import tensorflow as tf

from tensorflow.keras.models import Sequential #type:ignore

from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout

from tensorflow.keras.datasets import mnist #type:ignore

from tensorflow.keras.utils import to\_categorical #type:ignore

import matplotlib.pyplot as plt

# Load the MNIST dataset

(x\_train, y\_train), (x\_test, y\_test) = mnist.load\_data()

# Preprocess the data

x\_train = x\_train.reshape(-1, 28, 28, 1).astype('float32') / 255.0

x\_test = x\_test.reshape(-1, 28, 28, 1).astype('float32') / 255.0

y\_train = to\_categorical(y\_train, num\_classes=10)

y\_test = to\_categorical(y\_test, num\_classes=10)

# Build the CNN model

model = Sequential([

Conv2D(32, (3, 3), activation='relu', input\_shape=(28, 28, 1)),

MaxPooling2D((2, 2)),

Conv2D(64, (3, 3), activation='relu'),

MaxPooling2D((2, 2)),

Flatten(),

Dense(128, activation='relu'),

Dropout(0.5),

Dense(10, activation='softmax') # Output layer for 10 classes (digits 0-9)

])

# Compile the model

model.compile(optimizer='adam',

loss='categorical\_crossentropy',

metrics=['accuracy'])

# Train the model

history = model.fit(x\_train, y\_train,

epochs=10,

batch\_size=64,

validation\_split=0.2,

verbose=1)

# Evaluate the model on test data

test\_loss, test\_accuracy = model.evaluate(x\_test, y\_test, verbose=0)

print(f"Test Accuracy: {test\_accuracy \* 100:.2f}%")

#OUTPUT

Epoch 1/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 11s 13ms/step - accuracy: 0.8157 - loss: 0.5674 - val\_accuracy: 0.9809 - val\_loss: 0.0638

Epoch 2/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 9s 12ms/step - accuracy: 0.9717 - loss: 0.0988 - val\_accuracy: 0.9849 - val\_loss: 0.0484

Epoch 3/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 9s 12ms/step - accuracy: 0.9784 - loss: 0.0704 - val\_accuracy: 0.9871 - val\_loss: 0.0430

Epoch 4/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 9s 12ms/step - accuracy: 0.9825 - loss: 0.0543 - val\_accuracy: 0.9876 - val\_loss: 0.0405

Epoch 5/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 10s 13ms/step - accuracy: 0.9866 - loss: 0.0459 - val\_accuracy: 0.9904 - val\_loss: 0.0352

Epoch 6/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 10s 13ms/step - accuracy: 0.9880 - loss: 0.0376 - val\_accuracy: 0.9899 - val\_loss: 0.0372

Epoch 7/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 10s 13ms/step - accuracy: 0.9894 - loss: 0.0340 - val\_accuracy: 0.9886 - val\_loss: 0.0379

Epoch 8/10

750/750 ━━━━━━━━━━━━━━━━━━━━ 10s 13ms/step - accuracy: 0.9903 - loss: 0.0310 - val\_accuracy: 0.9899 - val\_loss: 0.0368

Test Accuracy: 99.09%