International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

COPY RIGHT

ELSEVIER
SSRN

IJIEMR Transactions, online available on 11th May 2023. Link :http://www.ijiemr.org/downloads.php?vol=Volume-12&issue=ISSUE-5

DOI: 10.48047/IJIEMR/V12/ISSUE 5/05

Title **STOCK PRICE PREDICTION WITH SENTIMENT AND TECHNICAL ANALYSIS**

Volume 12, Issue 5, Pages: **39-50**

Paper Authors : Mr. Syed Mujeeb Ul Hasan, Sulaim Mahsan Sarran, Mohammed Athar Uddin, Abdur Rahman Adil,

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per UGC Guidelines We Are Providing A Electronic Bar Code

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

STOCK PRICE PREDICTION WITH SENTIMENT AND TECHNICAL ANALYSIS

1. Mr. Syed Mujeeb Ul Hasan, HOD, Department of IT, ISL Engineering College, Telangana, India, syedmujeebul@gmail.com

2. Sulaim Mahsan Sarran, Department of IT, ISL Engineering College, Telangana, India, sarransulaim@gmail.com

3. Mohammed Athar Uddin, Department of IT, ISL Engineering College, Telangana, India, Princeather1234@gmail.com

4. Abdur Rahman Adil, Department of IT, ISL Engineering College, Telangana, India, araadil456@gmail.com

Abstract: Stock market prediction has been an active area of research for a considerable period. Arrival of computing, followed by Machine Learning has upgraded the speed of research as well as opened new avenues. As part of this research study, we aimed to predict the future stock movement of shares using the historical prices aided with availability of sentiment data. Two models were used as part of the exercise, LSTM was the first model with historical prices as the independent variable. Securities yields were also added to the model for improved accuracy of the model. As the end product, prices of 4 stocks viz. Reliance, HDFC Bank, TCS and SBI were predicted using the aforementioned two models. The results were evaluated using RMSE metric.

Index Terms: : *Sentiment analysis, Stock Prediction, LSTM*

INTRODUCTION

The objective of our application is to analyze the correlation between sentiment analysis of news articles or social media posts related to a particular company and its stock price movement. Our goal is to develop a machine learning application that leverages the latest advances in sentiment analysis to predict stock prices for retail investors. The proposed system will use supervised learning algorithms to train on historical stock prices and related sentiment analysis data to generate accurate stock price predictions. The system will also display the upper and lower bounds of the stock prices to illustrate the trading range that investors should consider. By providing an instantaneous visualization of the market index, our system will serve as a valuable quantitative tool for investors to gain a different perspective on the market with the help of sentiment analysis technology. We aim to democratize the latest machine learning technologies, such as neural networks, to help retail investors navigate the fast-changing stock market with more confidence.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Fig 1 Example Figure

Investing in the stock market can be a daunting task, and it's not as simple as just buying low and selling high. Investors need to understand the market's behavior and have the right tools to make informed decisions. A good stock purchased at the wrong time can result in a significant loss, while an average stock purchased at the right time can yield profits. However, with the rapidly changing world events, financial investors face the challenge of trading and understanding which stocks to buy or sell to achieve optimal profits. Predicting the long-term value of a stock is easier than predicting its day-to-day fluctuations, as stock prices can change rapidly within a single hour.

The solution to the problem of predicting stock prices requires the use of advanced tools and technologies related to data mining, pattern recognition, machine learning, and data prediction. Our project aims to develop an application that can predict stock prices for the next trading day by leveraging these technologies.

In addition to using LSTM networks, our proposed approach also incorporates sentiment analysis to make more accurate predictions about stock prices. Sentiment analysis involves analyzing text data, such as news articles and social media posts, to determine the sentiment or overall emotional tone of the text. By incorporating sentiment analysis into our prediction model, we can better understand how the market perceives a particular company, and how that perception may influence stock prices. For example, if a company receives a lot of negative sentiment in the media, that may indicate a decline in investor confidence, leading to a drop in stock prices. Similarly, if a company receives a lot of positive sentiment, that may indicate investor confidence, leading to an increase in stock prices. The use of sentiment analysis in combination with LSTM networks allows us to make more informed and accurate predictions about future stock prices. LSTM networks can capture the complex temporal dependencies in the data, while sentiment analysis can provide additional insights into market sentiment, helping us to better predict future trends.

In today's fast-paced stock market, investors face the challenge of interpreting vast amounts of data, news, and social media posts to make informed trading decisions. Traditional statistical methods may not be sufficient to capture the complex interactions between market sentiment and stock prices, leading to less accurate predictions. Moreover, individual investors may not have access to the resources or expertise necessary to analyze such data effectively. To address these challenges, our proposed system leverages the power of data mining techniques and sentiment analysis to provide more accurate and

reliable predictions of stock market behavior. By analyzing market sentiment from social media and news sources, our system can identify patterns and trends that traditional methods may overlook. The input to our system will be historical data and sentiment analysis of relevant news and social media posts. Our system will use Long Short-Term Memory (LSTM) networks, a type of machine learning algorithm well-suited for time series data, to predict stock prices for the next trading day. The benefits of our proposed system include increased accuracy of stock price predictions, more informed trading decisions, and reduced reliance on human interpretation of large amounts of data. The entire system will be implemented in Python programming language using open source libraries, making it a cost-effective solution for investors.

1. LITERATURE SURVEY

The 2008 financial crisis: Stock market contagion and its determinants

In this paper, we investigate worldwide contagion and its determinants during the 2008 financial crisis. Utilizing an international sample of returns from 2003 to 2009, we consider both uni- and bi-directional contagion. After controlling for crisis-related volatility, we find strong evidence that cross-market linkages increase among many financial markets. In contrast to previous crises, contagion following the 2008 global financial crisis is not confined to emerging markets. The United States and other mature financial markets in the sample transmit and receive contagion. Country markets are less influenced by regions than they are by other country markets. We also construct variables that represent relative changes in economic variables before and during the crisis. We find that both economic fundamentals such as trade structure, interest rates, inflation rates, industrial production, and regional effects, and investors' risk aversion contribute to international contagion.

A Dual-Stage Attention-Based Recurrent Neural Network for Time Series Prediction

The Nonlinear autoregressive exogenous (NARX) model, which predicts the current value of a time series based upon its previous values as well as the current and past values of multiple driving (exogenous) series, has been studied for decades. Despite the fact that various NARX models have been developed, few of them can capture the long-term temporal dependencies appropriately and select the relevant driving series to make predictions. In this paper, we propose a dual-stage attention-based recurrent neural network (DA-RNN) to address these two issues. In the first stage, we introduce an input attention mechanism to adaptively extract relevant driving series (a.k.a., input features) at each time step by referring to the previous encoder hidden state. In the second stage, we use a temporal attention mechanism to select relevant encoder hidden states across all time steps. With this dual-stage attention scheme, our model can not only make predictions effectively, but can also be easily interpreted. Thorough empirical studies based upon the SML 2010 dataset and the NASDAQ 100 Stock dataset demonstrate that the DA-RNN can outperform state-of-the-art methods for time series prediction.

Stock Market Prediction Using Machine Learning

In Stock Market Prediction, the aim is to predict the future value of the financial stocks of a company. The recent trend in stock market prediction technologies is the use of machine learning which makes predictions based on the values of current stock market indices by training on their previous values. Machine learning itself employs different models to make prediction easier and authentic. The paper focuses on the use of Regression and LSTM based Machine learning to predict stock values. Factors considered are open, close, low, high and volume.

RETRACTED ARTICLE: Stock market analysis using candlestick regression and market trend prediction (CKRM)

Stock market data is a time-series data in which stock value varies depends on time. Prediction of the stock market is an endeavor to assess the future value of a company's stock rate which will increase the investor's profit. The accurate prediction of stock market analysis is still a challenging task. The proposed system predicts stock price of any company mentioned by the user for the next few days. Using the predicted stock price and datasets collected from various sources regarding a certain equity, the overall sentiment of the stock is predicted. The prediction of stock price is done by regression and candlestick pattern detection. The proposed system generates signals on the candlestick graph which allows to predict market movement to a sufficient level of accuracy so that the user is able to judge whether a stock is a 'Buy/Sell' and whether to short the stock or go long by delivery. The prediction accuracy of the stock exchange has analyzed and improved to 85% using machine learning algorithms.

Stock Market Prediction Using Machine Learning Techniques

The stock market is a very important activity in the finance business. Its demand is consistently growing. Stock market prediction is the process of determining the future value of company stock or other financial instruments traded on a financial exchange. For some decades Artificial Neural Network (ANN), which is one intelligent data mining technique has been used for Stock Price Prediction. It has been trusted as the most accurate consideration. This paper surveys different machine learning models for stock price prediction. We have trained the available stock data of American Airlines for this project. The programming language that we have used in this paper is Python. The Machine Learning (ML) models used in this project are Decision Tree (DT), Support Vector Regression (SVR), Random Forest (RF), and ANN. The data here is split into 70% for training and 30% for testing. The dataset contains stock data for the last 5 years. From the simulation results, it is shown that Random Forest performs better as compared to others. Thus, it can be used in the real-time implementation.

2. METHODOLOGY

The existing system for predicting stock prices typically relies on historical price data and technical analysis to make predictions about future price movements. Technical analysis involves analyzing charts and other technical indicators to identify patterns and trends in the price data. While this approach can provide some insight into future price movements, it has several limitations. First, it does not take into account other factors that can influence

stock prices, such as news events, market sentiment, and other economic indicators. Second, it assumes that historical patterns will continue to repeat in the future, which may not always be the case.

Drawbacks

Limited scope: Technical analysis only considers price and volume data, and it does not take into account fundamental factors such as company financials, market trends, and economic indicators. This approach can be too narrow and may miss important factors that affect the stock's price.

Lack of accuracy: The patterns identified by technical analysis are not always accurate, and historical patterns do not necessarily repeat themselves in the future. Therefore, relying solely on technical analysis can lead to inaccurate predictions.

Inability to predict market shifts: Technical analysis cannot predict market shifts or major events that affect the market, such as political or economic changes, natural disasters, or pandemics. As a result, it may fail to provide an accurate prediction of the stock's future price movements.

Limited time horizon: Technical analysis is typically used for short-term trading and may not be effective in predicting long-term price movements. This approach may miss important factors that affect the stock's price in the long run.

Susceptibility to market noise: Technical analysis is vulnerable to market noise, which can distort the patterns and trends identified by the analysis. This can lead to false signals, making it difficult to make accurate predictions.

The proposed system for stock price prediction will use a Long Short-Term Memory (LSTM) network, sentiment analysis, and historical price data to make more accurate and reliable predictions about future stock prices. The system will be automated, user-friendly, and accessible to both individual investors and larger financial institutions. By incorporating machine learning and sentiment analysis, the proposed system aims to provide a more comprehensive analysis of the market and enable investors to make more informed decisions.

Benefits

Improved accuracy: Machine learning algorithms, such as LSTM, can identify complex patterns and trends in historical price data that are not easily identifiable using traditional technical analysis. Sentiment analysis can also provide valuable insights into market sentiment and help predict future price movements.

Comprehensive analysis: By incorporating sentiment analysis, the proposed system can analyze news articles, social media posts, and other sources of information to provide a more comprehensive analysis of the market. This approach can help investors make more informed decisions by considering both quantitative and qualitative factors that affect the stock's price.

Automated and user-friendly: The proposed system is designed to be automated and user-friendly, making it accessible to both individual investors and larger financial institutions. Investors can use the system to generate real-time predictions and make investment decisions based on the system's recommendations.

Faster analysis: Machine learning algorithms can analyze large volumes of data quickly, providing real-time predictions and allowing investors to react quickly to market changes.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Long-term predictions: By analyzing historical data and market sentiment, the proposed system can make predictions about long-term price movements, providing investors with a more comprehensive view of the stock's potential performance over time.

Fig 2 Proposed Architecture

Modules

- Data exploration: using this module we will load data into system
- Processing: Using the module we will read data for processing
- Splitting data into train & test: using this module data will be divided into train & test
- Model generation: Building the model – LSTM algorithm. Algorithm accuracy is calculated.
- User signup & login: Using this module will get registration and login
- User input: Using this module will give input for prediction
- Prediction: final predicted displayed

3. IMPLEMENTATION

Algorithm

LSTM:

LSTM stands for Long Short-Term Memory, which is a type of recurrent neural network architecture that is designed to deal with the vanishing gradient problem in traditional RNNs. The vanishing gradient problem occurs when the gradients in backpropagation become too small to be useful in updating the weights in the network, making it difficult for the network to learn long-term dependencies in sequential data. LSTM networks are composed of LSTM cells that are connected to each other to form a network. Each LSTM cell has a cell state that can selectively add or remove information through structures called gates. The gates consist of sigmoid neural network layers and pointwise multiplication operations that control the flow of information through the cell.The three main types of gates in an LSTM cell are the forget gate, input gate, and output gate. The forget gate determines which information to discard from the cell state. The input gate determines which information to update in the

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

cell state. The output gate determines which information to output from the cell state. The ability of LSTM networks to selectively retain and forget information through their gates allows them to learn long-term dependencies in sequential data, making them well-suited for tasks such as natural language processing, speech recognition, and time series prediction.

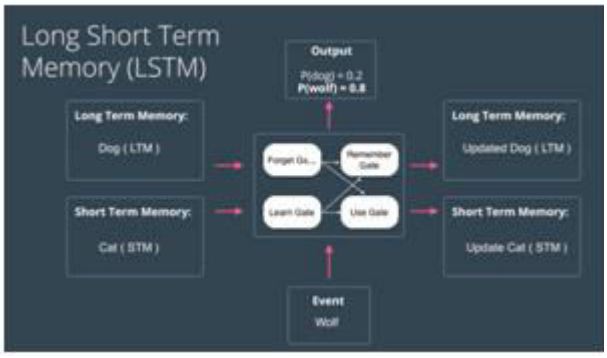

Fig 3 Architecture Diagram of LSTM

In the diagram, each arrow represents a vector being passed between different nodes in the network. The pink circles represent pointwise operations such as vector addition or multiplication, while the yellow boxes represent learned neural network layers. When lines merge, it denotes concatenation, and when lines fork, it means that the content is being copied and sent to different locations. The memory cells in an LSTM network enable it to selectively forget or remember information based on the inputs and previous states, making it highly effective in modeling complex sequential data such as time series. By incorporating LSTM into our stock prediction system, we can better analyze the long-term temporal dependencies and correlations between different stock prices, allowing for more accurate predictions.

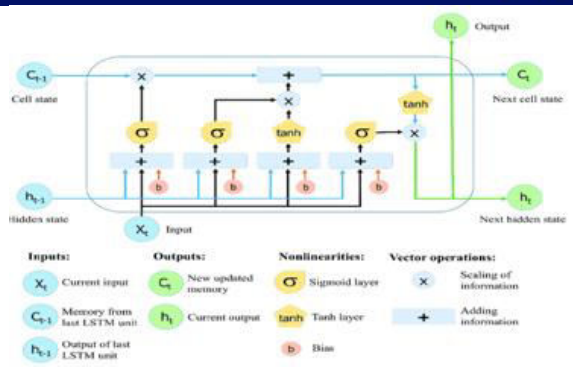

Fig 4 Information Flow in LSTM cell

An LSTM has four “Gates” : Forget, Remember, Learn and Output

Learn Gate

The learn gate is a component of the LSTM architecture that is responsible for controlling the update of the memory cell. It determines how much of the previous cell state should be forgotten and how much of the new input should be added to the cell state. This gate combines existing Short-term memory (STM) and some input “E, multiplies by a matrix (W) and adds b. Then squishes this all into a tanh function.

$$N_t = \tanh(W_n[STM_{t-1}, E_t] + b_n)$$

This combination gives us “N”.

