#SPRINT 1 TEAM ID: PNT2022TMID18363

#Importing required Libraries

```
import numpy#for numerical analysis
import tensorflow#open source ml tool by google
```

```
from tensorflow.keras.datasets import mnist #mnist dataset
from tensorflow.keras.models import Sequential# stack for layers
from tensorflow.keras import layers#input,middle and output layers
forcnn structure
```

```
from tensorflow.keras.layers import Dense,Flatten#dense and flatten
layers
from tensorflow.keras.layers import Conv2D#convolutional layers
from tensorflow import keras#library for building neural networks
built on tensorflow
```

```
from tensorflow.keras.optimizers import Adam#optimizers
from keras.utils import np_utils
```

#Loading dataset

Dataset is available in tensorflow dataset repository

```
(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
```

automatically data is splitted for train ,test -70:30 ratio

```
print(x_train.shape)
print(y_train.shape)
```

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

Training Dataset has 60000 images & testing has 10000 images

```
print(x_test.shape)
print(y_test.shape)
```

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

Analyze the data

```
x_train[3]
```

```
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, 124, 253, 255,  63,   0,   0,   0,
0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          0,   0,   0,   0,  96, 244, 251, 253,  62,   0,   0,   0,
0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          0,   0,   0,   0, 127, 251, 251, 253,  62,   0,   0,   0,
0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          0,   0,   0,  68, 236, 251, 211,  31,   8,   0,   0,   0,
0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          0,   0,  60, 228, 251, 251,  94,   0,   0,   0,   0,   0,
0,
          0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0, 155, 253, 253, 189,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,  20, 253, 251, 235,  66,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
          32, 205, 253, 251, 126,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
         104, 251, 253, 184,  15,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
80,
         240, 251, 193,  23,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,  32,
253,
         253, 253, 159,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0, 151,
251,
         251, 251,  39,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,  48, 221,
251,
         251, 172,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0, 234, 251,
251,
         196,  12,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0, 253, 251,
251,
          89,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0, 159, 255, 253,
253,
          31,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,  48, 228, 253, 247,
140,
           8,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,  64, 251, 253, 220,
0,
           0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,  64, 251, 253, 220,
0,
           0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,  24, 193, 253, 220,
0,
           0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
0,
           0,   0],
        [  0,   0,   0,   0,   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[36]
```

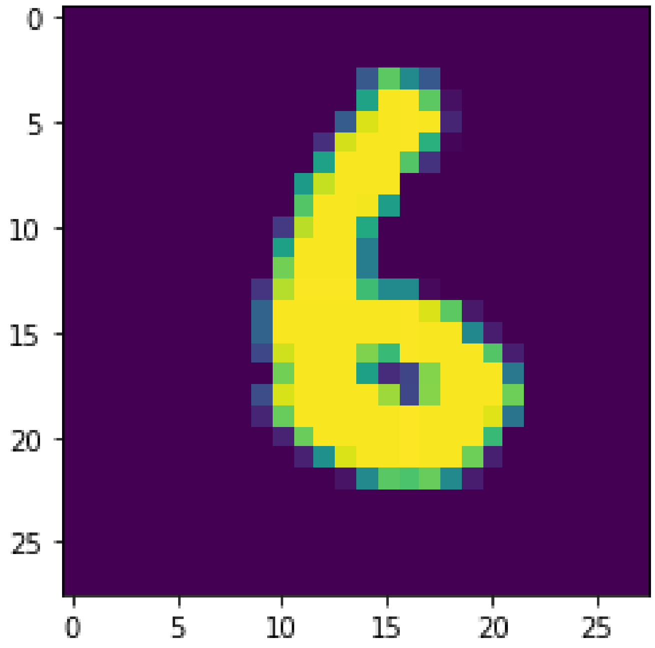
```
6
```

image in 36th position in training dataset

```
import matplotlib.pyplot as plt
```

```
plt.imshow(x_train[36])
```

```
<matplotlib.image.AxesImage at 0x7fa70fb3b550>
```



#Reshaping the data

,As we are using Deep learning neural network, the input for this network to get trained on should be of higher dimensional. Our dataset is having three-dimensional images so we have to reshape them too higher dimensions

```
#(batch,height,width,channel)
x_train=x_train.reshape(60000,28,28,1).astype('float32')
x_test=x_test.reshape(10000,28,28,1).astype('float32')
```

#Applying one hot encoding

One hot encoding to convert numerical values to classes where 0 to 9 are 10 seperate classes if value is 5 class 5 is 1 else 0

```
no_of_classes=10
y_train=np_utils.to_categorical(y_train,no_of_classes)
y_test=np_utils.to_categorical(y_test,no_of_classes)
```

```
y_test[3]
```

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