Task 4 Write-up

This project implements a **handwritten digit recognition system** using the **MNIST dataset** and a **feedforward neural network** built with **TensorFlow/Keras**. The goal was to train a model to correctly classify grayscale images of digits (0–9) based on pixel patterns.

Workflow:

1. **Data Loading & Exploration** – The MNIST dataset (60,000 training images, 10,000 test images) was loaded and sample digits were visualized to understand the input format.
2. **Preprocessing** – Images were normalized to scale pixel values between 0 and 1 for faster convergence, and labels were one-hot encoded for multi-class classification.
3. **Model Architecture** – A simple yet effective fully connected neural network was built:
    - Flatten layer to convert 28×28 images to a 1D array
    - Dense layer (128 neurons, ReLU activation)
    - Dense layer (64 neurons, ReLU activation)
    - Output layer (10 neurons, Softmax activation)
4. **Training & Evaluation** – The model was trained for 10 epochs with the Adam optimizer, achieving high accuracy on the test set. Training/validation accuracy and loss curves were plotted to assess performance.
5. **Predictions** – The trained model predicted labels for random test images. Predicted vs actual labels were displayed in a visual grid, and the results were automatically saved as a **screenshot** for submission.

Results:

- **Test Accuracy**: ~98% (varies slightly per run)
- Predictions matched actual labels for most test samples, demonstrating the model's strong generalization capability.

Outcome:

This project successfully demonstrates **image classification with neural networks** on a benchmark dataset. The model's high accuracy shows it can be adapted for similar digit or character recognition tasks with minimal modifications.