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Stock Market Prediction Using LSTM

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Abstract: This study proposes a model which will make use of an LSTM model for predicting stock prices. The stock prices will be predicted on the basis of past information. Stacked LSTM will be employed for the prediction because it utilizes the historic data, therefore, making the predictions more accurate since it is able to learn long term dependencies in data, which makes LSTM an ideal technique for stock market prediction due to its dynamic as well as complex nature. After training the model its accuracy will be checked by using the test data and then using the model the stock prices for the next 30 days will be forecasted using this model.
Keywords: Stock Price Prediction, Long Short Term Memory, Predictive Model.

I. INTRODUCTION

A financial instrument known as a stock is used to symbolize ownership in a business or corporation and a proportionate claim on its assets (what it owns) and income (what it generates in profits). Shares or equity are other names for stocks.[6] The group of people who buy and sell stocks, also known as shares, which stand for ownership holdings in corporations, is referred to as a stock market, sometimes known as an equity market or share market. [7] These securities, such as shares of private companies that are made available to investors through equity crowdfunding platforms, may be listed on a public stock exchange or solely traded privately. [8]

A stock market prediction is forecasting the future value of an individual stock. These forecasts are based on a fundamental analysis of a company's economy, and past performance of its stocks.[9] The stock market is known for being susceptible to change. Multiple factors, such as global economic conditions, unseen circumstances and a company's financial performance make stock price prediction difficult. Also, physical factors and physiological factors leading to rational and irrational behavior play a major role. Investor sentiment and market rumors are other parameters.[14] These factors work together thus making stock values unpredictable and challenging to forecast in an accurate way. Based on information gleaned from these stocks' previous prices, stock market prediction helps stock market investors in selecting an appropriate time to buy as well as sell equities. We look into how data analysis could revolutionize this field. According to the efficient market hypothesis, when every piece of information about a firm stock market development is instantly accessible to the participants as well as investors who are present in the market, the impacts of those developments have earlier been included in the stock price.[5]

All market events have an impact on the historical spot price, which can be used to forecast its future behavior. In order to predict future trends, we use techniques which are based on Machine Learning on historical stock price data while taking into account the stock price of the past.[4] ML approaches have the capacity to reveal patterns and insights that we had not previously noticed, thus could be made use of, to produce forecasts that are incredibly accurate.[1]. Recurrent neural networks with the capability to learn dependencies which are long term, in data are known as long short-term memory (LSTM) networks.[3] They have a long memory for patterns that they choose to recall. LSTM is a great option for modeling sequential data and is consequently utilized to understand the intricate dynamics of human behavior. Hence LSTM is suitable for predicting stock prices with accuracy.[2]

Through this project, a framework has been proposed that makes use of the LSTM (Long ShortTerm Memory) model to inspecting as well as predict the expansion of a company in long run, on the basis of the historic data and will predict the stock prices for the next 30 days using the built model.

II. LITERATURE REVIEW

The paper [2]was an endeavor to see long run costs of the stocks of a corporation with higher accuracy as well as dependable exploitation, regression and LSTM. Each technique has depicted an associated development within the accuracy of predictions, that yields optimum results with the LSTM model and is established to be additional economical. The results are quite promising.

Stock worth prediction exploitation LSTM and international intelligence agency (2020) during this paper, comparison of with international intelligence agency exploitation varied index information like S&P five hundred, NYSE, NSE, and BSE. Experiment analysis demonstrates that LSTM includes a higher accuracy with respect to international intelligence agencies.

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The projected algorithmic rule uses the market information to predict the share worth exploitation ML techniques like continual neural networks which is also known as Long STM, in this method weights area unit corrected for every information exploitation random gradient descent. This method can give correct outcomes as compared to presently out there stock worth predictor algorithms. In addition to training,the network is evaluated with varied sizes of computer file to urge graphical outcomes.

This study adopts a stacked Long STM network model for determining securities market behavior. The information used consists of historic securities market data from the yank securities market, National Association of Securities Dealers Automated Quotations Composite. Results acquired show that by creating use of a stacked Long STM network model, future securities market behavior may be expected.

