ABSTRACT

Stock price forecasting is a popular and important topic in financial and academic studies. Share market is an untidy place for predicting since there are no significant rules to estimate or predict the price of share in the share market. Many methods like technical analysis, fundamental analysis, time series analysis and statistical analysis, etc. are all used to attempt to predict the price in the share market but none of these methods are proved as a consistently acceptable prediction tool.

Stock market is basically nonlinear in nature and the research on stock market is one of the most important issues in recent years. People invest in stock market based on some prediction. For predict, the stock market prices people search such methods and tools which will increase their profits, while minimize their risks. Prediction plays a very important role in stock market business which is very complicated and challenging process. Employing traditional methods like fundamental and technical analysis may not ensure the reliability of the prediction. Stock market prediction is a way to determine the future value of a company's stock. Machine learning techniques are used to evaluate past data pertaining to the stock market and world affairs of the corresponding time period, in order to make predictions in stock trends. A model is built that will be able to give advice regarding buying and selling of stock based on profitable prediction.The model is trained and tested using LSTM that makes use of time series for prediction . LSTM advances the concept of RNN (recurrent neural network) by offering memory advantages i.e., it provides a feedback mechanism to ensure security of data. The proposed model can intake various fluctuating data values either by manual datasets or via API (Application Programming Interface) and has been tested with various single day values and consecutive day values for prediction. However, the accuracy over time series of two days gave the maximum accuracy. The experimental results thus obtained reveal that the LSTM model proposed in this paper can efficiently analyze and extract the features of the feeding input and can perform plenty good over any sort of fluctuating data.

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1.   INTRODUCTION

The stock market is basically an aggregation of various buyers &sellers of stock. A stock in general represents ownership claims on business by a particular individual or a group of people. A stock market is an organized set-up with a regulatory body and has registered members who can buy or sell shares. It's a public market, where different companies invest high capital and do trading of their shares. Stock market prediction provides information about stock market, which can help the shareholders to make decision about trading. It may serve as warning system for long-term shareholders while for short-term investors may serve as recommender system.

People tend to buy those stocks whose prices are expected to rise in the near future. The uncertainty in the stock market refrain people from investing in stocks. Thus, there is a need to accurately predict the stock market which can be used in a real time scenario. The method used to predict the stock market includes the various machine learning algorithms. Share Market is an area where prediction doesn't follow any significant rules to analyse the price of a share in the share market. Both investors and industry are involved in stock market and want to know whether a particular share would rise or fall over a certain period of time. The share market is based on the concept of demand and supply. If the demand for a particular company's stock is higher, then that company's share price would tend to increase and if the demand for company's share is low then the company share value tends to decrease. Stock markets are one of the important parts of the economy of a country. Actually it's the most important way for the companies to raise capital. Not only the investors but also the common peoples are also finding it as an investment tool. As stock market influences individual and national economy heavily, predicting the future values of stock market is essential task while taking the correct decision whether to buy or sell the share .But it was very difficult to predict the stock price trends efficiently because many factors such as economics, politics, environment etc. were deciding parameters.

Aim of preparing a model for stock analysis and prediction is to ease the functioning of human brain i.e., to prepare a computational model that can itself perform these operations as human intelligence does. The process of preparing such a model to behave as human brain is known deep learning. In our case, deep learning is implemented to train the proposed model that has been trained using LSTM algorithm. LSTM (Long Short-Term Memory) is an enhanced version of RNN that offers feedback mechanism thus making efficient use of memory space and ensures authenticity of data.

1.1 Basic Definition -

A place where trading of shares for any company takes place is known as stock market. Stock market analysis prediction is a way to determine the future value of a company's stock. Machine learning techniques are used to evaluate past data pertaining to the stock market and world affairs of the corresponding time period, in order to make predictions in stock trends. Various methodologies are available to increase the efficiency of stock price prediction as compared to human beings. Stock market being a huge zone of attraction for the youth is a deliberate area of economy. Thus a model with prediction capacity requires to be trained with an efficient algorithm such that the successful prediction of a stock's future price could yield significant profit.

1.2 Basic Concept -

Contemplating the patterns of the securities exchange, we have planned a model dependent on LSTM (Long Short-Term Memory), that can be utilized to investigate and gauge the patterns of stock qualities for any organization. Our model is prepared and has tried utilizing LSTM that utilizes time arrangement for forecast. LSTM propels the idea of RNN (intermittent neural system) by offering memory focal points i.e., it gives an input instrument to guarantee security of information. The proposed model can allow different fluctuating information esteems by manual datasets has been tried with different single day esteems and sequential day esteems for expectation. Anyway the exactness after some time arrangement of two days gave the greatest precision. The trial results in this way got uncover that the LSTM model proposed in this paper can productively investigate and extricate the highlights of the taking care of information and can perform bounty great over any kind of fluctuating information .

