AI Prediction of Stock Market Trends: An Overview for Non-Technical Researchers

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Abstract. The ability to forecast stock market patterns has emerged as an alluring use of artificial intelligence (AI) and machine learning, thanks to the field's fast breakthroughs in both fields. For non-technical researchers, this publication offers a thorough and understandable introduction of AI-driven stock market forecast methods. The aim is to demystify the difficulties associated with AI-based predictions and provide non-experts a basic comprehension of the approaches used. The study examines the numerous data sources utilized in the setting of AI-driven stock market forecasting, including historical stock prices, financial statements, market sentiment, and macroeconomic indicators. To make it easier to prepare data for AI algorithms, data pretreatment and feature engineering approaches are discussed in a non-technical way. Support Vector Machines, Random Forests, and Deep Neural Networks—three important AI models used in stock market prediction—are introduced with an emphasis on comprehending their high-level operation. The review also covers difficulties and restrictions related to AI predictions, such as poor data quality and model overfitting. Algorithmic biases, market manipulation, and responsible AI usage in finance are further ethical issues that are covered. The study provides a concise summary of key findings for non-technical scholars, enabling them to understand the potential and constraints of AI in forecasting stock market developments. Non-technical researchers may make intelligent judgements, participate in conversations, and significantly progress this game-changing subject by gaining this fundamental information.

Keywords: Stock market prediction, Artificial Intelligence, Machine Learning, Non-technical researchers, Data, Models.

1 Introduction

The stock market is critical to the global economy, with billions of dollars traded every day. Predicting stock market trends is critical for investors and traders wanting to make informed stock purchase and sale choices [1]. While traditional methods of

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stock market prediction, such as technical analysis, have been utilized for decades, the rise of artificial intelligence (AI) and machine learning (ML) approaches has considerably improved stock market forecast accuracy and efficiency [2]. AI and machine learning techniques can evaluate massive volumes of historical and real-time data to detect patterns and forecast future stock market movements. These strategies have the potential to bring considerable benefits to investors and traders, such as greater risk management and increased accuracy in predicting stock prices [3]. However, for non-technical researchers, the technical aspect of AI and ML might be a considerable barrier to entry, preventing them from completely understanding and exploiting these techniques [4]. As a result, a complete outline of the use of AI and ML in stock market prediction that is accessible to non-technical researchers is required. This study intends to provide a complete introduction to the use of AI and machine learning in stock market prediction for non-technical researchers [5].

The exciting realm of AI Stock Market Trend Prediction! We examine the groundbreaking intersection of artificial intelligence and finance in this overview aimed for non-technical academics. AI forecasts anticipated stock movements by analyzing massive datasets, historical patterns, and market trends using advance algorithms and machine learning. With the help of this cutting-edge technology, investors will be able to make better decisions thanks to data-driven insights [6]. The intriguing potential of AI in forecasting stock market movements is transforming the financial environment, notwithstanding certain difficulties. Join us as we explore the guiding principles and ramifications of this revolutionary financial instrument.

2 Literature Review

The author [7] in his research gives a non-technical explanation of the machine learning paradigm and how sports analytics may benefit from it. This pertinent studies on the ways that machine learning and artificial intelligence have been used in the sports sector.

The author [8] in his research explains how artificial intelligence may be used to find non-technical losses (NTLs) in the electrical distribution system, such as theft of electricity, malfunctioning meters, and billing problems. It gives a broad overview of how NTL affects the economy and analyses current research efforts in this field, highlighting the principal technical and scientific difficulties in NTL detection.

The author [9] in his research explains how data science is being used more and more in digital marketing to make decisions and gain insights from huge databases. It intends to examine the analytical techniques, applications, and performance indicators based on Data Sciences in digital marketing and makes suggestions for more studies in this area.

The author [10] in his research explains how supply chain inventory distortions may be predicted and minimized using no-code artificial intelligence. The abstract illustrates how customer demand negatively affects inventory distortion and how AI may be able to solve this problem.

The author [11] in his research presents a thorough, methodical examination of several techniques for identifying power theft and energy consumption fraud. It focuses on the most recent and effective non-technical loss (NTL) detection methods put out by data mining and AI researchers.

The author [12] in his research explains how data became important in digital marketing tactics and plans. It seeks to analyses data science-based analytical approaches, use patterns, and performance indicators and generates valuable information into the advancement of unconventional data mining and knowledge discovery methods.

The author [13] in his research explains how disruptive technologies are being implemented in the insurance industry and the difficulties that have arisen. Through the use of substantial and ongoing datasets, it emphasizes how general insurance markets and their business processes are changing.

