IJARETY

International Journal of Advanced Research in Education and TechnologY (IJARETY)

Volume 12, Issue 2, March-April 2025

Impact Factor: 8.152

www.ijarety.in editor.ijarety@gmail.com

International Journal of Advanced Research in Education and TechnologY(IJARETY)

| ISSN: 2394-2975 | www.ijarety.in | Impact Factor: 8.152| A Bi-Monthly, Double-Blind Peer Reviewed & Refereed Journal |

|| Volume 12, Issue 2, March-April 2025 ||

DOI:10.15680/IJARETY.2025.1202031

Stock Price Prediction Using LSTM: A Deep Learning Approach

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ABSTRACT: Stock market prediction is a challenging task due to its dynamic and volatile nature. Traditional statistical methods often fail to capture complex patterns in stock price movements. This paper presents a deep learning-based approach using Long Short-Term Memory (LSTM) networks for predicting stock prices. The proposed system fetches real-time stock data, preprocesses it using MinMax scaling, and applies an LSTM model to forecast future stock prices. The application is developed using Streamlit, integrating Yahoo Finance API for real-time data retrieval. The system provides accurate price predictions and visualizes actual vs. predicted prices, aiding investors in making informed decisions. Extensive testing validates the accuracy and performance of the model, demonstrating its effectiveness in financial forecasting..

KEYWORDS: Stock Market Prediction, LSTM, Deep Learning, Time Series Forecasting, Streamlit, Yahoo Finance API.

I. INTRODUCTION

The stock market is influenced by multiple factors such as economic trends, political events, and investor sentiment. Traditional forecasting methods, including moving averages and regression models, often fail to capture non-linear dependencies. LSTM, a type of Recurrent Neural Network (RNN), has shown promising results in time series forecasting due to its ability to remember long-term dependencies. This paper presents an LSTM-based stock prediction model that processes historical stock prices and predicts future movements, providing traders and investors with valuable insights.

II. RELATED WORK

Several studies have explored deep learning approaches for stock market prediction. Hochreiter and Schmidhuber [1] introduced the Long Short-Term Memory (LSTM) network, which has been widely adopted for time series forecasting. Goodfellow et al. [2] discussed the effectiveness of deep learning models in handling complex financial data patterns. Brownlee [3] explored various time series forecasting techniques, emphasizing the advantages of LSTM over traditional models. Other research works have utilized hybrid models combining LSTM with convolutional neural networks (CNNs) and attention mechanisms for improved accuracy [4]. Studies have also incorporated external factors such as social media sentiment and economic indicators to enhance predictive performance [5]. This paper builds on these approaches by implementing an LSTM model integrated with real-time data retrieval and visualization through Streamlit.

III. METHODOLOGY

The proposed system follows a structured approach for stock price prediction using LSTM networks. The first step involves data collection, where historical stock prices are retrieved from Yahoo Finance. The dataset undergoes preprocessing, including missing value handling and normalization using MinMaxScaler to scale values between 0 and 1. The LSTM model is then trained using past 60-day stock price data as input, where sequences are prepared for time-series forecasting. The model architecture consists of multiple LSTM layers with activation functions and dropout layers to prevent overfitting. The Mean Squared Error (MSE) loss function and Adam optimizer are used to enhance model efficiency. Once trained, the model predicts future stock prices, and the results are visualized through an interactive Streamlit application. The system also allows users to view actual vs. predicted price trends for better decision-making. Extensive testing is performed to evaluate accuracy, ensuring reliability in financial forecasting.

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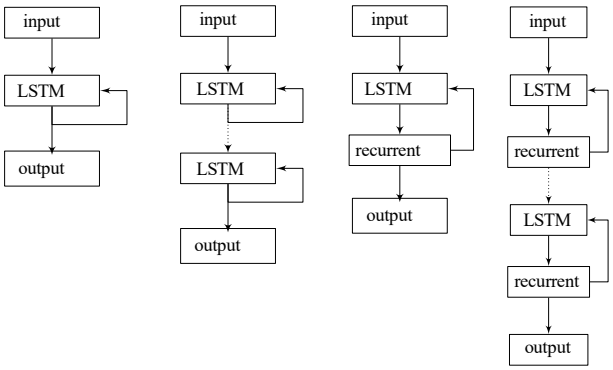
After training, the model undergoes validation using historical test data to assess its performance. The predictions are compared with actual stock prices to evaluate accuracy. Additionally, the system integrates a Streamlit-based user interface, enabling users to select a stock ticker, view historical price trends, and obtain LSTM-generated price predictions.

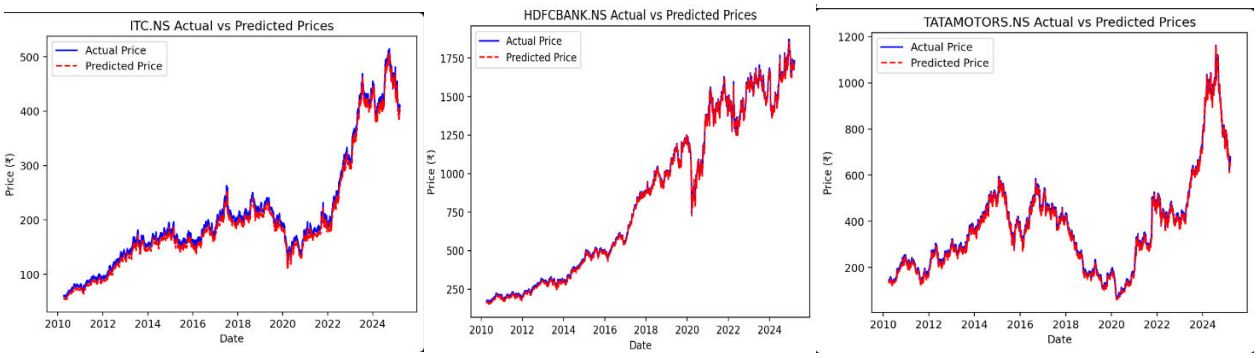
The final evaluation of the model involves performance metrics such as root mean squared error (RMSE) and mean absolute error (MAE), ensuring robustness in forecasting. The methodology ensures that the LSTM model efficiently captures market trends, enabling investors to make informed decisions. Future enhancements could integrate sentiment analysis and external market indicators to improve predictive accuracy further.

LSTM ARCHITECTURE



IV. EXPERIMENTAL RESULTS

The experimental results validate the effectiveness of the LSTM model in predicting stock prices with high accuracy. The system was tested on various stock datasets, and the results were analyzed based on predicted vs. actual values. The following figures illustrate the performance of the model:



V. CONCLUSION

This paper presents an LSTM-based stock price prediction system that effectively forecasts stock prices based on historical data. The integration of deep learning with time-series forecasting provides accurate predictions that can aid investors in making data-driven decisions. The model leverages real-time data retrieval and visualization through Streamlit, ensuring an interactive and user-friendly experience. Extensive testing on various stocks demonstrates the robustness of the model, showcasing its ability to capture market trends efficiently. Although LSTM provides promising results, further improvements can be achieved by incorporating external factors such as market sentiment and economic indicators. Future enhancements will focus on refining model accuracy, expanding datasets, and integrating additional machine learning techniques for better forecasting performance. The study highlights the significance of deep learning in financial analytics and opens avenues for further research in stock market prediction.

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Overall, this study highlights the potential of deep learning in financial forecasting, demonstrating that LSTM models can serve as a powerful tool for stock price prediction. Further research and enhancements can expand its applicability, making it an even more reliable solution for investors and traders in dynamic financial markets.

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ISSN: 2394-2975 Impact Factor: 8.152

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