1.3 Mathematical Formulae -

Following are the 6 information processing equation of LSTM:
1. $i_t = \sigma(W_i x_t + H_i h_{t-1} + b_i)$
2. $f_t = \sigma(W_f x_t + H_f h_{t-1} + b_f)$
3. $o_t = \sigma(W_o x_t + H_o h_{t-1} + b_o)$
4. $b_t = \tanh(W_b x_t + H_b h_{t-1} + b_b)$
5. $c_t = f_t * c_{t-1} + i_t * b_t$
6. $h_t = o_t * \tanh(c_t)$

where:
i_t = input gate, it provides input to cell.
f_t = forget gate, it determines which data to be dropped.
o_t = output gate , it determines what to output .
b_t = eligible value for memory cell state at time 't'.
c_t = present memory cell state at time 't' .
h_t = output value calculated as element-wise multiplication of o_t and tan value of c_t .
x_t = the input fed at time 't' .
W_i , W_f , W_o , W_b , H_i , H_f , H_o , H_b are the weight matrices .
b_i , b_f , b_o, b_b are the biasing vectors .

2. LITERATURE REVIEW

2.1 Analysis of Studied Literature:

Below listed are some of the prominent research papers on various aspect of stock market analysis .

Stock market prediction forecast using sentiment analysis.

Published in: 2013 Sunil Kumar Khatri, Aayush Srivastava, 'Using Sentimental Analysis in Prediction of Stock Market Investment'.

In this paper sentimental analysis is performed on the data extracted from Twitter and Stock Twits. The data is analysed to compute the mood of user's comment. These comments are categorized into four category are happy, up, down and rejected. The polarity index along with market data is supplied to an artificial neural network to predict the results. In our research work we have performed analysis on sentiments collected from yahoo and trained the artificial neural network with the results and stock prices of five top I.T. companies to predict the return of investment for the future day.

Optimised Prediction Model For Stock Market Trend Analysis .

Published in: 2014 Dr.Devpriya Soni, Sparsh Agarwal, Tushar Agarwal, 'Optimised Prediction Model For Stock Market Trend Analysis'.

The main objective of this work is to add to the academic understanding of stock market analysis using some well define algorithms and machine learning techniques. The goal of this work is to analyse stock market trends using some machine learning and nature inspired techniques, these were first studied and then implemented (a few of them used in this paper are Decision Tree, PSO , Black-Hole , Naïve Bayes.) After analysing the trends with the help of standard techniques, we then proposed an entirely new approach to analyse stock market indices over which accuracy is calculated and compared over different techniques and algorithms.

Survey of stock market prediction using machine learning.

Published in: 2012 Ashish Sharma , Dinesh Bhuriya, Upendra Singh, 'Survey of stock market prediction using machine learning'.

In this paper we survey of well-known efficient regression approach to predict the stock market price from stock market data based. In future the results of multiple regression approach could be improved using more number of variables. Prediction of stock prices is very challenging and complicated process because price movement just behaves like a random walk and time varying. Recent years various researchers have used intelligent methods and techniques in stock market for trading decisions.

Stock Market Prediction based on Social Sentiments using Machine Learning

Published in: 2017 Tejas Mankar, Tushar Hotchandani, Manish Madhwani, Akshay Chidrawar, 'stock market prediction based on Social Sentiments using Machine Learning '.

Machine learning and artificial intelligence techniques are being used in conjunction with data mining to solve a plethora of real world problems. These techniques have proven to be highly effective, yielding maximum accuracy with minimal monetary investment and also saving huge amounts of time. This project is quite relevant as it guides people who possess limited know-how of investments and finance into making well informed decisions regarding stock market investments.

Stock Market Prediction Using Hidden Markov Models

Published in: 2016 Aditya Gupta, 'Stock market prediction using hidden markov model'.

We present the Maximum a Posteriori HMM approach for forecasting stock values for the next day given historical data. In our approach, we consider the fractional change in Stock value and the intra-day high and low values of the stock to train the continuous HMM. This HMM is then used to make a Maximum a Posteriori decision over all the possible stock values for the next day. We test our approach on several stocks, and compare the performance to some of the existing methods using HMMs and Artificial Neural Networks using Mean Absolute Percentage Error (MAPE).

Stock Market Prediction Based on Interrelated Time Series Data

Published in: 2015 Ryotakato, TomohauNgao, 'Stock market prediction based on interrelated time series data.

In this paper, we propose a stock market prediction method based on interrelated time series data. Though there are a lot of stock market prediction models, there are few models which predict a stock by considering other time series data. Moreover it is difficult to discover which data is interrelated with a predicted stock. Therefore we focus on extracting interrelationships between the predicted stock and various time series data, such as other stocks, world stock market indices, foreign exchanges and oil prices.

A Machine Learning Model for Stock Price Prediction

Published in: 2013 Supriya Madiwal, Prachi Mane, 'A machine learning model for stock price prediction '

In this paper we survey of well-known efficient regression approach to predict the stock market price from stock market data based. Stock traders mainly use three indicators for prediction: OHLC average (average of Open, High, Low and Closing Prices), HLC average (average of High, Low and Closing Prices) and Closing price. This project computes the accuracy of the model on the trained and tested dataset, by comparing the actual values of the stock with the predicted values. Stock market prediction has attracted much attention from academia as well as business. Due to the nonlinear, volatile and complex nature of the market, it is quite difficult to predict

Stocks Market Prediction Using Support Vector Machine

Published in: 2016 Zhen Hu, Jie Zhu, and Ken Tse 'Stocks market using support vector machine '.

The macroeconomic environment and the financial market are complex, evolutionary, and non-linear dynamical systems. The field of financial forecasting is characterized by data intensity, noise, non-stationarity, unstructured nature, and hidden relationships. Predicting financial indicators is therefore a difficult task. However, forecasting is important in the sense that it provides concrete data for investment decisions. Firstly, four company-specific and six macroeconomic factors that may influence the stock trend are selected for further stock multivariate analysis. Secondly, Support Vector Machine is used in analysing the relationship of these factors and predicting the stock performance. Our results suggest that SVM is a powerful predictive tool for stock predictions in the financial market.

2.2 Prominent Approach :

Stock price prediction serves as an interesting and challenging field for most of the researchers. Prices of stock being fluctuating in nature require proper acquisition of the predicting model. Taking into consideration the trends of the stock market, we have designed a model based on LSTM (Long Short-Term Memory), that can be used to analyze and forecast the trends of stock values for any company. The model is trained and tested using LSTM that makes use of time series for prediction. LSTM advances the concept of RNN (recurrent neural network) by offering memory advantages i.e., it provides a feedback mechanism to ensure security of data. The proposed model is able to intake various fluctuating data values either by manual datasets or via API (Application Programming Interface) and has been tested with various single day values and consecutive day values for prediction. However, the accuracy over time series of two days gave the maximum accuracy.

Raw data from either the downloaded dataset or from the dataset fetched from the API is fed during the first phase. This data is used for the stock analysis and prediction. Preprocessing of data is done using data distinction, data normalization, data filling

and data recombination. After these steps, the refined data is split into training and testing sets of data. In the training of model, the essential feature or attributes present amongst the data sample are extracted it i.e., those features that will be fed to the neural network present in next phase. Here we are going to feed Open Price, Low Price, High Price, Volume, Close Price and the time. This model is basically a layered LSTM model that consists of an input layer proceeded by two or more LSTM layers with a further dense layer that consists of ReLU activation function. Number of layers of LSTM required is dependent on how complex the operation is. Then finally comes the output layer that outputs the prediction. It has linear activation functions that are applied to the output. Output layer is the last phase in this approach. It receives the output from all the earlier layers and then compares the computed value with the expected value and finds the error from the difference of both.

2.3 Motivation:

Stock market is a great and major point of attraction for the youth in terms of less input and maximum output. Being a part of this youth, it has been a motivation to design and studies such models that can bring efficiency and intelligence in machines more than humans such that the profits while investing in stock market are maximum .The existing works on stock price predictions are efficiently good at their levels. But stills most of the works lack efficiency in real time stock price prediction .Thus we were concerned about bringing perfection in the existing works. Our model has achieved splendid amount of efficiency in the prediction of future stock prices that you will notice as you go through the further report.

3. Problem Definition and Requirement Analysis

3.1 Problem Definition

Stock market is very vast and difficult to understand. it is considered too uncertain to be predictable due to huge fluctuation of the market. Stock market prediction task is interesting as well as divide researches and academics into two groups, those who believe that the market is efficient, Stock market analysis & prediction is basically defined as trying to determine the stock value and offer a robust idea for people to know and predict the market and the stock prices. It is generally presented using the quarterly financial ratio using the dataset. Thus, relying on a single dataset may not be sufficient for the prediction and can give a result which is inaccurate. Hence, we are contemplating towards the study of machine learning with various datasets integration to predict the market and the stock trends. Investing in a good stock but at a bad time can have disastrous result, financial investors of today are facing this problem of trading as they do not properly understand as to which stocks to buy or which stocks to sell in order to get optimum result.

The problem with the estimate the stock price will remain a problem if a better stock market prediction algorithm is not proposed. Predicting how the stock market will perform is quite difficult .the movement in the stock market is usually determine by the sentiments of thousands of investors. Stock market prediction, calls for an ability to predict the effect of recent events on the investors. These events can be political events like a statement by a political leader, a piece of news on scam etc. It can also be an international event like sharp movements in currencies and commodity etc. All these events affect the corporate earnings, which in turn affects the sentiment of investors.it is beyond the scope of all the investors to correctly & consistently predict prediction very difficult. Once the right data is collected, it then can be used to train a machine and to generate a predictiveresult.so, the purposed project will reduce the problem with suitable accuracy faced in such real time scenario.

3.2 Requirement Analysis

3.2.1 Scope of the Project:
Analysis of **stocks** using data mining will be useful for new investors to invest in **stock market** based on the various factors considered by the software. Demand
and Supply of shares of a company is a major reason **price** change in **stocks**. When Demand Increase and Supply is less, **price** rises.

3.2.2 Aim of the Project:
The aim of the project is to create software that analyses previous stock data of certain companies, with help of certain parameters that affect stock value. We are going to implement this value in data mining algorithms. We will determine the month's high and low with help of data mining algorithms.

3.2.3 Prominent features:
• Analysing stock data- Need to provide the data of a particular company ,and its monthly sales / profit report with months high & low points of its stock
• Analysing the factors-To obtain the data in the same period for the following factors.
1. Demand & Supply-we will obtain by the previous data entered.
2. Corporate results-Companies declare their performances results and profit at the end of each quarter.

3. Popularity-if any news about a company is about to come and is it bad or good.

We have to analyse the variation in the stock value of the variations In the stock value of the companies with respect to these factors using Some data-mining algorithms.

3.2.3 Objectives to be achieved:
• To identify factors affecting share market.
• To generate the pattern from large set of data of stock market.
• To predict an appropriate value of share price.

4. Proposed Approach& Methodology

4.1 Proposed Approach:

We focus on predicting the stock values using different machine learning algorithms. We proposed the system of stock market analysis and prediction.in this proposed system ,we were able to train the machine from the various data points from the past to make a future prediction .we took the data from the previous year stocks to train the model. We will majorly use machine learning libraries like numpy & scikit. The data set we used was from the previous year's stock markets collected from the public database available online, 80 % of data was used to train the machine and the rest 20 % to test the data. The basic approach of the supervised learning model is to learn the patterns and relationships in the data from the training sets and reproduce it for the test data. We are going to use python pandas library for data processing which will combined different datasets into a data frame. The data frame features were date and the closing price for a particular day.

We used all these features to train the machine on algorithms and predicted the object variable, which is the price for a given day. We also quantified the accuracy by using the predictions for the test set and the actual values. The proposed system touches different areas of research including data pre-processing, and so on.
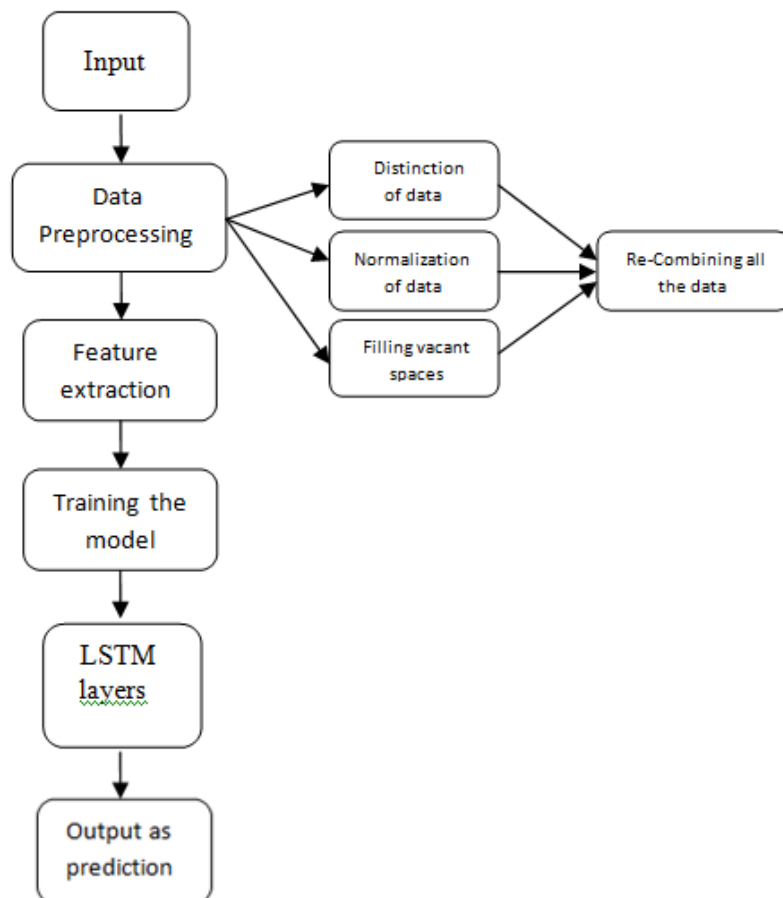
4.1.1 Block schematic of the approach:

Fig.1

4.1.2 Algorithm:

LSTM

LSTM (Long Short-Term Memory) frameworks are a kind of irregular neural framework prepared for learning demand dependence in course of action desire issues. This is a lead required in complex issue regions like machine translation, talk affirmation, to say the very least. LSTMs are a confounding area of significant learning. It might be hard to get your hands around what LSTMs are, and how terms like bidirectional and progression to-plan relate to the field. LSTM is an improved form of RNN with a yield entryway that is fit for detecting which information to keep and which to dispose of at the shrouded layer. This element of LSTM assists with keeping up a proficient usage of memory. LSTM likewise takes care of the evaporating inclination issue.

A LSTM unit basically consists of an input gate, output gate, forget gate and a cell. All the three gates are responsible for the in and out of data whereas the cell is responsible for storing values at random instances.

Steps of LSTM:
3.1   Data sample (Input):
Raw data from either the downloaded dataset or from the dataset fetched from the API is fed during the first phase. This data is used for the stock analysis and prediction.
3.2   Data Pre-processing:
Data pre-processing refers to the process of analyzing, modifying and correcting the data if needed; before feeding it to the next phase. It is basically composed of four steps:
   3.2.1   Data Distinction:
   Also known as the separation of data is the process of reducing the amount of data
    based on its Importance by distinguishing different elements of data.

   3.2.2   Data Normalization:
   Normalization of data refers to the reduction in magnitude of the data so as to lessen up the complex processing and avoid the redundancy of data.

   3.2.3   Data Filling:
   In this step, vacant spaces present in the data sample are filled in, manually.

    3.2.4   Data Recombination:
    Here the recombination of data takes place i.e., the data processed in the earlier three steps is combined into a whole so as to complete the pre-processing of data.

After these steps, the refined data is split into training and testing sets of data. The ratio that we have used is 7:3 for training: testing respectively.
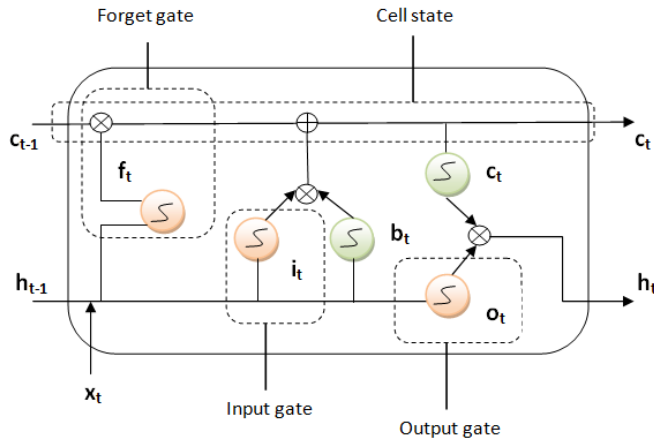
A LSTM unit is as shown in Fig.2:

Fig.2

4.2 Methodology:

The purposed method for developing the system consist of mainly three main steps firstly, data is collected and sorted for relevancy from various sources. Secondly, analysis is carried out on the collected data by examining the current market direction, tracking the industry group and specific companies after which the data is represented and scored accordingly.at last LSTM is designed and a suitable and suitable algorithm yielding best accuracy is chosen to predict the stock value.

4.3 Data flow diagram:

Analysis is carried out on the collected data by examining the current market directions, tracking the companies after which data is represented and scored accordingly. Flow of data while under analysis is as follows:
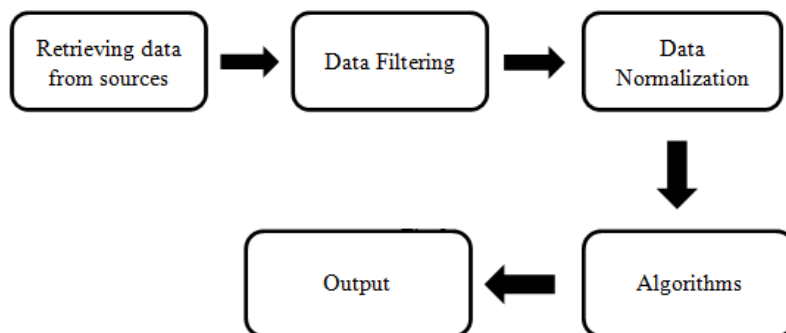

Fig.3

4.4 Architectural flow diagram:

Data scoring the process of applying a predictive model to a set of data is referred to as scoring the data.it also shows the vulnerabilities of a particular stock or entity. The user authentication system control is implemented to make sure that only the authorized entities are accessing the result.
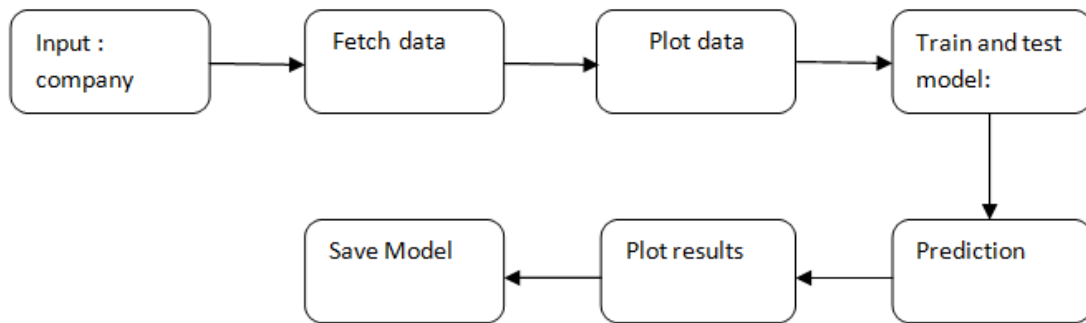
Fig.4

4.5 Control flow diagram:

The dataset used in this project is downloaded from Kaggle. This datasets is present in what we call raw format. The data set is a collection of stock market information about a few companies.
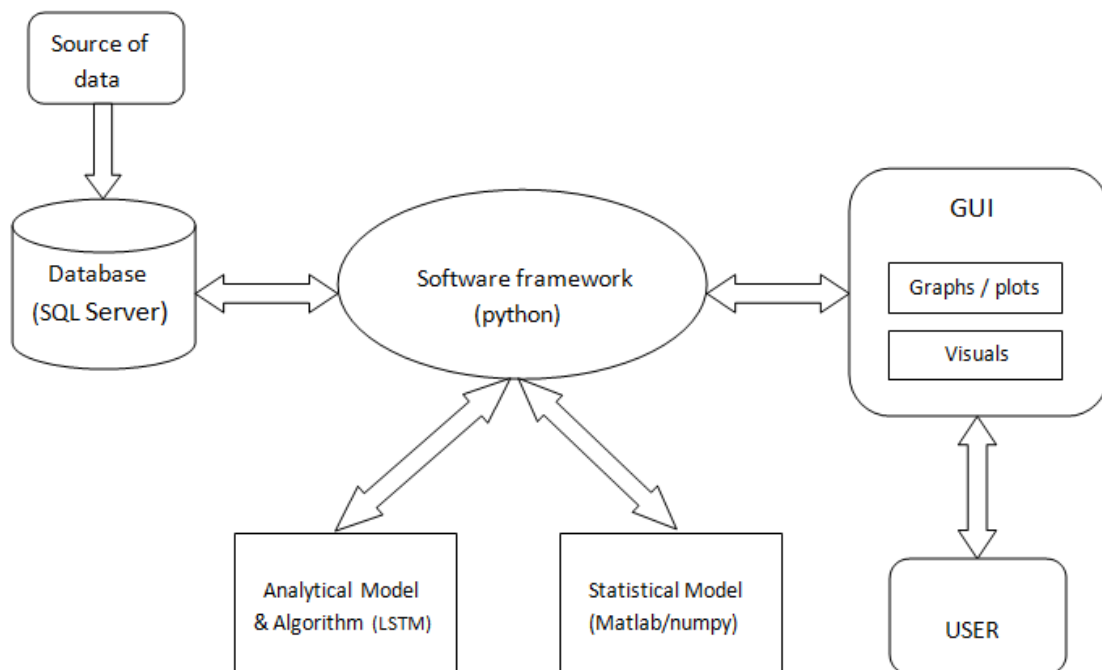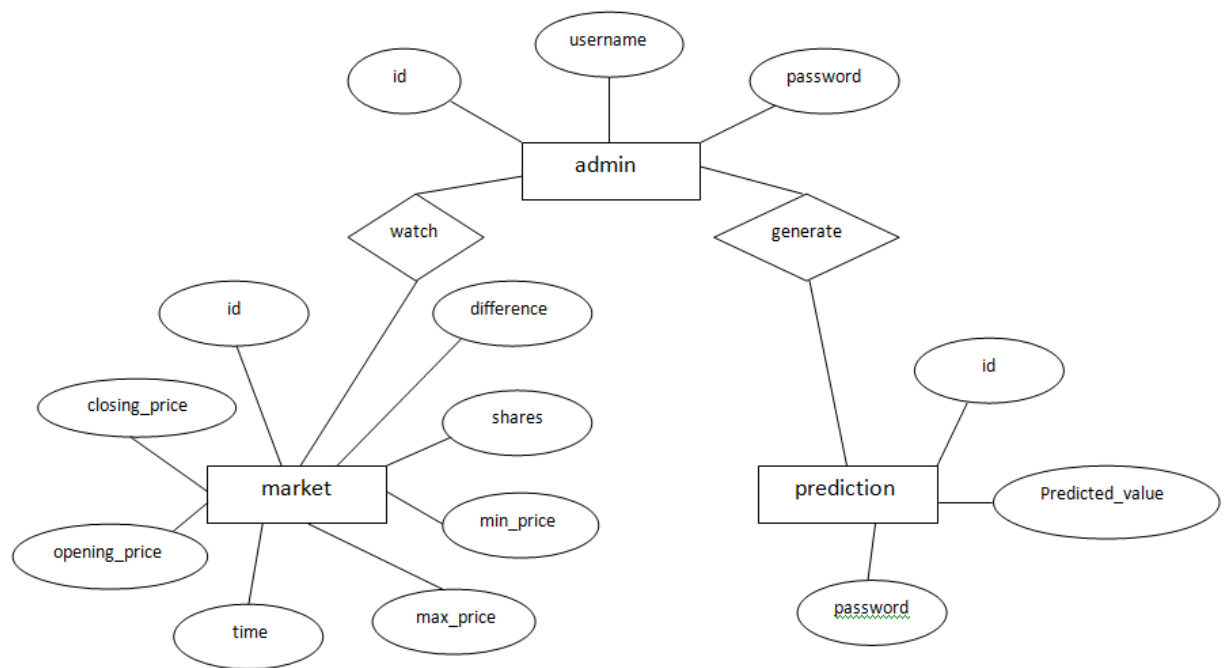
Fig.5

4.6 E-R diagram:

Fig.6

4.7 Pseudo code:

<u>Explanation of LSTM</u>

- Processing input through the input gate :

```
1  #xc already calculated above
2  self.state.i = sigmoid(np.dot(self.param.wi, xc) + self.param.bi)
3  #in the photo Gate gate is actually C't(pronounce it  as c bar t)
4  self.state.g = np.tanh(np.dot(self.param.wg, xc) + self.param.bg)
```

The input is processed through the input gate comprising of sigmoid
Function.

- The output is obtained through the output gate :

```
1   #to calculate the output state
2   self.state.o = sigmoid(np.dot(self.param.wo, xc) + self.param.bo)
3   #output state h
4   self.state.h = self.state.s * self.state.o
```

The output is obtained from the output gate after flowing through the sigmoid and the tanh function .

- The use of forget gate :

```
1   #stacking x(present input xt) and h(t-1)
2   xc = np.hstack((x,  h_prev))
3   #dot product of Wf(forget weight matrix and xc +bias)
4   self.state.f = sigmoid(np.dot(self.param.wf, xc) + self.param.bf)
5   #finally multiplying forget_gate(self.state.f) with previous cell state(s_prev) to get present state
6   self.state.s = self.state.g * self.state.i + s_prev * self.state.f
```

The data segments which are further not required in the LSTM cell are removed from the cell using the forget gate. This improves the memory utilization of algorithm .

