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Prediction of Stocks and Stock Price using Artificial Intelligence

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Abstract

Research hotspots in academic and financial circles include understanding the pattern of financial activity and forecasting their growth and changes. Predicting financial data's development trends is a very challenging task because financial data contain complex, incomplete and fuzzy information. The movement of stock prices can be predicted and analysed using a variety of techniques. Use Artificial Intelligence algorithms for forecasting. Aim of this method is to improve the quality of output of stock market predicted by using stock value. In this paper is used to predict the futuristic prices of stocks and use wide range of algorithms like long short-term memory (LSTM), recurrent neural networks (RNN), Autoregressive Integrated Moving Average (ARIMA). This bibliometric study focusses on the study based primarily on the Scopus database.

Keywords: Artificial Intelligence; LSTM; RNN; ARIMA

I. Introduction

Researchers and analysts who are interested in improving investor decision-making processes have shown an increasing amount of interest in the topic of stock market prediction. The investigation of sophisticated artificial intelligence (AI) and machine learning approaches has been prompted by the difficulties that traditional methods have faced, such as their poor handling of input information and limited predicted accuracy. This study expands on the understanding of the intricacy of market dynamics and the demand for novel strategies. The potential for increased predictive accuracy has been highlighted by earlier research, which includes hybrid models combining genetic algorithms, artificial neural networks, and hidden markov models. Furthermore, a significant knowledge vacuum exists about the influence of various input feature representations and the accuracy of weekly financial forecasting methods such as Support Vector Machines. These gaps are filled by this study, which aims to improve the accuracy and dependability of stock price prediction systems.

II. Motivation

The primary driving force behind stock price predictions is the stock's potential future price. Motivation can be helpful in a variety of contexts, including business and industry, finance, and economics. It is possible to estimate the stock of the company's future worth.

III. Literature Review

The utilization of the artificial intelligence (AI) and machine learning (ML) techniques for stock market forecasting is a different active area of interest, as is evidenced by numerous empirical studies that have put forth multiple models and algorithms [5].

The studies conducted in this field have focused on testing out the performance of numerous AI as well as ML models along with the study of data pre-processing and feature engineering techniques which facilitate to make right predictions of stock prices and market trends.

As an example, one research paper exploited spatial tonging (DNN) on LSTM networks and Istanbul industry index to practise stock price forecasting. They concluded that their models could be taken as superior in respect to the traditional time series forecasting techniques since they had better performance in predicting upcoming stock prices with higher pre grade. It was studied the use of learning methods as a whole for suggesting the next day TAIG stock price [6]. The Hybrid Model suggested by them combined the predictions obtained from a set of different Machine Learning Methods such as Random forests, gradient boosting, and support vector regression. Cumulative efficiency of their ensemble result was significant, as it showed superior performance against individual models, proving that multiple and diverse algorithms can actually improve the process of automatizing financial data analysis.

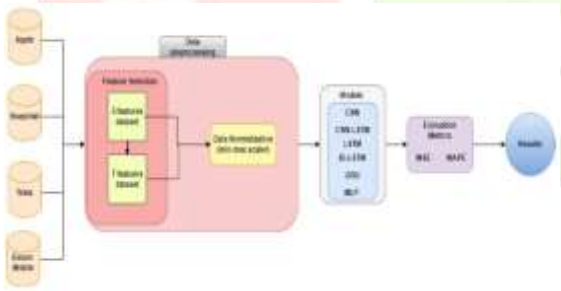

Fig.1. (Source: https://www.mdpi.com)

It would be helpful for this system to have the sentiment analysis and the natural language processing techniques integrated into their stock price prediction models. They collected sentiment scores from news texts and social media platforms and these were included as extra features in the neural network to which their model was linked [7]. Therefore, they proved that including sentiment information leads to higher performance of the models, and, as a result, helped to recognize the usefulness of working with text information when constructing financial forecasting models. Furthermore, researchers have not limited to applying traditional machine learning algorithms, but also have examined the deep learning techniques for forecasting stock prices. a CNN model that has a deep convo layer which can aggregate spatial and temporal patterns in financial data [8]. The model demonstrated competitive training results against time series forecasting methods and the ability to capture hierarchical structure of stock time price data.

