Project Development Phase
Delivery of Sprint-1

Date	**29.10.2022**
Team ID	PNT2022TMID53601
Project Name	Project - A Novel Method for Handwritten Digit Recognition System

Importing the Required Libraries

1. Import the required libraries and datasets

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import keras
from keras.datasets import mnist
from keras.models import Sequential
from keras.layers import Dense,Conv2D, MaxPool2D, Flatten, Dropout
```

Loading the data

2. Load the data into training and testing datasets

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

    X_train.shape, y_train.shape, X_test.shape, y_test.shape
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz
11493376/11490434 [==============================] - 0s 0us/step
11501568/11490434 [==============================] - 0s 0us/step
((60000, 28, 28), (60000,), (10000, 28, 28), (10000,))
```

Analyzing the data

3. Analyze the obtained data by printing a sample value.

```
X_train[1]
```

```
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,  51, 238, 253,
        253, 190, 114, 253, 228,  47,  79, 255, 168,   0,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,  48, 238, 252, 252,
        179,  12,  75, 121,  21,   0,   0, 253, 243,  50,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   0,  38, 165, 253, 233, 208,
         84,   0,   0,   0,   0,   0,   0, 253, 252, 165,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,   7, 178, 252, 240,  71,  19,
         28,   0,   0,   0,   0,   0,   0, 253, 252, 195,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0,  57, 252, 252,  63,   0,   0,
          0,   0,   0,   0,   0,   0,   0, 253, 252, 195,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,   0, 198, 253, 190,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0, 255, 253, 196,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,  76, 246, 252, 112,   0,   0,   0,
          0,   0,   0,   0,   0,   0,   0, 253, 252, 148,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,  85, 252, 230,  25,   0,   0,   0,
          0,   0,   0,   0,   7, 135, 253, 186,  12,   0,   0,   0,
          0,   0],
       [  0,   0,   0,   0,   0,   0,  85, 252, 223,   0,   0,   0,   0,
          0,   0,   0,   0,   7, 131, 252, 225,  71,   0,   0,   0,   0,
          0,   0],
```

Reshaping the data

4. Now, reshape the data by expanding the dimensions of the dataset

```
[6] X_train = X_train.astype((np.float32))/255
    X_test = X_test.astype((np.float32))/255

    X_train = np.expand_dims(X_train,-1)
    X_test = np.expand_dims(X_test,-1)

    X_train.shape
```

```
(60000, 28, 28, 1)
```

Apply One Hot Encoding

5. Apply One hot encoding using to_categorical() function

```
y_train =keras.utils.np_utils.to_categorical(y_train)
y_test =keras.utils.np_utils.to_categorical(y_test)
```