ProjectDevelopment Phase

Sprint 1

MNIST Dataset pre processing

Date	10 November 2022
Team ID	PNT2022TMID49804
Project Name	A Novel Method For Handwritten Digit Recognition System
Maximum Marks	4 Marks

1.Understanding the Data

Importing the required libraries

```
import numpy as np import tensorflow from tensorflow.keras.datasets import mnist from tensorflow.keras.models import Sequential from tensorflow.keras.layers import Dense, Flatten from tensorflow.keras.layers import Conv2D from keras.optimizers import Adam from keras.utils import np_utils
```

2.Loading data

Input:

```
(X_train,y_train) , (X_test,y_test)=mnist.load_data()
```

Output:

Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz 11490434/11490434 [==============================] - 0s 0us/step

3.Analyzing the data

Input:

```
X_train[0]
```

Output:

```
array([[ 0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
         0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
         0,  0],
       [ 0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
         0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
         0,  0],
       [ 0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
         0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
```

```
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,                    0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],

[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,                    0,
0, 0, 0, 0, 0, 0, 0, 0, 0,                  0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0,                  0, 0, 0, 0, 0, 3,
18, 18, 18, 126, 136, 175, 26, 166, 255, 247, 127, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0,                0, 30, 36, 94, 154, 170,
253, 253, 253, 253, 253, 225, 172, 253, 242, 195, 64, 0,      0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 49, 238, 253, 253, 253, 253,
253, 253, 253, 253, 251, 93, 82, 82, 56, 39, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 18, 219, 253, 253, 253, 253,
253, 198, 182, 247, 241, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 80, 156, 107, 253, 253,
205, 11, 0, 43, 154, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 14, 1, 154, 253,
90, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 139, 253,
190, 2, 0, 0, 0, 0, 0, 0,                0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 11, 190,
253, 70, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0,              0, 0, 0, 0, 0,       0, 0, 35,
241, 225, 160, 108, 1, 0, 0,       0, 0,      0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0,              0, 0, 0, 0, 0,       0, 0, 0,
81, 240, 253, 253, 119, 25, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0,              0,     0, 0,     0, 0, 0,
0, 45, 186, 253, 253, 150, 27,     0, 0,    0, 0,    0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0,              0,     0, 0,     0, 0, 0,
0, 0, 16, 93, 252, 253, 187, 0, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,                    0,
0, 0, 0, 0, 249, 253, 249, 64, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,                    0,
0, 46, 130, 183, 253, 253, 207, 2, 0, 0, 0, 0, 0,
0, 0],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 39,
```

148, 229, 253, 253, 253, 250, 182, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 24, 114, 221,
253, 253, 253, 253, 201, 78, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 0, 0, 0, 0, 23, 66, 213, 253, 253,
253, 253, 198, 81, 2, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 0, 0, 18, 171, 219, 253, 253, 253, 253,
195, 80, 9, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 55, 172, 226, 253, 253, 253, 253, 244, 133,
11, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 136, 253, 253, 253, 212, 135, 132, 16, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0],
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0]], dtype=uint8)

Input:

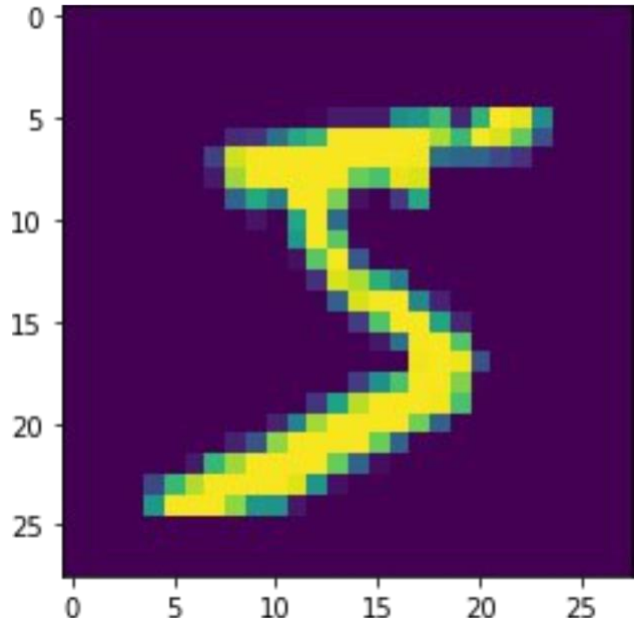
```
y_train[0]
```

Output:

5

Input:

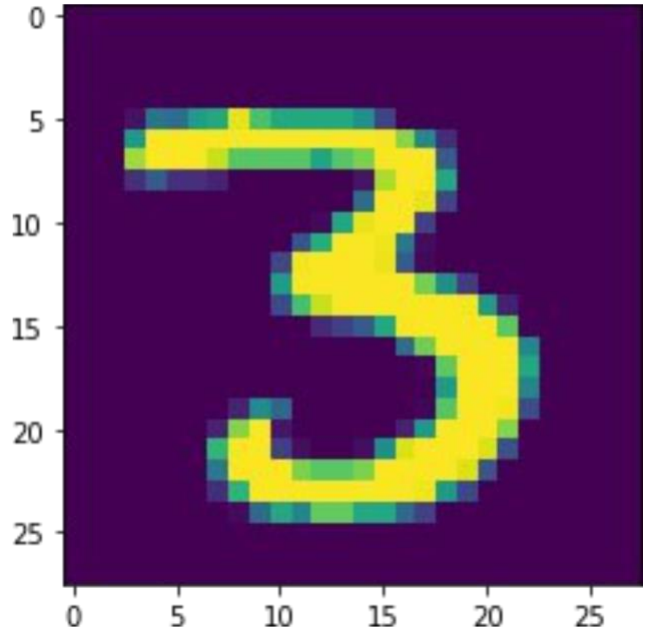
```
Import matplotlib.pyplot as plt
plt.imshow(X_train[0])
```



Input:

```
plt.imshow(X_train[12])
```

Output:



4.Reshaping the data

```
X_train=X_train.reshape(60000, 28, 28, 1).astype('float32')
X_test=X_test.reshape(10000, 28, 28, 1).astype('float32')
```

5.Apply one-Hot Encoding

```
number_of_classes= 10
```

```
y_train=np_utils.to_categorical(y_train,
number_of_classes) y_test=np_utils.to_categorical(y_test,
number_of_classes)
```

Input:

```
y_train[0]
```

Output:

```
array([0., 0., 0., 0., 0., 1., 0., 0., 0., 0.], dtype=float32)
```