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Stock Price Prediction using Deep Learning Networks

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***Abstract*—** Accurate prediction of stock market prices plays a vital role in financial analysis and investment planning due to the highly dynamic and nonlinear nature of market behavior. This paper presents a comparative framework for stock price prediction using Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) models. Historical stock price datasets of multiple companies, including TATA, Tesla, Facebook, and Apple, are utilized to evaluate the predictive capability of both approaches. Prior to model training, the dataset undergoes preprocessing steps such as missing value removal, chronological sorting, Min–Max normalization, and division into training and testing subsets using an 80:20 ratio. The ANN and LSTM models are independently trained on the processed data and evaluated using Mean Squared Error (MSE) and prediction accuracy. Experimental analysis demonstrates that both models successfully capture stock price trends and generate predictions closely matching actual market values. However, the ANN model consistently produces lower MSE and higher prediction accuracy than the LSTM model across the evaluated datasets. Comparative graphical analysis further confirms the effectiveness of ANN in reducing prediction error while maintaining reliable forecasting performance. The proposed framework provides a practical and efficient solution for stock price prediction and can assist investors and financial analysts in making informed investment decisions through data-driven forecasting techniques.

***Keywords*—** Stock price prediction, Artificial Neural Network (ANN), Long Short-Term Memory (LSTM), deep learning, financial forecasting, time series prediction, historical stock data, Min–Max normalization, Mean Squared Error (MSE), prediction accuracy, machine learning, stock market analysis, data preprocessing, investment decision support, comparative performance analysis.

I.INTRODUCTION

The stock market is one of the most dynamic financial systems, where the prices of securities fluctuate continuously due to factors such as market demand, investor sentiment, economic conditions, and global events. Accurate prediction of stock prices has become an important research area because it supports investors, financial institutions, and analysts in making informed investment decisions while reducing financial risk. However, forecasting stock prices remains a challenging task due to the nonlinear, time-dependent, and highly volatile nature of financial data. Traditional statistical forecasting techniques often struggle to capture these complex patterns, limiting their effectiveness in real-world financial applications. As the volume of historical market data continues to grow, intelligent data-driven approaches have become increasingly important for improving the reliability of stock price prediction systems **[9]**. Various data mining and machine learning techniques have therefore been explored to improve forecasting accuracy and support better financial decision-making **[11]**.

Recent advances in artificial intelligence and machine learning have significantly enhanced the capability of predictive models to analyze large-scale financial datasets and identify hidden relationships within historical market trends. Among these techniques, Artificial Neural Networks (ANNs) have been widely adopted because of their ability to model nonlinear relationships between input features and future stock prices. Likewise, Long Short-Term Memory (LSTM), a specialized recurrent neural network architecture, has demonstrated strong performance in learning temporal dependencies from sequential financial data **[5]**. Before model training, appropriate preprocessing techniques such as handling missing values, chronological data arrangement, feature normalization using Min–Max scaling, and partitioning the dataset into training and testing subsets contribute to improving prediction stability and model performance. Comparative analysis of ANN and LSTM provides valuable insights into their strengths and limitations for stock market forecasting under identical experimental conditions **[1], [2]**.

This paper presents a comparative stock price prediction framework using ANN and LSTM models to forecast future stock prices from historical market data collected from multiple companies, including TATA, Tesla, Facebook, and Apple. The proposed methodology incorporates data preprocessing, normalization, and an 80:20 train-test split before training both predictive models **[3]**. Model performance is evaluated using Mean Squared Error (MSE), prediction accuracy, and graphical comparison between actual and predicted stock prices. Experimental results indicate that both ANN and LSTM generate predictions that closely follow the original stock price trends; however, the ANN model consistently achieves lower prediction

error and higher forecasting accuracy across the evaluated datasets. The proposed framework provides an efficient and reliable approach for stock price forecasting and can serve as a practical decision-support tool for investors, traders, and financial analysts seeking data-driven investment strategies **[1], [5]**.