In the paper written by the authors [13] Murtaza Roondiwala, Harshal Patel and Shraddha Varma, continual Neural Network in conjunction with Long STM approach has been used for stock worth prediction. 1180 samples were taken for coaching functions and 132 samples were taken for testing functions. The authors conducted pre-processing of the information that concerned data cleansing, transformation and integration. Then, the feature extraction was conducted followed by the coaching of the neural network. the utilization of ReLU activation was done. The errors were decreased with the assistance of the rear Propagation algorithmic rule. the utilization of RMSProp optimizer was done. They analyzed the potency exploitation of the basic Mean sq. methodology.

In [12], the authors evaluated the stacked and duplex LSTMs performance. They concluded that BLSTM networks showed an improved performance for the future in addition to short term predictions. the utilization of performance measures like Root Mean square. Error, constant of determination and Mean Absolute Error was done.

In the paper titled 'Survey of securities market Prediction exploitation Machine Learning Approach' [9], authors have expressed the aim of multivariate analysis. varied regressions like statistical regression, polynomial regression, sigmoid regression, and RBF regression are mentioned. The connected formulae of those regressions have conjointly been expressed.

Neural network, one amongst the intelligent processing of data techniques that has been made use of by researchers in varied fields throughout the past ten years. The network was wont to train the stock worth one company from NSE and expected for five totally disparate corporations from each NSE and N. Y. Stock Exchange. CNN was then found to outstrip alternative models. it absolutely was conjointly determined that the network was able to build predictions for the N. Y. Stock Exchange despite the fact that it absolutely was trained solely with NSE information. This was doable as a result of the 2 sharing some common dynamics. And once examining the results with the ARIMA model, it absolutely was determined that the neural network outperforms the exciting ARIMA model.

This work uses deep learning ways to predict the intraday directional movements of the quality & Poor's five hundred index exploitation monetary news headlines and a collection of technical indicators as input. This text focuses on architectures like Convolutional Neural Networks and Continual Neural Networks that have performed well in ancient natural language processing tasks.

The results showed that CNN may be higher than RNN in capturing linguistics from texts, and RNN is best in capturing discourse information and modeling complicated temporal characteristics for securities market prediction. And this methodology shows some development compared to similar precursory tries.

This article provides a comprehensive summary of thirty analysis papers recommending ways that embody procedure ways, milliliter algorithms and performance parameters. Thus, these studies facilitate seeking out milliliter techniques in conjunction with the dataset for securities market prediction.

Typically, ANN and NN techniques area units want to reach correct securities market predictions. whereas a good deal of labor has been done, the newest prediction methodology associated with the securities market has several limitations. division by mathematical and milliliter ways. The focus of this survey is to categorize the present approach associated with changed methodologies, totally different datasets used, performance matrices and application techniques, the foremost dominant journals exploitation thirty inquiring articles.

The main objective of this study is to effectively make use of machine learning algorithms to make a robust model for securities market prediction. The work concerned 3 phases, the primary part concerned pre-processing for the securities market dataset, then the second part that concerned the utilization of two supervised machine learning techniques particularly K-Nearest Neighbor i.e. KNN, and Random Forest (RF) and evaluation of the accuracy in the last stage. Effectiveness of the prediction for these two projected models was done.

The results acquired from the two projected models attained a high accuracy and therefore the RF model, achieved an accuracy of 93.12% - 93.23% in step with the analysis measures of exactitude, recall and F-measure.

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III. METHODOLOGY

A. *Theory*

An LSTM model was used to build this project. It is an advanced RNN that can handle long-term dependencies and recall information.It was introduced to overcome the limitation of RNN i.e. they can not remember Long term dependencies due to vanishing gradients.

The LSTM works very much like an RNN cell. The LSTM cell is made of 3 parts known as gates known as the Forget gate, the Input gate and the Output gate.

