International Journal for Modern Trends in Science and Technology, 8(09): 119-123, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0809023
Available online at: http://www.ijmtst.com/vol8issue09.html

Predicting Stock Market Trends using Machine Learning and Deep Learning Algorithms via Continuous and Binary Data; A Comparative Analysis

V. Kishore[1] | Ch. Srinivasa Rao[2]

[1]PG Scholar, Department of Computer science, SVKP &Dr K S Raju Arts & Science College(A), Penugonda, W.G.Dt., A.P, India
[2]Associate Professor in Computer science, SVKP &Dr K S Raju Arts & Science College(A), Penugonda, W.G.Dt., A.P, India

To Cite this Article
V. Kishore and Ch. Srinivasa Rao. Predicting Stock Market Trends using Machine Learning and Deep Learning Algorithms via Continuous and Binary Data; A Comparative Analysis. International Journal for Modern Trends in Science and Technology 2022, 8(09), pp. 119-123. https://doi.org/10.46501/IJMTST0809023

Article Info
Received: 22 August 2022; Accepted: 12 September 2022; Published: 17 September 2022.

ABSTRACT

The nature of stock market movement has always been ambiguous for investors because of various influential factors. This study aims to significantly reduce the risk of trend prediction with machine learning and deep learning algorithms. Four stock market groups, namely diversified financials, petroleum, non-metallic minerals and basic metals from Tehran stock exchange, are chosen for experimental evaluations. This study compares nine machine learning models (Decision Tree, Random Forest, Adaptive Boosting (Adaboost), eXtreme Gradient Boosting (XGBoost), Support Vector Classifier (SVC), Naïve Bayes, K-Nearest Neighbors (KNN), Logistic Regression and Artificial Neural Network (ANN)) and two powerful deep learning methods (Recurrent Neural Network (RNN) and Long short-term memory (LSTM).Ten technical indicators from ten years of historical data are our input values, and two ways are supposed for employing them.

1. INTRODUCTION

The task of stock prediction has always been a challenging problem for statistics experts and finance. The main reason behind this prediction is buying stocks that are likely to increase in price and then selling stocks that are probably to fall. Generally, there are two ways for stock market prediction. Fundamental analysis is one of them and relies on a company's technique and fundamental information like mar-ket position, expenses and annual growth rates. The second one is the technical analysis method, which concentrates on previous stock prices and values. This analysis uses historical charts and patterns to predict future prices.

Stock markets were normally predicted by financial experts in the past time. However, data scientists have started solving prediction problems with the progress of learning techniques. Also, computer scientists have begun using machine learning methods to improve the performance of prediction models and enhance the accuracy of predictions. Employing deep learning was the next phase in improving prediction models with better performance.It is clear that there are always unpredictable factors such as the public image of

companies or political situation of countries, which affect stock markets trend.

Therefore, if the data gained from stock values are efficiently preprocessed and suitable algorithms are employed, the trend of stock values and index can be predicted. In stock market prediction systems, machine learning and deep learning approaches can help investors and traders through their decisions. These methods intend to automatically recognize and learn patterns among big amounts of information. The algorithms can be effectively self-learning, and can tackle the predicting task of price puctuations in order to improve trading strategies.

Since recent years, many methods have been improved to predict stock market trends. The implementation of a model combination with Genetic Algorithms (GA), Artificial Neural Networks and Hidden Markov Model (HMM) was proposed by Hassan et al.

A comparison between SVM, Linear Discriminant method, Elman Back propagation Neural Networks and Quadratic Discriminant method was their goal. The results indicated that SVM was the best classifier method. New financial prediction algorithm based on SVM ensemble was proposed by Sun et al. The method for choosing SVM ensemble' s base classifiers was proposed by deeming both diversity analysis and individual prediction. Final results showed that SVM ensemble was importantly better than individual SVM for classification. Ten data mining methods were employed by Ou et al.

2. LITERATURE SURVEY

In this study, ten years of historical data of four stock market groups (petroleum, diversified financials, basic metals and non-metallic minerals) from November 2009 to November 2019 is employed, and all data is gained from www.tsetmc.com website. Figures 1-4 show the number of increase or decrease cases for each group during ten years.

In the case of predicting stock market movement, there are several technical indicators and each of them has a specific ability to predict future trends of market; however, we choose ten technical indicators in this paper based on previous studies [24]–[26]. Table 10 (in Appendix section) shows technical indicators and their formulas, and Table 11 (in Appendix section) indicates summary statistics of the indicators of four stock groups. The inputs for calculating indicators are open, close, high and low values in each trading day.

This paper involves two approaches for input information. continuous data is supposed to be based on actual time series, and binary data is presented with a preprocessing step to convert continuous data to binary one with respect to each indicator nature.

A. CONTINUOUS DATA In this method, input values to prediction models are computed from formulas in Table 10 for each technical indicator. The indicators are normalized in the range of (0, +1) before using to prevent overwhelming smaller values by larger ones. Figure 5 shows the process of stock trend prediction with continuous data.

B. B. BINARY DATA In this approach, a new step is added to convert continuous values of indicators to binary data based on each indicator's nature and property. Figure 6 indicates the process of stock trend prediction with binary data. Here, binary data is intro1duced by +1 as the sign of upward trend and −1 as the sign of downward trend.

3. PROBLEM STATEMENT

In the proposed system, the system concentrates on comparing prediction performance of nine machine learning models (Decision Tree, Random Forest, Adaboost, XGBoost, SVC, Naïve Bayes, KNN, Logistic Regression and ANN) and two deep learning methods (RNN and LSTM) to predict stock market movement. Ten technical indicators are utilized as inputs to our models. The proposed study includes two different approaches for inputs, continuous data and binary data, to investigate the effect of preprocessing; the former uses stock trading data (open, close, high and low values) while the latter employs preprocessing step to convert continuous data to binary one. Each technical indicator has its specific possibility of up or down movement based on market inherent properties.

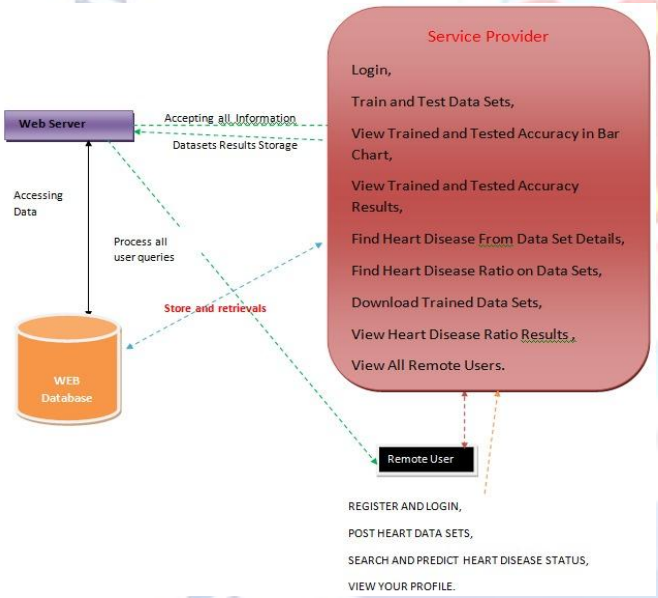
The performance of the mentioned models is compared for the both approaches with three classification metrics, and the best tuning parameter for each model (except Naïve Bayes and Logistic Regression) is reported. All experimental tests are done with ten

years of historical data of four stock market groups (petroleum, diversified financials, basic metals and non-metallic minerals), that are totally crucial for investors, from Tehran stock exchange. We believe that this study is a new research paper that incorporates multiple machine learning and deep learning methods to improve the prediction task of stock groups' trend and movement.