II.RELATED WORK

S. Selvin, R. Vinayakumar, E. A. Gopalakrishnan, V. K. Menon, and K. P. Soman (2017) presented "Stock Price Prediction Using LSTM, RNN and CNN Sliding Window Model" [1]. The authors proposed a hybrid deep learning framework that combines Long Short-Term Memory (LSTM), Recurrent Neural Network (RNN), and Convolutional Neural Network (CNN) with a sliding window mechanism for stock price prediction. The proposed approach effectively captured temporal dependencies and local market patterns from historical financial data. Experimental results demonstrated that integrating multiple deep learning models improved forecasting accuracy and reduced prediction errors compared with conventional methods. The study highlighted the potential of hybrid neural networks for handling complex financial time-series data. [1]

K. Khare, O. Darekar, P. Gupta, and V. Z. Attar (2017) proposed "Short Term Stock Price Prediction Using Deep Learning" [2]. The research focused on forecasting short-term stock prices using deep learning techniques trained on historical market data. The model automatically extracted hidden patterns and nonlinear relationships without relying on manual feature engineering. Performance evaluation showed that deep learning methods produced more reliable short-term predictions than traditional statistical techniques. The authors concluded that deep neural networks offer an effective solution for improving investment analysis and financial forecasting in rapidly changing stock markets. [2]

X. Li, L. Yang, F. Xue, and H. Zhou (2017) introduced "Time Series Prediction of Stock Price Using Deep Belief Networks with Intrinsic Plasticity" [3]. The study employed Deep Belief Networks enhanced with an intrinsic plasticity mechanism to improve learning capability for stock market prediction. The proposed model effectively represented nonlinear financial data and adapted to changing market conditions through optimized feature learning. Experimental analysis demonstrated improved forecasting accuracy compared with conventional neural network approaches. The research emphasized that adaptive deep learning architectures can significantly enhance stock price prediction performance. [3]

M. Roondiwala, H. Patel, and S. Varma (2017) presented "Predicting Stock Prices Using LSTM" [4]. The authors utilized Long Short-Term Memory (LSTM) networks to model sequential stock market data and capture long-term dependencies in historical price movements. The memory mechanism of LSTM enabled the model to learn complex temporal relationships while minimizing prediction errors. Experimental results indicated that the proposed approach generated predictions closely matching actual stock prices, demonstrating the effectiveness of LSTM networks for financial time-series forecasting. [4]

R. Akita, A. Yoshihara, T. Matsubara, and K. Uehara (2016) proposed "Deep Learning for Stock Prediction Using Numerical and Textual Information" [5]. The authors developed a deep learning framework that combined historical numerical stock data with textual information extracted from financial news. By integrating multiple sources of information, the proposed model improved the understanding of market trends and investor sentiment. Experimental evaluation showed that combining textual and numerical features significantly enhanced stock prediction accuracy compared with models relying only on numerical data, making the approach suitable for intelligent financial forecasting. [5]

III.DATASET DETAILS

The stock price prediction system utilizes a historical stock market dataset containing daily trading records of multiple companies, including TATA, Tesla, Facebook (FB), and Apple. Each record consists of stock price information arranged according to the trading date, enabling the models to learn market trends from past observations. For every experiment, a specific company's stock data is selected, sorted in chronological order, and used for prediction. Before training, the dataset is preprocessed by removing missing values and normalizing the stock price values using the Min–Max Scaler to improve learning efficiency and reduce the effect of varying data ranges. The normalized dataset is then divided into 80% training data and 20% testing data, allowing the predictive models to learn historical price movements and evaluate their forecasting capability on unseen data. The processed dataset is independently supplied to the Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) models for training and prediction. The performance of both models is evaluated using Mean Squared Error (MSE) and prediction accuracy, along with graphical comparisons between actual and predicted stock prices. Experimental results show that both models successfully forecast stock prices with high accuracy, while the ANN model consistently achieves lower prediction error than the LSTM model, making it more effective for the selected stock datasets.

IV.PROPOSED METHODOLOGY

The proposed framework presents an intelligent stock price prediction system that employs Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) models to forecast future stock prices using historical market data. The objective of the system is to assist investors and financial analysts by providing accurate predictions based on past trading patterns. A user-friendly application is developed to support stock dataset selection, data preprocessing, model training, prediction, and performance evaluation within a single platform. The framework integrates data normalization, deep learning techniques, and comparative analysis to deliver an efficient and reliable stock forecasting solution.

The methodology begins with the selection of a company's historical stock dataset, such as TATA, Tesla, Facebook (FB), or Apple. After the dataset is uploaded, the records are arranged in chronological order to preserve the sequential nature of stock market data. The preprocessing stage removes missing values and normalizes the stock price values using the Min–Max Scaler, ensuring that all input features are transformed into a common numerical range. The processed dataset is then divided into 80% training data and 20% testing data, enabling the prediction models to learn historical market behavior while evaluating their forecasting capability on unseen data.