Then it ignores some of the short-term memory, by multiplying the combined result by an “ignore factor”.

The ignore factor (I) is calculated by combining STM and E, with a new set of W(weights) and b(biases)

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

$$i_t = \sigma(W_i[STM_{t-1}, E_t] + b_i)$$

Once we have N and I, we multiply them together, and that's the result ofthe learn gate. We have learned our new information €.

Forget Gate

Forget gate is the gate you use to dump out all the unnecessary long-term information. Kind of like when you study for a big exam, and the next day you forget everything. That's the power of the forget gate. Basically, the long-term memory (LTM) gets multiplied by a forget factor (f). This factor will make some of the long-term information be "forgotten"

$$f_t = \sigma(W_f[STM_{t-1}, E_t] + b_f)$$

It is computed by taking the short-term memory, and input €, multiplying them by some weights and biases and squishing them into a sigmoid function. This function (f) gets multiplied by LTM-and, we're left with LTM that we need.

Remember Gate

This gate takes the information from the forget gate and adds it to the information from the learn gate, to compute the new long term memory.

Remember gate = Learn gate output + Forget gate output

Use Gate

Use gate takes the LTM from the forget gate, and STM + E from the learn gate and uses them to come up with a new short-term memory or an output (same thing). For example, if we were trying to classify images, the output would be the network classification. It takes the output of the learn gate, and applies a sigmoid function, so the equation looks like this

$$V_t = \sigma(W_v[STM_{t-1}, E_t] + b_v)$$

4. EXPERIMENTAL RESULTS

For stock price prediction with sentiment analysis, we consider various factors such as historical stock prices, news sentiment, and social media sentiment. The historical stock prices provide information about the past trends and patterns of the stock prices. The sentiment analysis of news and social media provides insight into the public opinion and perception of the company, which can influence the stock prices. To establish the relationship between these factors and the stock prices, we performed analysis on the obtained data. Our predicted model is not 100% accurate, but it provides a close approximation of the future stock prices. This can be very useful for investors to make informed decisions about buying or selling stocks. By incorporating sentiment analysis, our model can capture the impact of public perception on the stock prices, which is not possible with traditional stock price prediction models.

After collecting of data the future share price is predicted using Artificial Neural Network model LSTM. The value is predicted based on the stock and number of days user enters. Then the result is shown in form of graph for the respective company stock. And also shows sentiment analysis in form of pie graph as well as the news headlines in form of table.