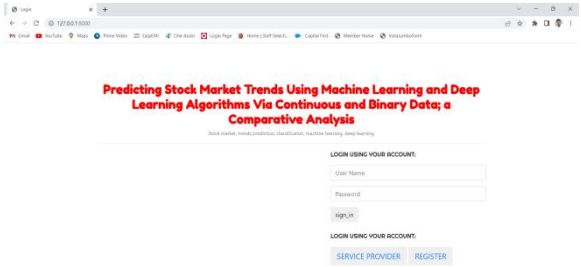
Advantages:

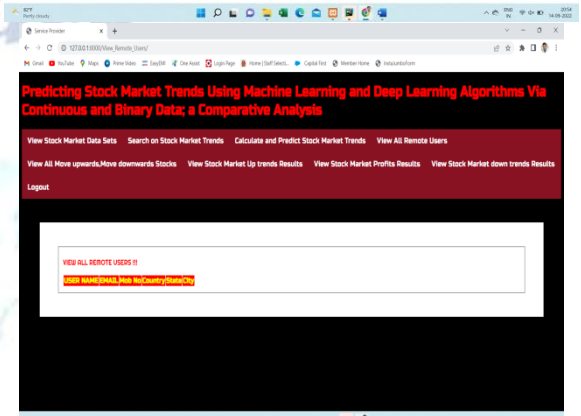
- In the proposed system, each of the algorithms can effectively solve stock prediction problems.
- To The system is more effective due to presence of eXtreme Gradient Boosting (XGBoost), Support Vector Classier (SVC) techniques.

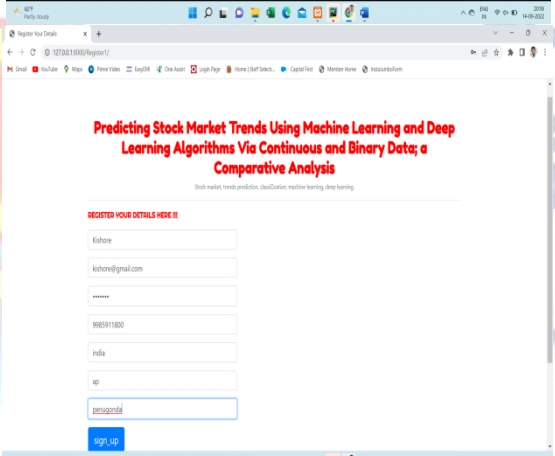
Architecture:

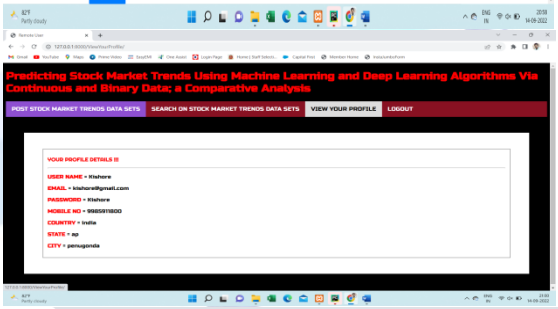


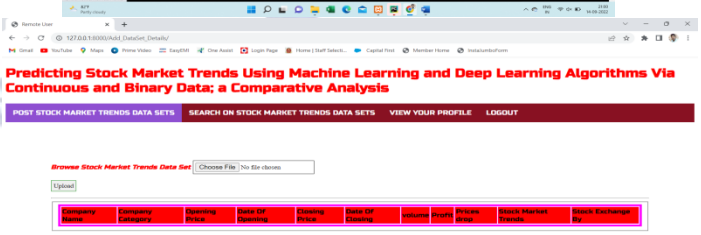
4. RESULT:

