Sprint 2

Team ID - PNT2022TMID41730

Importing the required libraries

In [43]:

```
import numpy as np
import tensorflow #open source used for both ML and DL for computation
from tensorflow.keras.datasets import mnist #mnist dataset
from tensorflow.keras.models import Sequential #it is a plain stack of
layers
from tensorflow.keras import layers #A Layer consists of a tensor- in
tensor-out computat ion funct ion
from tensorflow.keras.layers import Dense, Flatten #Dense-Dense Layer is
the regular deeply connected r
#faltten -used fot flattening the input or change the dimension
from tensorflow.keras.layers import Conv2D #onvoLutiona l Layer
from keras.optimizers import Adam #opt imizer
from keras. utils import np_utils #used for one-hot encoding
import matplotlib.pyplot as plt   #used for data visualization
```

In [44]:

```
(x_train, y_train), (x_test, y_test)=mnist.load_data ()
x_train=x_train.reshape (60000, 28, 28, 1).astype('float32')
x_test=x_test.reshape (10000, 28, 28, 1).astype ('float32')
number_of_classes = 10  #storing the no of classes in a variable
y_train = np_utils.to_categorical (y_train, number_of_classes) #converts
the output in binary format
y_test = np_utils.to_categorical (y_test, number_of_classes)
```

Add CNN Layers

In [45]:

```
#create model
model=Sequential ()
```

In [46]:

```
#adding modeL Layer
model.add(Conv2D(64, (3, 3), input_shape=(28, 28, 1), activation='relu'))
model.add(Conv2D(32, (3, 3), activation = 'relu'))
```

In [47]:

```
#flatten the dimension of the image
model.add(Flatten())
```

In [48]:

```
#output layer with 10 neurons
model.add(Dense(number_of_classes,activation = 'softmax'))
```

Compiling the model

In [49]:

```
#Compile model
model.compile(loss= 'categorical_crossentropy', optimizer="Adam",
metrics=['accuracy'])
```

In [50]:

```
x_train = np.asarray(x_train)
y_train = np.asarray(y_train)
```

Train the model

In [51]:

```
#fit the model
model.fit(x_train, y_train, validation_data=(x_test, y_test), epochs=5,
batch_size=32)
```

```
Epoch 1/5
1875/1875 [==============================] - 120s 63ms/step - loss: 0.2808
- accuracy: 0.9487 - val_loss: 0.1263 - val_accuracy: 0.9649
Epoch 2/5
1875/1875 [==============================] - 95s 50ms/step - loss: 0.0734 -
accuracy: 0.9780 - val_loss: 0.0947 - val_accuracy: 0.9733
Epoch 3/5
1875/1875 [==============================] - 88s 47ms/step - loss: 0.0524 -
accuracy: 0.9839 - val_loss: 0.1133 - val_accuracy: 0.9701
Epoch 4/5
1875/1875 [==============================] - 97s 52ms/step - loss: 0.0375 -
accuracy: 0.9884 - val_loss: 0.1308 - val_accuracy: 0.9720
Epoch 5/5
1875/1875 [==============================] - 96s 51ms/step - loss: 0.0275 -
accuracy: 0.9912 - val_loss: 0.1233 - val_accuracy: 0.9781
```

Out[51]:

Observing the metrics

In [52]:

```
# Final evaluation of the model
metrics = model.evaluate(x_test, y_test, verbose=0)
print("Metrics (Test loss &Test Accuracy) : ")
print(metrics)
```

```
Metrics (Test loss &Test Accuracy) :
[0.12333168834447861, 0.9781000018119812]
```

In [53]:

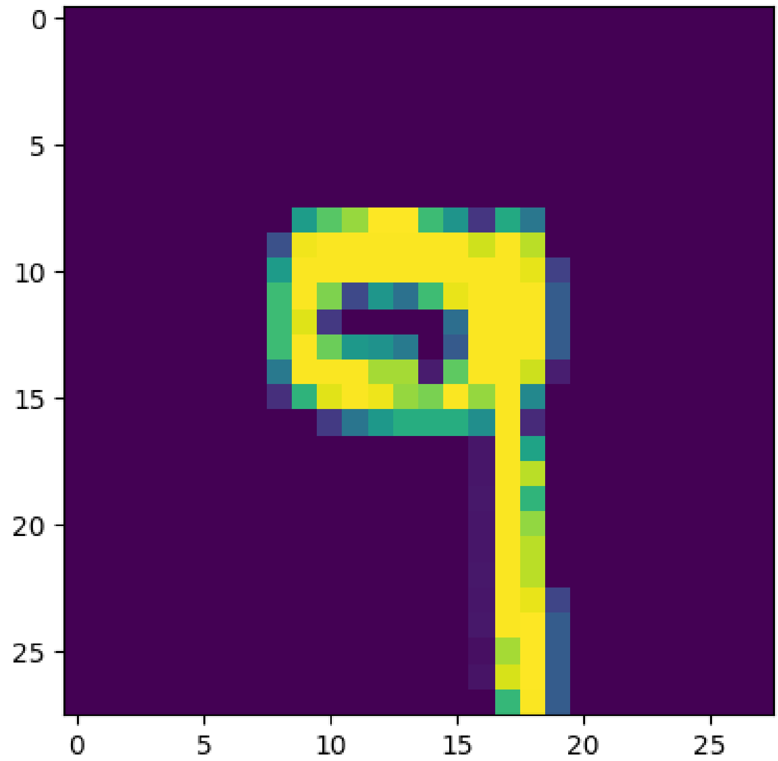
```
prediction=model.predict(x_test[6000:6001])
print(prediction)
```

```
1/1 [==============================] - 0s 93ms/step
[[1.1050688e-15 9.2188809e-14 5.0320639e-15 5.0875104e-10 2.6267043e-01
  1.0428948e-08 5.2634429e-17 2.9271017e-09 6.4425700e-07 7.3732901e-01]]
```

In [54]:

```
plt.imshow(x_test[6000])
```

Out[54]:



In [55]:

```
import numpy as np
print(np.argmax(prediction, axis=1)) #printing our Labels from first 4
images
```

```
[9]
```

In [56]:

```
np.argmax(y_test[6000:6001]) #printing the actual labels
```

Out[56]:

```
9
```

Save The model

In [57]:

```
# Save the model
model.save('models/mnistCNN.h5')
```

In [ ]: