Project Report: Stock Price Trend Prediction Using LSTM

1. Introduction

The stock market is known for its volatility and sensitivity to a wide range of factors like global events, company news, and investor sentiment. Because of this, accurately predicting stock prices is a difficult task. However, with the advancement of machine learning, especially in time series models like LSTM (Long Short-Term Memory), it's now possible to identify trends and make reasonable predictions. This project explores how LSTM can be applied to stock price data to observe and predict future price movements, using historical stock data and a couple of well-known technical indicators like Moving Average (MA) and the Relative Strength Index (RSI).

2. Abstract

This project involves building a deep learning model using LSTM to predict future trends in stock prices. The data was collected using the Yahoo Finance API via the `yfinance` Python library, covering historical stock prices over several years. To improve the model's ability to learn from the data, technical indicators such as the 20-day Moving Average and RSI were added. After preprocessing and preparing the data, an LSTM model was built and trained using Keras. To make the results interactive, a web application was developed using Streamlit, allowing users to input any stock ticker and get a visual trend prediction along with MA and RSI values. While not intended to provide financial advice, this project demonstrates the use of LSTM models for time-series forecasting in a real-world context.

3. Tools Used

- Python - Programming language used throughout the project

- Pandas / NumPy - For data preprocessing and manipulation

- Matplotlib / Seaborn - For data visualization

- TensorFlow / Keras - To design, train, and evaluate the LSTM model

- yfinance - For downloading historical stock price data

- ta - Technical Analysis library used to compute RSI and MA

- Streamlit - For creating a simple, interactive web-based dashboard

4. Steps Involved in Building the Project

1. Data Collection: Historical stock data was pulled using the `yfinance` library from Yahoo Finance.

2. Data Preprocessing: The data was cleaned, normalized, and transformed into sequences for time series modeling.

3. Technical Indicators: RSI and a 20-day Moving Average were calculated and added as additional features.

4. Model Design: An LSTM model was created using Keras, with stacked layers for better learning of time dependencies.

5. Training and Evaluation: The model was trained on part of the data and tested on the rest to measure performance.

6. Visualization: Plots comparing actual and predicted stock prices were generated.

7. Dashboard Deployment: A Streamlit interface was created to allow users to input stock tickers and view predictions.

5. Conclusion

This project demonstrates how LSTM-based models can be used to analyze and predict stock price trends with reasonable accuracy. The inclusion of technical indicators like MA and RSI helped the model understand market behavior better. While the model doesn't claim to predict prices with full accuracy, it shows potential in identifying general trends. The Streamlit dashboard makes the tool accessible and user-friendly. There are many ways this project can be improved, such as adding more indicators, using different models, or incorporating real-time news sentiment for deeper analysis.