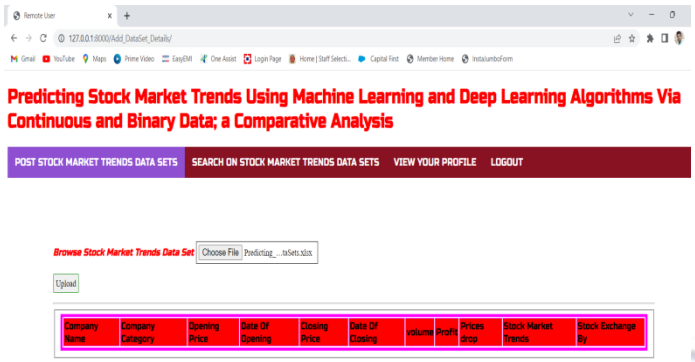


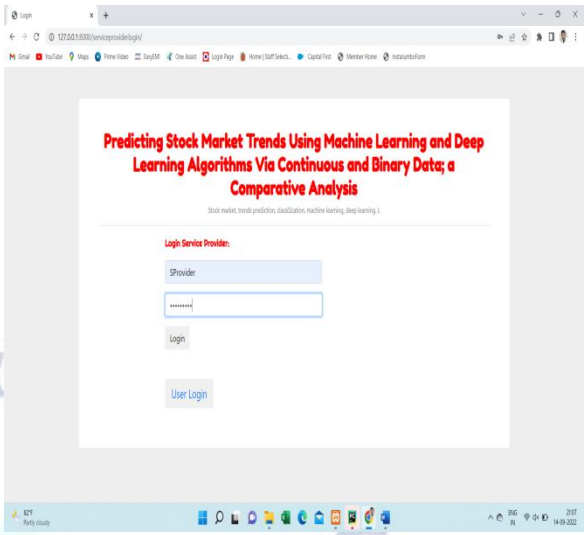


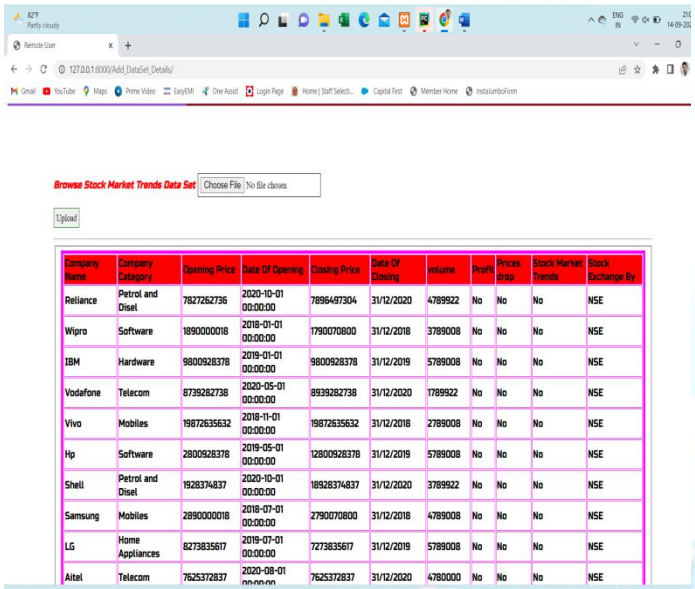


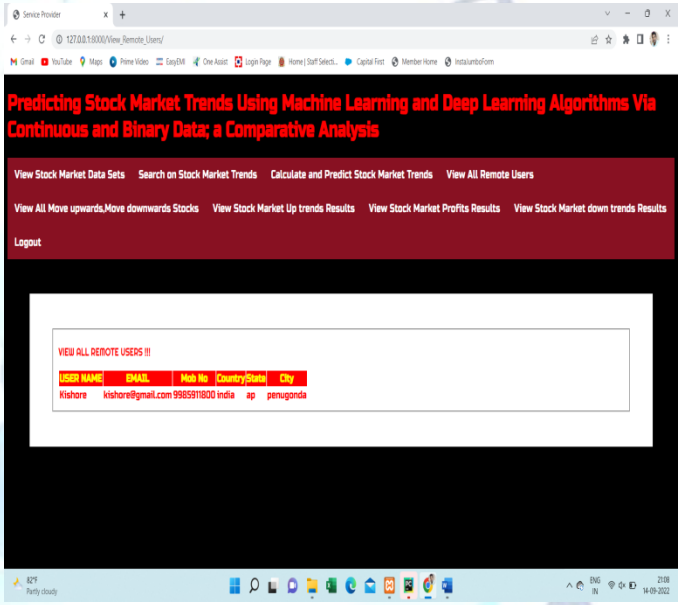


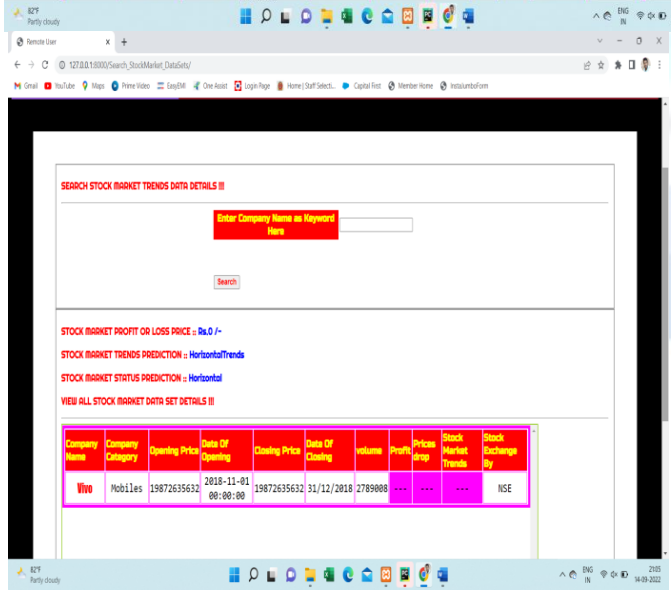












5. CONCLUSION:

The purpose of this study was the prediction task of stock market movement by machine learning and deep learning algorithms. Four stock market groups, namely diversied financials, petroleum, non-metallic minerals and basic metals, from Tehran stock exchange were chosen, and the dataset was based on ten years of historical records with ten technical features. Also, nine machine learning models (Decision Tree, Random Forest, Ada boost, XG Boost, SVC, Naïve Bayes, KNN, Logistic Regression and ANN) and two deep learning methods (RNN and LSTM) were employed as predictors. We supposed two approaches for input values to models, continuous data and binary data, and we employedthreeclassication metrics for evaluations. Our experimental works showed that there was a

signicant improvement in the performance of models when they use binary data instead of continuous one. Indeed, deep learning algorithms (RNN and LSTM) were our superior models in both approaches.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] J. Murphy, Technical Analysis of the Financial Markets: A Comprehensive Guide to Trading Methods and Applications. Penguin, 1999.

