



A SUPERVISED MACHINE LEARNING REGRESSION APPROACH FOR PREDICTION OF NIFTY 50 INDEX DAILY RETURNS DURING RUSSIA-UKRAINE WAR

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Abstract

The Russia Ukraine war is a perpetual international conflict between Russia and Ukraine which has started in February, 2014. The revolution of dignity or the Ukraine's revolution also led to the upsurge of the Russia Ukraine war. Here, the study has considered the beginning of the war up to 1st December, 2022 as the time period for the study. This study is more focused towards prediction of daily market returns with the use of machine learning regression algorithms and selection of the best algorithm. It was found that the score for variation explained (R-square) by Lasso regression followed by Random forest algorithm while prediction of market returns. The decision tree algorithm has given least score for variation explained (R-square) with respect to rest of the algorithms.

Key words: NIFTY 50; Regression algorithms; Russia-Ukraine war; Market returns.



1. INTRODUCTION

The Russia Ukraine war is a perpetual international conflict between Russia and Ukraine which has started in February, 2014. The revolution of dignity or the Ukraine's revolution also led to the upsurge of the Russia Ukraine war. In February, 2022, Russia initiated an exhaustive invasion of Ukraine. Among all other democracies of the world, India has maintained a neutral status towards this war. Though India's annoyance with Moscow's war, it has been distinctive among strategic partners of the world. The Russia-Ukraine war conflict is major storm to the global economy. The disruption in production of the commodities from these two nations has caused global prices to rise. Commodities like oil, natural gas and food etc. prices have jumped abnormally due to this conflict. The high energy prices have given rise to inflation in the economies for some countries. India comes in third position as an importer of crude oil in the world. India around 80 percent import mostly based on energy products has fear of witnessing inflation in its economy. There are several indicators which influence in rise and fall of a country's gross domestic product (GDP). Apart from all the other factors, financial markets or stock markets play the role as sentiment indicators for rise and fall of economy of nations. The ongoing war has directly or indirectly affected the financial markets. The two of the important Indian stock exchanges i.e. Bombay stock exchange (BSE) and National Stock Exchange (NSE) was also affected from this war. The indices introduced by these two exchanges (SENSEX and NIFTY) drop few points during the war. NIFTY 50 had dropped by 1.36 percent (224.10 points to 16,273.95) and BSE index SENSEX points had fallen from 747.66 to 54,355.02 points. This paper has attempted to study the market movement of NIFTY 50 index from 24 February, 2022 to 1st December, 2022. The paper has considered the beginning of the war up to 1st December, 2022 as the time period for the study. This study is more focused towards prediction of daily



market returns with the use of machine learning regression algorithms and evaluation of the best algorithm. The prediction of daily market returns of the NIFTY 50 index is achieved through supervised machine learning regression algorithms such as Decision tree, Random forest and Lasso regression. Decision tree and Random forest regression prediction is based on linear regression method whereas the study has considered more standardized regression algorithm i.e. Lasso regression which has overcomes the classical regression method in terms of assumptions, accuracy etc. It has considered some evaluation metrics for selection of algorithms in terms of accuracy and variation explained. The study has considered intraday variables such as open price, close price, adjusted close price, high price and low price and observe the influence on daily stock returns of NIFTY 50 index. The latter section of the paper consists of literature review followed with research methodology, analysis and results and conclusion.

2. LITERATURE REVIEW

The following previous research studies in accordance to present study were reviewed. Verma et al. (2022) observed market recovery of three sectors of Indian stock market. They conclude that a negative reaction was observed during the event day whereas positive market recovery was recorded in the post-event period. Kumar K et al. (2022) adopted event study methodology to observe impact of Russia-Ukraine war on NIFTY 50 market index. Their study has found that the war has significantly affected the Indian stock market. Kumar B et al. (2022) investigated effect of Russia-Ukraine war on stock markets of USA and India. The study has found that there is a positive return of Indian stock market in comparison to USA stock market. Mohite et al. (2022) had tried to study the effects of Russian-Ukraine conflict on Indian economy. Their research study is to aware Indian government to take necessary measures and formulate policies in the areas where the war has affected adversely. Boungou and