The first gate determines whether the data coming from the earlier timestamp is relevant or can be forgotten. In the second part, the cell learns information from the input. In the third part, the updated information from the current timestamp is passed to the next timestamp.

B. *Materials/Components*

TensorFlow: TensorFlow is a free, open-source library for dataflow. It is mainly used to train neural networks. These neural networks perform operations on multidimensional arrays which are known as 'Tensors'. This library helps us build Machine Learning powered applications and programs.

Keras: Keras is a library that provides a Python interface for neural networks. It provides clear and actionable error messages. It reduces the cognitive load. This library contains all the implementations of all the neural networking build blocks such as layers, objectives, activation functions, etc. These activation functions are used to simplify the code.

Scikit-learn Library: Scikit-learn is a machine learning library that supports the Support Vector Machine algorithm. It is used in classification, regression, and in reducing dimensionality. It is built upon the libraries of NumPy and Matplotlib.

NumPy: Numpy is a free and open-source library. It is a library that can be used in Python and deals with computations of arrays.

Pandas: The Pandas library is used for the analysis of data. It is a Python-based library. It allows us to import data from JSON, CSV and Excel. The merging of datasets is possible with the help of this library.

Matplotlib:Matplotlib is a library used for plotting and visualizing graphs which helps in easy understanding and marking out co-relations. It supports line plots, histograms, bar plots, pie charts, scatter plots, etc.

IV. ALGORITHM

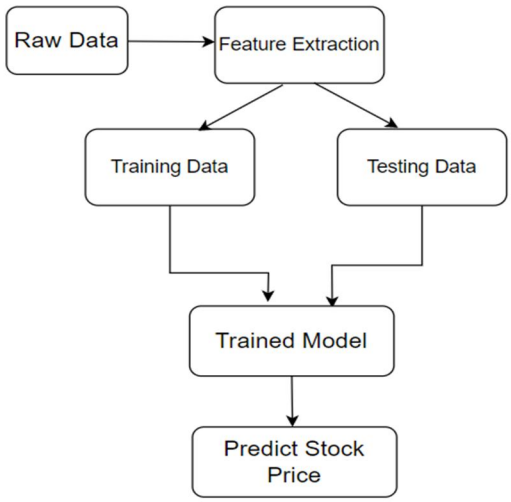


Fig.1. Flow chart of Prediction model

1) *Collect Stock Data:* Pandas_datareader library will be used for data collection. In order to get stock market data, Tiingo has been used. Tiingo, which is a financial data platform which makes high- quality financial tools obtainable to everyone. The apple stock market dataset(AAPL) has been used.
2) *Pre-processing:* Field Selection: Out of all the fields present, such as low, high, open ,close etc, we will select one to visualize the stock price changes. The selected field is the close price of that stock.

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3) *Scaling:* LSTM is scale-sensitive. Therefore the values in the dataset are scaled down to values between 0-1 using minmax scaler.
4) *Train-Test Split:* The training size is 65% of the total dataset and testing size of 35%.
5) *Building the LSTM model:* Since the data we are working with is "Time series data", the next value is dependent on the previous values. We can say that day 2 is dependent on day 1 and day 3 on day 1 and 2 and so on. Timesteps - to compute output of the next day how many previous days output should be considered=3 For this project we have considered that the timestep=100. Therefore 100 values will be appended into our x_train and in the y_train we will have 1 value. Similarly for x_test and y_text.
6) Predict the test data and check its accuracy. Predict the test data by making use of the built model and then the predicted values are plotted to visualize the accuracy of the model.
7) *Predict The Next 30 Days Stock Prices Using Our Model*: Using the model, the prediction of the stock prices for the next 30 days would be done thereby plotting the predicted output.

