Stock Price Trend Prediction with LSTM

1. Introduction

The stock market is inherently volatile and influenced by numerous unpredictable factors. Accurate trend forecasting is a crucial task in the domain of financial analytics. This project aims to predict stock price trends using Long Short-Term Memory (LSTM) neural networks — a type of recurrent neural network (RNN) particularly effective at modeling sequential data.

2. Tools and Technologies

- **Language & Libraries**: Python with pandas, numpy, yfinance, scikit-learn, ta, and tensorflow

- **Frontend**: Streamlit dashboard for real-time interactive prediction and visualization

- **Model**: LSTM model trained using historical stock prices

- **Deployment**: Local or cloud-hosted Streamlit application

3. Data Acquisition and Preprocessing

Stock data is pulled from Yahoo Finance using the yfinance API for the last two years. The features used include:

- Open, High, Low, Close, and Volume prices

- Derived indicators: Moving Average (MA), Relative Strength Index (RSI), and MACD

To ensure consistent scaling for LSTM input, data is normalized using MinMaxScaler. A sliding window of the last 60 days is used to predict the next day's price.

4. Model Architecture

The LSTM model, stored in model_weights.h5, is designed to capture temporal dependencies. Key features:

- One or more LSTM layers to handle sequential patterns

- Dense output layer for predicting a single future price

- Trained using MSE loss and Adam optimizer

The model is trained on closing prices to predict the trend of future prices.

5. Streamlit Dashboard Overview

The application provides a user-friendly interface to:

- Enter a stock ticker symbol (e.g., AAPL)

- Select the number of days to predict (1–30)

- Visualize:

    - **Historical stock prices** (Open, High, Low, Close)

    - **Trading volume**

    - **50-Day Moving Average with Close price**

    - **RSI & MACD indicators**

    - **Predicted future prices** alongside historical prices

Example Visualization

Here's a sample stock chart as generated by the dashboard:

Figure: Historical and Predicted Stock Price Trend

6. Prediction Workflow

1. The app takes the last 60 days of closing prices.

2. Normalizes the data and reshapes it to the model's input format.

3. Predicts the next *n* days sequentially by feeding the model its own previous output.

4. The predictions are then reverse-scaled and plotted.

7. Output and Trading Signal

Alongside numerical predictions, the app computes a trading signal:

- **Buy**: If price is expected to increase by more than 1%

- **Sell**: If price is expected to drop by more than 1%

- **Hold**: Otherwise

These signals are derived from comparing the last real close price to the first predicted price.

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8. Conclusion

This project effectively combines deep learning with a simple, intuitive UI to provide real-time stock price trend forecasts. While the LSTM model shows promising results, users are advised to treat these predictions as educational tools rather than financial advice.

9. Future Work

- Incorporate more features like news sentiment or macroeconomic indicators.

- Improve model performance through hyperparameter tuning or alternative architectures (e.g., GRU, Transformer).

- Deploy as a cloud-hosted application with user authentication and portfolio tracking.

Explore the interactive dashboard: https://stocktrendai.streamlit.app/

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