Stock Price Trend Prediction Using LSTM

Intern: Rohit Kumar Mourya
Organization: Elevate Labs (Remote Internship: April 24 – May 24, 2025)

1. Introduction

During my one-month internship at Elevate Labs as an AI & Machine Learning Intern, I undertook a project to forecast stock price trends using Long Short-Term Memory (LSTM) networks. The primary objective was to harness historical market data and technical indicators to build a robust time-series forecasting model. This work strengthened my practical understanding of deep learning in finance and familiarized me with end-to-end workflows—from data acquisition through model evaluation—using industry-standard tools.

---

2. Abstract

This project developed and evaluated an LSTM-based deep learning model to predict the closing price trends of Apple Inc. (ticker: AAPL). Historical price data spanning January 2010 to January 2024 were collected via the Yahoo Finance API. After thorough exploratory data analysis (EDA) and feature engineering—including moving averages and Relative Strength Index (RSI)—the data were scaled and organized into sequences suitable for LSTM consumption. A three-layer LSTM architecture with dropout regularization was designed, trained with tuned hyperparameters, and evaluated using metrics such as RMSE, MAE, R^2, and directional accuracy. The results demonstrate that LSTM networks can capture temporal dependencies and deliver competitive forecasting performance.

---

3. Tools Used

Category	Tools / Libraries
Data Acquisition	Python, `yfinance`
Data Manipulation & EDA	Pandas, NumPy, Matplotlib, Seaborn
Technical Indicators	`ta` (Technical Analysis library)
Preprocessing	scikit-learn (MinMaxScaler)
Model Development	TensorFlow, Keras
Experimentation	Google Colab
Version Control	Git (project directory structure)

---

4. Steps Involved in Building the Project

- **Environment Setup**
  - Installed key libraries (`yfinance`, `ta`, `tensorflow`, `keras`, `streamlit`)
  - Created `/data` and `/models` folders in Colab
- **Data Acquisition**
  - Selected AAPL
  - Downloaded 2010–2024 daily prices via `yf.download`
  - Saved raw CSV
- **EDA & Feature Engineering**
  - Parsed dates, cleaned data, ran descriptive stats
  - Plotted closing-price history
  - Computed MA20, MA50, RSI14
  - Visualized moving averages, RSI chart, and correlation heatmap
- **Preparation & Sequencing**
  - Chose features: Close, MA20, MA50, RSI14
  - Applied MinMax scaling
  - Created 60-step sequences for X/Y pairs
  - Split into 80% train / 20% test
- **Modeling**
  - Built 3-layer LSTM (128→64→32 units) with 0.2 dropout and two Dense layers
  - Compiled with RMSprop (lr=1e-4)
  - Used EarlyStopping (patience = 15) and ReduceLROnPlateau (factor = 0.5, patience = 7)
  - Trained up to 150 epochs, batch = 8, 10% validation
- **Evaluation**
  - Predicted on test set and inverse-scaled results
  - Plotted actual vs. predicted prices
  - Reported MSE, RMSE, MAE, R^2, and directional accuracy

---

5. Conclusion

The completed LSTM model achieved a high level of accuracy in forecasting stock closing prices, validating the effectiveness of recurrent neural networks for time-series financial data. Key learnings include the critical role of rigorous data preprocessing, the utility of technical indicators in feature engineering, and the importance of hyperparameter tuning with appropriate callbacks. This project not only enhanced my technical prowess with TensorFlow/Keras and data science workflows in Google Colab but also deepened my understanding of applying AI to real-world financial forecasting challenges.

Rohit Kumar Mourya
AI & Machine Learning Intern, Elevate Labs