

Market Requirements Document on the Use of AI to Facilitate and Manage Stock Price Prediction

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Abstract. This market requirements document explores the potential of artificial intelligence (AI) in stock price prediction, an area integral to the financial market's profit-maximization aspirations. Historically, the prediction of stock prices, with its intricate patterns and influences, has posed significant challenges. Traditional techniques like PCA and LSTM have limitations in adapting to the dynamic nature of stock markets. AI, on the other hand, offers transformative possibilities, with its capabilities to process vast data sets, identify patterns, and continuously learn. Drawing parallels from AI's success in other sectors, like healthcare, the essay suggests that AI can revolutionize stock price prediction by offering higher accuracy and adaptability. It underscores the need to combine various AI methodologies for optimized results while also emphasizing the importance of regulating AI applications. In essence, this paper envisions a future where AI becomes the fulcrum of stock price prediction, potentially overhauling the entire financial sector's operations and delivering unparalleled benefits to all stakeholders.

Keywords: Stock Price Prediction, artificial intelligence, data sets, identify patterns, continuously learn.

1. Introduction

This market requirements document (MRD) provides insight into the possible application of artificial technology in the prediction of stock prices. Firstly, in the global economy, it is increasingly becoming important to engage in financial activity that is profitable, for example, stock market trading. In this market, how successful one is depends on the skills they engage in their work. Particularly, there is stock price prediction which is a critical financial topic and highly challenging [1]. The activity is worth researching and developing as it leads to the possibility of profit-making in the financial sector. As stakeholders continue seeking ways of improving their prediction strategies, avenues for innovation are created. One such avenue is the application of artificial intelligence (AI) in the stock prediction process. This text details the vision of using the technology, target market, personas, competitor analysis, high-level capabilities, and metrics strategy concluding that the strategy is likely to be highly successful if implemented strategically.

2. Vision

As noted earlier, stock price prediction is a critical financial topic. There are aspects of the stock price series that make it a volatile area. Particularly, the stock price has complex, volatile, and dynamic characteristics [1]. Different solutions have been proposed to this issue in the past. An example is the use of technology in the context of self-organizing map (SOM) neural networks and genetic programming (GP) [1]. Hossain *et al.* [2] also talk about a hybrid deep-learning model for the prediction of stock prices. Further, Wen, Lin, and Nie [3] also talk about the problems experienced in the stock market providing that the industry experiences inaccuracies in stock price forecasts. In their paper, Wen *et al.* [3] recommend the application of a prediction model that is based on long short-term memory (LSTM) and principal component analysis (PCA).

Based on these texts, it is clear that there is a crisis in the industry concerning the approach to use. As a solution, the application of AI technology would come in handy to provide a workable solution.

Mainly, the expected success of the technology in carrying out stock price prediction is pegged on the noted adaptability of the technology in other sectors and how it has successfully revolutionized different undertakings. For example, AI is said to have been successfully implemented in the healthcare sector to facilitate precision medicine [4]. The technology was used to revolutionize and improve upon the traditional method of symptom-driven practice [4].

Already, there is application of AI in the financial sector. Particularly, Giudici [5] talks about how there is increasing focus on the application of technology in the financial sector. The newer technologies are changing the financial industry creating opportunities in the sector and leading to more access to financial services. Giudici discusses how AI can be used in the financial sector to automatize solutions. Particularly, the researcher talks about how the technology can be used to facilitate supervisory monitoring (SupTech) and fintech compliance (RegTech). [5]

3. Target Market

The targeted market is the financial market. Particularly, there are issues in the market that warrant the use of AI technology seeking to improve the situation. For insurance, there are noted issues with the implementation and use of financial technology that are raising concerns in the sector.

4. Personas

The main personas that are connected to AI technology in the financial sector include the financial and fintech companies. These are persons who are expected to have a detailed understanding of the business models that are used in the sector and how these are applied in financial technologies. The other concerned personas are the regulators and supervisors. These persons are tasked with the role of undertaking the regulation of the sector and checking on the risks that are experienced in the sector as well. The other stakeholders likely to be interested in the technology are research centers and universities that engage in research into financial technologies and how such technologies are applied in the sector. Such institutions will likely have the know-how of the associated risks of implementing AI technology in the sector.

5. Competitor Analysis

The main competitor to the use of AI technology in stock market prediction is the analogous methods of stock analysis and prediction. One such method is the pattern recognition methodology which focuses upon the patterns in the stock market. As explained by Khoojine, Shadabfar, and Tabriz [6]. The patterns are the recurring sequences experienced in the stock market. These sequences are found in the candlestick charts where there is an indication of the open-high-low-close (OHLC) charts. These patterns were used as buy or sell signals in the traditional market. To facilitate the analysis, charting is carried out which is a method of carrying out technical analysis where the market price and the volume history are compared [6]. The comparison is used to predict possible future price trends depending on the degree to which they match. The method relies on specific familiar chart patterns. Particularly, there the various tops and bottoms, head-and-shoulder, saucers, wedges, flags, and spikes [7][8]. It is possible, as it has been utilized and applied in the past, to use the patterns to predict the evolution of the stock. This method stands to contend with the utilization of AI. The other competing method that is applied in stock price prediction is the hybrid approach. This method makes use of a combination of multiple approaches.

