**Stock Analysis and Prediction Based on LSTM**

1. **Abstract :**

Stock price volatility is a highly complex nonlinear dynamic system. Stock value developments were anticipated by using different stock data by specialized methods for profound learning. The design dependent on LSTM utilizing attention, proposed right now, demonstrated through analysis to have the option to successfully improve expectation exactness. LSTM (Long-Short Term Memory) is a sort of time repetitive neural system, which is appropriate for handling and anticipating the significant occasions of interim and long postponement in time arrangement. In light of fleeting qualities of stock and LSTM neural system calculation. This paper utilizes the LSTM repetitive neural systems to channel, extricate include esteem and investigate the stock information, and set up the expectation model of the comparing stock exchange. Its main motive is to discover the role of time series through analyzing the historical information of the stock market, and to deeply explore its internal rules through the selective memory advanced deep learning function of LSTM neural network model, so as to achieve the prediction of stock price trend.

**2. Introduction:**

The stock market is the place where the stocks are transferred, traded and circulated. Stock value anticipating is the most well-known conjecture dependent on time-arrangement information in money related market. Stock value information are loud, complex and non-straight which is anything but difficult to be influenced by numerous elements, for example, arrangement, economy and brain science. The stock market is often regarded as an indicator of stock prices and quantities. However, due to the complexity, variability and uncertainty of the stock market, the stock price formation mechanism presents the characteristics of complexity and unpredictability. Stock prices not only from the political, economic, market, technology, and investor behavior aspects such as individual factors, influenced by various factors in the interaction between the role at the same time, these will lead to changes in stock prices, the existence of the various uncertain factors lead to the complexity of the stock price changes. Accordingly, we have to lead information preprocessing and investigation before the forecast.

As the stock price, volume and other data contains a large number of information affecting the stock price changes, ANN can learn the historical data of the stock, so as to find the law of stock prices. But the financial data is affected by many factors in reality, and the time series formed by it is more random and random, and it usually has multi-level and multi scale characteristics. Therefore, the prediction model of single neural network has limitations and has a certain impact on the prediction accuracy of stock prices. Prediction strategies can't precisely catch chronicled data, which frequently depend on direct relapse and parameter estimation. Along these lines, most money related expectation will in general form nonlinear models, for example, SVM and profound learning neural system model. Deep learning is one of the main technologies being developed by research teams and even many countries with great efforts. Deep learning is a technique for AI which created from the first neural system. As of late, an ever increasing number of researchers have been attempting to take care of time series issue dependent on profound learning strategies. Recurrent Neural Network (RNN) adds the idea of time to its system structure, making it devoted to preparing time series data. LSTM is a special recurrent structure that improves the ability of the RNN network to handle long-term dependent tasks and is resistant to vanishing gradient problem. LSTM to stock forecast and accomplished great outcomes. For instance,d weighted LSTM model to rethink stock pattern gauges was proposed in. The bidirectional LSTM and the stacked LSTM with the basic LSTM were looked at, and the outcomes demonstrated that the presentation of the bidirectional LSTM is the best in stock expectation in. Also, in, a multi-branch LSTM stock momentary expectation. The LSTM prediction model over traditional prediction models, which can be applied to various nonlinear time-series data, but have not studied the influence of timeseries stationary difference on prediction results.

**3. Literature Review** :

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

* **Prediction of Stock Price Based on LSTM Neteural work**

Published in :2019 Dou Wei, ‘ Prediction of Stock Price Based on LSTM Neural Network’.

LSTM neural network model has some limitations, such as the time lag of prediction, but with attention layer, it can predict stock prices. Its main principle is to discover the role of time series through analyzing the historical information of the stock market, and to deeply explore its internal rules through the selective memory advanced deep learning function of LSTM neural network model, so as to achieve the prediction of stock price trend.

* **Stock Prediction Based on LSTM under Different Stability**

Published in :2019 Xianfu Chen, Fei Qian, ‘Stock Prediction Based on LSTM under Different Stability.

Stock price forecasting is the most common forecast based on time-series data in financial market. Stock price data are noisy, complex and non-linear data get analysed & predicted by using algorithm Long Short Term Memory network (LSTM) is a special algorithm for processing time-series problem. In this work, we conducted a stationary analysis of the stock's time-series data and then used the LSTM neural network algorithm to predict stock data under different stationary conditions, and performed statistical analysis on multiple experimental data.

* **prediction forecast using sentiment analysis**.

Published in: 2013 Sunil Kumar Khatri, Ayush Srivastava, ‘**Stock market prediction forecast using sentiment analysis**.

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 Ryota kato, Tomohau Ngao, ‘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.

* **Share Price Trend Prediction Using Attention with LSTM Structure**

Published in: 2019 Wun-Syun ġJhang, Ming-Chuġ Hsieh ‘Share Price Trend Prediction Using Attention with LSTM Structure’.

In this paper, stock price movements were predicted by utilizing various stock information by technical means of deep learning. The architecture based on LSTM using Attention proposed in this paper was proven through experiment to be able to effectively improve prediction accuracy.

This paper tried to predict stock price through deep learning and discuss relevant issues. Deep learning was applied because it was able to calculate the characteristics or trends that cannot be calculated or noted by human; in addition, deep learning has a great development space.

* **Stock Transaction Prediction Modeling and Analysis Based on LSTM**

Published in :2019 Siyuan Liu, Guangzhong Liao ,Yifan Ding ‘Stock Transaction Prediction Modeling and Analysis Based on LSTM.

