```
In [ ]: !pip install tensorflow

import numpy as np
import matplotlib.pyplot as plt
from tensorflow import keras
from tensorflow.keras import layers
from tensorflow.keras.datasets import mnist
```

Requirement already satisfied: tensorflow in /usr/local/lib/python3.12/dist-pac
kages (2.19.0)
Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.12/dis
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l/lib/python3.12/dist-packages (from tensorflow) (0.6.0)
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ages (from tensorflow) (25.0)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.2
1.3,!=4.21.4,!=4.21.5,<6.0.0dev,>=3.20.3 in /usr/local/lib/python3.12/dist-pack
ages (from tensorflow) (5.29.5)
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.1
2/dist-packages (from tensorflow) (2.32.4)
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n3.12/dist-packages (from tensorflow) (4.15.0)
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ackages (from tensorflow) (3.15.1)
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3.12/dist-packages (from tensorflow) (0.5.3)
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dist-packages (from astunparse>=1.6.0->tensorflow) (0.45.1)
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(from keras>=3.5.0->tensorflow) (0.1.0)
Requirement already satisfied: optree in /usr/local/lib/python3.12/dist-package
s (from keras>=3.5.0->tensorflow) (0.17.0)
Requirement already satisfied: charset_normalizer<4,>=2 in /usr/local/lib/pytho

In [ ]:
```python
(train_images, train_labels), (test_images, test_labels) = mnist.load_data()

print("Training data shape:", train_images.shape)
print("Test data shape:", test_images.shape)
```
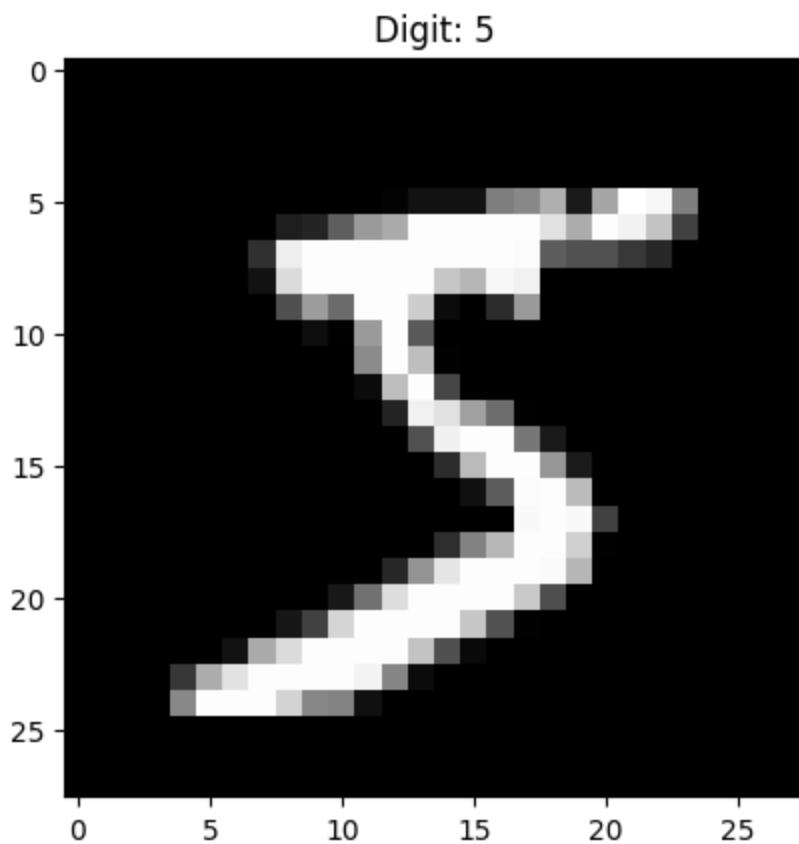
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datase
ts/mnist.npz
11490434/11490434 ──────────────────── **1s** 0us/step
Training data shape: (60000, 28, 28)
Test data shape: (10000, 28, 28)

In [ ]:
```python
image = train_images[0]
label = train_labels[0]
plt.imshow(image, cmap='gray')
plt.title(f"Digit: {label}")
plt.show()
```

Digit: 5

```
In [ ]: train_images = train_images.reshape((60000, 28 * 28))
        test_images = test_images.reshape((10000, 28 * 28))

        # Convert to float and normalize pixel values (0–1)
        train_images = train_images.astype("float32") / 255
        test_images = test_images.astype("float32") / 255
```

```
In [ ]: model = keras.Sequential([
            layers.Dense(512, activation='relu'),
            layers.Dense(10, activation='softmax')
        ])
```

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

```
In [ ]: model.fit(train_images, train_labels, epochs=5, batch_size=128, verbose=1)
```

```
Epoch 1/5
469/469 ──────────────── 6s 11ms/step - accuracy: 0.8681 - loss: 0.4636
Epoch 2/5
469/469 ──────────────── 6s 13ms/step - accuracy: 0.9667 - loss: 0.1176
Epoch 3/5
469/469 ──────────────── 5s 10ms/step - accuracy: 0.9805 - loss: 0.0686
Epoch 4/5
469/469 ──────────────── 6s 12ms/step - accuracy: 0.9860 - loss: 0.0486
Epoch 5/5
469/469 ──────────────── 5s 11ms/step - accuracy: 0.9901 - loss: 0.0358
```

Out[ ]: <keras.src.callbacks.history.History at 0x7a8547f2cbc0>

In [ ]: