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Stock Price Prediction Using Machine Learning and LSTM-Based Deep Learning Models

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Abstract: A stock market is a place or a public market where you can sell or buy shares for all the publicly listed companies. The stocks have values and rights that represent ownership in the company. The stock exchange is the arbitrator which allows the buying and selling of shares. The future value of the company stocks and the other financial assets traded on an exchange can be done with the help of stock price prediction using machine learning. A significant amount of profit and gain can be done with the help of stock price prediction and that is the main reason behind that because predicting how the stock market will perform is a hard task to do.

There are many factors involved in the prediction, such as physical and psychological factors, rational and irrational behaviour, and so forth. These kinds of factors combine to make share prices volatile and dynamic. This makes it very hard to predict stock prices with high accuracy. There were numerous strategies or algorithms which we are able to select to build this project, for now we are going to use one of the famous topics of Machine Learning which are Long short-term memory (LSTM).

Long short-term memory (LSTM) is an artificial recurrent neural network (RNN) architecture used in the field of deep learning. Unlike conventional server neural networks, it has a feedback loop. It can process not only single data points such as images, but also whole data sequences such as speech or video. For example, LSTM works on tasks such as unsegmented, connected handwriting recognition, speech recognition and anomaly detection in network traffic or IDSs (intrusion detection systems). A standard LSTM unit is made up of a cell, an input gate, an output gate and a forget gate. The cell remembers numbers periodically and the three gates control the entry and exit of information from the cell.

Linear Regression: In statistics, linear regression is a linear approach for modelling the relationship between a scalar response and one or more explanatory variables. In case for a single descriptive variable is called a simple linear regression; for more than one, the process is called multiple linear regression. This term is distinct from multivariate linear regression, in which multiple related dependent variables are predicted, rather than a single scalar variable.

Keywords: Recurrent Neural Network, Stock Price, Stock Price Prediction, Long Short-Term Memory

I. INTRODUCTION

The Stock Price Prediction application using Machine Learning and Python can be used as a full source tool for those who are ready or are already investing in the stock market. The most difficult task is to predict how the stock market will perform. There are numerous factors involved in the prediction – physical factors vs. psychological, rational and irrational behaviour, etc. All of these factors combine to make price fluctuations and make it extremely difficult to predict with high accuracy. Stock price analysis has become an important area of research and is one of the top machine learning tools.

The main objective of the stock market prediction is to determine the future value of a company stock or other financial instrument traded on an exchange. Successful predicting of future stock prices may capitulate significant returns. A well-functioning market hypothesis suggests that stock prices reflect all available information at present and any price changes that are not based on new information are presented and therefore not naturally predictable. Others disagree and those with this viewpoint possess myriad methods and technologies which purportedly allow them to gain future price information. Stock price prediction is one of the most important issues faced by many investors.

This increases the risk of investing our investment that we have earned with the fear of losing it.Therefore, many are afraid to speculate within the stock exchange. Investing in Stock markets generates huge foreign exchange. If a successful model for stock prediction is developed, we will gain an understanding of market movements over time, recognizing trends that may not have been observed.Along with the growing integration capacity of computers, machine learning is going to be a coherent method to resolve this problem. Our main motivation for this project is to develop a much better stock price prediction system that the investments increases and therefore the investors can maximize their profits.

LITERATURE SURVEY

The first focus of our literature review was to test different algorithms and models to determine if stock price predictions could be made at real stock prices. However, since we could not detect any potential change in this stock price forecast,

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we decided to look at existing plans, analyze major problems, and improve ourselves. A brief search of common solutions to the above problem led us to LSTM. After deciding to use the LSTM neural network to make stock forecasts, time series data is collected from stock firm prices of the stock and related macroeconomic variables over a period of 10 years.

1.Stock Market Prediction using Machine Learning Techniques
→The paper predicts the market performance of the Karachi stock market (KSE) using different machine learning techniques. Various methodologies were discussed like Single Layer Perceptron, Multi-Layer Perceptron, Radial Basis Function, and Support Vector Machines. The technique proposed is to use various factors impacting the market as input attributes for the machine learning model. Many different factors were found to own a major impact on the market performance. [1]

2. Survey of Stock Market Prediction Using Machine Learning Approach
→This paper has proposed the survey of a widely known efficient regression approach to predict the stock exchange price from the stock exchange database. Various regression techniques like polynomial regression, rectilinear regression, RBF regression, and sigmoid regression were described. Polynomial regression is that the variety of statistical regression which is that the best fit exchange prediction because it is largely for the non-linear relationship between one dependent and another experimental variable. [2]

3. Stock Market Prediction using Data Mining Techniques
→In this paper, the prediction of the exchange trends was done using machine learning models just like the Random Forest model and Support Vector Machine. The historical data, further as sentimental data, were analyzed as they players an important role in market performance. Researchers applied sentiment analysis on Twitter feeds to find the interrelationship among "public sentiment" and therefore the "market sentiment". Data retrieved from Twitter was wont to predict the general public mood. A Self Organizing Fuzzy Neural Network was used on predicted mood from the Twitter feeds and Dow-Jones Industrial Average values from the previous day to predict the movement of the securities market for the longer term. [3]

4. Stock Closing Price Prediction Using Machine Learning
→This paper predicted the price of the stocks within the stock market of Thailand (SET). Various methodologies wont to predict the damage of the stock were the Multi-Layer Perceptron model, Support Vector Machine model, and Partial Least Square Classifier. The experimental result proves that Partial Least Square is that the best algorithm of the three algorithms to predict the stock terms. [4]

6. Stock Market Prediction using Machine Learning Algorithms:
→ A Classification Study The objective of this paper is to classify different machine learning algorithms. This paper introduced the concept of economic derivatives just like the "no arbitrage" principle and people of the predictive model, like stochastic process theory and efficient market hypothesis (EMH). News articles were analyzed and also the prediction was made on their basis. Steps involved in prediction were data preparation, analysis, aggregation, and visualization. The results were neutral, positive, and negative. Data were collected daily and predictions were made on Logistic Regression. The accuracy obtained was 70%. A generalized linear model (LM) (binomial family) is often used as a logistic regression model. [6]

7. Empirical Study on Stock Market Prediction Using Machine Learning
→This paper aims to review the securities market prediction using multiple Traditional, Machine learning, and Deep learning algorithms. together with these algorithms, the survey has also focused on various datasets used for securities market prediction, the features of those datasets were selected as input parameters, and also the evaluation metrics used for comparing the results of predictions. All of these were taken into consideration to create an efficient prediction. [7]

7. DP-LSTM: Differential Privacy-inspired LSTM for Stock Prediction Using Financial News
→This paper proposes a novel profound deep neural network DPLSTM for stock value prediction. It coordinates news stories as restricted data and joins distinctive news sources through the differential security system. In view of the autoregressive moving average model (ARIMA), an estimation ARIMA is assembled by contemplating the data of monetary news stories in the model. At that point, an LSTM-based profound neural organization is outlined. It has three parts: LSTM, VADER model, and differential protection (DP) component. The planned DP-LSTM plan can altogether decrease forecast blemishes and expands vigor. The paper incorporates the profound neural organization with the well-known NLP models (VADER) to distinguish and remove suppositions inside a given content, joining the stock change close cost and compound score to lessen the speculation hazard. In the event that we accept the information separated

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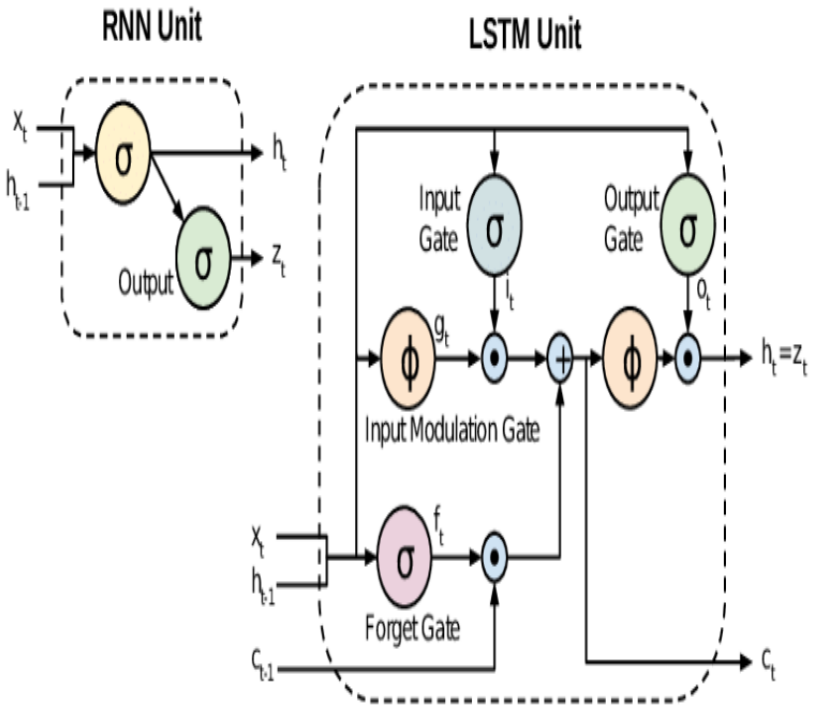
from the news for expectation completely, we may expand inclination because of some nontarget reports. Accordingly, the DP-LSTM improves the power of the forecast model. [7]

PROPOSED METHODOLOGY

LSTM:

Long Short-Term Memory or LSTM, which is a robust Machine Learning algorithm. LSTM is nothing but an artificial and recurrent neural network used to solve complex problem like unsegmented, connected handwriting recognition, speech recognition and anomaly detection in network traffic or IDSs (intrusion detection systems). A common LSTM unit consist of a cell, an input gate, an output gate and a forget gate. Here LSTM is used because of getting control over the input which an excel sheet which is a continuous data of a specific stock. LSTM is well-suited to distinguish, process and predict time series given time lags of unknown duration. Relative insensitivity to gap length gives an advantage to LSTM over alternative RNNs, hidden Markov models and other sequence learning methods.

This gives us an advantage over other algorithms such as the ARIMA model, Liner Regression etc.



Advantages of LSTM

The main advantage of LSTM is its ability to read the intermediate or middle ground. Each unit remembers details for a long or short period without explicitly utilizing the activation function within the recurring components. An important fact is that any cell state is repeated only with the release of the forget gate, which varies between 0 and 1. That is to say, the gateway for forgetting in the LSTM cell is responsible for both the hardware and the function of the cell state activation. Thus, the data from the previous cell can pass through the unchanged cell instead of explicitly increasing or decreasing in each step or layer, and the instruments can convert to their appropriate values over a limited time. This allows LSTM to solve a perishable gradient problem - because the amount stored in the memory cell is not converted repeatedly, the gradient does not end when trained to distribute backwards.

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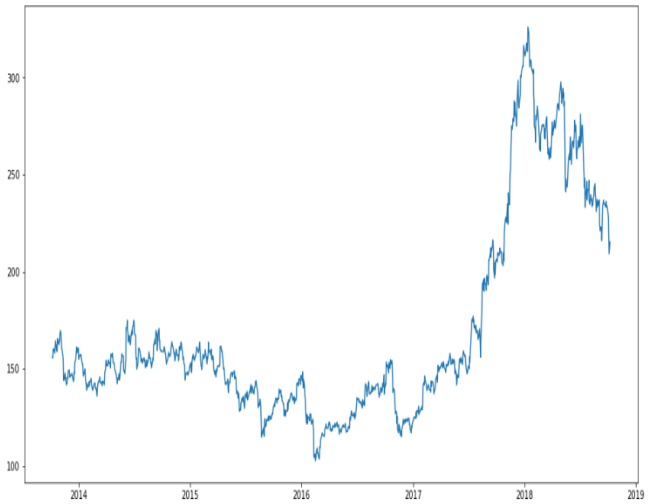

CONCLUSION

Stock investments is in the of interest to several investors around the globe. However,choosing can be a difficult task as there are many factors are involved. In order to get a successful investment, investors are willing to predict the longer-term nature of the securities market. Even the small improvements of forecasting efficiency will be of great benefit. A high-quality prediction system will help investors make investments more accurate and more profitable by providing supportive information like the long-run direction of stock prices. Numerous studies have proven that the sentiment or emotional analysis contributes significantly to future targets. Therefore, a combination of technical and fundamental analyses can produce a highly efficient prediction.

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