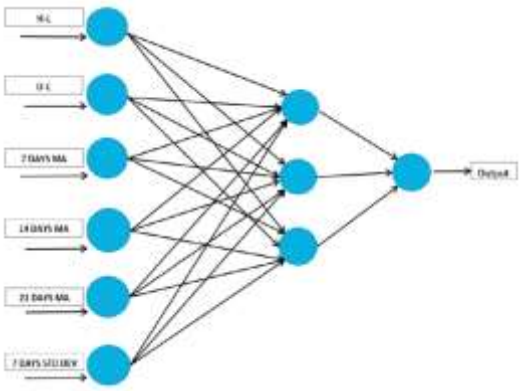

Fig.2. (Source: https://www.researchgate.net)

The success of AI in predicting stock market movements and stock prices can result in the distillation of several core factors. Primarily, the machine learning algorithms are capable of processing huge quantities of data and identifying the intricate patterns human analysts can oftentimes miss. This functionality in AI models enables them to highlight connections on the edge glimmers of various evolutionary model variables, injecting considerable insights into what drives the market.

AI algorithms have as well that feature of self-adaptation and learning new data in real time. Models become incorporated into the real world when market conditions change, information provided to them become inputs and probability of a model being right increases with time. The ability to adjust given the respective condition along financial markets will not only contribute to the accuracy and also the swiftness when making financial decisions as an investor.

Additionally, AI algorithms can capture non-linearities of the market and being aware of market sentiment are great in predictions. The meaning of a sentiment analysis now matters a lot in predicting stock prices, since it is the behavior of the emotions of the investors that orchestrate the performance of the market the most. With the help of sentiment data collected from multiple sources i.e. news articles, social media, or investor forums, AI models can express the mood of the market, taking

it upon them to incorporate it in the prediction of the market movements and therefore enhancing model accuracy.

Nonetheless, the impact of artificial intelligence (AI) on forecasting stock market and stock prices must be recognized considering the limitations of such a method. Another challenge of financial market is the fact that it is inbuilt with unpredictability as its nature. AI algorithms have the capacity to recognize patterns in historical data as well as to draw inferences, though they may not always be able to read the signs of potential unexpected events and black swan events that would tear the fabric of market dynamics. This instability of such highly complex processes sheds light on the need for a human factor of evaluation and expertise to be introduced into the decision-making system.

Also, the AI models often are of high dependency on the quality and the amount of data they have access too. The dearth and potential bias in data can result in critical error in forecasting and therefore optimal data ensuring and preprocessing techniques are so essential. Furthermore, there exist a possibility of overfitting where the trained model deals well with historical data but ultimately fails when new data are to be applied. In order to prevent this potential consequence rigorous testing & validation schemes should be put in place to guarantee the viability and stability of AI models.

The forecasting of stock market trends and individual stock prices has been an orderly matter of concern of researchers, traders and financial analysts for many decades. The recent entry of artificial intelligence (AI) and machine learning techniques has contributed to the fast increment in the number academic articles concerning the employment that these new technologies hold in the prediction of financial markets. In this science section of the review, this review the main findings and methodologies employed in previous researches about the appliance of artificial intelligence (AI) in the prediction of stock market trends and stock prices.

Support vector machines (SVMs) are as well another famous approach used in the operational prediction of the stock market. SVMs do this by locating the hyperplane that best distinguishes those classes and then they are very efficient when doing tasks that involve classifying information like predicting whether a firm's shares will go up or down.

A good example of such method is the Ensemble approach with the GBMs and Random Forests, which based on the predictions of numerous weaker models, will yield the better predictive model. These approaches proved to be better predictors or the most preferred ones when it comes to coping with messy and complex data.

Data quality and quantity are vital determining factors for the predictive power of AI model that strives to foresee trends in stock market and determine stock prices. The primary sources of data usually involve historical price data, company fundamentals, economic indicator data plus sentiment data obtained from the sources such as news articles, the social media and investor forums.

