```
import numpy
import tensorflow
from tensorflow.keras.datasets import mnist
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers
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 the data

```
(x_train,y_train),(x_test,y_test)=mnist.load_data()
```

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

```
print(x_train.shape)
print(x_test.shape)
```

```
(60000, 28, 28)
(10000, 28, 28)
```

3.Analyzing the data

```
x_train[0]
```

```
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,
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,  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,  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,  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,  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,   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,   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,   0, 136, 253, 253, 253, 212, 135, 132,  16,
0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
```

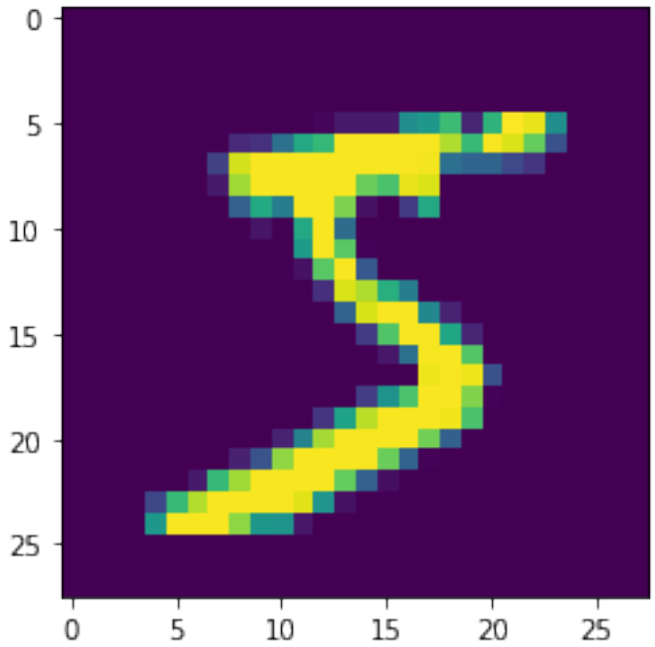
```
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          0,   0,   0,   0,   0,   0,   0,   0,   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,   0]], dtype=uint8)
```

```
y_train[0]
```

```
5
```

```
import matplotlib.pyplot as plt
plt.imshow(x_train[0])
```

```
<matplotlib.image.AxesImage at 0x7fbfc7eac890>
```



4.Reshaping the dataset

```
x_train=x_train.reshape(60000, 28, 28, 1).astype('float32')
x_test=x_test.reshape(10000, 28, 28, 1).astype('float32')
```

5.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)
```

```
y_train[0]
```

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