Stock Retail Projection: Prediction of Future Stock Market Using LSTM Model

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Abstract

Predicting the stock market is difficult due to its complicated nature in this competitive world. There are many factors like physical behavior, industrial performance, economic factors, etc., which are going to affect the stock price. Due to these factors and a wide range of markets, Predicating Future stock values with high accuracy become tough. As we know that, learning from the past and predicting the future is one of the best things provided by machine learning algorithms for us. Our paper describes how to use machine learning algorithms such as recurrent neural networks (RNN) and, in particular, the Long-Short Term Memory model (LSTM) to forecast stock prices in the future. The central theme of our paper is how we will forecast stock prices and how we will use these algorithms to achieve high precision in forecasting stock prices.

***Keywords*:** Recurrent neural network, Long-Short Term Memory, Predication, Neural-Networks, Stock Market, Long-Term dependencies, National Stock Exchange(NSE).

I. Introduction

The Indian stock exchanges are the most famous investment destinations. India's two largest stock exchanges are the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE) (NSE). Companies list their shares for the first time in the main market through an Initial Public Offering, and investors purchase and sell their shares in the secondary market. On many occasions, stocks worth INR 6, 00,000 cores have been traded on India's two stock exchanges. The uninitiated in India may mistakenly regard stock market investments as gambling, but a basic understanding of the stock market would change their minds. The Securities and Exchange Board of India (Securities and Exchange Board of India) is in charge of overseeing and controlling India's capital markets. The SEBI Act of 1992 established SEBI as a separate body with the authority to audit stock exchanges. The inspections look into the market's processes and organizational structure, as well as regulatory compliance.

The fundamentals of an organization are unimportant to technical experts, also known as chartists. They attempt to forecast a stock's future price based solely on historical price trends (a form of time series analysis). Head and shoulders, as well as cup and saucer, are among the styles used.In accordance with the patterns, techniques such as the exponential moving average (EMA), oscillators, aid and resistance ratios, and momentum and volume metrics are used. Scientific observers still use candlestick patterns, which are believed to have originated with Japanese rice merchants. In technical analysis, short-term approaches are more often used than long-term techniques. As a result, commodity and forex markets, where traders are mainly concerned with short-term price fluctuations, have embraced it.

With the advent of the digital machine, stock market forecasting has progressed into the scientific realm. Artificial neural networks (ANNs) are the most well-known system. Back propagation networks are the most common name for these networks. Another form of ANN that is best suited for market prediction is the time recurrent neural network (RNN).The aim of this project is to design the

algorithms in such a way that they can accurately predict stock prices. As we all know, market value prediction is in high demand, and it is a valuable tool for people who want to maximize their income while minimizing their risk. To plan a project like this, where something needs to be expected, Machine learning algorithms and neural networks will be needed.
We will use the LSTM (long short-term memory based) algorithm, which is one of the RNN (recurrent neural network) architecture-based algorithms, in this project since we need to predict stock prices. Our aim in this project is to achieve the highest level of accuracy possible. so As a result, the first step is to choose an appropriate algorithm. The same reasons for why we chose LSTM and why it is more effective than other neural networks are mentioned below.

Indian stock market

Stock exchanges are where people will buy and sell shares of publicly listed companies. It is a secondary marketplace where trading is done by investors. When any company wants to become public, then the company lists itself on any stock exchange. Then the promoter group sells a considerable number of shares to the public. When the company is incorporating, the shares took by promoter groups in a primary market. When these shares are sold to public retail investors, they could be traded in stock exchanges.
The Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE) are the two largest stock exchanges in India, where the bulk of trades are conducted (NSE). There are 5000 companies on the BSE, while there are 1600 on the NSE. The trading mechanisms, market open and closing times, and settlement procedure are all identical on each of these exchanges. Any individual investor can become a member of the stock market through these stock exchanges, and the public can buy shares of any listed company using a trading account or a demand account. The Indian investment arena benefited from government measures such as tax benefits on investments, National Pension Scheme (NPS) investing in stock markets, and so on, thanks to this online marketing. Because of the constant reduction in bank interest rates and rising inflation, middle-class investors are shifting their investments from fixed deposits to equity markets. As a result of all of this, the capitalization of both exchanges has increased.