V. RESULTS AND DISCUSSION

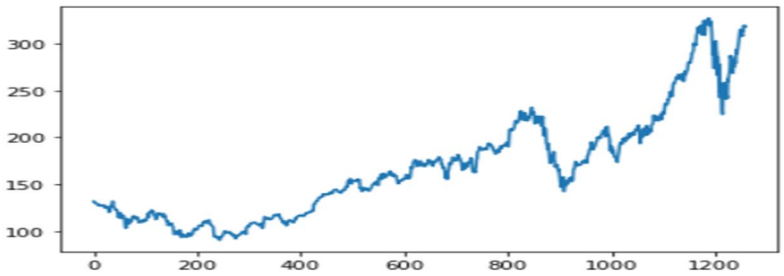


Fig.2. The stock prices of apple from 2015-2022

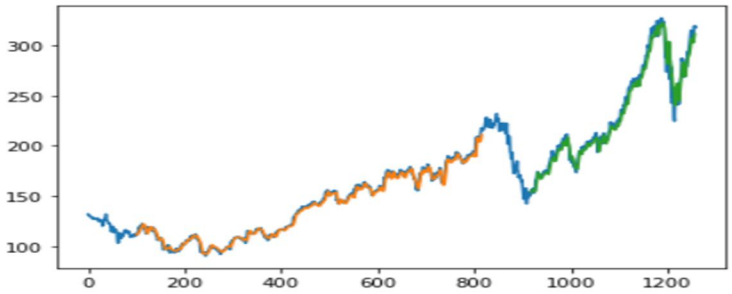


Fig.3. The train and test predicted output plot

Orange plot depicts the training data and green plot depicts the tested data. We can see that the predicted test output almost overlaps with the actual stock price. Therefore, the accuracy of the LSTM model is very good.

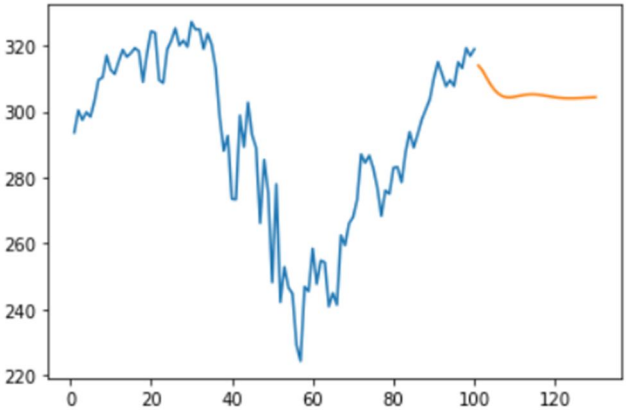


Fig.4. The 30 days predicted stock values

The orange plot represents the predicted values of stock prices for the next 30 days.

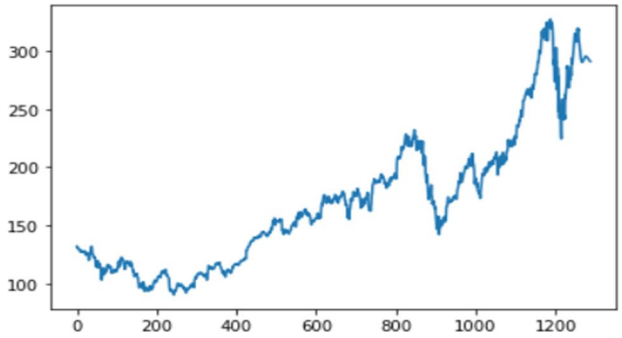


Fig.5. The final output plot

We can see the final output plot consisting of the previous stock prices and our predicted prices.