[2] T. Turner, A Beginner's Guide To Day Trading Online, 2nd ed. New York, NY, USA: Simon and Schuster, 2007.

[3] H. Maqsood, I. Mehmood, M. Maqsood, M. Yasir, S. Afzal, F. Aadil, M. M. Selim, and K. Muhammad, ``A local and global event sentiment based efcient stock exchange forecasting using deep learning,'' Int. J. Inf. Manage., vol. 50, pp. 432451, Feb. 2020.

[4] W. Long, Z. Lu, and L. Cui, ``Deep learning-based feature engineering for stock price movement prediction,'' Knowl.-Based Syst., vol. 164, pp. 163173, Jan. 2019.

[5] J. B. Duarte Duarte, L. H. Talero Sarmiento, and K. J. Sierra Juárez, ``Evaluation of the effect of investor psychology on an articial stock market through its degree of efciency,'' Contaduría y Administración, vol. 62, no. 4, pp. 13611376, Oct. 2017.

[6] Lu, Ning, A Machine Learning Approach to Automated Trading. Boston, MA, USA: Boston College Computer Science Senior, 2016.

[7] M. R. Hassan, B. Nath, and M. Kirley, ``A fusion model of HMM, ANN and GA for stock market forecasting,'' Expert Syst. Appl., vol. 33, no. 1, pp. 171180, Jul. 2007.

