

Strategy recommender for stock options in india using deep learning and live stock data from NSE

Revathi A^{1,*}, Chunduru Anilkumar², Vimaladevi M¹ and Nikil Laddha¹

¹ Department of Computational Intelligence, SRM Institute of Science and Technology, Kattankulathur, Tamil Nādu, India -603 203

² Department of Information Technology, GMR Institute of Technology, Rajam, Andhra Pradesh

revathial@srmist.edu.in

Abstract. An Option is a financial instrument, which is extensively used in share markets, money markets, and commodity markets to hedge the investment risks. It acts as financial leverage investment and is a kind of derivative instrument along with forwards, futures and swaps, which are used for managing risk of the investors. Though derivatives are theoretically risk management and leveraged investment tools, it is mostly used as speculative tools. The objectives of this work is to build a positional stock trading strategy in derivatives (Options) and recommending the users the strategy based on the predicted price of the stock, and, to generate P&L charts and Payoff graphs based on different ‘Options’ strategies selected by the user. For this, the stock market data is collected from various online sources such as NSE, and BSE websites. The contributions of this work include, a comparison of various strategies and to predict the range of the stock based on Implied Volatility (IV); providing the user with the Option Chain and enable to calculate several Options indicators like PCR, Max Pain; and, the implementation of machine learning algorithm (LSTM) to predict the sentiment of the stock. An interactive web application for users is created, which provides consolidated data in the form of a dashboard from where the users can analyse the stocks and make strategic decisions on procuring stocks.

Keywords: deep learning, LSTM, option in share market, NSE.

1. Introduction

Calculations and data are involved in information technology, as is stocks trading [1]. This was an inescapable fit that increased the organization's efficiency. Nowadays, traders can negotiate a trade in nanoseconds, considerably faster than a person can [2]. Algorithms have transformed the way investment dealers choose which stocks to buy and sell [3]. Algorithm Trading utilises computer algorithms that are programmed to calculate charts and models in order to make secure investments. In addition to high-velocity predictions, technology has had other impacts where the instant information on buy-backs and prices, allowing traders to make more informed choices from the online newspapers and websites like Bloomberg, The FT and this leads to fluctuate the price of stocks quickly. It is obvious that the stock exchange will continue to evolve in a more sophisticated way as technology progresses

[4]. Big Data will be able to be utilised to assess market psychology, as the human element will continue to be required in the computer's calculations, despite the effectiveness of automated trading [5].

2. Related work

After having a careful analysis of the previous works done in the stock market price prediction field we came out with the understanding that the correct technique to build our predictive system is by using Recurrent Neural Networks. After analyzing different RNN units we figured out that LSTM performance outstands in comparison to other and we implemented bidirectional LSTM for learning the stock price trend[6]. We utilized NSE python package for getting past six years of data from the NSE website and using that data we trained and fine-tuned our model [7]. We also tried to involve the sentiment based feature for a stock which we could get from the news, twitter and various other platforms but challenge to adding this feature and considering the sentiment also is that we could not figure out a reliable source of information, since the data on twitter and other platforms is always not reliable and so could not be taken into consideration [8][9]. Adding this feature would have increased the model's performance by manifold [10][11].

Table 1. Review Summary.

S. No.	Paper Title	Author – Journal	Work in Paper
1.	Artificial Intelligence Applied to Stock Market Trading: A Review	Fernando G. D. C. Ferreira, Rodrigo T. N. Cardoso and Amir H. Gandomi	The application of AI to financial investment.
2.	Stock Price prediction with LSTM Based Deep Learning Techniques	Satish S #1, Kiran G M *2	Algorithmic knowledge that uses market data to predict the share price using machine learning strategies such as LSTM.
3.	Stock Market Prediction Analysis by Incorporating Social and News Opinion and Sentiment	Zhaoxia WANG, Zhiping LIN	Uses news sentiments to successfully predict the stock price.
4.	Stock Market Forecasting Using Hidden Markov Model: A New Approach	Md. Rafiul Hassan and Baikunth Nath	Use of Hidden Markov Models (HMM) for predicting stock price for markets.
4.	Stock Market Forecasting Using Hidden Markov Model: A New Approach	Md. Rafiul Hassan and Baikunth Nath	Use of Hidden Markov Models (HMM) for predicting stock price for markets.
4.	Stock Market Forecasting Using Hidden Markov Model: A New Approach	Md. Rafiul Hassan and Baikunth Nath	Use of Hidden Markov Models (HMM) for predicting stock price for markets.