- Calculation of cell state :

```
1   #to calculate the present state : forget_gate*previous_hidden_state + gate_gate*input_gate
2   self.state.s = self.state.g * self.state.i + s_prev * self.state.f
```

For in the data from next state cell state i.e., currently active is calculated.

5. Experimental setup and results:

To test the dissecting and expectation limit of our model, we have played out the forecast procedure in a unique manner. In that, the forecast was about proportionate to the constant qualities i.e. the mistake factor was immaterial.

Remembering the time arrangement system used to help the LSTM, we have considered the latest information i.e. the most recent two days details to anticipate the following days' worth .

## 5.1 Experimental setup:

Hardware used :

- Laptop
- Wi-Fi-connection

Software used :

- Windows 10 as OS
- My SQL
- Python 3.9
- Anaconda Navigator
- VS Code
- Google Chrome

5.2 Results:

Analysis and prediction on historic datasets:

Here, we have downloaded the dataset of stock prices for Hang Seng Index, Hong Kong from 2008-07-01 to 2016-09-30 and then analyzed those data values to feed in our model. Thus, we obtained the contrast between the real time values and the predicted value. Result was as follows:
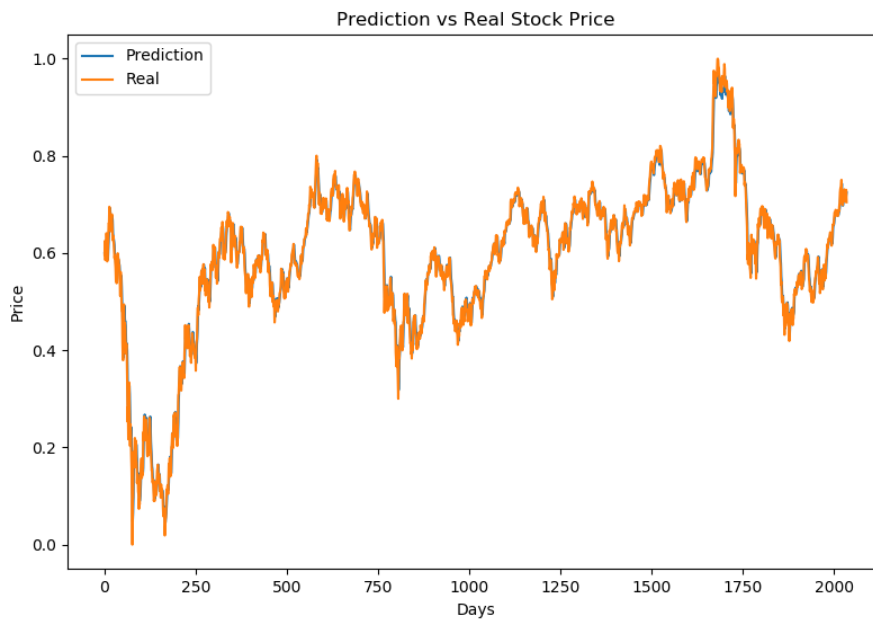
As shown, the blue lines represent the predicted value by our model followed by the real time values represented by the orange lines. An average error of 0.01874 was obtained.

6. CONCLUSION:

Stocks are volatile. Prices change according to supply and demand so to analysis and measure the accuracy of prediction of stock so that investors get profit by investing.so we are going to check various algorithms that which algorithm gives more accuracy. The algorithm will be a great asset for brokers and investors for investing money in the stock market since it is trained on a huge collection of data . has been chosen after being tested on a sample data.

We consisted of one LSTM layers and Attention layer, and was used for extracting the fluctuation characteristics in stock price data through neural network and recurrent neural network. The LSTM recurrent neural networks to extract feature value and analyse the stock data. The experimental results show our model can play a better forecasting effect. In addition, LSTM architecture was used for addressing the gradient disappearance and expansion issues of time series data and then efficiency was improved by using Attention.

7.   FUTURE ENHANCEMENT:

Future scope of this project will involve adding more parameters and factors like the financial ratios; multiple instance, etc. the more the parameters are taken into account more will be the accuracy .the algorithms can also be applied for analysing the contents of public comments and thus determine patterns/relationships between the customer and the corporate employee. The used of traditional algorithms and data mining techniques can also help predict the corporation's performance structures as a whole.

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