

# Artificial Intelligence in Stock Market: Concepts, Applications and Limitations

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**ABSTRACT:** Today's stock markets are more volatile than ever. The amount of information freely available is increasing at an exponential rate. However, such massive amounts of information is difficult for human traders to fully utilise. This information is thus used by advanced artificial intelligence algorithms and models which identify even the smallest of irregularities in the markets and exploit them for a profit. The scope, limitations and the technical variables that are a part and parcel of these AI systems need to be understood and evaluated in order to make the most out of these systems. The study shows that the indicators with a high correlation with the stock prices such as Triangular Moving Average and Simple Moving Average must be a part of the machine learning AI model. On the other hand, the indicators such as MACD and RSI are inaccurate predictors. The study also pinpoints 2 key problems with this technology: finding sufficient high-quality data to feed and train systems, and the scale of human effort required to run systems.

**KEYWORDS:** Stock Market, Artificial Intelligence, Future of Artificial Intelligence in Stock Market

## I. INTRODUCTION

With the growing technological and industrial development taking all around the world, stands a drive to never stop exploring. With their being monumental increase in research towards Stock Trading, the most promising has been towards integration of Artificial Intelligence in it. "Artificial Intelligence to trading is what fire was to caveman." AI is going to change the world of Stock Trading completely. Using AI, robotic advisers analyse tons of data points, aid the execution of trade at the optimal and viable prices, the analysis of forecasts happen with greater accuracy and trading firms are capable of calculating risks more efficiently and provide for

higher returns to investors. Artificial intelligence (AI) is increasingly becoming part of our lives, often without us even realizing it.

With unfamiliar inventive utilization of Artificial Intelligence, there's wide potential for Stock Trading to review their devices and functionalities and think of an ideal model of working. This advantages the business, nations economy and business in manners nobody can deny. Stock Trading is advancing. However, there still are admonitions to utilize this innovation with exchanging. Man-made intelligence actually depends on quality information being contributed, just as the understanding of that information. The translation of the information and its examinations still simply depends upon the sum contributed and the methodology in question.

Artificial Intelligence is increasing in scope everyday with stock market being the one most influential aspect affecting economies all around the world, it is an attractive arena for financial enthusiasts and coders to come together and form intelligent algorithms which can predict financial markets with most accuracies using traders models and concepts put in using multi layered networks. The purpose of this research paper is to understand and evaluate the prospects of integrating AI in Stock Trading while also understanding the challenges faced by it.

## II. LITERATURE REVIEW

[1]. Predictions in the stock market have fancied humans for decades. It is not just a matter of curiosity but also because of the global economic impact that stock market fluctuations bring. Efforts have been made to know and understand stock market volatility via artificial intelligence especially through deep learning models which helps to predict stock future indexes with greater accuracy. The new method of forecasting stock market futures using artificial

intelligence can help stock traders and investors to a greater extent. Analysing stock markets has always been complicated due to various factors affecting stocks such as environment, economy, politics, industries, pandemics etc but significant developments in artificial intelligence has led to some fruitful results. (L. Chen, 2018)

[2]. Stock market has become a money making medium for millions of people despite the fact that predicting stock prices is ambiguous. Artificial Intelligence has proved to be used wherein it intakes the fluctuating prices and by collecting the previous data and running it on algorithms such as Artificial Neural Network (ANN), Swarm Intelligence etc, make accurate predictions.(Shah, 2019)

[3]. Artificial Intelligence with the help of machine learning algorithms was used in an experiment conducted on the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) in India using historical data collected for 10 years. Fusion prediction models using Artificial Neural Network (ANN), Random Forest (RF) and SVR were used to predict the 10, 15, 30 day future stock prices.(Direct, 2018)

[4]. High volatility, non-linearity, high frequency and chaos in the stock market makes it difficult to predict via simple algorithms. Basic statistical tools along with indicators are combined with predictive models. Artificial Intelligence using multi layered algorithms and hybrid models are used to make predictions for stock market indexes with better accuracy.(Q. Chen, 2020)

[5]. The relationship between the Foreign markets with the domestic markets can also be exploited in order to use machine learning and make predictions about the stock market. Using machine learning it was found that returns higher than the market indices can be made. This was previously tried by many but many have failed in outperforming the market. Thus it is evident that algorithms along with machine learning can play a massive role maximising the ROI.(Shunrong Shen, n.d.)

[6]. Stock Prediction is one of the major goals that artificial intelligence developers are trying to solve. Since investors want to have a fair idea about when to buy and sell a certain share. Therefore a research was conducted by Y.F Wang entitled prediction stock price using grey prediction system that studies about this issue. The purpose of this study is to predict the stock instantly by using a combination of fuzzification techniques and grey theory. Another model prepared by researchers has provided positive returns irrespective of whether the market is bullish or bearish. It especially is

highly efficient when the market is in complete bullish or bearish trend. This new hybrid model has performed better than traditional forecasting methods.(Ching-Hsue Cheng a, 2010)

### III. OBJECTIVES

Artificial Intelligence has been overtaking the existing technology for a few years now. Stock Trading becomes the next milestone for it. The integration of AI in the operations of stocks and its trading analysis is unfolded. The objectives of our study are:

- To understand the implications of AI in the different processes of stock trading
- To understand the limitations or drawbacks of the association of tools of Artificial Intelligence in Stock analysis.
- To analyse the scope of integrating upcoming technologies in the working of stock market and other financial instruments.

### IV. RESEARCH METHODOLOGY

Research Methodology involves specific procedures, methods, and techniques that the research was carried out with and data was collected for analysis and interpretations. This paper has used both qualitative and quantitative data to study the various aspects. Secondary data has been referred to and used as well to help get a better understanding of the reasons and arguments involved. Since a primary data collection would not have made the research feasible secondary data was preferred.

In this study, the researchers have used qualitative data to define the environment and the background of the study. Qualitative data such as research papers, journals, and articles have been referred to set a knowledge base and theoretical background for the topic. The framework adopted to carry out this research work is completely reliable and objective. The structure of the paper is appropriate, simple, well-planned, and meticulously organized.

### V. RELEVANCE

Artificial Intelligence has been exploring different disciplines and researchers and developers have been trying to introduce AI in trading as well. They have made substantial progress yet AI has not been able to dominate the stock market operations yet. With the help of this research study, the researchers aimed at identifying the application of AI in the day to day activities in the stock market and how it is being used by different companies all across to make trading a rather simpler task for the traders and institutions.

The process of integrating AI in stock trading has already begun and with the help of this research the researchers wanted to look at more future prospects but also understand the challenges that developers are going to face all over the stock trading world. Before understanding the applications and making further progress in using AI in stock market trading the challenges and limitations have to be understood as well. As it is better to understand the consequences of certain actions before the execution.

The human aspect can never be excluded from the equations used for stock prediction and analysis of trading patterns but somewhere or the other AI can be involved as well to make the work easier and better focus can be made on the analytical part of the decision making.

## VI. ANALYSIS AND INTERPRETATION

Artificial intelligence has been fast growing with more complex algorithms every now and then making it more accurate day after day. Even with this artificial intelligence in the stock market has been using the same underline concepts as used by traders for long periods of time. Latest technology gives emphasis on multi-layer analysis done via neural networks but the underlying concepts of mean, min, median, mode, normality, skewness, kurtosis, stationarity etc. Along with these, indicators used in technical trading are also imbibed while programming these algorithms. Some of them are:

**1. Simple Moving Average (SMA)**-Even the simplest concepts such as SMA are used in artificial intelligence where in an average a selected range of prices, which are closing prices are taken over a period of time, be it 10 days, a month, or years. It is basically used to determine if an asset portrays a bullish or a bearish trend in a specific time frame.

**2. Highest-High, Lowest-Low-** Even though Highest-High and Lowest-low are merely the graphical analysis of stock prices and don't accurately predict much about the future, still it is used by artificial intelligence to have a base for other complex indicators used for analysing the stock market. It is mostly used by algorithms to provide more accurate entry and exit points to its users.

**3. Bollinger Bands-** These are another type of statistical charts which envelop stock price graphs at standard deviation below and above the moving average price of a chart. It takes into consideration

volatility and price of a financial instrument. Basic concepts state that the band widens when volatility increases and contracts as volatility decreases. There are three bands- Upper band, lower band and middle band (indicating simple moving average). This is used while developing artificial intelligence to generate overbought or oversold signals in a financial market for a particular stock.

**4. Moving Average convergence Divergence (MACD)**- Moving Average Convergence Divergence (MACD) is an indicator that elaborates the relationship between two moving averages of a financial or marketable security's price. It is a trend-following momentum indicator. The MACD is calculated by subtracting the 26-period Exponential Moving Average (EMA) from the 12-period EMA. The MACD indicator shows a correlation value of 0.203426 with the stock prices. This means that this indicator is **not an accurate predictor of future trends and incorporating it into an AI model** may lead to inefficiency and lack of effectiveness.