6. High-level Capabilities and Technological Strategy

The high-level capabilities of AI are the reason for the prediction that it can be used successfully to predict stock prices. The conclusion is based on the past effective implementation of the technology in other sectors where prediction was a critical function of the technology. Particularly, as mentioned

earlier, AI has been implemented successfully in the healthcare sector. As detailed by Ahmed *et al.* [4], AI has facilitated high-performance medicine and ended up facilitating the improvement of workflow and reduction of medical errors as well. However, the success has not been without challenges. Nevertheless, it was still successful in aspects such as the application of deep learning to electronic health records (EHR) with a focus on estimating the risk of patient readmission to the hospital. The technology has also been used in the past to assist doctors with decision-making when they have to consider risks and the possible development of other diseases.

In the financial sector, AI technology is a plausible option offering robot advice to the players in the sector. This is despite the possible market risks and compliance risks associated with the use of the technology. There are different ways that the technology can be used in the stock market. As noted by Ferreira, Gandomi, and Cardoso [9]. AI technology can be used to facilitate trading in the stock market. Although the technology has gained much attention in the recent past, it is not a new topic. There is past research on the subject of AI and the finance market going as far back as the 1990s when there was the introduction of computational methods in the finance industry. Overall, stock price prediction can be undertaken using AI and data mining as explained in the next section.

The main advantage of using AI technology in the prediction of stock pricing is its automatic characteristic. As noted by Ferreira *et al.* [9], one of the main advantages of AI is its lack of momentary irrationality as experienced by human beings. This is an experience that has a negative influence on the person making the decisions concerning the stock market. Currently, there is still heavy reliance on hardcoded procedures in the computer performance of hedge fund trades [10]. Generally, AI technology is mainly used to optimize financial portfolios, provide predictions of possible expected future prices, sentiment analysis, and analysis of trends in financial assets [10].

There are also some other ways that computational finance is AI undertaken in the industry. These include the expression of control over the dynamic systems that are applied in the financial market, the analysis of investor behavior, and that of the network [10]. Also, there is the clustering of the financial assets as well. Different metric strategies are applied by AI technology in these contexts with an example being the calibration of the volatility of the options. The calibration is undertaken to the movement in the futures prices recorded in the stock market. These are methods directed by AI involving data mining techniques.

Different methodologies can be applied in the prediction of stock prices. These include genetic algorithms where AI can be used to offer support to vector machines [11]. The advantage of this method is that the support vector machines (SVMs) collect the inputs and transform these into decision classes. Also, they provide a correlation between the prices of different stocks. The methodology takes into consideration the closing, mean, standard deviation, and opening of the period where the correlation is determined.

Then there is the sentiment analysis which is a trading model where sentimental analysis is carried out on aggregated information collected from multiple online sources [12]. Here, aggregating information is collected from multiple sources. Then the information is analyzed to determine the ratio of sentimental signals. The findings from the analysis were then used to make predictions concerning the stock prices as well as the expected market trends. Although it is a successful method, it is important to consider the effects of applying different sentiment analyses.

The other strategy that can be applied when using AI is the artificial neural network method that utilizes the back-propagation algorithm. This particular method is highly suitable for the stock market sector as it is highly effective in fields where accurate mathematical models are not effectively applied [13]. Furthermore, it is effective when analyzing noisy data a form which the stock market takes on. Nevertheless, this is a complicated method especially when it comes to the design process.

AI can also be used to facilitate data mining using linear regression technology. According to Gharehchopogh, Bonab and Khaze [14]. the methodology allows the establishment of a relation between the predicted values and the target values. Data mining is a highly effective technique that facilitates the collection of relevant data and information that can be used to make predictions on stock pricing. Sadly, accuracy is also low in this particular methodology involving very complex

calculations. It is also possible to combine the linear regression and the neural networks in one methodology [15]. In this case, there is case-based reasoning. This method is particularly helpful when it comes to the gathering of financial data. Also, the methodology comes in handy in facilitating the mapping of the relations between financial news and financial products [15]. All these methodologies could be analyzed and different methods combined using AI to design better technological tools to predict stock pricing. Another vital aspect of AI would be the regulation of the same technology. It suffices to note that AI technology would need overseeing to prevent illegalities.

7. Conclusion

In conclusion, it has been established in this text that AI is a viable technological innovation for the financial markets that can be used to design a strategic stock price prediction technology. In the past, there have been other methods such as the PCA and LSTM that are proving redundant. Seeing that the targeted market is still actively engaging in trading, with the improving change in innovation, it is also recommended that AI be used to predict the prices.

The financial market, characterized by its dynamic nature and the constant quest for profit maximization, requires tools that can adapt, learn, and predict with a high degree of accuracy. Traditional methods, while foundational, often fall short of capturing the multifaceted influences on stock prices. AI's ability to process vast amounts of data, recognize patterns and adapt to new information positions it as a game-changer in this domain.

In summary, the future of stock price prediction, as envisioned in this document, is one where AI plays a central role. Its integration promises not only enhanced accuracy but also the potential for reshaping the financial sector's modus operandi. Stakeholders, from traders to investors and financial institutions, stand to benefit immensely from this AI-driven paradigm shift. As we move forward, the fusion of finance and technology, epitomized by AI's role in stock price prediction, is set to redefine the boundaries of what's possible in the world of finance.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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