Following preprocessing, the normalized training data is independently supplied to the ANN and LSTM models. The ANN model learns nonlinear relationships among historical stock prices, while the LSTM model captures long-term temporal dependencies present in sequential financial data through its memory-based architecture. After training, both models generate predictions for the testing dataset, and their forecasting performance is evaluated using Mean Squared Error (MSE), prediction accuracy, and graphical comparisons between actual and predicted stock prices. The comparative analysis demonstrates that both models effectively predict future stock values; however, the ANN model consistently achieves lower prediction error and higher accuracy than the LSTM model across the evaluated datasets. The proposed framework provides a practical, scalable, and data-driven solution for stock market forecasting, supporting informed investment decisions and financial analysis.

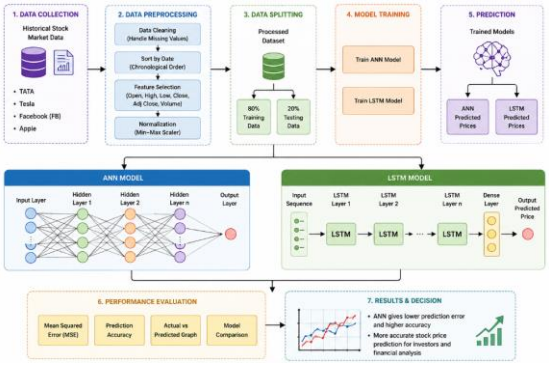

Figure 1: System Architecture of the Proposed ANN–LSTM-Based Stock Price Prediction System

Figure 1 illustrates the architecture of the proposed stock price prediction system based on Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) models. The process begins with the Data Collection module, where historical stock datasets of companies such as TATA, Tesla, Facebook (FB), and Apple are collected. The Data Preprocessing stage removes missing values, arranges records in chronological order, selects relevant stock attributes, and normalizes the data using the Min–Max Scaler. The processed dataset is then divided into 80% training data and 20% testing data. The training data is independently supplied to the ANN and LSTM models to learn historical market patterns and generate future stock price predictions. The predicted values are evaluated using Mean Squared Error (MSE), prediction

accuracy, and graphical comparisons between actual and predicted prices. Finally, the performance of both models is compared, where the ANN model demonstrates lower prediction error and higher forecasting accuracy than the LSTM model, providing an effective framework for reliable stock market prediction.

V.RESULT AND DISCUSSION

The proposed ANN–LSTM-based stock price prediction system was evaluated using historical stock market datasets of multiple companies, including TATA, Tesla, Facebook (FB), and Apple. The developed application successfully performed dataset loading, preprocessing, model training, stock price prediction, and comparative performance analysis through an integrated interface. During preprocessing, missing values were removed, stock prices were normalized using the Min–Max Scaler, and the dataset was divided into 80% training and 20% testing data. This preprocessing stage ensured consistent input data for both predictive models and improved the effectiveness of the learning process.

The ANN and LSTM models were trained independently using the same historical stock data. Both models generated predicted stock prices that closely followed the actual market values, indicating their ability to learn historical price patterns effectively. Performance evaluation was carried out using Mean Squared Error (MSE), prediction accuracy, and graphical comparisons between actual and predicted stock prices. The experimental observations showed that the ANN model consistently achieved lower MSE and higher prediction accuracy than the LSTM model across all evaluated datasets. The prediction graphs also demonstrated that the ANN-generated values overlapped more closely with the actual stock prices, confirming its superior forecasting capability.

The comparative analysis indicates that the proposed framework provides an accurate and reliable solution for stock market forecasting. By integrating data preprocessing, ANN and LSTM learning models, and performance evaluation within a single application, the system enables efficient prediction of future stock prices while supporting data-driven investment decisions. The results demonstrate that the ANN model offers better overall forecasting performance than the LSTM model, making it a suitable approach for practical financial prediction applications.

