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The Analysis of Stock Market Trends Using The K-Nearest Neighbor (KNN) Algorithm

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Abstract: *For many years, stock forecasting has been a challenging subject for experts in finance and statistics. In general, there are two methods for predicting the stock market. One of them is fundamental analysis, which is reliant on a business's operating procedures and foundational information. The performance of the supervised machine learning algorithm KNN (K-Nearest Neighbor) is evaluated by the author in this study. The K-Nearest Neighbor machine learning technique is used in this study to anticipate using prices with daily and minute frequency, the three separate markets' stock prices for high and small capitalizations. Forecasting trends for the stock market are thought to be a significant and effective activity. As a result of intelligent investing decisions, stock prices will result in favourable returns. Due to the static and noisy data, investors find it challenging to make predictions about the stock market. As a result, investors who seek to increase the value of their investment have a significant challenge when trying to anticipate the stock exchange. Making analysis about the stock market involves the use of mathematical techniques and educational technology. In this article, past and suggested procedures are presented, including computation techniques, machine learning calculations, and execution elements. This research is therefore helping to uncover datasets and machine learning strategies for stock market Forecasting. The most often used techniques for producing precise stock market forecasts are ANN and NN. The most modern method of forecasting the stock market has many shortcomings despite the extensive work that went into it. In this perspective, stock showcase estimation is seen as a coordinates handle, therefore specific factors for doing so should be given more consideration. The economies of developed countries are assessed in terms of their power economy. Stock markets are currently regarded as a prestigious trading industry since, in many circumstances, they provide simple gains The most modern method of forecasting the stock market. The stock market/exchange, with its extensive and dynamic data sources, is seen to be an ideal setting for data mining and business researchers. To help investors, managers, decision-makers, and users make wise and informed investment decisions, we forecasted stock prices for a list of the companies that are listed on the stock market/exchange using the k-nearest neighbour method and a non-linear regression technique. The results demonstrate the robustness and low error ratio of the KNN approach, leading to sensible and reasonable results. Furthermore, the forecast results were near to and practically parallel to actual stock prices, based on the actual stock price data. Because the stock market has such a huge influence on a country's economy, it's intriguing to observe how stock market prediction may be employed and whether or not the expected outcomes are accurate. Using the closing prices of shares listed on the Stockholm stock market OMX, this research will compare the prediction approaches, the kNN 9K Nearest Neighbour) algorithm, and the MA (moving average) formula. The paper covers these theoretical principles allowing the reader to obtain a good familiarisation of the backdrop of stock markets and the formulae used. With the help of appropriate charts and tables, the data is distributed properly. Finally, a commentary highlights the ramifications of the findings, as well as the conclusion that the K Nearest Neighbor algorithm provided more accurate data than the moving average approach.*

1. INTRODUCTION

Due to a variety of deciding elements, For investors, It has never been easy to predict how the stock market will move. In this study, the risk associated with trend prediction is significantly reduced using ML techniques. The Stock Exchange's varied financials, petroleum, non-metallic minerals, and basic metals market groups

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were chosen for experimental evaluations. Stock market forecasting is still an esoteric science. If somebody is willing to share their effective tactics, it's rare. This project's main objective is to further scholarly knowledge of stock market forecasting. Investors might potentially avert another financial disaster if they have a better knowledge of how the market functions. The study will offer a quantitative assessment of novel techniques as well as a scientifically rigorous examination of certain current tactics.

Numerous data mining techniques may be applied to financial forecasting. Examples include the classification and regression tree algorithm, the k closest neighbour (KNN) algorithm, and the naive Bayes classifier (Wu et al. 2007). 2007 (Wu et al.). All of the aforementioned methods might serve the paper's objectives, but the focus will be on the kNN algorithm and the MA formula for predicting stock market moves. A well-estimated prediction will be created by analysing a huge quantity of previous data and looking for patterns to identify the changes. This method was chosen since it is simple to use and implement for analysing enormous samples of data (Berson et al. 1999). The KNN method simply states: "Furthermore, the prediction values of items that are "close" to one another will be similar. Therefore, you may anticipate it for an item's closest neighbours if you know the prediction value for that object " (Berson et al. 1999). The MA formula was chosen to compare to the KNN method. The MA formula and the KNN algorithm share a similar simplicity, but traders frequently use this statistical approach (Interactive Data Corp, 2014).