The author [14] in his research gives a succinct summary of the research outcomes on the application of artificial intelligence (AI) in business. It describes the study agenda for upcoming studies in this field and emphasizes the significance of AI in enhancing company operations and decision-making.

The author [15] in his research explains the necessity of an Early Warning System (EWS) to predict energy costs in ambiguous situations brought on by occurrences such as the COVID-19 pandemic and the Russia- Ukraine war. By using uncertainty indices as a stand-in for forecasting energy market fluctuation, the study forecasts energy equity prices using Machine Learning (ML) models.

The author [16] in his research examines how artificial intelligence methods are used in distribution power networks for data-driven energy services. It also investigates data driven distribution network systems, including terrain estimation, observability, fraud detection, forecasting, energy management systems, aggregated flexibility services, and trading. It also identifies potential AI technology in handling power system applications.

The author [17] in his research examines current methods for applying artificial intelligence to find unusual energy use in structures. It explores the value of anomaly detection in encouraging environmentally friendly and energy-efficient behavior and illustrates the difficulties and directions this sector still faces.

The author [18] in his research discusses how academic research lags behind actual application, despite the BFSI sector being a key adopter of AI. Credit risk was the first focus of AI research, but it has since been hampered by unsuccessful implementations and underrepresentation. Investments, securities, customer connections, and compliance are examples of successful AI deployments.

3 Related Works

Several studies using various types of data and models have been investigated to assess the performance of various AI and ML methodologies for stock market prediction. In this section, we look at some of the most recent and relevant articles on the subject, highlighting their contributions, limitations, and differences from our study report [9]. We intend to provide a inclusive outline of existing approaches as well as identify gaps and opportunities for future study by evaluating the available literature

[19]. The paper "Forecasting Stock Prices using Machine Learning Methods" by M. Arun and P. Kannan studies the application of machine learning techniques for forecasting the stocks prices. Among other techniques, SVR is the most reliable technique which has a consistency of 96.21% [20]. Researchers have also used this technique in prices of shares in the stock market using machine learning [21]

In this particular research the researchers propounded a unique network model under which they have used both short term memory and long-term memory to predict the share prices In the stock market. After experimenting with this combined technique, they have identified that this technique worked way better than the older persisting techniques [22].

After assessing the outcomes of both the models they have come up with the outcomes that the hybrid model performed better in comparison to other models in terms of accuracy. [23]. This research is comparable to our research report in that it uses machine learning techniques to forecast stock market movements, but the models and attributes used differ. The study makes use of sentiment analysis, which we do not specifically address in our work. Our paper, on the other hand, gives an overview of various machine learning models that can be used to predict stock market patterns, including LSTM [24]. The following paper by G. G. Trivedi, H. R. Patel, and J. K. Patel is titled "Predicting Stock Prices Using Sentiment Analysis of Twitter Data." The goal of this study is to look into how sentiment analysis of tweets can be used to forecast stock values in the Indian stock market. The authors collect tweets about certain stocks and use natural language processing techniques to compute sentiment scores. These scores are then fed into machine learning models that forecast stock values. In terms of forecasting accuracy, the authors discover that their proposed method outperforms traditional time series forecasting methods [25].

This research is relevant to our post because it, too, uses machine learning techniques to forecast stock values. It does, however, take a unique approach by integrating sentiment analysis of tweets as a feature [26].

4 Background Overview

The stock market is a financial market in which stocks or shares of public listed companies are bought or sold. It is a platform that allows you to buy and sell corporate shares or securities. The stock market is key block of global financial system that influences capital allocation to businesses. The stock market's history goes back to 17th century, the pioneer first stock exchange was shaped in Amsterdam, Netherlands. This marked the beginning of modern-day stock markets. There after many countries created their own stock exchanges, such as the London Stock Exchange in 1801, and the New York Stock Exchange in 1817. These stock exchanges evolved as the primary venues for purchasing and selling publicly listed firm shares. The stock market works on the supply and demand principle. The price of a stock rises when there is a great demand for it; when there is a high supply, the price decreases. Economic data, business financials, news events, and geopolitical events all have an impact on stock prices. The use of electronic trading and use of computer algorithms have made a drastic change in how shares are traded in stock markets world over. Now a days the transactions taking place in the stock markets with high speed. It has

become much easier for seller and buyer to do the transactions, which was quite slow before coming of electronic trading.

Factors impacting Stock market:

Economic Indicators

There are various factors which have a good or adverse impact on the stock market. Out of many, factors like unemployment in the country, higher inflation rates, low GDP growth, corruption can have serious negative impact on the growth of stock markets. On the contrary if the country is having good growth rate, low interest rates and lower inflation rate, this makes a good place for the investors to invest their money. Corporates grows when the economic indicators are in their favour, good government policies, large middle class population, skilled workers, good infrastructure boosts the investment and helps in overall growth of the country

Political Measures

Political stability in the country, good governance, good established policies, push from government to develop new avenues of the business helps in increasing investment in the country and helps in the overall growth of the country,

C. *Global Scenario*

When it comes to global level, tensions between two or multiple countries creates an unfavorable condition for the investors to invest. Many investors feel uncertain on investing in a country which may goes in war in future. This uncertainty leads removal of investment from that country. Once the this happened, the inflation rate started to sore, to control the inflation rates, union banks go for higher interest rates. On the one the side union banks try to control inflation rate and at the same time they want to win the confidence of investors to invest the money. As result the stock market of that country becomes highly volatile, and investors feels difficult whether to invest or take out money from such country. Due to this volatility, it becomes important that investor should have a detailed information of that country. Investor should be aware of every big geopolitical move so that the investor can take right decision on his/her investment

Methodology

Forecasting in the stock market is something which is of great importance if you can predict accurate stock prices movement. This is where use of artificial intelligence has created an impact in the modern-day stock market predictions. Earlier the predictions were completely dependent on human experience and judgement, under which many a time due to human judgmental errors predictions went wrong. On the contrary the amalgamation of artificial technology, large data analysis in quick succession combined with human experience leads to a much-improved stock market prediction.

Stock market predictions heavily rely on past data, its trends and more over the economic sentiment, social media sentiments, change in government, policy or any other change in the macro-economic situation in the country leads to volatility in the stock market. The use of highly complex and complicated traditional predictive models was

not so reliable because these models were not able to process large amount of data. On the other hand, the use of AI, RNN short term and long-term memory models have helped to analyse such a large scale data and helps in stock market predictions more accurately.

With the use of AI every now and then new AI based models are emerging which consume versatile type of data to predict stock market future trends. Only key element which can make a model more reliable is how accurately that specific model can predict stock market fluctuations. People are using various techniques to make it more reliable like, the use of CNN the convolutional neural network which was originally designed for image processing but later it is used to analyse the stock market or financial news articles.

The main advantage of use of use of AI based models is that they use different type of data sets to analyse and predict the future. It is very useful for the people who have less knowledge on stock markets, and they can use such predictive software's to make their decisions more accurate, on the contrary the people who have in depth knowledge of stock markets, they understand that the stock markets are highly unpredictable. It is very difficult to accurately predict the future and give an accurate outcome. But the amalgamation of AI based models along with human intelligence can help in better decision making.

5 Data Used

The use of AI in stock market predictions is in a nascent stage, still a lot of advancement is required to make it more reliable. With passage of time there will be improvements in the AI technology, use of more accurate data sets, new data analysis techniques and removal unrequired data will lead to more accurate predictive models.

1. Based on Past Prices: The historic stock prices is the most crucial dataset for future predications. It is the only data set which highlight the past stock prices trend and helps in forecasting future trends. Data's like opening price, closing price, total shares traded. Using the time series data and analyse it with the help of available models like ARIMA helps in predicting the future price of specific stock.
2. Company Financial Performance: Any companies financial report highlights the financial health of a company, if a company financial report highlights more debt on the organisation, this clearly indicates that the company needs to do a lot to improve its financial condition in future and by seeing this many investors don't feel confident in investing in such organizations. Companies cash flow statements, balance sheet, its liabilities, assets, cash flow etc. is used to analyse the company's overall financial health and ultimately it helps in predicting the future of the organisation.
3. Stock Market Sentiment Analysis: Stock market is the place which is not just get affected from financial numbers but is also gets impacted from the sentiments in the country. Sentiments can bring positive or negatives fluctuations in the stock market. Change in government can lead to volatility in the stock market, change in interest rates, change some Marco economic factor,

articles in the financial newspapers can have positive or negative impact on the stock markets.

4. Important Indicators: There are various technical indicators which helps the investors to identify the right time to enter and right time to exit the stock market. Indicators like relative strength index, candle charts, rooted in chart analysis etc. are some good indicators which can help the traders to identify the movement of stocks trends and helps in better decision making.

