

Impact of Covid-19 Pandemic and other global economic factors on the Indian Stock Market

Abstract

Stock trading is one of the most significant financial activities in this dynamically expanding economy. Stock price prediction is the act of finding the future worth of the firm stock and other financial assets traded on a marketplace. With economic uncertainty and a number of other dependent and independent variables that predict the rise and fall of the market, anticipation of stock price is one of the hardest tasks to do. Numerous models have been used since the advent of artificial intelligence to forecast the movement of the equities market. The effects of many elements in India, such as the festival season, changes in oil prices, the impact of an increase in gold prices, the covid-19 pandemic, and many other factors that affect stock values are compared using several machine learning modeling techniques in this study. Stock price forecasting will be done based on the examination of these elements. This paper presents the thorough investigation of the stock price forecast using yearly and historical data and an analysis of how Covid-19 pandemic, Oil Prices and Gold Prices impacted the Indian Stock Market.

Introduction

Due to the large global epidemic of the coronavirus disease (COVID-19), which had a substantial impact on many nations in different ways, the year 2020 was marked by many uncertainty. Public health declined, governments were overthrown, the global economy collapsed, inflation peaked, the price of gold and other commodities skyrocketed, etc. Behavioral patterns, trade and exchange, education, the economy, and other sectors all underwent changes. Since the epidemic, there has been a significant transformation in many areas of the world.

Similar to other stock markets throughout the world, the Indian stock market experienced significant volatility during the pandemic. The market fell by around 38\% following the pandemic's onset. The market's decline during this period was the most significant since the 2008 Global Economic Crisis. All of the world's major stock markets experienced this influence. It was anticipated that it would take at least a few years to recover from such a significant fall.

In this study, we shall observe how the market performed in the pre-covid era, covid pandemic era and post-pandemic era. We will also examine how the market performed during the pandemic era and how factors affecting the global economy, such as the price of gold and oil, affected that performance.

The paper is organized into five sections. Following this introduction, Section 2 explains significant concepts through a literature review of related work. We put forth the proposed methodology in Section 3 and provide results in Section 4. Ultimately, we've encapsulated our research with a conclusion in Section 5, followed by a list of references.

Related Works

The authors of [1] have presented an extensive process of building an ARIMA model for stock price prediction. The implementation has been carried out on the Nokia and Zenith bank stock index. The model can compete reasonably well with emerging forecasting techniques in only shortterm prediction of the stock prices.

Wenjie Lu, presents an implementation of a CNN-BiLSTM-AM in predicting the stock closing price of subsequent days [2]. CNN is used to extract the features of the input data. BiLSTM is used to learn and predict the extracted feature data. AM can be used to capture the influence of the feature states of the time series data at different times on the prediction results. This method has proved to be extremely effective when compared to other competitive methods including MLP, CNN, RNN, LSTM and their combinations.

The research studies as shown in [3], [5], [6], [7], [11] have fairly used the time series model ARIMA and have improvised the model by introducing variations and different combinations in it. Ayodele Ariyo Adebisi's study [5] and ÖznurÖztunç Kaymak's research [12] also focus on ANN models implemented as a predictive model comparison.

The most unique methodologies that have been incorporated so far are as in [4], [7], [8], [9]. A Markov process has been optimized by a Reinforcement Learning to predict the stock index by Jae Won Lee [4]. In the paper [7], MeiyaoTao implements a LSTM combination with a Graph Network based approach in predicting a stock price. Xiaodong Li incorporates market style hierarchical clustering method to improvise stock prediction performance in the paper [8]. The study by Francesco Colasanto in [9] a BERT model for sentiment analysis with Gibbs Sampling was applied to predict future stock prices.

A Systematic Review of most of the different Models under ML and Neural Networks have been carried out in the study by Payal Soni et al in [10]. In the paper [13] the authors study and apply different methods to predict stock prices but a high rate of accuracy is still not achieved even after analyzing major factors affecting the stock price.

Kunal Pahwa, et al uses Linear Regression, the supervised learning approach to predict stock prices [14]. The proposed research work basically outlines the entire process of using a given dataset to forecast the closing value, by studying the GOOGL stock and extracting approximately 14 years of data.