One of the most exciting modern inventions is the development of financial markets. These financial markets significantly [1] affect a range of industries, including as trade, employment, and innovation. Investment experts have used two fundamental approaches to choosing stocks on the stock exchange with the goal of maximising returns and lowering risk. Professional investors and financial analysts are paying more attention as [2] stock market forecast advances. Because of the chaotic nature of the market, it is quite difficult to analyse stock display activity [3] and price movements. Quarterly earnings reports and stock exchange headlines are only two examples of how complicated stock prices can be.

The market capitalization is used to construct the stock exchange indexes [4]. Forecasting the stock market accurately [5] becomes an extremely difficult task. For researchers and market professionals, developing and evaluating stock market behaviour has been a top goal [6,7]. As a result, numerous statistical methods are used to anticipate the stock market, including ARIMA and clustering. This model provides explanations for the normalcy theories as well as historical data. The area of stock exchange estimating applications has seen substantial usage of SVM, NN, and ML techniques [8,9]. The relative quality index is a cost oscillator that contrasts cost efficiency in the present with cost quality in the past [11]. Using pre-existing financing bits of information, some analysts [12] on the stock exchange use long short-term memory (LSTM) and a genetic algorithm (GA) for stock market forecasting.

The feed-forward network is often used by businesses to forecast stock movement. The major objective of this article is to give a thorough review of stock forecasting methods that might be extremely helpful in predicting the future the direction of the stock market. This article examines a variety of machine and statistical learning forecasting methods using pertinent datasets. A range of methods, assessment indices, records, and stock exchange forecasting tools should be employed in the study.

2. LITERATURE SURVEY

Stock markets are now an important aspect of any country's financial system, and they may provide a clear indication of how a country's economic development and downturn are proceeding. Several methods are now being developed to assist market participants in forecasting market movement. The most widely used market forecasting methods rely on software-based solutions that employ graphical and statistical approaches to forecasting market behavior (Beattle, 2011). The moving average, which is frequently utilized by traders, is an example of a statistical procedure (Interactive Data Corp, 2014). These approaches, on the other hand, are not reliable enough to be depended upon, and the advice of a seasoned market trader is frequently regarded higher than software-based forecasts (Beattle, 2011). If a credible prediction mechanism existed, one might forecast huge market volatility and implement safeguards to mitigate the repercussions of such large changes. This might also result in less chaotic stock market behavior.

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Because computers would be utilized more frequently if this type of prediction mechanism existed, the area of computer science would become more important. The discipline of computer science is constantly evolving these days, and it is becoming more and more visible in every part of one's life. As computers' capabilities grow, more and more jobs are accomplished with the assistance of computers rather than humans, removing the possibility of human mistakes. Complicated activities are now being performed by computers thanks to artificial intelligence, which is getting closer to replacing a portion of the human mind that is riddled with errors. Many examples of technology replacing human mistakes may be seen in aviation, suggesting that it may one day be observed in other professions (Ihilliard1 2011). This reduction in human error might be used in the financial sector, for example, when forecasting stock market fluctuations. Computational intelligence, machine learning, and data mining are currently being used to uncover connections in big data sets that people are incapable of finding as a prediction approach in finance, medicine, and biology (Alexander, 1998).

Numerous data mining approaches may be applied to forecast outcomes in the financial sector. Examples include the classification and regression tree approach, the k closest neighbour (KNN) method, and the naive Bayes classifier (Wu et al. 2007). All of the above algorithms might be useful for achieving the article's goal, but the kNN algorithm and the MA formula will be highlighted as a method for forecasting stock market movements. The movements will be identified by analysing a massive quantity of historical data and identifying trends in order to give an informed prediction. This approach was chosen because it handles vast volumes of data in an easy-to-use but efficient manner (Berson et al. 1999). The KNN algorithm is as follows: "Prediction values for things that are "close to" one another will be similar. You may thus forecast what the values of an object's close neighbours will be provided you know the predicted value of one of the objects " (Berson et al. 1999).The MA formula was chosen to compare to the KNN method. The MA formula shares some similarities with the KNN algorithm in terms of simplicity; however, it is a statistical strategy that is often utilized by traders (Interactive Data Corp, 2014).

