

#Understanding the Data (Sprint-1)

TEAM ID:PNT2022TMID43750

#Import all Necessary Libraries

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

from tensorflow.keras.datasets import mnist

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

x_train

```
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],
```

[illegible]

[illegible]

[illegible]

```

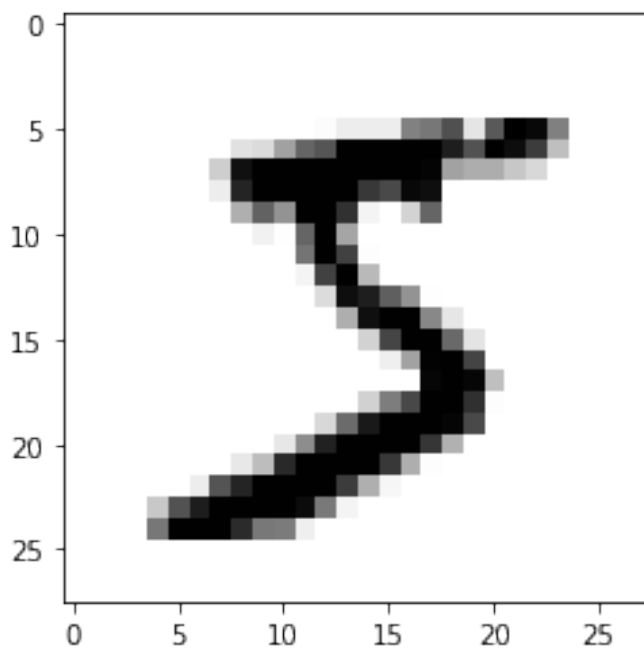
0,
    0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
    0,  0],
[ 0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
    0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
    0,  0],
[ 0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
    0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,
0,
    0,  0]], dtype=uint8)

```

#plot the single image

```
plt.imshow(one_img,cmap='binary')
```

<matplotlib.image.AxesImage at 0x7f36882992d0>



y_train

```
array([5, 0, 4, ..., 5, 6, 8], dtype=uint8)
```

#categories the data

```
from tensorflow.keras.utils import to_categorical
```

y_train.shape

```
(60000,)
```

```
y_example = to_categorical(y_train)
print(y_example,y_example.shape)
```

```
[0. 0. 0. ... 0. 0. 0.]
[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. ... 0. 1. 0.]] (60000, 10)
```

```
y_example[0]
```

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

```
y_cat_test = to_categorical(y_test,num_classes=10)
```

```
y_cat_train = to_categorical(y_train,10)
```

```
one_img.max(),one_img.min()
```

(255, 0)

```
x_train = x_train/255
```

$$x_test = x_test / 255$$

```
scaled_img = x_train[0]
```

```
scaled_img
```

[illegible]

0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.01176471, 0.07058824, 0.07058824,
0.07058824, 0.49411765, 0.53333333, 0.68627451, 0.10196078,
0.65098039, 1. , 0.96862745, 0.49803922, 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0.11764706, 0.14117647,
0.36862745, 0.60392157, 0.66666667, 0.99215686, 0.99215686,
0.99215686, 0.99215686, 0.99215686, 0.88235294, 0.6745098 ,
0.99215686, 0.94901961, 0.76470588, 0.25098039, 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.19215686, 0.93333333, 0.99215686,
0.99215686, 0.99215686, 0.99215686, 0.99215686, 0.99215686,
0.99215686, 0.99215686, 0.98431373, 0.36470588, 0.32156863,
0.32156863, 0.21960784, 0.15294118, 0. , 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.07058824, 0.85882353, 0.99215686,
0.99215686, 0.99215686, 0.99215686, 0.99215686, 0.77647059,
0.71372549, 0.96862745, 0.94509804, 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0.31372549, 0.61176471,
0.41960784, 0.99215686, 0.99215686, 0.80392157, 0.04313725,
0. , 0.16862745, 0.60392157, 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0.05490196,
0.00392157, 0.60392157, 0.99215686, 0.35294118, 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0.54509804, 0.99215686, 0.74509804, 0.00784314,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.],
[0. , 0. , 0. , 0. , 0. ,

0. , 0. , 0. , 0. , 0. ,
0. , 0.04313725, 0.74509804, 0.99215686, 0.2745098 ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.1372549 , 0.94509804, 0.88235294,
0.62745098, 0.42352941, 0.00392157, 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0.31764706, 0.94117647,
0.99215686, 0.99215686, 0.46666667, 0.09803922, 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0.17647059,
0.72941176, 0.99215686, 0.99215686, 0.58823529, 0.10588235,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0.0627451 , 0.36470588, 0.98823529, 0.99215686, 0.73333333,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.97647059, 0.99215686, 0.97647059,
0.25098039, 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0.18039216,
0.50980392, 0.71764706, 0.99215686, 0.99215686, 0.81176471,
0.00784314, 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0.15294118, 0.58039216, 0.89803922,
0.99215686, 0.99215686, 0.99215686, 0.98039216, 0.71372549,
0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. ,],
[0. , 0. , 0. , 0. , 0. ,
0. , 0. , 0. , 0. , 0. ,
0.09411765, 0.44705882, 0.86666667, 0.99215686, 0.99215686,


```

0.99215686, 0.99215686, 0.78823529, 0.30588235, 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          ],
[0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.09019608, 0.25882353,
0.83529412, 0.99215686, 0.99215686, 0.99215686, 0.99215686,
0.77647059, 0.31764706, 0.00784314, 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          ],
[0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.07058824, 0.67058824, 0.85882353, 0.99215686,
0.99215686, 0.99215686, 0.99215686, 0.76470588, 0.31372549,
0.03529412, 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          ],
[0.          , 0.          , 0.          , 0.          , 0.21568627,
0.6745098 , 0.88627451, 0.99215686, 0.99215686, 0.99215686,
0.99215686, 0.95686275, 0.52156863, 0.04313725, 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          ],
[0.          , 0.          , 0.          , 0.          , 0.53333333,
0.99215686, 0.99215686, 0.99215686, 0.83137255, 0.52941176,
0.51764706, 0.0627451 , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          ],
[0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          ],
[0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          , 0.          , 0.          ,
0.          , 0.          , 0.          ]]

```

#reshape the scaled data

x_train = x_train.reshape(60000,28,28,1)

x_test = x_test.reshape(10000,28,28,1)

x_train.shape,x_test.shape

((60000, 28, 28, 1), (10000, 28, 28, 1))