Stock Price Trend Prediction Using LSTM Neural Networks

Introduction

Predicting stock prices accurately is a challenging and highly sought capability in financial technology. This project implements a Long Short-Term Memory (LSTM) neural network to forecast stock price trends using historical market data. By leveraging time-series analysis and deep learning techniques, the model aims to capture complex patterns in stock movements, improving prediction reliability over traditional statistical models. The project further integrates popular technical indicators to enrich data representation, offering a comprehensive dashboard for user interaction and visualization.

Abstract

This project builds an end-to-end stock trend prediction system. It combines data acquisition from Yahoo Finance, feature preparation including Moving Averages, RSI, MACD, and Bollinger Bands, and trains a bidirectional LSTM model implemented in Keras. The model is optimized to predict near-future price trends based on past behavior. The solution features an interactive Streamlit web dashboard for real-time stock selection, parameter tuning, model training, and forecasting, complete with graphical visualizations and export capabilities. This approach demonstrates the practical utility of deep learning in financial forecasting and user-centric system design.

Tools Used

- Python: Core programming language.
- yfinance: Fetching historical stock market data.
- Pandas & NumPy: Data manipulation and numerical computations.

- TA-Lib / ta: Calculation of technical indicators (RSI, MACD, Bollinger Bands).
- TensorFlow/Keras: Construction and training of the LSTM neural network.
- Scikit-learn: Data scaling and preprocessing.
- Plotly & Matplotlib: Interactive and static data visualization.
- Streamlit: Dashboard development and deployment framework.

Steps Involved in Building the Project

1. Data Acquisition
   Historical stock data is retrieved using the yfinance API for user-specified tickers and date ranges.
2. Data Preprocessing & Feature Engineering
   Raw data undergoes normalization and is augmented with Moving Averages, Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), and Bollinger Bands indicators to capture market momentum and volatility.
3. Sequence Preparation for LSTM
   Time windows (lookback days) are converted into input sequences with corresponding target values to train the sequential model effectively.
4. LSTM Model Construction & Training
   A bidirectional LSTM architecture with dropout is designed to handle temporal dependencies. The model is trained with options for epochs, batch size, and dropout rate to optimize performance.
5. Prediction & Forecasting
   The trained model generates future stock price forecasts for specified forecast days, providing actionable insights.
6. Dashboard Development
   An interactive Streamlit dashboard integrates all functionalities, including parameter tuning, model training, technical indicator visualization, real-time forecasting, and CSV export of forecast data.

Conclusion

This project demonstrates the application of LSTM networks to enhance stock price prediction accuracy using technical indicators. The interactive dashboard enables users to customize models, visualize data, and generate forecasts effectively. Although market prediction is inherently uncertain, this framework offers a solid foundation for future improvements and practical financial analytics