Hyperspectral predictions, fuzz predictions, and Lempel-Ziv-based prediction are a few of the well-known stocks forecasting models. These are based on the idea that by removing duplicate data, the data representation may be made more compact while still maintaining the accessibility of the important data (Azhar et al. 1994). Despite the above-mentioned existing approaches, the intricacy of the project made the KNN algorithm and the MA formula the best tools to use. The best approach to predict the direction of the financial markets is a strongly debated topic. It might be challenging to consider every factor that might have an impact on a stock's performance. For instance, societal change, world events, interest rates and inflation, currency exchange rates, and last but not least, hype (Wolski 2014). The idea of using data mining to try to prognosticate the stock market has grown more investigated in recent years due to people's growing interest in it and their ability to benefit from it.

The stock market is dynamic and unpredictable due to its volatility character. When estimating a stock's value, various factors must be considered, including news, sentiments, the economy, financial reports, and much more. The strategies for investing in the stock market are intricate and rely on a big quantity of data. The danger of loss is intrinsically tied to profit. Predicting stock value can help you reduce the risk of losing money while also increasing your rewards. Two primary approaches are used to anticipate stock prices. In the first methodology, the Traditional Time Series method, the projection is based on the stock's previous performance data. This technique took into account the stock's closing price, opening price volume, and other criteria. The qualitative second method of forecasting is based on factors such as a company's profile, news stories, the economy, social media, market sentiments, and so on. The stock market's high data volume and unpredictability need efficient models that can deal with the complexity of such a big amount of data. The stock data is tough to understand due to hidden patterns. Machine learning algorithms can cope with a lot of data and dig deep into it to solve various complicated patterns and produce accurate predictions.

Data analysis, machine vision, aeronautical engineering, economics, entertainment, and bioinformatics have all benefited from machine learning techniques, in addition to applications in medicine and biology. In today's high-trading frequency market, machines execute deals worth billions of dollars every day with reaction times estimated in microseconds. The robots carry out over 73% of all transactions under normal circumstances. These machines take into account all of the available historical financial data based on extremely complicated data. Machine learning algorithms are unlikely to completely replace people, just as robots haven't replaced

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people in other industries. However, some activities will undergo considerable modifications as a result of software. One thing is certain: we must work harder to integrate technology into every aspect of society given the current environment.

Future applications of machine learning will frequently not only employ market prices but also social media, news trends, and other data sources. Numerous human-related variables that are unrelated to ticker symbols cause the stock market to move. By identifying new patterns, it is hoped that machine learning will be able to simulate human intuition in financial activities. Menon A et al. in 2019 The review of neural networks for stock price prediction is the main objective of this paper. Researchers have concluded after analysing a neuronal model that the long short term memory method would be the most effective method for forecasting economic data that coincides with the current fashion. Kia, A. N et al. in 2018, Several experiments and methods have been developed for historical data prediction, similar to stock forecasts, such as the HyS3 graph-based semi-supervised model presented in this research by the author using the ConKruG network views Kruskal based graph method. They believe that in the future, social media and Twitter data might be utilised to predict stocks more accurately using these algorithms. Oliveira, N., Cortez et al. in 2016, The purpose of this study's author was to provide a method for gaining access to the value of the share forecasting and micro - blogging data they used, for share prices and return indices, as well as some data that is more similar to a portfolio. They combined the microblogging data with some data from outside sources using the Kalman filter for this experiment, and as a consequence, They found that both the Twitter data and the blogging data were relevant for the forecasting objective and were very beneficial. This conclusion will be strengthened by the use of additional and other types of data, such as social media datasets and others. Smruti rekha das et al. in 2019, Using the backpropagation, neural network, and additional two methods for prediction, the authors of this paper used the firefly method to forecast stock prices. The NSE-India, BSE, S&P 500, and FTSE websites were used to collect the input datasets. Using the appropriate mathematical methods, the obtained data was properly converted. By providing more parameters to the developed algorithms, there may be an opportunity for future work to produce findings that are more accurate.

3. PROPOSED SYSTEM

Since the beginning of the stock market, investors have struggled with and sought to predict it. On the market, billions of dollars are traded every day, and each dollar has an investor who is looking to make a profit in some way. Every day, entire businesses emerge and collapse in response to market behaviour. If an investor can correctly forecast market trends, it holds forth the alluring prospect of money and power. Therefore, it is understandable why the Stock Market and the difficulties it faces frequently enter the public's mind. The abundance of movies and documentaries on the disaster show that the 2008 financial crisis was no different. If there was one thing these works had in common, it was how little individuals understood how the market operated. A deeper understanding of stock market forecasting could prove useful if similar circumstances recur in the future.