Yatie (2022) had observed the effect of Russia-Ukraine war on global stock market returns. They found that the countries which are bordered with Russia and Ukraine and members of United Nations (UN) were most affected. Dole (2022) reviewed the after effects of Russia-Ukraine war in Indian economy. Nazeeruddin (2022) study reviewed the drawbacks of Russia-Ukraine war on prices of commodities like wheat, edible oil ect. Goel (2022) reviewed the positive and negative adverse effects of Russia-Ukraine war on Indian economic system. Alam et al. (2022) findings observed the relationship between certain specific commodities (gold and silver) and stock markets. The study also had tried to provide some policy implications for better investment decisions. Pathak et al. (2023) observed the linear interdependence relationship among Indian stock market performance, crude oil index and Gross domestic product (GDP). They observed that the values of NIFTY 50 market index and crude oil index effects could be used to explain the GDP index. The study also revealed that past values of NIFTY market index affects GDP as well as crude oil index. Izzeldin et al. (2023) studied the effect of Russia-Ukraine war on European stock markets and some of the representative commodities. They have also tried to compare the war effects with Covid-19 pandemic and 2008 global financial crisis. In their study, the production of wheat and nickel are found to be mostly affected from the war. Nain (2023) reviewed the strategies through which Indian economy could survive the Russia-Ukraine conflict. Kamal R., Md. et al. (2023) investigated the effect of Russia-Ukraine war on Australian Stock Market. Their research study found that there is a significant negative abnormal return on the event date. The study also depicted the adverse effect of the War on small and medium sized firms. The present study discovers the research gap among the previous studies in prediction of market returns with the help of more efficient methods i.e. machine learning algorithms. The present study has further tried to overcome the problems of multi-collinearity with the



adoption Lasso regression algorithms to understand the market returns during the war period.

3. RESEARCH METHODOLOGY

The analysis of the study is performed using the python programming language. Sklearn module is used for supervised machine learning regression algorithms. Matplotlib module is used for graphical visualization of regression plots among intraday variables of NIFTY50 index. Seaborn module is used for data visualization. The following supervised machine learning regression algorithms used in the study are discussed below:

- **Decision tree regression**

Decision tree is decision tool which falls under supervised learning algorithm. It uses flow-chart which resembles a tree structure with decision nodes at each step of the algorithm. In the end of the algorithm, it consists of result nodes. Decision tree algorithm is used for both classification and regression purpose. In regression, the algorithm is trained to predict values for both continuous and discrete variables.

- **Random forest regression**

Random forest is a combination of techniques which is used to perform both classification and regression problems. The random forest algorithm uses the technique bootstrap and aggregation which is also known as bagging. The algorithm use multiple numbers of decision trees to give conclusion to certain problem in contrast to results generated from individual decision trees. It is effective in detection of outliers and noisy features.

- **Lasso regression**

The abbreviation “LASSO” stands for **Least Absolute Shrinkage and Selection Operator**. Lasso regression is a standardize method. The algorithm is often used as an alternative to classical regression methods for better prediction. The lasso technique



animate regression models with less number of parameters. The algorithm is used in case of variables which show multi-co linearity among variables. It is used in case of large number of variables for selection subset of variables.

3.1. Data

The data for the study is secondary in nature. It was collected from some useful websites such as **nseindia.com**, **moneycontrol.com** and **yahoofinance.com**. The daily NIFTY 50 market index data was collected from 24th February, 2022 to 1st December, 2022. It consists of intraday variables such as Open Price, High Price, Low Price, Close Price and Adjusted Close Price. The daily stock returns of the NIFTY 50 market index is also calculated for further analysis purpose.

Table 1: Percentage of each industrial sector in NIFTY50

Industrial Sectors	Percentage
Financial Services	37.40
Information Technology	14.72
Oil, Gas and Consumable Fuels	12.27
Fast Moving Consumer Goods	9.35
Automobile and Auto Components	5.60
Metal and Mining	3.17
Healthcare	3.74
Consumer Durables	2.97
Construction	3.34
Telecommunication	2.43
Power	2.06
Construction Materials	1.87
Services	0.59
Chemicals	0.48

Source: www.nseindia.com



The following intraday variables of NIFTY50 index are discussed below:

- **Market Index Price :**

The market index price of indices is calculated from the diversified portfolio of different stocks of companies. This price could be used as an indicator to know the status of the market along with the stocks. NIFTY and SENSEX are two benchmark indices of Indian stock market and they adopt free float market capitalization weighted method to calculate the price of the indices. The weights are assigned to companies of the index based on total number of outstanding shares of companies stock in the market.