Neural Networks

In common artificial neural networks consist of 3 layers 1) input, 2) hidden, and 3) output layer. We wonder how these neural networks work and are used for information storage or information process, let's see how it works, Input layer connects to the hidden layer by links, which are also called synapses. There will be some coefficient weights, which signified the relation between nodes I,e, between the input layer and hidden layer.
These weights are in charge of sending signals to decision-makers and are very useful.
Since the learning process is naturally a continuous adjustment of weights, the Artificial NN will have optimal weights for each synapsis after learning.
The hidden layer nodes apply a sigmoid or tangent hyperbolic (tanh) function to the number of weights from the input layer; this transformation produces values with a reduced error rate between the train and test data using the SoftMax function. We'll get some output values here that aren't really the highest. So, in this case, the back propagation process is used to reduce the error and optimise the performance. This propagation mechanism connects the hidden layer and the output layer, which is useful for transmitting signals and responsible for providing the best error. This procedure will be repeated in order to reduce the prediction error.
Following the above steps, the model will be conditioned. Recurrent neural networks are neural networks that predict future values based on previous performance (RNN). The previous results will be saved, and future values will be predicted based on them. The RNN cannot store long-term memory since the data storage could be back data. So, here is a picture of the LSTM, which was very useful in predicting with long-term memory.

- **Recurrent Neural Networks:**

The recurrent neural network it is a king of artificial network that work with time series or sequential data. It will store the data which provided to it to predict the future values. RNN is recursive it performs the same operation to the given data values. The inputs and outputs will depend on the

previous execution. The output will be noted and sent back to the network. Then it will create the new input and output from the previous input when making a decision

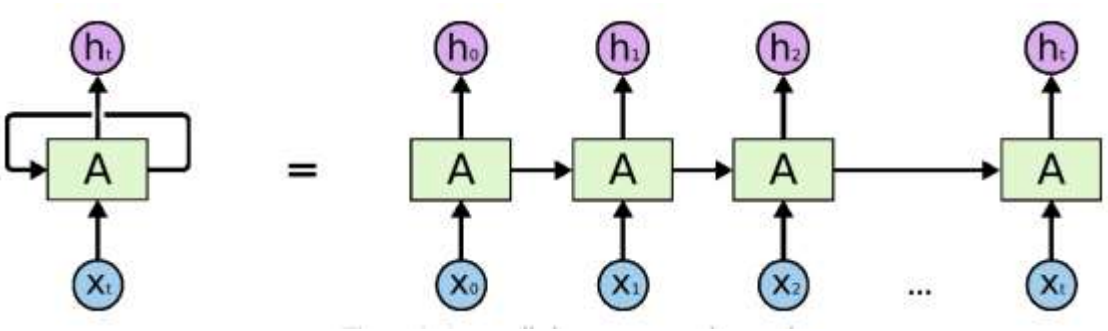

Figure 1. An unrolled recurrent neural network

It takes X(0) as an input, then outputs h(0), which, along with X(1), is used as an input for the next step. As a consequence, the inputs for the next step are h(0) and X. (1). Similarly, h(1) is the next step's input, and X(2) is the next step's input, and so on. As a consequence, the meaning is remembered during the learning process...

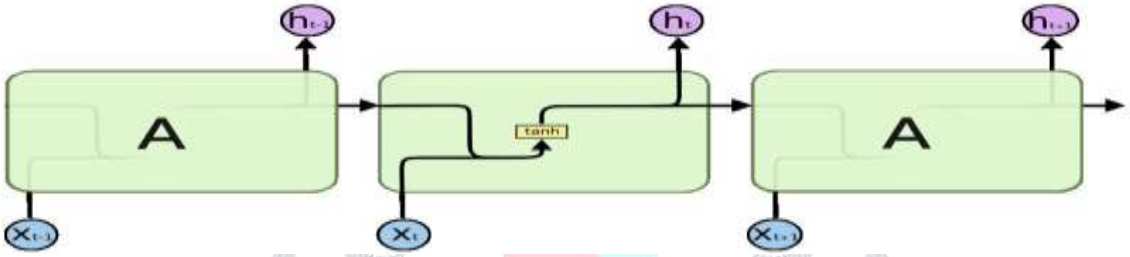

Figure 2.Recurrent Neural Network Internal structure

In the above figure, the Recurrent Neural Network interacts with only one layer, It cannot process very long sequences. Training Recurrent Neural Network is also a difficult task to do. So here comes the concept of an LSTM which is the modified version of RNN and it remembers the past data and eliminates the problem of Gradient Vanishing.

