

## MNIST Dataset pre\_processing

Date	8 November 2022
Team ID	PNT2022TMID06779
Project Name	A Noval Method For Handwritten Digit Recognition System
Maximum Marks	4 Marks

## Understanding the Data

## Importing the required libraries

```
import numpy as np
import tensorflow as tf
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 tensorflow.keras.optimizers import Adam
from keras.utils import np_utils
```

## 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

## 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, 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, 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, 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, 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, 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, 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, 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, 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, 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, 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],
[ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 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:

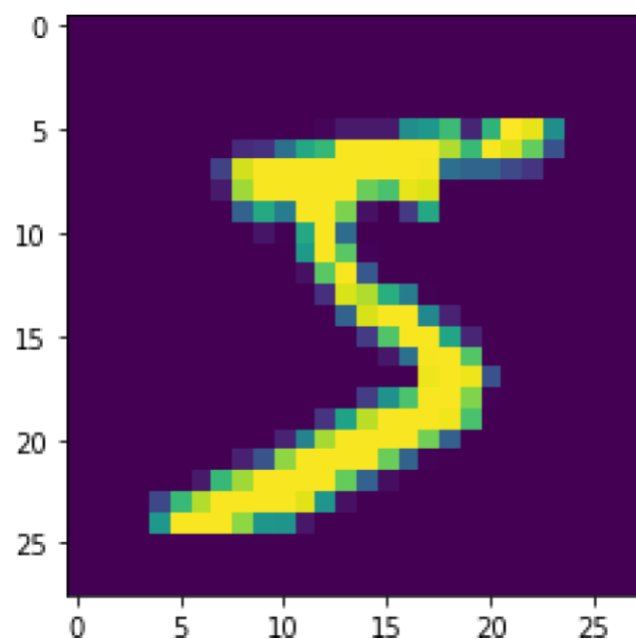
```
y_train[0]
```

Output:

```
5
```

Input:

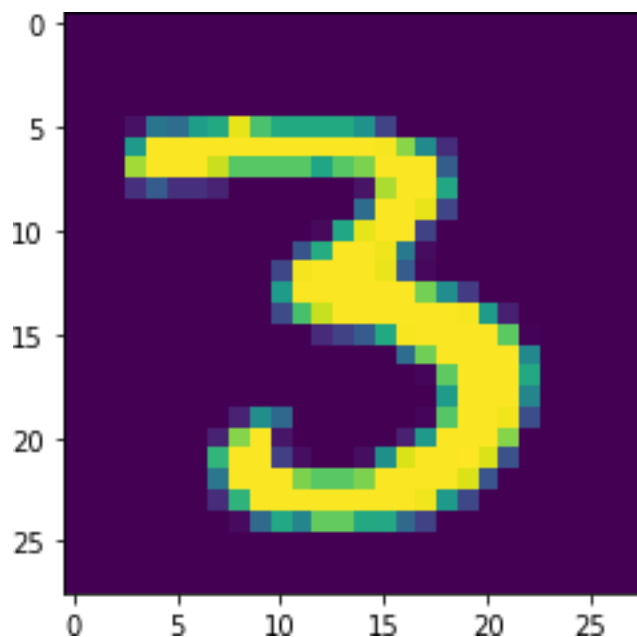
```
Import matplotlib.pyplot as plt plt.imshow(X_train[0])
```



Input:

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

Output:



## 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')
```

## 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)
```