Table 1. (continued).

4.	Stock Market Forecasting Using Hidden Markov Model: A New Approach	Md. Rafiul Hassan and Baikunth Nath	Use of Hidden Markov Models (HMM) for predicting stock price for markets.
5.	Positive Analysis of the stock Option Pricing Model	Lei Jianguang	Used Black Scholes model & Binomial Tree adjustments to real world data.
6.	Comparison of Predictive Algorithms: Backpropagation, SVM, LSTM and Kalman Filter for Stock Market	Ameya Nambisan, Ruman Kazi, Divit Karmiani, Vijaya Kamble Aastha Shah	Machine learning is used for forecasting security prices.
7.	Deep learning networks for stock market analysis and prediction: Methodology, data representations, and case studies	Chulwoo Hanb, Eun-suk Chonga, Frank C. Park	Proposed a deep feature learning based stock market forecasting model. Seven sets of features generated from raw input of flagged stocks.
8.	Deep Learning for Stock Market Prediction	P. Nayyeri, M. Nabipour, A. Mosavi, H. Jabani, and Shahab S and E. Salwana.	Tree-based machine learning models (Random Forest, Decision Tree, Bagging, Gradient Boosting, Adaboost and XGBoost) and neural networks (RNN and LSTM) to accurately predict the values of four stock market groups (Diversified, Non-metallic, Financials, Petroleum, minerals, and Basic metals) as a regression problem.
9.	NSE Stock Market Prediction Using Deep-Learning Models	Vijay Krishna Menona, Hiransha M, Soman K.P and Gopalakrishnan E.A	Authors tried four Deep Learning models to predict relation of two different stock markets their stock prices of NSE India & NYSE, across the globe. They have formed four networks NLP, RNN, LSTM and CNN with the share price of TATA MOTORS from NSE.
10.	Short-term stock market price trend prediction using a comprehensive deep learning system	Jingyi Shen and M. Omair Shafq	LSTM is used to predict the stock price trend. Data mining and China stock market data sets preprocessing were done initially.

The above Table 1 summarizes the existing research work in the stock market price prediction and reveals the research gap to be fixed. Hence our proposed system applies using Recurrent Neural Networks and LSTM to predict the price [12][13].

3. Proposed work

A web app created using Flask, starting with the homepage if user is logged in, it will redirect to the dashboard where all the features are available [14]. Else if the user is not logged in, they will be redirected to login page where they can login or sign up if already not registered with the server [15]. In

order to verify the login credentials, SQL lite database is used (to maintain the privacy and making the server and database less vulnerable to hackers hashing is used where no direct access to the database is possible) [16]. Once the user is logged in, user can select the indices/stock, he/she wish to work on and expiry date as well, this will fetch the data from NSE India website, it will update the optionchain.xlsx and liveprice.txt [17].

In the next process, dashboard will appear where all the features including, Option Chain, Strategy Selection, IV, OI, PCR, Max Pain, Strategy Recommender are available. User can choose the feature he/she wants to work on. Machine Learning and LSTM algorithms used to predict the price of a particular stock and using that predicted price to analyse the best strategy for the given stock. Figure 1 shows the entities present in a Strategy recommender model [18][19].