RELATED WORK : The main index's impressive development over the past ten years has contributed to the recent surge in popularity of stock market. Ordinary individuals may purchase shares in recently privatised companies under certain conditions. The market differs from financial markets in other nations in a number of ways, including a daily dealing price cap of 5% of the each index's opening price. This issue prevents market shocks and erratic market swings, political issues, etc. over a specific period of time and might make the market more uniform. However, the market is significantly impacted by fundamental factors, making it difficult to anticipate future moves [23]. The challenge of forecasting future trends was investigated in this study using stock market groups, which are crucial for traders. Despite the stock market in Tehran making significant strides in the last ten years, there haven't been enough publications on stock price patterns and projections using cutting-edge machine learning algorithms.

However, Nabipour et al. [23] recently released a work in which they used deep learning algorithms and tree-based models to predict future stock values from one day to thirty days in advance. Our study combines continuous data and binary data in two distinct ways to explore the impact of preprocessing; the first method uses stock trading data (open, close, high, and low values), while the second method uses a pre-processing step to turn continuous data into binary data. Based on the underlying characteristics of the market, each technical

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indicator has a distinct potential for upward or downward movement. Three classification metrics are used to evaluate the performance of the aforementioned models for the two methods, and for each model (apart from Naive Bayes and Logistic Regression), the optimal tuning parameter is presented. The Tehran Stock Exchange provided 10 years of historical data for four stock market groupings (petroleum, diversified financials, basic metals, and non-metallic minerals), all of which are absolutely essential for investors. This study, we think, is a novel research work that combines a number of machine learning and deep learning techniques to enhance the task of predicting the trend and movement of stock grouping.

4. IMPLEMENTATION

4.1 PARAMETERS : THE SYSTEM PRESENTED HERE COMPOSES OF FIVE MODULES

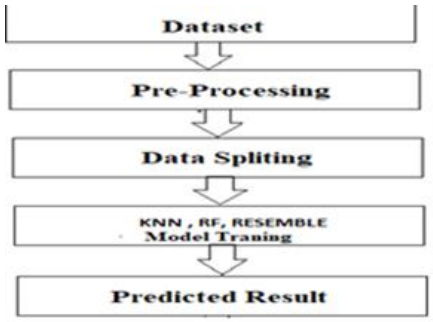

Figure 1 Workflow

1. Input as Dataset
2. Pre processing
3. Data splitting
4. Build & Model train KNN ,RF , Ensemble model
5. Output as Predicted Result

As input to the models for training, attributes like price of open, high, low, close, and modified closing price are obtained from a large dataset. Data pre-processing techniques like normalisation and one hot encoding are then used to the dataset. After that, the data is split into two sets, training and testing, with a ratio of 80:20 each. Then, using three separate techniques—KNN, RF, and Ensemble model—this set is utilised to train a model.

5. RESULT

Step 1: Data Analysis

I started by doing data analysis for company stock prices. The stock information shown in the graph include the date, open, close, high, low, , and volume**.**

Step 2 **:** Read Data

Date	Open	High	Low	Close
2021-08-09	442.459991	442.799988	441.309998	442.130005
2021-08-10	442.609985	443.440002	441.880005	442.679993
2021-08-11	443.820007	443.880005	442.619995	443.779999
2021-08-12	443.619995	445.260010	442.660004	445.109985
2021-08-13	445.589996	445.940002	445.070007	445.920013

Figure 2 : Read Data

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I have studied the dataset following data analysis. From the tail up, it displays the dataset information table.

Step 3: Define Predictor Variable

Date	Open-Close	High-Low
2021-08-09	0.329987	1.489990
2021-08-10	-0.070007	1.559998
2021-08-11	0.040009	1.260010
2021-08-12	-1.489990	2.600006
2021-08-13	-0.330017	0.869995

Figure 3:- Defining the predictable variable

The predictor variable provides details about a linked dependent variable in regard to a certain result.

Step 4:- Train Test Split

The predictor variable provides details about a linked dependent variable in regard to a certain result.

Step 5:- Applying Model (KNN**)**

After applying the KNN Model on the train data, test data. we get the accuracy on the train and test data.

Table 1 :- Train and test data accuracy.