The stock's trading volume affects the stock's self correlation , and inertial effect, and the adjustment of the stock is not to advance with a homogeneous time process, which has its own independent time to promote the process. LSTM is a kind of time recurrent neural network, which is suitable for processing and predicting the important events of interval and long delay in time series. Based on temporal characteristics of stock and LSTM neural network algorithm, this paper uses the LSTM recurrent neural networks to filter, extract feature value and analyze the stock data, and set up the the prediction model of the corresponding stock transaction.

1. **Long Short Term Memory (LSTM):**

Long Short Term Memory network (LSTM) is an upgraded version of RNN. Different from the traditional neural network, there are connections between the hidden layers of RNN. Therefore, the input of the hidden layer not only includes the input of the input layer but also the output of the hidden layer at the previous moment. Long Short Term Memory organizes (LSTM) is an overhauled form of RNN. Not the same as the conventional neural system, there are associations between the concealed layers of RNN. Along these lines, the contribution of the shrouded layer not just incorporates the contribution of the information layer yet in addition the yield of the concealed layer at the past minute. LSTM consists of unit, input gate, output gate and forget gate. Moreover, memory time interval value was further designed with three special gates, namely, input gate, forget gate and output gate, for transmission of time information. Also the gate structures effectively solves the vanishing gradient problem, making it very suitable for dealing with long-term dependency problems

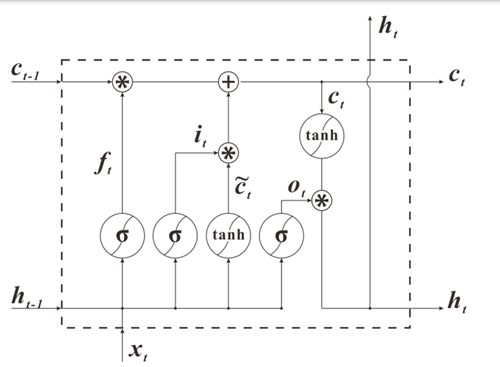


Fig. LSTM Structure.

1. **Proposed Approach** :

We focus on predicting the stock values using LSTM here .We proposed the system of stock market analysis and prediction. In this , 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 instances of stocks to train the model.

LSTM is a brilliant algorithm that uses time series mechanism , to predict the stock values . Being an advancement of RNN, LSTM uses feedback mechanism to ensure safe training and testing of data in the input phase . Moreover LSTM provides various hidden layers for fast and efficient processing of data .

Herein, LSTM uses data fetch value as n=2 i.e our algorithm logic will fetch the data value of previous two days to predict the stock value of present day. Thus it doesn’t matter whether we have to predict the stock value from previous or present datasets . For future predictions we will be using yahoo “yfinance” api to fetch the live time data values extending from the period of time from where we need the data and the company whose stock datasets we need to fetch remains flexible . While performing we have performed the prediction and analysis of Facebook and Microsoft for previous one year from current day and the outputs were flexible to remain above the effiecient accuracy . Thus over other algorithms , LSTM has helped us achieve our aim.

1. **Conclusion :**

Stock value forecast has consistently been the issue talked about by monetary foundations and even specialists and researchers. As of late, with the improvement of profound learning, budgetary forecast is additionally getting well known. This paper attempted to foresee stock cost through profound learning and examine significant issues. Profound learning was applied in light of the fact that it had the option to ascertain the attributes or patterns that can't be determined or noted by human; moreover, profound learning has an incredible improvement space.

In this paper 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 analyze 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.

1. **References:**

1.Wang Bo, Zhang Fengling. "Comparison of Artificial Neural Network and Time Series Model for Forecasting Stock Prices." Journal of Wuhan University of Technology (Information and Management Engineering) 27.6(2005):69-73.

2. Lin Jie, Guo Yaohuang. "Short Term Prediction of Stock Prices Based on Neural Networks." Journal of Southwest Jiaotong University 33.3(1998):299-304.

3. Gododfellow I, Bengio Y, Courville A. Deep learning [M]. The MIT Press, 2016 .

4. Rumelhart, D. E., Hinton, G. E., and Williams, R. J. (1986c). Learning representations by back-propagating errors. Nature, 323, pp. 533-536.

5. Gododfellow I, Bengio Y, Courville A. Deep learning [M]. The MIT Press, 2016 [5] Rumelhart, D. E., Hinton, G. E., and Williams, R. J. (1986c). Learning representations by back-propagating errors. Nature, 323, pp. 533-536.

6. M. Owayjan, R. Achkar and M. Iskandar, "Face Detection with Expression Recognition using Artificial Neural Networks," Beirut, Lebanon, 3rd Middle East Conference on Biomedical Engineering (MECBME), October 2016, pp. 116-120.

7. H. C. Yin, C. Y. Zhao, “Research on stock forecasting based on neural network”, Natural Science Journal of Harbin Normal University, vol. 23, no. 3, pp. 47-49, 2007.

8. S. Hochreiter, J. Schmidhuber, “Long short-term memory.”, Neural computation, vol. 9, pp. 1735–1780, 1997.

9. Khaled A. Althelaya, El-Sayed M. El-Alfy, Salahadin Mohammed, “Evaluation of Bidirectional LSTM for Short- and Long-Term Stock Market Prediction,” in 9th International Conference on Information and Communication Systems (ICICS), 2018 IEEE, pp. 151-156.

10. Sun Jihong. "Long time series clustering method and its application in stock price.". Diss. WuHan University, 2011.