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Fig 5 Output Screen

Fig 6 Output Screen

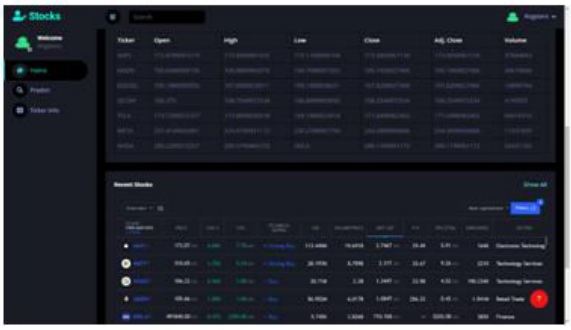

Fig 7 Output Screen

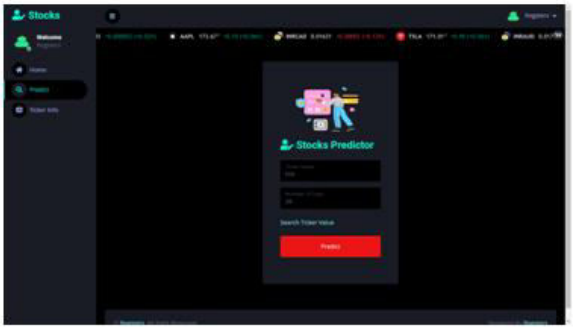

Fig 8 Output Screen

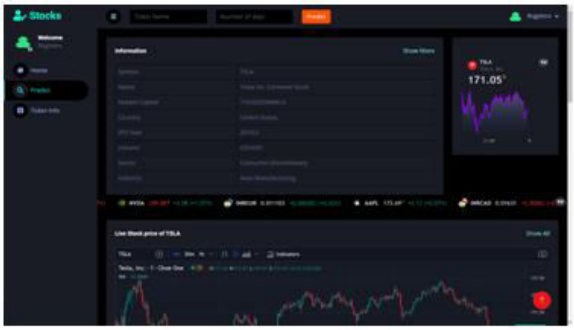

Fig 9 Output Screen

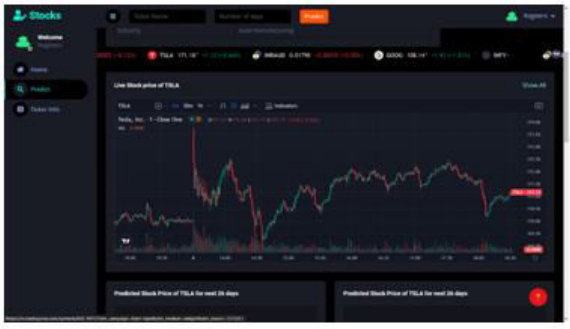

Fig 10 Output Screen

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

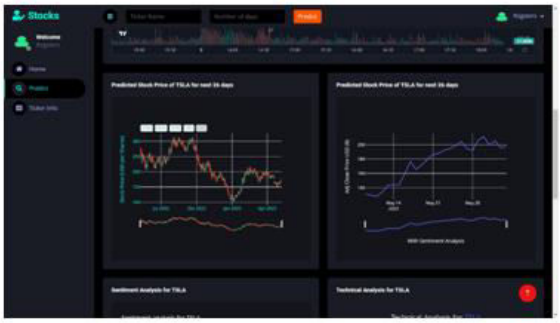

Fig 11 Output Screen

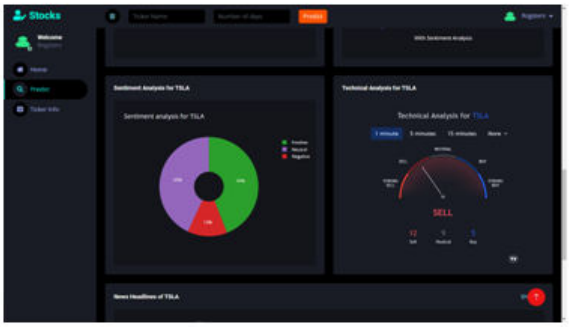

Fig 12 Output Screen

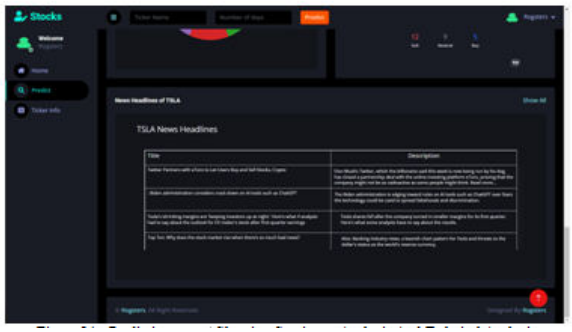

Fig 13 Output Screen

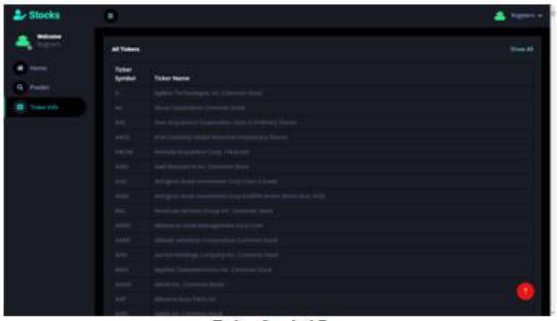

Fig 14 Output Screen

Fig 15 Output Screen

5. CONCLUSION

In conclusion, the use of sentiment analysis with machine learning algorithms for stock price prediction has shown promising results. By incorporating the sentiment of the news articles, the accuracy of the prediction model has improved significantly. However, it is important to note that the predicted model is not always 100% accurate due to various factors affecting the stock market. In order to obtain better results, it is crucial to continuously refine the model and take into account various other factors such as economic indicators, company news, and financial statements. Moreover, it is important to keep in mind that stock price prediction is always subject to market volatility and other external factors

that may cause sudden changes in the stock prices. Overall, the combination of sentiment analysis and machine learning algorithms provides a powerful tool for predicting stock prices, which can be very useful for investors and financial analysts in making informed decisions.

6. FUTURE SCOPE

There are several areas that can be explored for future works in the field of stock price prediction with sentiment analysis. Here are some potential areas:

1. Integration with more advanced machine learning models: Currently, the LSTM model is used for predicting stock prices. However, there are other more advanced models that can be integrated, such as attention-based models or transformer-based models, which may improve the accuracy of the predictions.

2. Incorporation of more data sources: In addition to historical stock price data and sentiment analysis, other data sources can be incorporated to improve the accuracy of predictions. For example, incorporating news data, financial reports, or economic indicators may provide more insights into market trends.