- **Long Short Term Memory (LSTM)**

Long short term memory-based (LSTM) algorithm is one of the successful machine-learning algorithms in recurrent neural network architecture. It is a powerful algorithm that predicts the future based on past results. The advantage of the LSTM algorithm is that it uses memory cells and which results in giving high accuracy results. It is also responsible for extract the real-time data dynamically and stores the data.

The normal recurrent recursion algorithm (RNN) is unable to connect the information when we have to know about very past information that is when gaps are growing between them. But LSTM doesn't have any problem like that. It is designed to overcome the normal RNN's long-term dependency problems. LSTM's are designed to remembering information for a long period instead of struggling to grasp the new information.

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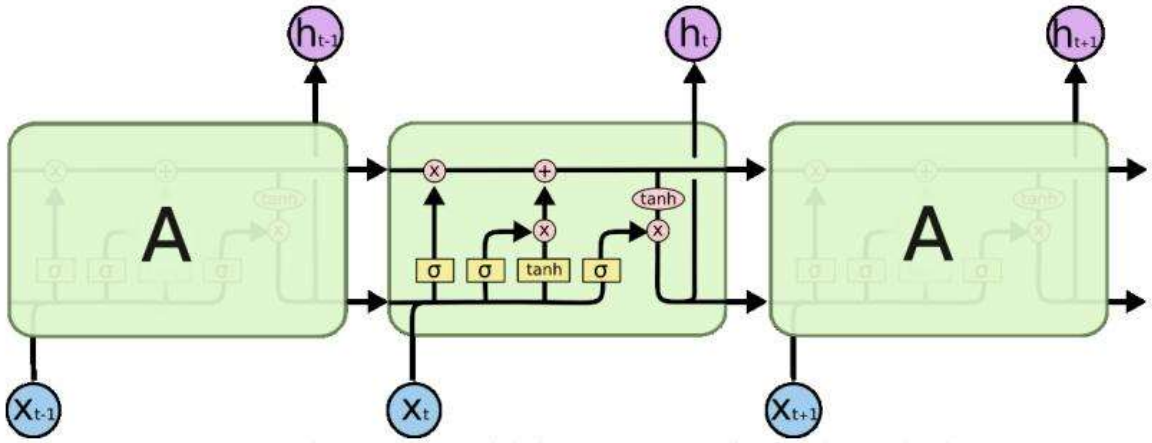


Figure3. The internal structure of an LSTM.

We can see the sigma outputs it will give whether 0 or 1, which 0 means completely ignores the data and 1 means keep the data. Here the tan creates a vector of new values, which could be added to the state. By combining these two values we will give an update to the state. We can see that it is interacting with 4 layers, unlike Normal RNN.

Working of an LSTM

The cell state is the LSTMs' entry point; it works similarly to a conveyor belt. With just a few minor linear associations, this runs all the way down the series. The ability of an LSTM to add or remove information from the cell state is controlled by gates. Information will pass through gates if they are opened. A sigmoid neural net layer and a point-wise multiplication method make up gates. The sigmoid layer produces numbers ranging from 0 to 1, indicating the amount of each segment that should be allowed to move. A value of 0 means "nothing should be allowed through," and a value of 1 means "anything should be allowed through!" Three of these gates protect and monitor an LSTM.
The first step in the LSTM algorithm is to figure out which knowledge from the cell state can be ignored. Its formation is due to the "forget gate layer," a sigmoid layer. It looks at the files ht1ht1 and xtxt and returns a number between 00 and 11 for each. Ct1Ct1. The number 11 denotes "fully hold," while the number 00 denotes "actively delete." The next stage determines which new data from the cell state will be processed. It is divided into two sections. A sigmoid layer called the "data gate layer" determines which values should be changed first.
A tanh layer then produces a vector of new candidate values, CtCt, which can be added to the array. Make a declaration these two are combined in the next stage to create a state transition. Now is the time to update. Ct1Ct1, the previous cell state, into CtCt, the new cell state. ftft multiplies the previous condition. Then we put it to use*Ctit*Ct.The existing candidate values have been scaled in this graph. Depending about how much each state value is going to change. Finally, we must choose a production. The result would be a filtered representation of the cells' current state.

