Introduction and Dataset Overview

Basic Handwritten Digit Recognition Model

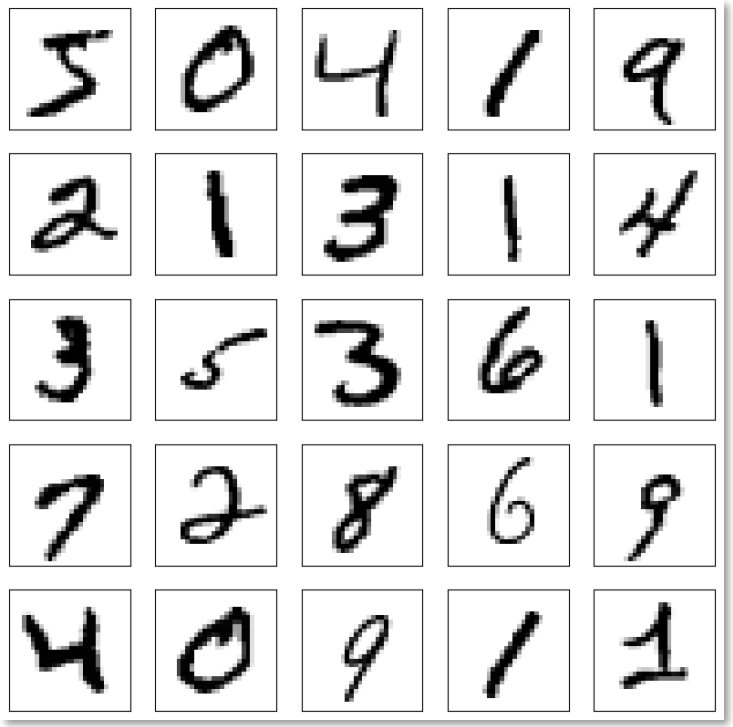
→ This project aims to develop a neural network model capable of recognizing handwritten digits. The goal is to accurately classify images of handwritten digits into their respective numerical values.

Dataset:

Utilized the MNIST dataset containing 70,000 handwritten digits (56,000 for training and 14,000 for testing).

Dataset Details:

- Features: 28x28 grayscale pixel images.
- Target: Numerical values representing digits (0-9).



Problem:

Develop a model that accurately identifies handwritten digits, enabling applications in character recognition.

Data Preprocessing and Exploratory Data Analysis

Data Preprocessing

- Normalization: Scaling pixel values between 0 and 1 for faster convergence.
- Data Cleaning: Noisy data handling (if any) and resizing images.

Key Feature Exploration

- Visualized and analyzed characteristics of handwritten digit images.

→ Real-time Prediction Feature

- Key Feature: Demonstrating the model's real-time prediction capability.
- Implementation: Loading the pre-trained model in a separate Colab file for immediate image prediction.
- Interactive Demonstration: User uploads an image for the model to predict the handwritten digit.

Data Splitting

- Data Split: Segregation into training (56,000) and testing (14,000) sets.
- Split Ratio: 80% Training, 20% Testing

Model Building and Evaluation

Model Selection

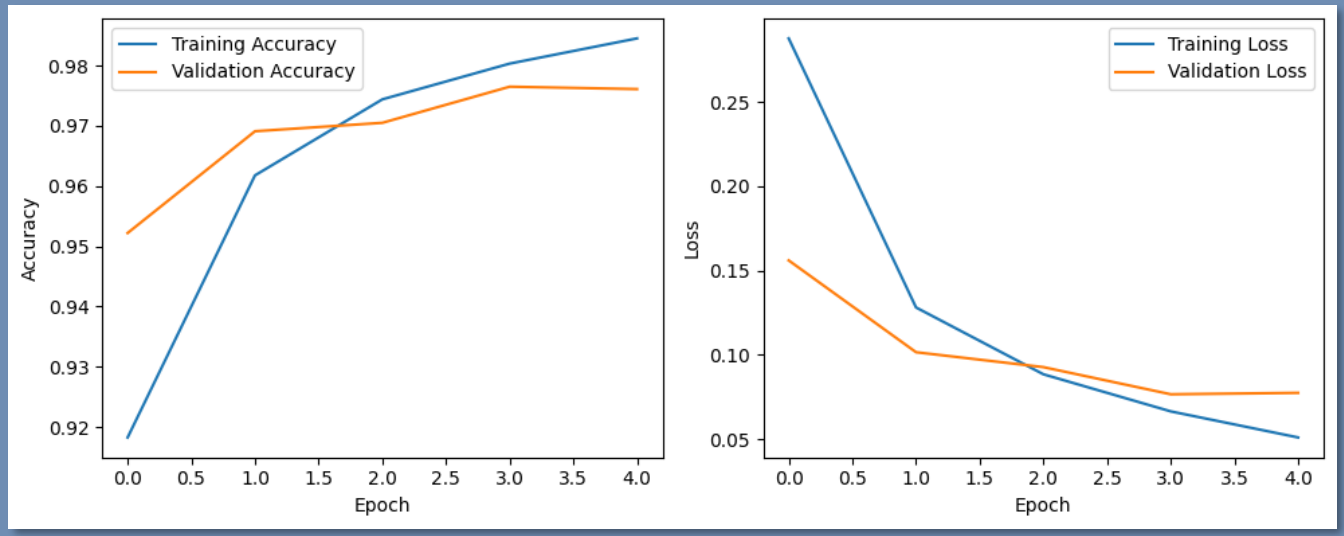
- Chosen Model: Sequential Neural Network with Flatten and Dense layers.
- Reasoning: Designed to learn spatial hierarchies and patterns in images.

Model Training

- Training Overview: Trained over 5 epochs with Adam optimizer and sparse categorical crossentropy loss function.
- Performance: Achieved accuracy of approximately 97.61% on validation data.

```
history = model.fit(x_train, y_train, epochs=5, validation_data=(x_test, y_test))
```

```
Epoch 1/5
1500/1500 [==============================] - 4s 2ms/step - loss: 0.2876 - accuracy: 0.9183 - val_loss: 0.1560 - val_accuracy: 0.9522
Epoch 2/5
1500/1500 [==============================] - 3s 2ms/step - loss: 0.1282 - accuracy: 0.9618 - val_loss: 0.1017 - val_accuracy: 0.9691
Epoch 3/5
1500/1500 [==============================] - 3s 2ms/step - loss: 0.0886 - accuracy: 0.9744 - val_loss: 0.0928 - val_accuracy: 0.9705
Epoch 4/5
1500/1500 [==============================] - 4s 2ms/step - loss: 0.0666 - accuracy: 0.9803 - val_loss: 0.0767 - val_accuracy: 0.9765
Epoch 5/5
1500/1500 [==============================] - 3s 2ms/step - loss: 0.0511 - accuracy: 0.9845 - val_loss: 0.0776 - val_accuracy: 0.9761
```



Model Evaluation and Conclusion

- Model Performance Metrics: Accuracy, loss, and validation metrics plotted for evaluation.
- Conclusion: Highlighted successful model training and performance.