In [1]:

```
from tensorflow.keras import layers
from tensorflow.keras import models
from keras.datasets import mnist
from keras.utils import to_categorical

(train_images, train_labels), (test_images, test_labels) = mnist.load_data()

model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3), activation='relu', input_shape=(28, 28, 1)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))

model.add(layers.Flatten())
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(10, activation='softmax'))
model.summary()

train_images = train_images.reshape((60000, 28, 28, 1))
train_images = train_images.astype('float32') / 255
test_images = test_images.reshape((10000, 28, 28, 1))
test_images = test_images.astype('float32') / 255
train_labels = to_categorical(train_labels)
test_labels = to_categorical(test_labels)

model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])
model.fit(train_images, train_labels, epochs=5, batch_size=64)

test_loss, test_acc = model.evaluate(test_images, test_labels)

print(test_acc)

model.save('mnist.h5')
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 26, 26, 32)        320

 max_pooling2d (MaxPooling2D  (None, 13, 13, 32)       0
 )

 conv2d_1 (Conv2D)           (None, 11, 11, 64)        18496

 max_pooling2d_1 (MaxPooling  (None, 5, 5, 64)         0
 2D)

 conv2d_2 (Conv2D)           (None, 3, 3, 64)          36928

 flatten (Flatten)           (None, 576)               0

 dense (Dense)               (None, 64)                36928

 dense_1 (Dense)             (None, 10)                650

=================================================================
```

```
Total params: 93,322
Trainable params: 93,322
Non-trainable params: 0
_________________________________________________________________
Epoch 1/5
938/938 [==============================] - 21s 21ms/step - loss: 0.1964 -
accuracy: 0.9398
Epoch 2/5
938/938 [==============================] - 20s 21ms/step - loss: 0.0557 -
accuracy: 0.9828
Epoch 3/5
938/938 [==============================] - 21s 23ms/step - loss: 0.0395 -
accuracy: 0.9877
Epoch 4/5
938/938 [==============================] - 23s 25ms/step - loss: 0.0314 -
accuracy: 0.9901
Epoch 5/5
938/938 [==============================] - 25s 27ms/step - loss: 0.0244 -
accuracy: 0.9924
313/313 [==============================] - 3s 8ms/step - loss: 0.0315 - ac
curacy: 0.9901
0.9901000261306763
```