- **Open Price**

Open price of stocks is the price at which the stocks trade when the stock exchange opened for the day. The price remains varied from close price and previously close price. Similar to other day trading prices, it is found to be significant for the trading strategies. From this price estimation could be made regarding closing price for respective stocks.

- **High Price**

The high price of stocks could be considered as a highest point of traded stocks in a day. This price is greater than all other day trading prices for particular stocks. The price could also be served as an indicator for other price value rise and fall for the day of stocks. The 52 weeks high price of stocks are calculated and compared with other similar sector stocks.



- **Low Price**

The low price of stocks is also defined as lowest value of a stock in a respective day. Low price of a stock could be used as an indicator for buy/sell of day trading stocks. Similar to 52 week high price, 52 week low price could be also calculated and compared with other stocks for performance evaluation.

- **Close Price**

The close price of stocks is the last price of the day at which the stocks trade. It is used as a standard benchmark for the performance evaluation of stocks over a period of time. The close price is considered as most accurate valuation for a stock till its next opening price. It is compared with the previously closed price or longer period of time for measurement of the sentiment of investors towards the stocks.

- **Adjusted Close Price**

The adjusted closing price changes a stock's closing price to outline that stock's value after accounting for any corporate actions such as stocks splits, dividend share among investors etc. It is used for detailed analysis of past performance of stocks and historical returns. It helps the investors to form an idea about their returns in a certain stock and also used comparison purpose among different assets.

- **Market returns**

The market returns is the return of profit for particular stocks or portfolio of stocks over a period of time. The growth of money invested by the investors is indicated by the returns on respective stocks. It is also used as an indicator for profitable companies



whose stocks provide high returns. The returns could be calculated for daily, weekly, monthly and yearly with close price and previous day close price.

4. ANALYSIS AND RESULTS

In order to evaluate the performance of the four selected supervised regression algorithms, the data are split into two parts- one for training of the models and the other for testing as well as evaluation of the models performance. The training part and testing part of the data consists of 75 percent and 25 percent respectively. Here in this study, daily market returns is considered as dependent variable and open price, low price, close price, adjusted close price are independent variables. The evaluations of the algorithm are based on mean absolute error, mean squared error, median absolute error, explained variance score and R square. The following results of the study are discussed below:

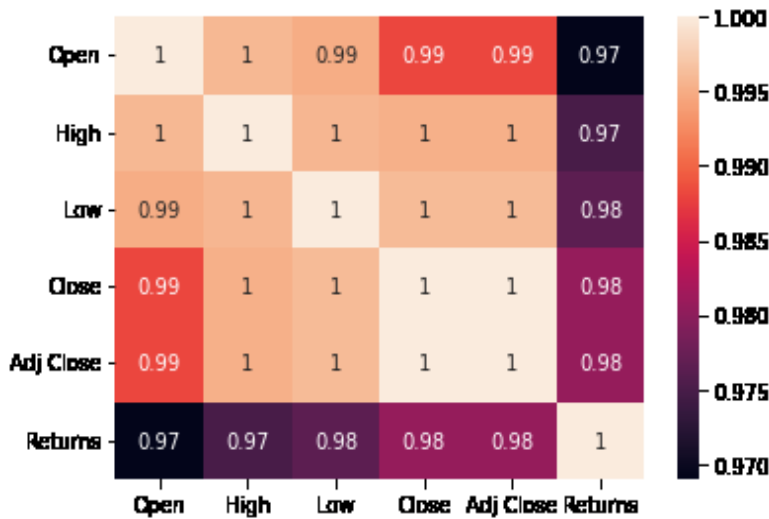


Figure 1: Graphical representation of Pearson correlation coefficient matrix

Source: python programming language graphics

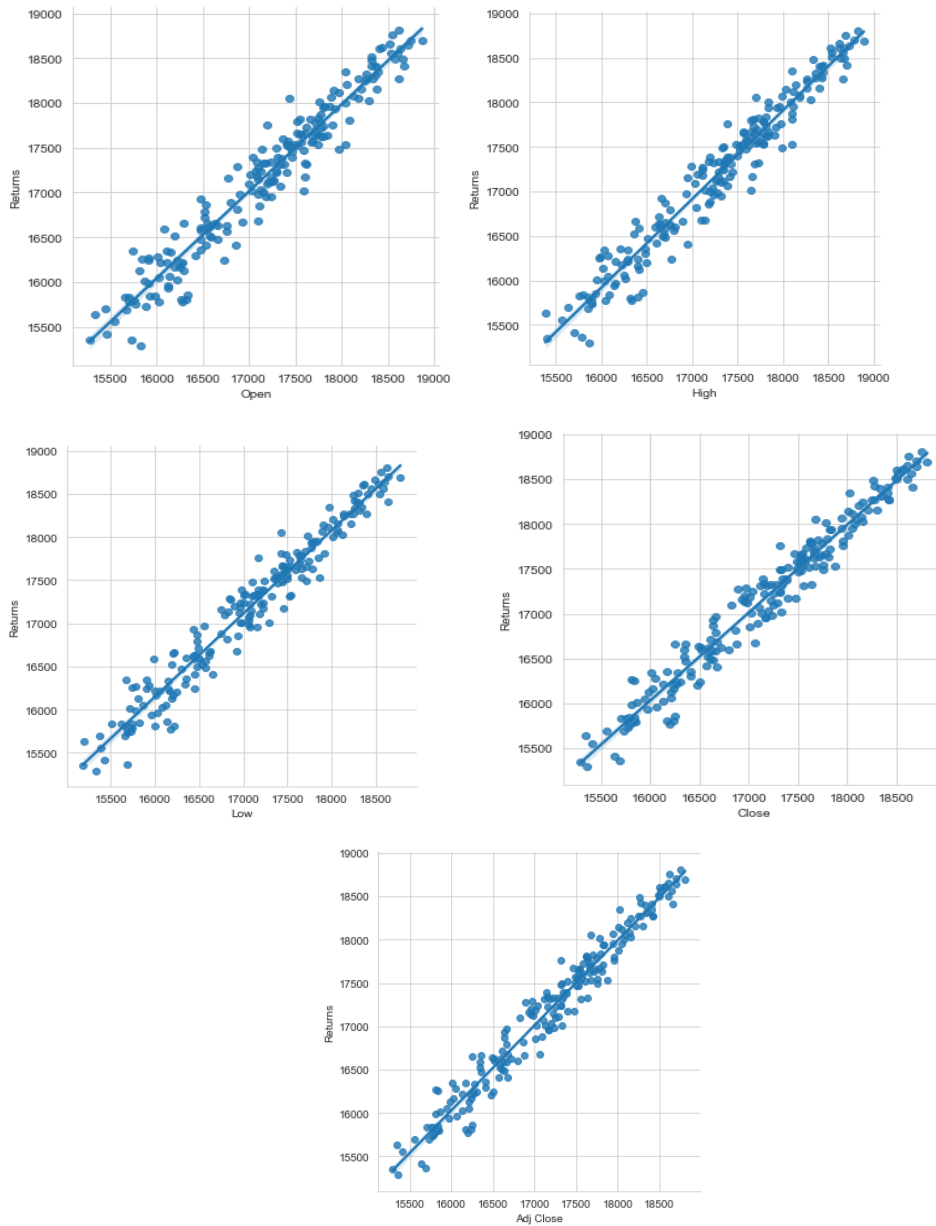


Figure 2: Graphical representation of regression plots of intraday variables



4.1. Evaluation of the model

Table 2: Evaluation metrics of the supervised regression algorithms

Algorithms	Mean absolute error	Median absolute error	Mean squared error	Explain Variance score	R-square
Decision Tree	244.37	206.52	89649.14	0.88	0.88
Random Forest	127.50	99.98	27582.72	0.96	0.96
Lasso Regression	123.32	121.50	20834.48	0.97	0.97

Source: Python programming language

The table 2 shows the mean absolute error, mean squared error, median absolute error and explain variance score and r-square of the supervised machine learning regression algorithms. The mean and median absolute error values are less for Lasso regression followed by other algorithms. From table 1, it is observed that mean squared error value is less for Lasso regression algorithm in comparison to other algorithms. The score for variation explained (R-square) by Lasso regression is found to be high followed by Random forest algorithm. The decision tree algorithm gives least score for variation explained (R-square).

5. CONCLUSION

This study was undertaken to predict the market returns of NIFTY 50 index during Russia- Ukraine war period. It has considered supervised machine learning regression algorithms for prediction. The Decision tree and Random forest regression algorithm used in this study for prediction of the market returns is based on the classical linear regression algorithm. The Lasso algorithm used in this study for prediction overcame



certain assumptions of multi-co-linearity of the data. The score for variation explained (R-square) by Lasso regression is high followed by Random forest algorithm while prediction of market returns. The decision tree algorithm gives least score for variation explained (R-square) with respect to rest of the algorithms.

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