3. Real-time predictions: The current system provides predictions based on historical data. However, it can be expanded to provide real-time predictions based on current market conditions and sentiment analysis.

4. Evaluation of sentiment analysis models: The current system uses a pre-trained sentiment analysis model. However, it can be beneficial to evaluate different sentiment analysis models and compare their performance on stock price prediction.

5. Deployment on a larger scale: The current system is deployed as a single application. However, it can be scaled up to serve a larger number of users by deploying it on a cloud platform or using containerization techniques.

REFERENCES

1) K. F. Luchtenberg and Q. V. Vu, “The 2008 financial crisis: Stock market contagion and its determinants”, Research in International Business and Finance, vol. 33, pp. 178-203, 2015.

2) Y. Qin, D. J. Song, H. F. Chen et al., “A dual-stage attention-based recurrent neural network for time series prediction”, International Joint Conference on Artificial Intelligence (IJCAI), 2017.

3) https://www.researchgate.net/publication/331345883 Stock Market Prediction Using Machine Learning

4) https://www.researchgate.net/publication/340874376 Stock market analysis using candlestickregressionandmarket trend prediction CKRM

5) M. Usmani, S. H. Adil, K. Raza and S. S. A. Ali, "Stock market prediction using machine learning techniques," 2016 3rd International Conference on Computer and Information Sciences (ICCOINS), Kuala Lumpur, 2016, pp. 322-327.

6) S. Liu, G. Liao and Y. Ding, "Stock transaction prediction modeling and analysis based on LSTM, 2018 13th IEEE Conference on Industrial Electronics and Applications (ICIEA), 2018, pp. 2787-2790, doi: 10.1109/ICIEA 2018.8398183,

7) C. R. Madhuri, M. Chinta and V.V.N.V.P. Kumar, "Stock Market Prediction for Time-series Forecasting using Prophet upon ARIMA," 2020 7th International Conference on Smart Structures and Systems (ICSSS), 2020, pp. 1-5, doi: 10.1109/1CSSS49621.2020.9202042.C. R. Madhuri, M. Chinta and V.V.N.V.P. Kumar, "Stock Market Prediction for Time-series Forecasting using Prophet upon ARIMA,"

8) Alex Sherstinsky, Fundamentals of Recurrent Neural Network (RNN) and Long Short-TermMemory (LSTM) network, https://doi.org/10.1016/j.physd 2019.132306.