II. Literature Review

Kannan, Sekar, Sathik, and P. Arumugam [17] used data mining technology for uncovering latent trends in historical data that could be used for forecast investment decisions. Stock market forecasting is a difficult job in financial time series forecasting. The focus of this paper is on Bollinger brands instead of MA, RSI, and CMI, the author was able to get an 84.24 percent profitable signal. Artificial neural networks were used by Jing Tao Yao and chew Lim tan for classification, estimation, and recognition. It takes an artist to train a neural network. Trading with neural network outputs, also known as the trading technique is an art form. In this paper, the authors explore a 7-step neural network prediction model construction approach.

Fazel Zarandi M.H., Rezaee B., Turksen I.B., and Neshat E. developed a type-two fuzzy rule based expert method for stock price prediction. In the purposed type-two fuzzy model, the fundamental and technical indices are used as input values. The formula for predicting the value of an Asian automaker's stock. The output values were used to the input fields and tuned using a genetic algorithm to create the

next values of input values. The type-one method was used for inference to improve the system's robustness. This method was chosen for its low error rate, robustness, and adaptability. It's used to forecast future trade that will be more effective.

Using multi-technical metrics, Ching-Hseue Cheng [19], Tai-Liang Chen, and Liang-Ying Wei proposed a hybrid forecasting model for predicting stock market trends. Among the four procedures listed are selecting essential technical indicators, creating common indicators based on a correlation matrix, and using CDPA to minimize the entropy theory process. Then, using the RST algorithm to extract linguistic rules, increase forecasting precision and stock return by optimizing the extracted rules using the genetic algorithm. Producing more reliable and intuitive rules, as well as predicting rules based on quantitative stock data rather than human judgment data, is said to be advantageous.

To predict the three publicly traded companies' annual excess returns. ANFIS and a neural network were used by Trinkle (2006) [11].These two methods are compared to the autoregressive moving average model in terms of predictive capacity. As the comparison results show, the ANFIS and neural network techniques are capable of providing more substantial prediction capacity. To forecast stock prices, Afolabi and Olatoyosi (2007) [14] use fuzzy logic, neuro-fuzzy networks, and Kohonen's self-organizing plan. As compared to other strategies, the variance in Kohonen's self-organizing strategy is minimal, as shown by the results.

Abbasi and Abouec (2008) [12] analyzed the existing trend of the stock price of Iran Khodro Corporation at the Tehran Stock Exchange using an Adaptive Neuro-Fuzzy Inference Method. The findings of the study indicate that stock price patterns can be predicted with less error.
For predicting Taiwan Stock Exchange price, Hang and Liu (2008) [13] developed a Takagi-Sugeno-Kang-type fuzzy rule-based method. With a precision of up to 97.6percent in the TSE index and 98.08 percent in MediaTek, this model effectively predicts stock price movements. To forecast daily changes in the Kuala Lumpur Composite Index, Yunos, Shamsuddin, and Sallehuddin (2008) [15] built a hybrid neuro-fuzzy with ANFIS (KLCI). To interpret the findings, four technical indicators were selected.
A neuro-fuzzy adaptive control system is developed by Atsalakis and Valavanis (2009b) [16] it is used to predict the future stock price movements of the ASE and the NYSE index. In trading simulations, this approach produced positive results. They had the highest result in terms of percentage of stock market trend forecast accuracy, which is also shown by it

III. Proposed Methodology

In our project, we used timestamps of 100. As a result, calculating a single value would necessitate using 100 sets of previous data. I compiled a list of Tata NSE's previous performances. We used root mean square error to verify the difference between the real and expected effects. The Root Mean Square Error (RMSE) is the residuals' standard deviation (prediction errors). The RMSE is a measure of how far the data points are separated from the regression line; residuals are a measure of how far the data points are separated from the regression line. To put it another way, it indicates how closely the data is clustered along the line of best fit. In climatology, forecasting, and regression analysis, the root mean square error is widely used to assess experimental results.

