```
#task-1 datascience
# DEEP LEARNING PROJECT

# IMPLEMENT A DEEP LEARNING MODEL FOR IMAGE CLASSIFICATION OR NATURAL LANGUAGE PROCESSING TENSORFLOW OR PYTORCH USING

# DELIVERABLE: A FUNCTIONAL MODEL WITH VISUALIZATIONS OF RESULTS.
!pip install tensorflow matplotlib numpy

import tensorflow as tf
import matplotlib.pyplot as plt
import numpy as np

def build_and_train_mnist_classifier():
    """
    Builds and trains a simple deep learning model for MNIST digit classification.

    Visualizes the results using Matplotlib.
    """
    # 1. Load and preprocess the MNIST dataset
    (x_train, y_train), (x_test, y_test) = tf.keras.datasets.mnist.load_data()
    x_train, x_test = x_train / 255.0, x_test / 255.0  # Normalize pixel values

    # 2. Build the model
    model = tf.keras.models.Sequential([
        tf.keras.layers.Flatten(input_shape=(28, 28)),  # Input layer (flatten images)
        tf.keras.layers.Dense(128, activation='relu'),   # Hidden layer with ReLU activation
        tf.keras.layers.Dense(10, activation='softmax')  # Output layer with softmax activation
    ])

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

    # 4. Train the model
    history = model.fit(x_train, y_train, epochs=5, validation_data=(x_test, y_test))

    # 5. Visualize results (loss and accuracy)
    plt.figure(figsize=(12, 4))

    plt.subplot(1, 2, 1)
    plt.plot(history.history['loss'], label='Training Loss')
    plt.plot(history.history['val_loss'], label='Validation Loss')
    plt.title('Training and Validation Loss')
    plt.xlabel('Epoch')
    plt.ylabel('Loss')
    plt.legend()

    plt.subplot(1, 2, 2)
    plt.plot(history.history['accuracy'], label='Training Accuracy')
    plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
    plt.title('Training and Validation Accuracy')
    plt.xlabel('Epoch')
    plt.ylabel('Accuracy')
    plt.legend()

    plt.show()

    # 6. Make predictions on some test images
    predictions = model.predict(x_test[:10])
    predicted_labels = np.argmax(predictions, axis=1)

    # 7. Visualize predictions
    plt.figure(figsize=(10, 5))
    for i in range(10):
        plt.subplot(2, 5, i + 1)
        plt.imshow(x_test[i], cmap='gray')
        plt.title(f"Predicted: {predicted_labels[i]}, Actual: {y_test[i]}")
        plt.axis('off')
    plt.show()

    return model

# Build and train the model
model = build_and_train_mnist_classifier()
```

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  super().__init__(**kwargs)
Epoch 1/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 9s 4ms/step - accuracy: 0.8710 - loss: 0.4425 - val_accuracy: 0.9581 - val_loss: 0.1386
Epoch 2/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 8s 4ms/step - accuracy: 0.9646 - loss: 0.1229 - val_accuracy: 0.9703 - val_loss: 0.1000
Epoch 3/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 7s 4ms/step - accuracy: 0.9768 - loss: 0.0791 - val_accuracy: 0.9744 - val_loss: 0.0804
Epoch 4/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 11s 4ms/step - accuracy: 0.9828 - loss: 0.0566 - val_accuracy: 0.9748 - val_loss: 0.0778
Epoch 5/5
1875/1875 ━━━━━━━━━━━━━━━━━━━━ 11s 4ms/step - accuracy: 0.9862 - loss: 0.0438 - val_accuracy: 0.9765 - val_loss: 0.0751
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