**5. Relative Strength Index (RSI)**- The relative Strength index is a technical indicator used to show whether the stock or an index is in an overbought or oversold zone. For an overview of this indicator, when this indicator shows a value of 20 or below, it means that the underlying asset is in an oversold zone meaning it is unlikely that the price will go below the current price. Similarly if the RSI value is 80 or above 80, it means that the underlying asset is in an overbought zone and the prices will likely fall once RSI reaches such high levels.

However when the RSI value is between 20 and 80, this indicator is not very useful in making predictions. As a result it has a low correlation score of 0.150152, thus it is not highly advisable to incorporate in an AI model although if added it can be useful when the market enters oversold or overbought zone.

## 6. Triangular Moving Average (TMA)

A Triangular Moving Average is the average of an average, which creates a line on the charts which typically moves in steady and long waves than a Simple Moving Average. The TMA calculation is the SUM of SMA values, divided by the number of periods you want to average. It reacts slightly slow to the price changes in the markets than the other moving averages. TMA has a correlation coefficient of 0.9964 which means it can accurately predict the stock market to a great degree however it may not always provide accurate

information. Thus adding it to an AI stock prediction model would be a wise choice.

Technical Indicators in addition to the machine learning algorithms are not a fool proof tool to predict the stock markets. But the predictions provided by these models become an aid to skilled traders who may get a certain signal in order to complete their analysis by gaining outputs from such AI models. The analysis of various technical indicators shows that the indicators with a high correlation with the stock prices such as TMA and SMA must be a part of the machine learning AI model. On the other hand the indicators such as MACD and RSI are inaccurate predictors.

## VII. APPLICATION of AI in STOCK MARKET

Over the past decade, artificial intelligence has touched almost every discipline and has been successful but developers have also been trying to bring artificial intelligence into stock trading as well. Artificial Intelligence is to stock trading what fire is to cavemen.

AI is definitely a game changer in the stock trading sector, in the current times humans use traditional algorithms to predict the stock market and what other algorithms will result in, it's an infinite circle of complexity.

According to a recent study in the U.K, electronic trades account for almost 45 percent of revenues in cash equities trading. Hedge funds are particularly reluctant towards AI Automation but they still use AI-Powered analytical tools to build portfolios and other investment related decisions.

Currently, Companies, individuals and investors are using AI in some or the other way and some of the ways have been listed as follows:

**Quantitative Trading Strategies:** Quantitative trading refers to the trading strategy that uses large sets of data of total market data to create daily trading patterns and this helps make traders make better and informed decisions without having to enter big huge numbers into a complex formula. AlpacaForecast is a Japanese deep-learning investment tool. It combines AI with data storage and produces very accurate estimates on not only short movements but long-term movements as well.

**Assessing trading patterns and Risk:** A company named Trading Technologies based in Chicago is using AI to identify complex trading patterns across the markets on a massive scale and providing their clients with an assessment of the compliance risk.

**Voice recognition enables ease of research:** With the help of voice recognition and natural language

processing technology, clients are able to use trading platforms better as they can easily access notes, market insights, conversions etc. of their stocks in real time.

**Stock Ranking Rating:** AI trading companies use some stock ranking models and use pattern recognition technology and price forecasting engines to determine top stocks of the day.

**Develop Investment Strategy:** Companies have formulated an investment strategy by developing an intelligent asset allocation system that uses deep learning to predict every asset in a particular portfolio.

**Formulate a cause and effect relationship:** By using various algorithms and combining AI with an Exchange Traded Fund various AI trading platforms extract data from social media, news to build a cause and effect relationship of markets, companies and management. It has helped systematize the trading or investment scheme.

**Using Blockchain for optimal earnings:** Combining AI and the trading community to increase earnings by scanning markets to locate optimal trading opportunities. Deals are done via blockchain-based smart contracts. All actions are logged on blockchain and cannot be changed.

**Encryption and Safety of Crypto Trading:** AI is being extensively used to create safe transactions by using end to end encryptions and advanced authentication and security models. This helps in facilitating safe transactions of Crypto assets.

**Construction of algorithms without using a code:** Algoriz is the invention of Goldman Sachs and Millennium partners hedge fund alumni. It employs various experts in quotative trading, machine learning and also capital markets to create the trading technology. Users can construct trading algorithms sans coding.

## VIII. LIMITATIONS of INTEGRATING AI in STOCK MARKET

Automation, anyway keen, isn't idiot proof. Specialists foresee that disappointment of believed calculations will undoubtedly occur — and this can bring about a 'progression of course disappointments' for money related foundations of each scale. It previously occurred during the trillion-dollar financial exchange crash of 2010, which was a consequence of an algorithmic blunder.