$$RMSE = \sqrt{\overline{(f-o)^2}}$$

Where, f= forecasts (unknown values)
o= observed values
This can be also Written as

$$RMSErrors = \sqrt{\frac{\sum_{i=1}^{n}(\hat{y}_i - y_i)^2}{n}}$$

Where Σ = summation ("add up")
(yi-yi)2 = differences, squared
N = sample size.

```
''Calculating Root Mean Square ''
import math
from sklearn.metrics import mean_squared_error
print("MSE of Training : ", math.sqrt(mean_squared_error(y_train,train_predict))
print("MSE of Testing : ", math.sqrt(mean_squared_error(y_test,test_predict)))
```

```
MSE of Training :  145.85562052715767
MSE of Testing :  261.05475490635905
```

Mean square error is 145.85 when we have taken root of this value 12.06. That means the difference is only 12.06. Which is a very minimal difference between the predicted and the actual data? We begin by forecasting the potential closing prices of five separate companies from predetermined industries. With the assistance of LSTM, this forecast will be based on historical evidence, and the future forecast will be based on completion for 30 days..

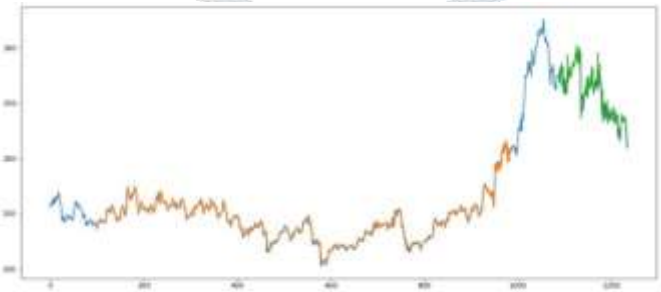
```
df=pd.read_csv("NSE-TATA.csv")
'''Shape of Data'''
print(df.shape)
'''Check missing value'''
print(df.isnull().values.any())
```

We are providing the previous data of NSE Tata in the project .We train the algorithm by providing the past data and it will predict the stock value for next 30 days.

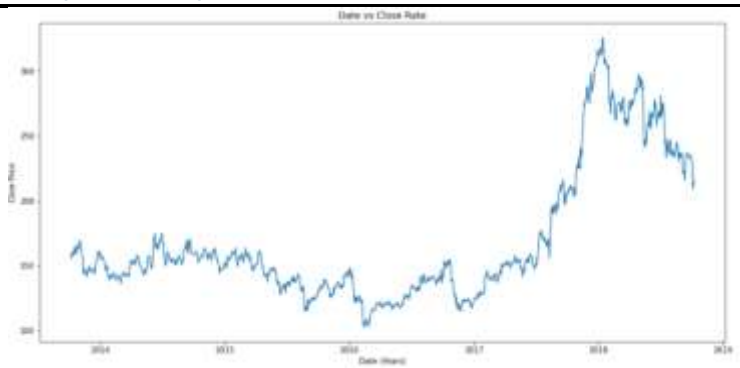
IV. Results and Discussion

The following graphs are showing the different variations in predicting the values. Included the forecasting and next 30 days prediction graph

This is model elevation. Here we can see that both training and testing are in almost same line. That means we can ignore under fit and over fit



This is the graph that we were predicted the closing price blue line is original data. Orange is training Prediction and green is testing prediction.



This is the graph between date and closing price before model implementation. This is our total graph including the forecast.

In the above graph the yellow line shows the prediction of next 30 days

V. Conclusion

In this article, we examine the development of companies from various industries to determine the best time frame for forecasting the future price of a share. As a result, this leads to the crucial inference that firms in the same industry have the same dependencies as well as the same opportunities.

The pace of growth If the model is trained on a larger set of data, the forecast would be a more reliable set. Furthermore, there might be some scope of specificity in the case of the projection of different securities. Analysis of market we should investigate the various patterns of share price movements in various industries and sectors. To fine-tune the precision, examine a graph with a wider range of periods. This method is useful for industry research and forecasting the growth of various firms over various periods. Other variables that are not directly associated with the closing price, such as market sentiment, election results, and geopolitical stability, can help to boost prediction accuracy.

