```
#Loading the MNIST dataset
import tensorflow as tf
from tensorflow.keras.datasets import mnist
from tensorflow.keras.utils import to_categorical
```

```
#Load Dataset
(x_train, y_train),(x_test, y_test)=mnist.load_data()
```

```
# normalize to range 0-1
x_train = x_train / 255.0
x_test = x_test / 255.0
```

```
# One Hot Encode target values
y_train = to_categorical(y_train)
y_test = to_categorical(y_test)
```

```
# Define Sequential Model

from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Flatten

model = Sequential([
    Flatten(input_shape=(28, 28)),
    Dense(128, activation='relu'),
    Dense(64, activation='relu'),
    Dense(10, activation='softmax')
])
```

```
/usr/local/lib/python3.10/dist-packages/keras/src/layers/reshaping/flatten.py:37: UserWarning: Do not pass an `input_shape`/`input_
  super().__init__(**kwargs)
```

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

```
# Fit Model
history = model.fit(x_train, y_train, epochs=5, batch_size=32, validation_split=0.2)
```

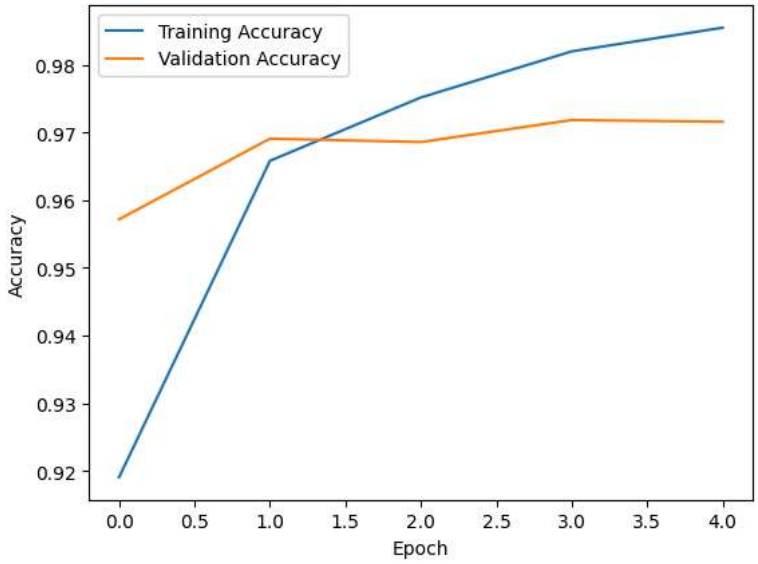
```
Epoch 1/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 10s 3ms/step - accuracy: 0.8585 - loss: 0.4840 - val_accuracy: 0.9572 - val_loss: 0.1497
Epoch 2/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 6s 2ms/step - accuracy: 0.9635 - loss: 0.1232 - val_accuracy: 0.9691 - val_loss: 0.1082
Epoch 3/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 4s 3ms/step - accuracy: 0.9757 - loss: 0.0778 - val_accuracy: 0.9686 - val_loss: 0.1006
Epoch 4/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 3s 2ms/step - accuracy: 0.9823 - loss: 0.0558 - val_accuracy: 0.9718 - val_loss: 0.0962
Epoch 5/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 3s 2ms/step - accuracy: 0.9868 - loss: 0.0418 - val_accuracy: 0.9716 - val_loss: 0.0955
```

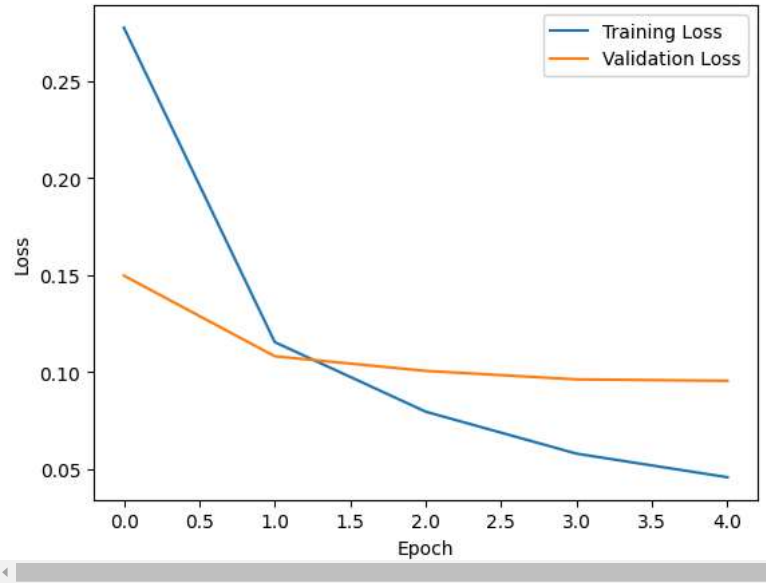
```
# Print Test Accuracy
test_loss, test_acc = model.evaluate(x_test, y_test)
print(f'Test accuracy: {test_acc}')
```

```
313/313 ━━━━━━━━━━━━━━━━━━━━ 1s 3ms/step - accuracy: 0.9686 - loss: 0.1062
Test accuracy: 0.9722999930381775
```

```
import matplotlib.pyplot as plt

# Plot Training Accuracy
plt.plot(history.history['accuracy'], label='Training Accuracy')
plt.plot(history.history['val_accuracy'], label = 'Validation Accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()
plt.show()
# Plot Training Loss
plt.plot(history.history['loss'], label='Training Loss')
plt.plot(history.history['val_loss'], label = 'Validation Loss')
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.legend()
plt.show()
```


Training Accuracy
Validation Accuracy
Accuracy
Epoch
0.92
0.93
0.94
0.95
0.96
0.97
0.98
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0


Training Loss
Validation Loss
Loss
Epoch
0.05
0.10
0.15
0.20
0.25
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0