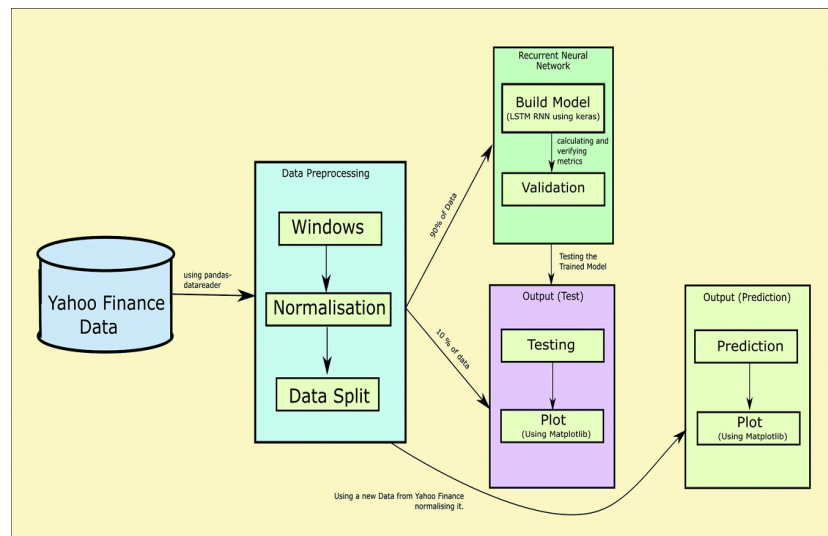


Figure 1. Strategy Recommender Model.

4. Result and discussion

Homepage, Login & Sign Up Page: Once the user comes on the home page he is asked to sign up if he is not a registered user. If the user is a registered user, he can go to the login page and enter his credentials to login or can sign up and register. In the admin module, all the registered member's data is visible, this will be further used for profile section & hashing the passwords. Once the user is logged in he is routed to the company selection page where he is asked to select a company for which he wants to see the option chain [20].

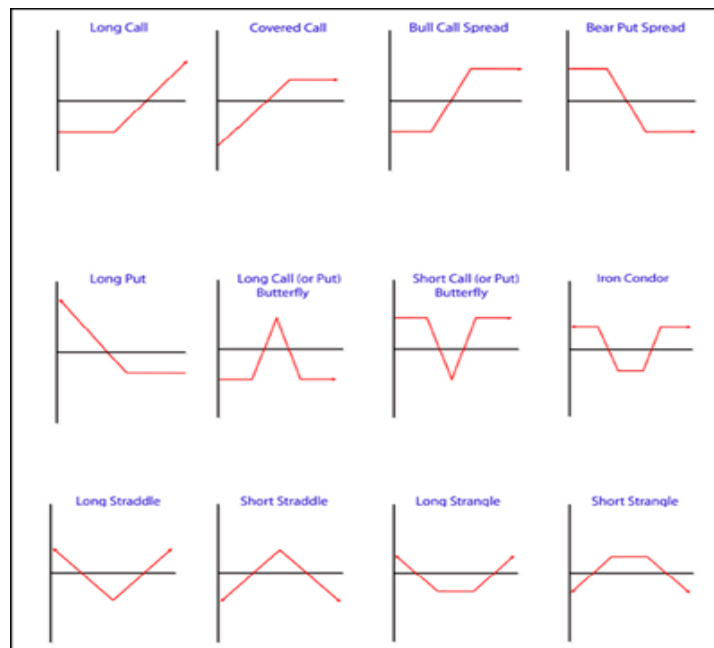


Figure 2. Sample graphs for different strategies.

User then selects an expiry date, which is the last Thursday of every month, Once the company selection and expiry date selection is done user can see the features like Option Chain, Strategy Selection etc. which we have implemented. Once company selection and expiry date selection is done, the user is routed to option chain page where we extract the data from NSE website and present those features which come under option chain to the user in a tabular format. User will now choose one of the strategies from the given thirteen strategies namely Straddle, Strangle, Iron Condor, Iron Butterfly, Gut, Bull Call Spread, Bear Call Spread, Bull Put Spread, Bear Put Spread, Covered Call, Covered Put, Protective Call, Protective Put. Once a user chooses a particular strategy based on that strategy some calculations will be done in the backend and we will finally display call price, put price and Net Profit & Loss to the user in a tabular format as well as in graphical format. A sample output of different strategies are shown in Figure 2. Input of stock or index and its expiry date, option chain, live price, the IV calculated and days to expiry, range can be predicted for the particular stock or index for the next expiry date. Verified mathematical algorithms frequently used in Indian stock market used for the above feature.

With the input of stock or index and its expiry date, features are extracted from option chain and using LSTM, price of the particular stock or index is predicted using the previous year's data. Using this predicted price and days to expiry, appropriate strategy for options is suggested based on all the details like bearish or bullish market, short or long term trade, risk high or low. As the Fig. 3 shows, the predicted plot coincides the original data. Hence, the difference between test and Original price is very less.