Train_data Accuracy	0.59
Test_data Accuracy	0.50

Table 2: Comparison of Machine Learning Algorithms on the basis of Accuracy

Algorithms Used	**Accuracy**
Random Forest	0.65
K-Nearest Neighbour	0.62
Ensemble model	0.64

Step 6:- Predicted Result:

The dataset used is taken from National Stock exchange, Kaggle and Yahoo datset. Machine to calculate the required results and by using the above-mentioned supervised learning algorithms. The accuracy score obtained by Random Forest, Ensemble model and K - Nearest Neighbour is shown below in Table 2. The best accuracy score is 65% that is of ensemble model.

Step 7:- Utilize the model to develop a trading strategy**.**

Simply buying or selling makes up our trading approach. Using the "predict" function, we will determine the buy or sell signal. The testing dataset's S&P 500 cumulative returns will then be calculated. The cumulative strategy return will then be determined using the signal that the model in the testing dataset anticipated. The KNN Algorithm's efficiency will determine then be displayed by plotting the cumulative returns for the S&P 500 and cumulative returns for the strategies in

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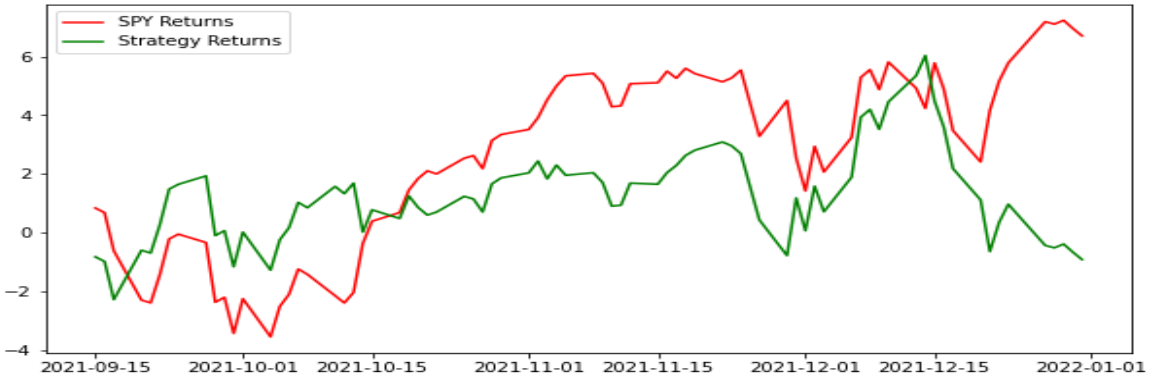

Figure 4: display the actual returns and strategy returns

The graph shows that between "2021-01-01 to 2022-01-01" the cumulative returns on the S&P 500 were roughly more than 6% while the cumulative returns on strategies were about 6%.

Step 8: Sharp ratio

The return received in excess of the market return for each unit of volatility is known as the Sharpe ratio. In order to get the Sharpe ratio, we must first determine the cumulative returns' standard deviation.

sharp ratio= (cumulative_strategy_returns-cumulative_spy_returns)/std

the sharpe ratio of our strategy is -0.83.

the moving average smoothes the line and highlights the upward or downward trend in stock price.

return deviation — to determine risk and return

The expectation of a return on an investment is measured by its mean, or anticipated value. According to investopedia, the expected return on the portfolio is calculated by multiplying the weight of each asset by its expected return, then adding the values for each investment.

The formula you may use is as follows:

$$r_t = \frac{p_t - p_{t-1}}{p_{t-1}} = \frac{p_t}{p_{t-1}} - 1$$

6. CONCLUSION

We employed supervised techniques such as k-nearest neighbor, svm, linear regression, and random forest. The k-nn algorithms were found to be the most successful and suited for prediction after we used all four of the algorithms that were helpful for stock prediction and calculated the outcomes for each approach. Is utilising the knn algorithm a more accurate technique of predicting the upcoming closing prices of stocks than using the more popular approach of ma? Is the question that has to be answered. The two prediction techniques were put into practise, and information was generated, to help answer this issue. Calculations were then made to determine the data's correctness after the findings were graphed and partially shown in tables. This was mainly expected because the knn algorithm used both past historical trends as well as the complete two years of data while making each forecast. It examined the historical trends of the days that were similar to the value that was being predicted. Clearly, this prediction method outperformed a method that is frequently employed by traders in terms of effectiveness and accuracy. As a result, traders need to understand more than they already do about prediction using algorithms and machine learning. Given how the computer science industry is expanding and

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taking new initiatives to make the world around us simpler, it could be suitable for the trading conditions to follow suit and depend less on statistical approaches and more on computer science. Stock investments have drawn the attention of many investors throughout the world. Making a decision.

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