[8] W. Huang, Y. Nakamori, and S.-Y. Wang, ``Forecasting stock market movement direction with support vector machine,'' Comput. Oper. Res., vol. 32, no. 10, pp. 25132522, Oct. 2005.

[9] J. Sun and H. Li, ``Financial distress prediction using support vector machines: Ensemble vs. Individual,'' Appl. Soft Comput., vol. 12, no. 8, pp. 22542265, Aug. 2012.

[10] P. Ou and H. Wang, ``Prediction of stock market index movement by tendata mining techniques,'' Modern Appl. Sci., vol. 3, no. 12, pp. 2842, Nov. 2009.

[11] F. Liu and J.Wang, ``Fluctuation prediction of stock market index by legendre neural network with random time strength function,'' Neurocomputing, vol. 83, pp. 1221, Apr. 2012.

[12] C.-F. Tsai, Y.-C. Lin, D. C. Yen, and Y.-M. Chen, ``Predicting stock returns by classier ensembles,'' Appl. Soft Comput., vol. 11, no. 2, pp. 24522459, Mar. 2011.

[13] R. D. A. Araäjo and T. A. E. Ferreira, ``A Morphological-Rank-Linear evolutionary method for stock market prediction,'' Inf. Sci., vol. 237, pp. 317, Jul. 2013.

[14] M. Ballings, D. Van den Poel, N. Hespeels, and R. Gryp, ``Evaluating multiple classiers for stock price direction prediction,'' Expert Syst. Appl., vol. 42, no. 20, pp. 70467056, Nov. 2015.

[15] S. Basak, S. Kar, S. Saha, L. Khaidem, and S. R. Dey, ``Predicting the direction of stock market prices using tree-based classiers,'' North Amer. J. Econ. Finance, vol. 47, pp. 552567, Jan. 2019.

[16] B. Weng, W. Martinez, Y.-T. Tsai, C. Li, L. Lu, J. R. Barth, and F. M. Megahed, ``Macroeconomic indicators alone can predict the monthly closing price of major U.S. indices: Insights from articial intelligence, time-series analysis and hybrid models,'' Appl. Soft Comput., vol. 71, pp. 685697, Oct. 2018.

[17] J. Long, Z. Chen, W. He, T. Wu, and J. Ren, ``An integrated framework ofdeep learning and knowledge graph for prediction of stock price trend: An application in chinese stock exchange market,'' Appl. Soft Comput., vol. 91, Jun. 2020, Art. no. 106205.

[18] G. Rekha, D. Bhanu Sravanthi, S. Ramasubbareddy, and K. Govinda, ``Prediction of stock market using neural network strategies,'' J. Comput. Theor. Nanoscience, vol. 16, no. 5, pp. 23332336, May 2019.

[19] X. Pang, Y. Zhou, P. Wang, W. Lin, and V. Chang, ``An innovative neural network approach for stock market prediction,'' J. Supercomput., vol. 76, no. 3, pp. 20982118, Mar. 2020.

[20] Kelotra, A. and P. Pandey, ``Stock market prediction using optimized deep-convLSTM model,'' Big Data, vol. 8, no. 1, pp. 524,2020.

Authors Biography

V Kishore currently pursuing MCA in SVKP & Dr.K.S Raju Arts & Science College affiliated to Adikavi Nannaya University, Rajamahendravaram. His research interests include Machine Learning , Big Data.

Ch.Srinivasa Rao Research Scholar in the Department of Computer Science & Engineering at Aacharya Nagarjuna University, Guntur, AP, India. He is working as Associate Professor in SVKP & Dr .KS Raju Arts & Science College (A), Penugonda, AP. He received Master's Degree in Computer Science & Engineering (M.Tech,CSE) from Jawaharlal Nehru Technological University, Kakinada, India. He qualified in UGC NET and AP SET. His research Interests include Data Mining, Data Science and Machine Learning.