Apple Stock Price Prediction using LSTM (2010–2023)

🖼️ Project Overview:

This project aims to predict Apple Inc. (AAPL) stock closing prices using a Long Short-Term Memory (LSTM) neural network. It uses historical data from 2010 to 2023, focusing on time series forecasting to understand future stock movement trends.

📊 Dataset:

- **Source**: Yahoo Finance via yfinance library
- **Period**: January 1, 2010 – December 31, 2023
- **Feature Used**: Close price
- **Total Records**: ~3500 daily entries

🧹 Data Preprocessing:

- Selected only the 'Close' price for prediction.
- Applied **MinMaxScaler** to scale data between 0 and 1.
- Split data into:
    - **Training set**: 80%
    - **Testing set**: 20%
- Created sequences of **60 past days** to predict the **61st day** price.

🧠 Model Architecture:

- **Model Type**: Sequential LSTM
- **Layers**:
    - LSTM (50 units, return_sequences=True)
    - Dropout (20%)
    - LSTM (50 units)

    - Dropout (20%)
    - Dense (25 units)
    - Dense (1 output)
- **Loss Function**: Mean Squared Error (MSE)
- **Optimizer**: Adam
- **Training Epochs**: 10
- **Batch Size**: 32

📈 **Model Evaluation:**

- **Root Mean Squared Error (RMSE)**: **5.412374626681074**
- This indicates the model predicts the closing price within an average error of **5.412374626681074**, which is acceptable considering the price range of AAPL during this period (~$10 to $200+).

📉 **Visual Results:**

- The line chart comparing **actual vs predicted** prices shows a close match, especially in recent years.
- The model successfully captured the **trend and seasonality** of the stock movement.

✅ **Key Findings:**

- The LSTM model performed well using only the closing price.
- It can be further improved by:
    - Adding more features (Open, High, Low, Volume)
    - Increasing training epochs
    - Including technical indicators (Moving Average, RSI)

📌 **Conclusion:**

This project demonstrates the potential of deep learning models like LSTM in stock market forecasting. Even with limited features, the model provided reasonably accurate predictions. It can be a strong foundation for more advanced financial time series models.

📂 **Future Work:**

- Forecast future prices (next 30 days)
- Add multivariate inputs
- Deploy the model via a dashboard or web app