	39	360

The model test accuracy is =0.83611

The model test precision is =0.84459

The model test recall is =0.83611

Dimensionality Reduction Using Principal Component Analysis(PCA)

Training on PCA data

Epoch 0, Training-Loss : 0.181109

INFO:root:=======Train Model with PCA Data========

INFO:root:====Inside constructor====

Epoch 100, Training-Loss : 0.165337

Epoch 200, Training-Loss : 0.149570

Epoch 300, Training-Loss : 0.134070

Epoch 400, Training-Loss : 0.118158

Epoch 500, Training-Loss : 0.102757

Averm004@odu.edu

Epoch 600, Training-Loss : 0.090475

Epoch 700, Training-Loss : 0.079702

Epoch 800, Training-Loss : 0.070920

Epoch 900, Training-Loss : 0.063679

Epoch 1000, Training-Loss : 0.057588

Epoch 1100, Training-Loss : 0.051790

Epoch 1200, Training-Loss : 0.046075

Epoch 1300, Training-Loss : 0.041273

Epoch 1400, Training-Loss : 0.037428

Epoch 1500, Training-Loss : 0.033688

Epoch 1600, Training-Loss : 0.030389

Epoch 1700, Training-Loss : 0.027901

Epoch 1800, Training-Loss : 0.025870

Epoch 1900, Training-Loss : 0.023784

Epoch 2000, Training-Loss : 0.022270

Epoch 2100, Training-Loss : 0.021004

Epoch 2200, Training-Loss : 0.019795

Epoch 2300, Training-Loss : 0.018804

Epoch 2400, Training-Loss : 0.017850

Epoch 2500, Training-Loss : 0.017021

Epoch 2600, Training-Loss : 0.015966

Epoch 2700, Training-Loss : 0.015204

Epoch 2800, Training-Loss : 0.014547

Epoch 2900, Training-Loss : 0.013864

PCA Confusion Matrix

Predicted 0 1 2 3 4 5 6 7 8 9 All

Actual

CS580 Assignment-5

Averm004@odu.edu

0	33	0	0	0	0	0	0	0	0	0	33
1	0	28	0	0	0	0	0	0	0	0	28
2	0	1	31	0	0	1	0	0	0	0	33
3	0	0	0	34	0	0	0	0	0	0	34
4	0	0	0	0	46	0	0	0	0	0	46
5	0	0	0	0	0	46	0	0	0	1	47
6	0	0	0	0	0	0	35	0	0	0	35
7	0	0	0	0	0	0	0	34	0	0	34
8	0	0	0	0	0	0	0	0	30	0	30
9	0	0	0	0	0	0	0	0	0	40	40
All	33	29	31	34	46	47	35	34	30	41	360

The model pca accuracy is =0.99167

The model pca precision is =0.99183

The model pca recall is =0.99167