References

[1] F. a. o. Eugene, "Efficient capital markets: a review of theory and empirical work," Journal of finance, vol. 25, no. 2, pp. 383-417, 1970.

[2] Z. A. Farhath, B. Arputhamary and L. Arockiam, "A Survey on ARIMA Forecasting Using Time Series Model," Int. J. Comput. Sci. Mobile Comput, vol. 5, pp. 104-109, 2016.

[3] S. Wichaidit and S. Kittitornkun, "Predicting SET50 stock prices using CARIMA (crosscorrelation ARIMA)," in 2015 International Computer Science and Engineering Conference (ICSEC), IEEE, 2015, pp.

[4] D. Mondal, G. Maji, T. Goto, N. C. Debnath and S. Sen, "A Data Warehouse Based Modelling Technique for Stock Market Analysis," International Journal of Engineering & Technology, vol. 3, no. 13, pp. 165-170, 2018.

[5]Chen, K., Zhou, Y., & Dai, F. (2015, October). A LSTM-based method for stock returns prediction: A case study of China stock market. In 2015 IEEE international conference on big data (big data) (pp. 2823-2824). IEEE.

[6]Patel, J., Shah, S., Thakkar, P. and Kotecha, K., 2015. Predicting stock and stock price index movement using trend deterministic data preparation and machine learning techniques. *Expert systems with applications*, *42*(1), pp.259-268.

[7]Patel, Jigar, Sahil Shah, Priyank Thakkar, and Ketan Kotecha. "Predicting stock and stock price index movement using trend deterministic data preparation and machine learning techniques." *Expert systems with applications* 42, no. 1 (2015): 259-268.

[8]Boyacioglu, Melek Acar, and Derya Avci. "An adaptive network-based fuzzy inference system (ANFIS) for the prediction of stock market return: the case of the Istanbul stock exchange." *Expert Systems with Applications* 37, no. 12 (2010): 7908-7912.

[9] Ghosh, Achyut, Soumik Bose, Giridhar Maji, Narayan Debnath, and Soumya Sen. "Stock price prediction using LSTM on Indian share market." In *Proceedings of 32nd international conference on*, vol. 63, pp. 101-110. 2019.

[10] Trinkle, B. S. (2006). Forecasting annual excess stock returns via an adaptive network-based fuzzy inference system. Intelligent Systems in Accounting, Finance and Management, 13(3), 165–177.

[11] Abbasi, E., & Abouec, A. (2008). Stock price forecast by using neuro-fuzzy inference system. Proceedings of World Academy of Science, Engineering and Technology, 36, 320–323.

[12] Chang, P.-C., & Liu, C. H. (2008). A TSK type fuzzy rule based system for stock price prediction. Expert Systems with Applications, 34(1), 135–144.

[13] Afolabi, M., & Olatoyosi, O. (2007). Predicting stock prices using a hybrid Kohonen self-organizing map (SOM). In 40th Annual Hawaii international conference on system sciences (pp. 1–8).

[14] Yunos, Z. M., Shamsuddin, S. M., & Sallehuddin, R. (2008). Data Modeling for Kuala Lumpur Composite Index with ANFIS. In Second Asia international conference on modeling and simulation, AICMS 08, Kuala Lumpur (pp. 609–614)

[15] Atsalakis, G. S., & Valavanis, K. P. (2009a). Surveying stock market forecasting techniques – part II: Soft computing methods. Expert Systems with Applications, 36(3), 5932–5941.

[16]K. Senthamarai Kannan, P. Sailapathi Sekar, M.Mohamed Sathik and P. Arumugam, “Financial stock market forecast using data mining Techniques", 2010, Proceedings of the international multiconference of engineers and computer scientists.

[17] Tiffany Hui-Kuang yu and Kun-Huang Huarng, “A Neural network-based fuzzy time series model to improve forecasting”, Elsevier, 2010, pp: 3366-3372.

[18] Ching-Hsue cheng, Tai-Liang Chen, Liang-Ying Wei, “ A hybrid model based on rough set theory and genetic algorithms for stock price forecasting”, 2010, pp. 1610-1629.