Forecasting Stock Prices: Implementing Simple RNN and LSTM Models

Objective:
The goal of this assignment is to apply Recurrent Neural Networks (RNNs) to predict stock prices using historical data. You will implement both a Simple RNN and an LSTM (Long Short-Term Memory) model and compare their performances in predicting future stock prices.

Data Description:
You will be working with a dataset composed of 2956 stock open prices, each corresponding to a specific day. The task is to predict the open price for the next day based on a rolling window of previous prices.

- **Dataset Source:** https://github.com/Irshad760786/

Instructions:

1. **Data Acquisition and Preprocessing (5 marks):**
   (a) **Handle Missing Data (1 mark):**
      - Check for missing values in the dataset.
      - If missing values are present, handle them appropriately.
   (b) **Normalize Features (2 marks):**
      - Normalize the open prices to a range suitable for training neural networks, typically between 0 and 1.
   (c) **Data Preparation (2 marks):**
      - Use a time step of 50 days.
      - Extract the first 50 open prices (from day 0 to day 49) and assign them to `X_train`.
      - The 51st price (day 50) will be the target value, assigned to `y_train`.
      - Shift the window by one day: prices from day 1 to day 50 will be the new `X_train`.
      - The 52nd price (day 51) will be the new `y_train`.
      - Repeat this process until you reach the end of the dataset.
2. **Model Implementation (6 marks):**

(a) **Simple RNN Implementation (3 marks):**

- Build and compile a Simple RNN model using TensorFlow/Keras.
- Train the model using the prepared `X_train` and `y_train` data.
- Evaluate the model on a testing dataset and record performance metrics.

(b) **LSTM Implementation (3 marks):**

- Build and compile an LSTM model using TensorFlow/Keras.
- Train and evaluate the LSTM model using the same procedure as for the Simple RNN.

3. **Model Evaluation (5 marks):**

- Compare the performance of the Simple RNN and LSTM models using metrics such as:
  - Mean Squared Error (MSE)
  - Root Mean Squared Error (RMSE)
  - Mean Absolute Error (MAE)
- Plot and analyze the predicted vs. actual stock prices for both models to visualize their accuracy.

4. **Analysis and Discussion (4 marks):**

- Provide a detailed analysis of the results.
- Discuss the differences in performance between the Simple RNN and LSTM models.
- Analyze the strengths and weaknesses of each model in the context of stock price prediction.