5. Future enhancements

Our recommendation model is a unique customization, instead of just providing another advanced LSTM model, we have developed a personalized deep learning prediction system and fine-tuned and used full-featured technique and combine it with LSTM to perform prediction. Furthermore, combining the most up-to-date sentiment analysis approaches with feature engineering and deep learning modelling has the potential to create a more comprehensive prediction system based on various forms of data i.e. various news from reliable resources such as such as Bloomberg, money control, company website and other text data about the company. Research has more potential in adding a new feature like sentiment on stocks by analyzing latest news and reports published about stocks which has great

influence on traders are considering buying that stock option. In this way, the solution will help predict the stock option and the strategies more accurately by looking at the latest news about the particular company. The paper places emphasis on building a simple web application to display option chain features extracted from NSE website to the user and implementation of the thirteen strategies namely Straddle, Strangle, Iron Condor, Iron Butterfly, Gut, Bull Call Spread, Bear Call Spread, Bull Put Spread, Bear Put Spread, Covered Call, Covered Put, Protective Call, Protective Put. It also includes the calculation of IV, OI, PCR, Max Pain, range prediction using these features. These features have been used for the implementation of strategy recommender which predicts the future price of a stock based on the previous performance of stock and hence suggests the appropriate strategy for that particular stock or index. Since the data related to stock will be a time series data so we used Recurrent Neural Networks to build such predictive model. In conclusion, we tested all the strategies on various stocks using paper trade in real markets and when we used the strategy feature of our software, it proved to be quite effective, and it saved significant chunk of time for generating results and decision-making process. The strategy recommender feature is giving satisfactory results but in case of external factors like sudden war or large scale pandemic, the algorithm tends to show irregularities.

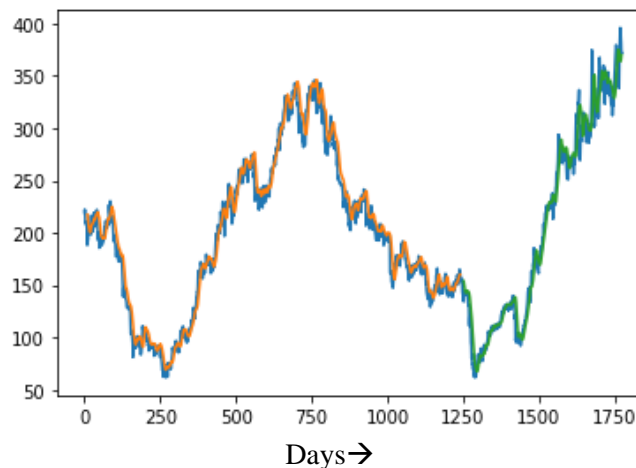


Figure 3. Plot of Original, Train and Test Data.

References

- [1] R. Nagendran¹ and S. Venkateshwar , Validating Black-Scholes Model in Pricing Indian Stock Call Options, Journal of Applied Finance & Banking, vol. 4, no. 3, 2014, 89-101 ISSN: 1792-6580 (print version), 1792-6599 (online) Scienpress Ltd, 2014.
- [2] Sunaina Kanojia , Neeraj Jain, Forecasting Volatility and Pricing Option: An Empirical Evaluation of Indian Stock Market, IOSR Journal of Business and Management (IOSR-JBM) eISSN: 2278-487X, p-ISSN: 2319-7668. Volume 19, Issue 7. Ver. I (July 2017), PP 01-08, www.iosrjournals.org.
- [3] Atheetha S Simran Mondal Dhanusha N Raghunandan H J, Options Trading Strategy: A quantitative study from an Investor's POV, International Journal of Business and Management Invention (IJBMI) ISSN (Online): 2319 – 8028, ISSN (Print): 2319 – 801X www.ijbmi.org, Volume 8 Issue 01 Ver. V, January 2019, PP 18-29.
- [4] R.Nagendran¹ and S. Venkateswar, Validating Black-Scholes Model in Pricing Indian Stock Call Options, Journal of Applied Finance & Ban, king, vol. 4, no. 3, 2014, 89-101 ISSN: 1792-6580 (print version), 1792-6599 (online) Scienpress Ltd, 2014.
- [5] Sathish S, Kiran G M, Stock Price prediction with LSTM Based Deep Learning Techniques, International Journal of Advanced Scientific Innovation Volume 02 Issue 03, August 2021 ISSN: 2582-8436.