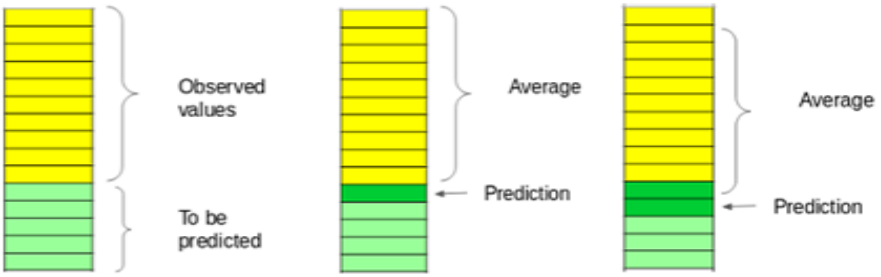

Fig 1. ML Models for Stock predictions: Tells the numerous predictions accuracies of different models by giving a brief comparison between observed values and predicted values by the model.

Stock market reliable, accurate predictions is one of the most difficult tasks to perform, in depth knowledge, procedures, data mining, data cleaning, using accurate data models, removing the duplicate data, using accurate data sets, data consistency, data cleaning, performing multiple data modeling simulations and many other things are required to make your predictions accurate. With the help of AI technology, these things can become much simpler and can helps in predicting the reliable accurate forecast for the investors.

6 Prediction Models

There are various stock markets models used by the investors. Models like Convolutional Neural Network model, RNN, autoencoder model etc. The autoencoder model helps in compressing the large volume of data and gives brief outcomes based on the large data. This model really helps in analysis large scale data and give prediction on a quick manner. The RNN model uses the time series data and helps in creating price simulations and helps in identifying the pricing trends for the stocks. People use different type of models to calculate their probability of pricing accuracy on the contrary AI gives the freedom to use multiple predictive models at the same time and give more accurate results in comparison to the traditional methods. No doubt there are multiple predictive models but the amalgamation of AI into such models new AI based models will emerge in future.

Prophet, developed by Facebook, is another tool that's gained traction in time-series forecasting. It accommodates seasonality and can handle missing data, making it adaptable to the stock market's unpredictable nature.

Reinforcement Learning models, like the Deep Q-Learning, have also been explored. They operate by continuously learning the best actions to take under various market conditions to maximize rewards, making them suitable for dynamic trading strategies.

Lastly**,** Support Vector Machines (SVM) and Random Forests have historical precedents in stock predictions. While they might seem overshadowed by deep learning models, their strength lies in their simplicity and effectiveness, especially when the feature space is well-defined.

In essence, the choice of model in AI-driven stock market predictions is contingent upon the specific problem, the nature of the data, and the desired outcome. Each model offers unique strengths, but their effectiveness is optimized when tailored to the intricacies of the financial realm.

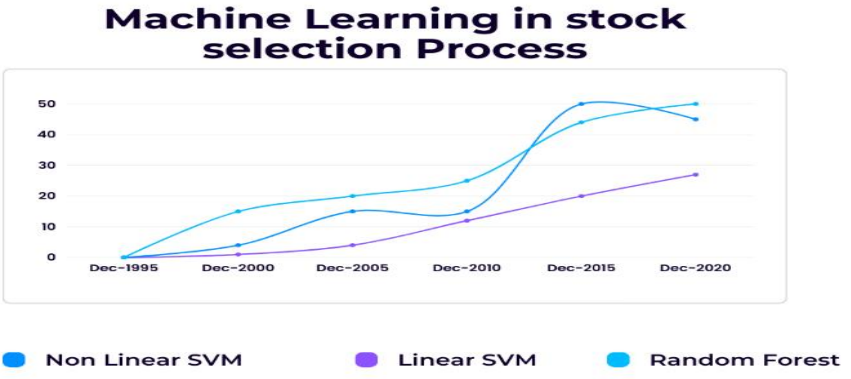

Fig 2. Line Graph representation of ML models and their application trends 1996-2016: Shows the usage of different models in different years. Higher the line, more successful the model was in terms of usage.

7 Limitations and Challenges

Stock market prediction, despite the massive advances in technology and data analytics, is not a guaranteed science. It remains fraught with challenges and inherent limitations that both analysts and investors should be cognizant of:

1. Market Volatility: The stock market is inherently volatile, impacted by a myriad of unforeseen events ranging from geopolitical issues to sudden economic shifts. Such volatility often makes it difficult to manage and predict accurately.
2. Historical Data Overdependence: Now a days there is saying that data is a new oil, and this is correct because investors are highly dependent on history data. With the use of historic data analytics predicts the future. The quality of data reflects the accuracy in the future predictions. However, if the historic data is not available or limited there would be high degree of inaccuracy in the predictive results. But some analyst also argues that the past results can-

not guaranty the accuracy in future perditions. So, a lot need to do in this context and there is light of hope from AI based predictive models.

3. Data Quality: Accurate, clean data is highly important for accurate predictions, the way crude oil is refined to make the final product as petrol or diesel, same way there is need of clean the data so that inaccurate data, information is removed, and clean data remains to use in the predictive models. If the data is clean and accurate it becomes much easier for the analytics to work with such data.