Proposed Methodology

Dataset

The Covid-19 Indian data, the Brent-oil Indian price data, the Gold price Indian data, and the NSE 500 index data have all been utilised in this study.

The top 500 NSE-listed firms are included in the Nifty 500. The Nifty 50 data has been used in a number of research. However, the Nifty 500 index data was used in this analysis primarily because it accounts for about 96.1\% of the free float market capitalization and roughly 96.5\% of all trading on the NSE. The primary elements of the dataset are the following: Date, Open, High, Low, Close,

Shares Traded (Volume), Turnover. The study's consideration period spans 5 fiscal years, from 03 April 2017 to 31 March 2022.

The World Health Organization (WHO) website is where the Covid-19 data for India was gathered. Date, New Cases, Cumulative Cases, New Deaths, and Cumulative Deaths are the attributes that make up the dataset. The study's consideration period is from January 1, 2020, until March 31, 2022.

Data on gold prices were taken into account from 02 March 2020 to 30 March 2022. Data on the price of Brent oil was taken into account from 02-03-2020 to 26-08-2022.

Pre-Processing

The Nifty 500 dataset was overlooked to remove unwanted attributes and keep only the ones most useful for the model building. After careful analyses and considering various related studies, the 'Close Price' was considered as the main attribute in considering the price of the particular day.

Further the entire dataset was divided in the ratio of 80:20 as a training set and testing set. These sets were used in the model to get the desired results.

Models

Traditional Machine Learning Techniques

RMSE - Root Mean Square Error is one of the most commonly used measures for evaluating the quality of predictions.

Linear Regression - It is a supervised learning algorithm used for performing a regression task in predicting an output.

K-Nearest Neighbours - It is a non-parametric, supervised learning classifier, which uses proximity to make classifications or predictions about the grouping of an individual data point.

RNN / Time Series

LSTM - Long Short-Term Memory (LSTM) networks are a type of recurrent neural network capable of learning order dependence in sequence prediction problems.

Analysis

Datasets of price movements for the NIFTY-500, OIL, GOLD, and COVID-19 Total Deaths and Cases Worldwide were extracted. The dataset for Brent has also been used because the conflict over oil prices between Saudi Arabia and Russia has had an effect on the market.

We have implemented price changes between the beginning of the financial year in 2020 and the conclusion of the financial year in 2022 in order to obtain an analysis of the impact of COVID-19. Thus, the actions of the Indian Stock Market during these times and their effects from COVID-19, the Oil Price War between Russia and Saudi Arabia, COVID-19- lockdowns, and other significant events that occurred during the time have been examined.

Along with the extraction of pricing actions, the datasets' normalization requires the extraction of necessary information, such as Covid case information for India and other name conventions and date formats.



The highest and lowest prices' percentage changes have been determined. As a result, the NIFTY-500 stock scatter plot on percentage change has been deduced. The scatter plot shows the closing prices of the GOLD, BRENT, and NIFTY-500 stocks with the data compared to the total number of cases on each day provided in the COVID-19 data. The conclusion showed that whereas GOLD produced irregular variation, the NIFTY-500 and BRENT stock prices implied consistent growth of a normal trend.