VI. FUTURE SCOPE

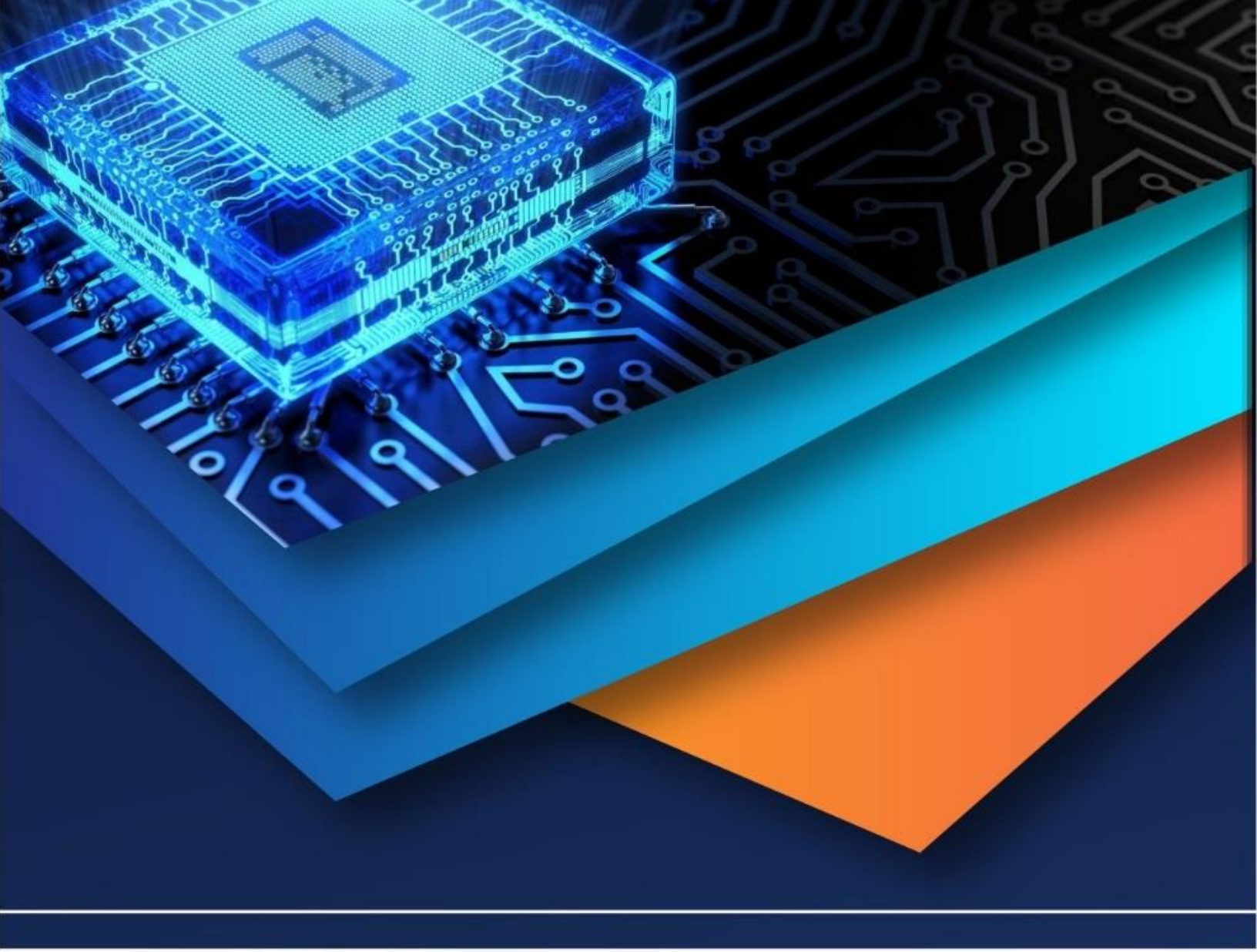
More timesteps can be used to increase accuracy. The accuracy can also be improved by using bi-directional LSTM[21]. The current model will not work in case of market crashes due to the sudden unpredictable change in the values. So this feature of immediate update can be added. Once the accuracy is improved the model can be deployed into the real world through an app or a website.

VII. CONCLUSION

Stock prediction requires a model that will make use of historic data and retain the memory of past values. There are several methods such as Regression, SVR etc, but they have certain drawbacks. Therefore, the LSTM is suitable for forecasting the stocks. In this project, an LSTM model was built to forecast stock prices on the basis of their past values. Accuracy of the model was checked by performing a train-test check. Finally, the stock values of the next 30 days were predicted using the built model.

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