4. Complex Models: All the predictive models present in today's era required different type of data sets, like use of time series data, use of news paper articles, balance sheet, opening price, closing price, organisation liabilities, assets, cash flows and many other data sets, which makes them quite complex operation to bring them together and analyse to get valuable information. All these complexities make predictive models complicated and non-user friendly.

5. One world: Now a days countries are so much interdependent on each other that if something happens in one part of the world it will have cascading effect on the other part of the country. Like during Covid 19 scenario countries were not able to get products which they wanted to have. Products like semiconductors were not available due to disruption in the global supply chain. All of this ultimately brings impact on the stock markets of entire world.

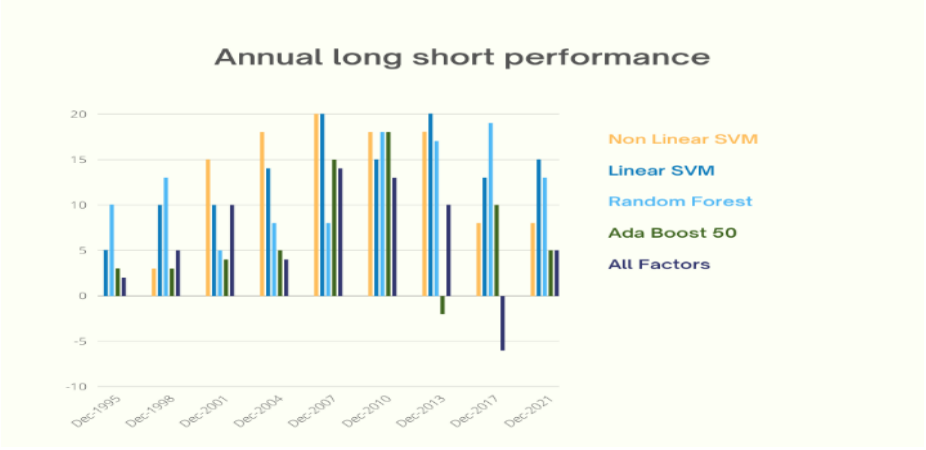

Fig 3. Bar Graph Representation of ML models Stock Market application trends 1995-2021: Shows the annual working performances of different models in long-short manner. Gives a brief overview about the performances of models that too of different types on yearly basis usage.

Before applying any kind of AI ML predictive models, it is important to understand its limitations and scope. Using such models blindly without having much of its knowledge leads to devastating outcomes for the investors. So, it is highly emphasize that one must have its proper knowledge and must be aware of its assumptions and limitations before using any predictive model.

8 Potential and Opportunities of AI

There are numerous benefits of using AI in stock market prediction models out of which one of key benefit is accuracy of the AI based predicted models. AI has the capability to process large volume of data and helps in doing analysis of large data in no time. There is no need to feed the data again and again into AI based models, such technology automatically gathers information from various online platforms, analyse them and give a comprehensive solution. It also provides customized outcomes in no time according to need of the analyst. It automatically cleans the data and provide best possible solution to the user.

One of the biggest challenges for the experts is how to properly integrate AI with the stock market models. Many a times AI technology may have an obstacle to understand the sentiments and not able to converts such sentiments into outcomes. This may lead to false prediction of stock market pricing. Over dependance on AI may also lead to used human expertise. So, it becomes crucial to work on AI model's very great caution. AI is great advancement but one must also take care of its ethical concerns. With knowing its assumptions, limitations and ethical concerns it may go haywire and results in false predictions.

9 Conclusion

In 21st century the evolution of AI technology has brought a new paradigm shift in human technological advancement. Use of AI has made human life much easier than before. New arena of businesses has emerged with the use of AI. Be it medical sector, education sector, automobile sector or financial stock markets everyone has been impacted with the AI. AI tools like RNNs, CNN, LSTMs etc. have made financial decision making easier than before. Such models not only do processes faster but they are much more transparent and easier to use. Whenever there is a need to analyse large scale data there was a requirement of multiple software and analyst to perform procedures. But with the use of AI all such procedures can be handled. There is no doubt that AI can be curse if humans don't use it best possible ethical manner. Humans' If handover control to AI, with this AI, can get control over use of different platforms to gather data and analyse it to give predictions. On the contrary if this data is not being protected well this can lead to unethical use of data and people can use it for their greed. So, there is high need to formulate policies regarding ethical use of AI technology. With proper ethical consideration this technology can help in analyzing large volume of data and help in accurate predictions of stock market pricings.

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