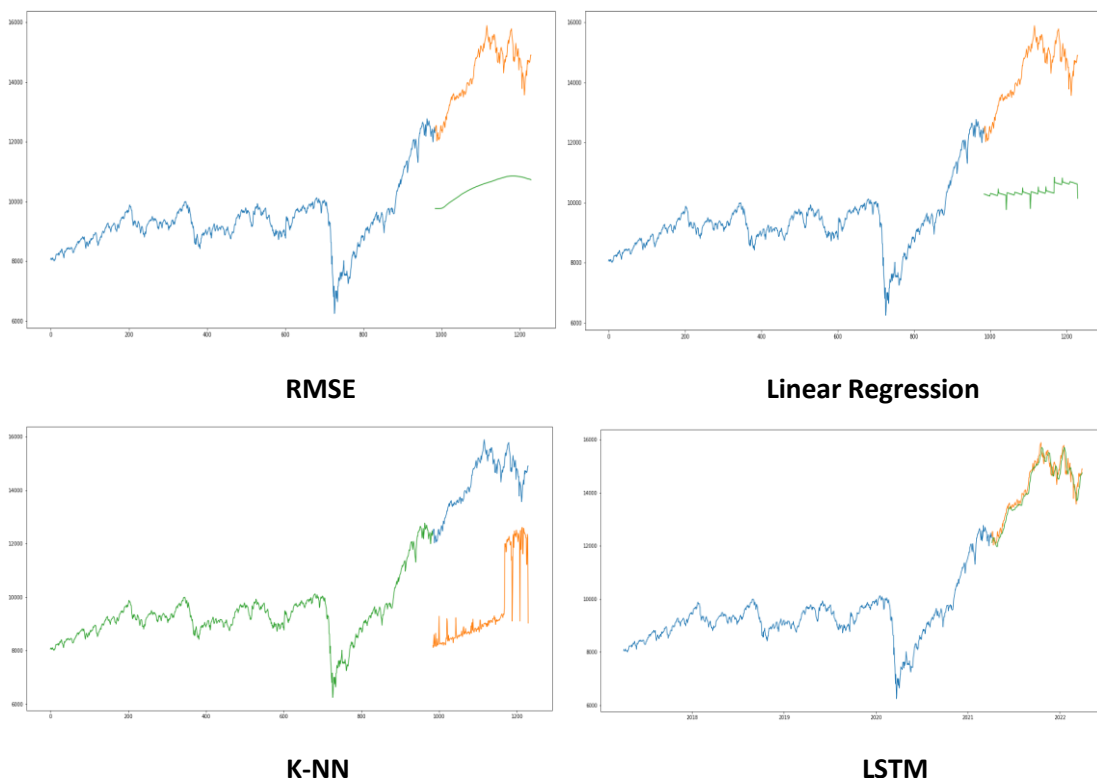
The plot of cumulative cases and cumulative deaths for each month is also examined because, as is well known, the biggest instances of COVID occurred in the year 2020. By the year's conclusion, the peak value had been identified.

Plots of the NIFTY market index closing price performance are shown on a monthly, halfannually, annual, and yearly basis. The sum of all the indicators revealed a consistent upward trend.

Finally, a comparison of the percentage returns from before the lockdown till the first COVID death to the March 2020 returns from before the lockdown and after the lockdown is plotted.

Results

The results obtained were exactly as expected. The RMSE, Linear Regression and KNN model fail to provide an accurate output in predicting the stock index as seen in fig.. However, the LSTM model provides an exceptionally accurate output in predicting the stock index as seen in fig.4,5,6,7. While KNN model works fairly well in problem statements that require multiclass classifications, a Linear Regression model helps in understanding the relation between only 2 variables. However, a LSTM model is a time series based that can be used in sequential prediction of data and thereby, works perfectly for the problem statement in predicting the stock index over the timeframe.



Conclusion

Relevant studies have focused on various methodologies and implementations to predict the stock prices and indexes based on the time series models. In this study, we have demonstrated how a sequential model clearly outperforms traditional Machine Learning techniques in a problem

statement that involves time sequence. LSTM model outperforms and provides an exceptionally accurate prediction when compared to the RMSE, Linear Regression and KNN model.

Further, we've also concluded some of the results based on the Analysis obtained after various careful observations, mentioned below:

- Oil Prices see a rapid increase in the months of April-July 2020 while the stock market sees a slow recovery.
- Gold Prices drastically increased in the months of March - May 2020 while the Market hits low. This is primarily because, due to the uncertainty in the market conditions, investors would prefer in switching over to safer investing options like Gold or Government Bonds. • Again, Gold Prices see a drastic drop as the Market condition improves during June - Nov 2020.
- It can be observed that whenever there has been an increase in the Oil prices, the Market has gone down (Jan - Mar 2022)

We can conclude that Covid lockdowns during Mar-May 2020 brought a major impact to the market than the lockdowns during April-June 2021. One primary reason can be said due to the fear of outbreak of a pandemic which was observed in March 2020 by WHO (World Health Organization).

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