Ashish Kumar B511002 BE-A

Assignment3. Build the Image classification model by dividing the model into following 4 stages: a. Loading and preprocessing the image data b. Defining the model’s architecture c. Training the model d. Estimating the model’s performance

In [1]:
```
#CNN is a type of artificial Neural Network which is widely used for object/image recognition and classificatio
#Deep Learning recognizes objects in an image by using CNN.
```

In [3]:
```
# Import the necessary packages
import tensorflow as tf
from keras.models import Sequential
from keras.layers import Dense,Conv2D,Dropout,Flatten,MaxPooling2D
import matplotlib.pyplot as plt
import numpy as np
```

In [4]:
```
# a. Loading and preprocessing the image data
mnist = tf.keras.datasets.mnist
(x_train, y_train), (x_test, y_test) = mnist.load_data()
input_shape = (28,28,1)  # images are greyscale thats why input chaneel is 1
```

In [5]:
```
# making sure that the values are float so that we can get the decimal points after devision
x_train = x_train.reshape(x_train.shape[0],28,28,1)
x_test = x_test.reshape(x_test.shape[0],28,28,1)

# print('Data type of x_train:',x_train.dtype)

x_train = x_train.astype('float32')
x_test = x_test.astype('float32')

# print('Data type of x_train after converting to float:',x_train.dtype)
```

In [6]:
```
# Normalizing the RGB codes by deviding it to the max RGB value

x_train = x_train/255
x_test = x_test/255

print('shape of training :',x_train.shape)
```

```
shape of training : (60000, 28, 28, 1)
```

In [7]:
```
print('shape of testing :',x_test.shape)
```

```
shape of testing : (10000, 28, 28, 1)
```

In [13]:
```
# b. Defining the model’s architecture

model = Sequential()  # used sequential as we have to add layers one after another
model.add(Conv2D(28, kernel_size=(3,3),input_shape=input_shape))
# kernel size - it is kernel size or filter size, it is an size of each convolutional layer, you can change size
# input shape is input size which we have declared above

model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())

model.add(Dense(200,activation='relu'))  # Hidden Layer
model.add(Dropout(0.3))                  # Will drop some random neurons from hidden layer, 30%neurons will be 
model.add(Dense(10,activation='softmax'))

model.summary()
```

```
C:\ProgramData\anaconda3\Lib\site-packages\keras\src\layers\convolutional\base_conv.py:107: UserWarning: Do not
pass an `input_shape`/`input_dim` argument to a layer. When using Sequential models, prefer using an `Input(shap
e)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 26, 26, 28)	280
max_pooling2d (MaxPooling2D)	(None, 13, 13, 28)	0
flatten (Flatten)	(None, 4732)	0
dense (Dense)	(None, 200)	946,600
dropout (Dropout)	(None, 200)	0
dense_1 (Dense)	(None, 10)	2,010

Total params: 948,890 (3.62 MB)

Trainable params: 948,890 (3.62 MB)

Non-trainable params: 0 (0.00 B)

In [15]:
```
# c. Training the model

model.compile(optimizer = 'adam',
loss = 'sparse_categorical_crossentropy',
metrics = ['accuracy'])

model.fit(x_train,y_train,epochs=5)
```

```
Epoch 1/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 11s 5ms/step - accuracy: 0.8939 - loss: 0.3491
Epoch 2/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 10s 5ms/step - accuracy: 0.9727 - loss: 0.0877
Epoch 3/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 10s 5ms/step - accuracy: 0.9824 - loss: 0.0555
Epoch 4/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 11s 6ms/step - accuracy: 0.9865 - loss: 0.0424
Epoch 5/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 10s 5ms/step - accuracy: 0.9889 - loss: 0.0331
```

Out[15]: <keras.src.callbacks.history.History at 0x1abe8c0bf80>

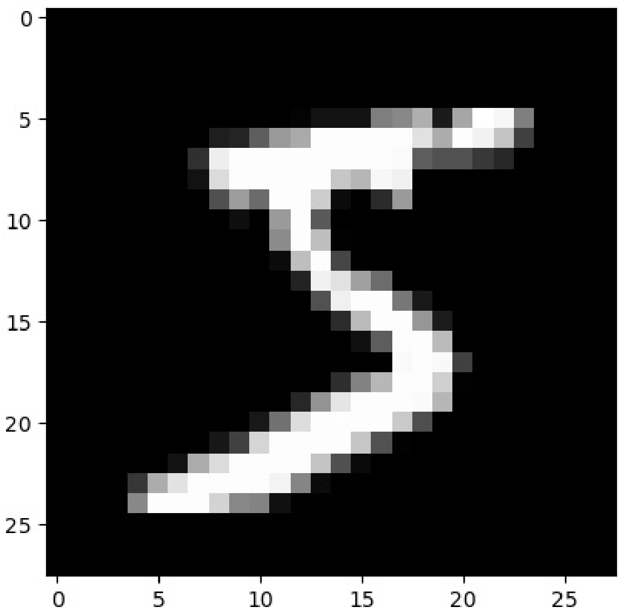
In [16]:
```
# d. Estimating the model’s performance

test_loss, test_acc = model.evaluate(x_test, y_test)
print('loss=%.3f' %test_loss)
print('Accuracy=%.3f' %test_acc)
```

```
313/313 ━━━━━━━━━━━━━━━━━━━━ 0s 965us/step - accuracy: 0.9795 - loss: 0.0671
loss=0.056
Accuracy=0.983
```

In [17]:
```
# Showing image at position[] from dataset

image = x_train[0]
plt.imshow(np.squeeze(image),cmap='gray')  # it will remove arrays of single diamensional
plt.show()
```



In [18]:
```
# predicting the class of image

image = image.reshape(1,image.shape[0],image.shape[1],image.shape[2])
predict_model = model.predict([image])
print('predicted class: {}'.format(np.argmax(predict_model)))  # it displays max value
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 36ms/step
predicted class: 5
```