- [6] Eunsuk Chong, Chulwoo Han, Frank C. Park, Deep learning networks for stock market analysis and prediction: Methodology, data representations, and case studies.
- [7] Nabipour M, Nayyeri P, Jabani H, Mosavi A, Salwana E, S. S. Deep Learning for Stock Market Prediction. *Entropy*. 2020; 22(8):840. <https://doi.org/10.3390/e22080840>.
- [8] Hiransha M, Gopalakrishnan E.A., Vijay Krishna Menon, Soman K.P., NSE Stock Market Prediction Using Deep-Learning Models, *Procedia Computer Science*, Volume 132, 2018, pp1351-1362, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2018.05.050>.
- [9] Sathishkumar V E, Changsun Shin, Youngyun Cho, "Efficient energy consumption prediction model for a data analytic-enabled industry building in a smart city", *Building Research & Information*, Vol. 49. no. 1, pp. 127-143, 2021.
- [10] Sathishkumar V E, Youngyun Cho, "A rule-based model for Seoul Bike sharing demand prediction using Weather data", *European Journal of Remote Sensing*, Vol. 52, no. 1, pp. 166-183, 2020.
- [11] Sathishkumar V E, Jangwoo Park, Youngyun Cho, "Seoul Bike Trip duration prediction using data mining techniques", *IET Intelligent Transport Systems*, Vol. 14, no. 11, pp. 1465-1474, 2020.
- [12] Sathishkumar V E, Jangwoo Park, Youngyun Cho, "Using data mining techniques for bike sharing demand prediction in Metropolitan city", *Computer Communications*, Vol. 153, pp. 353-366, 2020.
- [13] Sathishkumar V E, Yongyun Cho, "Season wise bike sharing demand analysis using random forest algorithm", *Computational Intelligence*, pp. 1-26, 2020.
- [14] Sathishkumar, V. E., Wesam Atef Hatamleh, Abeer Ali Alnuaim, Mohamed Abdelhady, B. Venkatesh, and S. Santhoshkumar. "Secure Dynamic Group Data Sharing in Semi-trusted Third Party Cloud Environment." *Arabian Journal for Science and Engineering* (2021): 1-9.
- [15] Chen, J., Shi, W., Wang, X., Pandian, S., & Sathishkumar, V. E. (2021). Workforce optimisation for improving customer experience in urban transportation using heuristic mathematical model. *International Journal of Shipping and Transport Logistics*, 13(5), 538-553.
- [16] Pavithra, E., Janakiramaiah, B., Narasimha Prasad, L. V., Deepa, D., Jayapandian, N., & Sathishkumar, V. E., Visiting Indian Hospitals Before, During and After Covid. *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems*, 30 (1), 111-123, 2022.
- [17] Easwaramoorthy, S., Moorthy, U., Kumar, C. A., Bhushan, S. B., & Sadagopan, V. (2017, January). Content based image retrieval with enhanced privacy in cloud using apache spark. In *International Conference on Data Science Analytics and Applications* (pp. 114-128). Springer, Singapore.
- [18] Sathishkumar, V. E., Agrawal, P., Park, J., & Cho, Y. (2020, April). Bike Sharing Demand Prediction Using Multiheaded Convolution Neural Networks. In *Basic & Clinical Pharmacology & Toxicology* (Vol. 126, pp. 264-265). 111 RIVER ST, HOBOKEN 07030-5774, NJ USA: WILEY.
- [19] Subramanian, M., Shanmuga Vadivel, K., Hatamleh, W. A., Alnuaim, A. A., Abdelhady, M., & VE, S. (2021). The role of contemporary digital tools and technologies in Covid-19 crisis: An exploratory analysis. *Expert systems*.
- [20] Sathishkumar, V. E., Rahman, A. B. M., Park, J., Shin, C., & Cho, Y. (2020, April). Using machine learning algorithms for fruit disease classification. In *Basic & clinical pharmacology & toxicology* (Vol. 126, pp. 253-253). 111 RIVER ST, HOBOKEN 07030-5774, NJ USA: WILEY.