In any event, for little scope exchanges, a moderate web association would already be able to be appalling. Exchanging happens in a relentless domain, and a solid innovation framework is vital for remaining on top of things.

All the evidence available indicates that most machine learning techniques face in cross sectional return predictability also the anomalous pattern of return are concentrated in a very difficult-to-arbitrage stocks specifically during episodes where there is a high limit to arbitrage. Even though machine learning has been offering and continues to offer some unprecedented opportunities to help us in shaping our understanding and belief about formulations relating to asset pricing, it is extremely important to consider the various common economic limitations in evaluating the success of brand new developing methods, and making it necessary to confirm the validity of such machine learning models before they are applied to real settings.

In AI, overfitting implies making a factual model with more information than is fundamental. Exchanging calculations tend to be taken care of with an excess of authentic data. That is not really downright terrible, overfitting can prompt rigidity of exchanging techniques present and future conditions. This is the reason back testing, while helpful, isn't totally dependable. It makes an inclination for positive results and gives the feeling that a specific system will perform precisely as anticipated in a live market.

With such a high selection rate in exchanging, automation is unmistakably setting down deep roots. The objectivity, availability, and speed it offers make it a ground-breaking and important apparatus for merchants. Nonetheless, automated exchanging frameworks ought not be left unmonitored. Cautious investigation and understanding is vital to forestalling a domino impact of algorithmic blunders.

#### IX. LIMITATIONS and SCOPE of STUDY

The application of AI in stock trading is still under the process. There aren't many examples and cases to understand the entire impact of using the given technology. It was difficult for us to analyse the technicalities and methods of using Artificial Intelligence as well as understand the upcoming changes the technology can bring about in the industry.

The technology is definitely touching new heights. Untouched avenues can be recognised and researched more to bring about new changes in the adaptation of the same.

#### X. CONCLUSION

Trading has now become a highly dynamic field where even the smallest opportunities of making profits are identified by algorithms and these opportunities are exploited.

Artificial Intelligence can be used in stock trading in a variety of ways. Encryption for Safety of Crypto Trading, investment strategy development and assessing stock patterns for trading are just some of the applications of Artificial Intelligence in trading models.

A detailed analysis of various technical indicators and their suitability for AI models was also conducted. This showed that the indicators with a high correlation with the stock prices such as TMA and SMA must be a part of the machine learning AI model. On the other hand the indicators such as MACD and RSI are inaccurate predictors.

Certain limitations of using AI trading models have also been discussed. Supervised machine learning is the prominent AI used in financial services. The applications that have been seen don't offer the autonomy to actually choose what to buy or sell, but where to buy and sell. The study pinpoints 2 key problems with this technology: finding sufficient high-quality data to feed and train systems, and the scale of human effort required to run systems.

#### REFERENCES

- [1]. L. Chen, Z. Qiao, M. Wang, C. Wang, R. Du and H. E. Stanley, "Which Artificial Intelligence Algorithm Better Predicts the Chinese Stock Market?," in IEEE Access, vol. 6, pp. 48625-48633, 2018, doi: 10.1109/ACCESS.2018.2859809.
- [2]. H. N. Shah, "Prediction of Stock Market Using Artificial Intelligence," 2019 IEEE 5th International Conference for Convergence in Technology (I2CT), Bombay, India, 2019, pp. 1-6, doi: 10.1109/I2CT45611.2019.9033776.
- [3]. (2020). Science Direct. Retrieved from <https://www.sciencedirect.com/science/article/pii/S0957417414006551#:~:text=Two%20stage%20fusion%20model%20comprising%20three%20machine%20learning%20techniques%20is%20used.&text=Emphasis%20is%20on%20adequacy%20of%20information%20given%20to%20prediction%20>
- [4]. Q. Chen, W. Zhang and Y. Lou, "Forecasting Stock Prices Using a Hybrid Deep Learning Model Integrating Attention Mechanism, Multi-Layer Perceptron, and Bidirectional Long-Short Term Memory Neural Network," in IEEE Access, vol. 8, pp. 117365-117376, 2020, doi: 10.1109/ACCESS.2020.3004284.
- [5]. Zhang, S. (2020). Stock Market Forecasting using Machine Learning Algorithms. Retrieved 21 November 2020, from <http://cs229>.

- stanford.edu/proj2012/ShenJiangZhangStock  
MarketForecastingusingMachineLearningAl  
gorithms.pdf
- [6]. (2020). Retrieved 21 November 2020, from  
<http://www.dl.ediinfo.ir/A%20hybrid%20model%20based%20on%20rough%20sets%20theory%20and%20genetic%20algorithms%20for%20stock%20price%20forecasting.pdf>