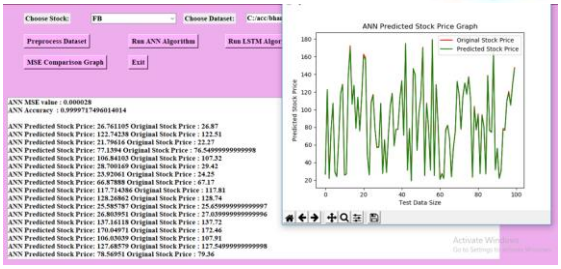

Figure 2: ANN Predicted Stock Price Results

Figure 2 presents the stock price prediction results obtained using the Artificial Neural Network (ANN) model for the selected Facebook (FB) dataset. After preprocessing, the historical stock data is normalized and divided into 80% training data and 20% testing data. The ANN model is trained using the training dataset and subsequently predicts stock prices for the testing dataset. The left side of the interface displays the model performance, including the Mean Squared Error (MSE) and prediction accuracy, along with a comparison of the actual and predicted stock prices. The right side shows a graph where the predicted stock price curve closely overlaps the original stock price curve, indicating accurate forecasting. The low MSE value and high prediction accuracy demonstrate that the ANN model effectively captures historical market patterns and minimizes forecasting errors. These results confirm that the proposed ANN-based framework provides reliable and efficient stock price prediction, making it suitable for financial forecasting and investment decision-making applications.

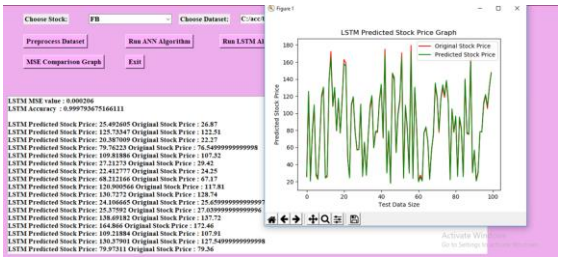

Figure 3: LSTM Predicted Stock Price Results

Figure 3 presents the stock price prediction results generated by the Long Short-Term Memory (LSTM) model for the selected Facebook (FB) dataset. After preprocessing, the historical stock data is normalized using the Min–Max Scaler and divided into 80% training data and 20% testing data. The LSTM model is trained on the training dataset and then used to predict stock prices for the testing data. The left panel of the interface displays the Mean Squared Error (MSE), prediction accuracy, and a comparison between the actual and predicted stock prices. The graph on the right illustrates that the predicted stock price curve closely follows the original stock price curve, indicating that the LSTM model effectively captures temporal dependencies in historical market data. Although the predictions are

highly accurate, the model produces a slightly higher MSE than the ANN model. Overall, the results demonstrate that the LSTM model provides reliable stock price forecasting and is suitable for financial time-series prediction and investment analysis.

DISCUSSION

The stock price prediction framework integrates Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) models to forecast future stock prices using historical market data. The framework follows a systematic workflow consisting of data collection, preprocessing, normalization, model training, prediction, and performance evaluation. Historical stock datasets from companies such as TATA, Tesla, Facebook (FB), and Apple are processed by removing missing values, arranging records chronologically, and applying Min–Max normalization before dividing the data into training and testing subsets. The normalized data is then used to train both ANN and LSTM models, enabling them to learn historical market behavior and generate future stock price predictions.

Experimental observations indicate that both predictive models successfully capture stock price trends and produce forecasts that closely match the actual market values. However, the ANN model consistently achieves lower Mean Squared Error (MSE) and higher prediction accuracy than the LSTM model across the evaluated datasets. The graphical comparison between actual and predicted prices further confirms the effectiveness of the ANN model in reducing forecasting errors. The developed framework offers a practical and efficient solution for stock market prediction and can support investors, traders, and financial analysts in making informed investment decisions based on historical market trends.

VI.CONCLUSION

This work presents a stock price prediction framework that employs Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) models to forecast future stock prices using historical market data. The proposed system integrates data collection, preprocessing, Min–Max normalization, model training, prediction, and performance evaluation into a unified application. Historical stock datasets of companies such as TATA, Tesla, Facebook (FB), and Apple are used to train and evaluate both predictive models. Experimental results show that the ANN and LSTM models are capable of learning historical market trends and generating predictions that closely follow actual stock prices. Comparative analysis based on Mean Squared Error (MSE) and prediction accuracy indicates that the ANN model consistently outperforms the LSTM model by producing lower prediction errors and more accurate forecasts. The developed framework provides a practical, reliable, and scalable solution for stock market forecasting, supporting investors and financial analysts in making informed investment decisions. Future work can focus on incorporating advanced deep learning architectures, integrating real-time financial news and market sentiment analysis, utilizing larger and more diverse datasets, and developing hybrid prediction models to further improve forecasting accuracy under dynamic market conditions.

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