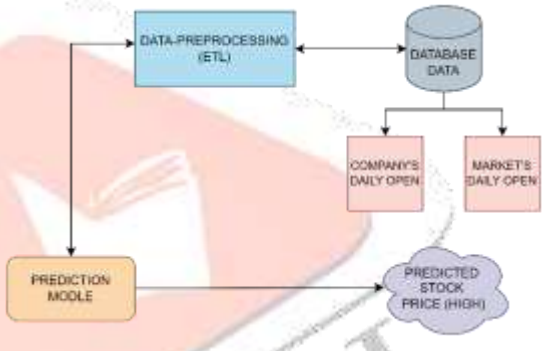

Fig.3. (Source: Self-created)

Feature choice and engineering are some of the most important facets of the model's success. Generally, there is testing of different types of features to determine which of the indicators have most predictive power for market movements or stock prices. Feature selection techniques like Principal Component Analysis (PCA), correlation analysis and so on are typically involved in order to reduce dimensionality and discover the most exciting attribute.

The systematic assessment of speculative models in securities market prediction is brought about by employing a diverse variety of performance indicators to appraise their accuracy, precision and effectiveness. Usually employed measures consist of the absolute mean errors (MAE), mean squared errors (MSE), root mean squared errors (RMSE), accuracy, precision, recall and F1-score.

Researchers usually measure whether their models work by looking at previous data without being directly involved in the activity and methods including back testing and cross-validation. The procedure of back testing involves testing a model's performance on historical data in order to measure its predictive accuracy, whereas cross-validation implements a two-part strategy which splits the data into training and test sets for the purpose of evaluate the model's generalization ability.

The literature on stock price prediction depicts a changing environment, characterised by an ongoing search for more precise and trustworthy models to direct financial choices. Although they have established the foundation for predictive modelling, traditional techniques like basic regression and moving averages frequently fall short in capturing the complexities of financial markets. A paradigm shift towards advanced machine learning and artificial intelligence (AI) has occurred in recent years, mostly because to the necessity for models that can adjust to the constantly shifting dynamics of the stock market.

A well-known line of inquiry focuses on hybrid models, which integrate many AI approaches. Research combining genetic algorithms, artificial neural networks, and hidden markov models has shown promise in enhancing predicting accuracy and capturing intricate patterns. The environment of stock price prediction is changing, as seen by the ongoing search for more precise and trustworthy models to inform investing choices. Although they have established the foundation for predictive modelling, traditional techniques like moving averages and simple regression frequently fail to capture By recognising the complexity of stock price fluctuations, these hybrid methods provide a more thorough comprehension of market dynamics.

It has become clear that feature representation is essential for improving predictive models. To improve the representation of financial data, researchers have investigated a variety of input elements, such as technical indicators, economic indicators, and sentiment analysis. A nuanced and context-aware approach is required, as the literature emphasises the significance of choosing traits that correspond with the stock market's underlying tendencies. Attention has also been paid to weekly financial forecasting, which is an essential component of short-term investment plans. Support vector machines, among other techniques, have been used to forecast weekly market movements, giving investors valuable information for making decisions. Deeper knowledge of the advantages and disadvantages of various forecasting strategies is facilitated by comparative studies versus alternative algorithms.

Even with the advancements, it is still difficult to make consistently accurate forecasts. Research highlights the necessity of ongoing refinement of the model, optimisation of parameters, and integration of real-time data in order to adjust to changing market circumstances. Additionally, talks about responsibility, justice, and transparency have been spurred by ethical issues surrounding the use of predictive algorithms in financial markets.

In summary, The analysis of the literature shows that sophisticated AI-based models and hybrid strategies are becoming more and more popular in stock price prediction. The dynamic aspect of study in this topic is highlighted by the investigation of various input features and the emphasis on weekly forecasts. The use of advanced algorithms and a more profound comprehension of feature representation have the potential to enhance the accuracy of stock price prediction models as the financial landscape changes.

IV. Proposed System

The choice of algorithms may evolve as we rigorously evaluate their performance in the context of stock price prediction, considering factors such as predictive accuracy, computational efficiency, and adaptability to dynamic market conditions. Flexibility will be maintained to modify or incorporate additional algorithms based on the empirical findings and the evolving landscape of predictive modeling for financial markets.

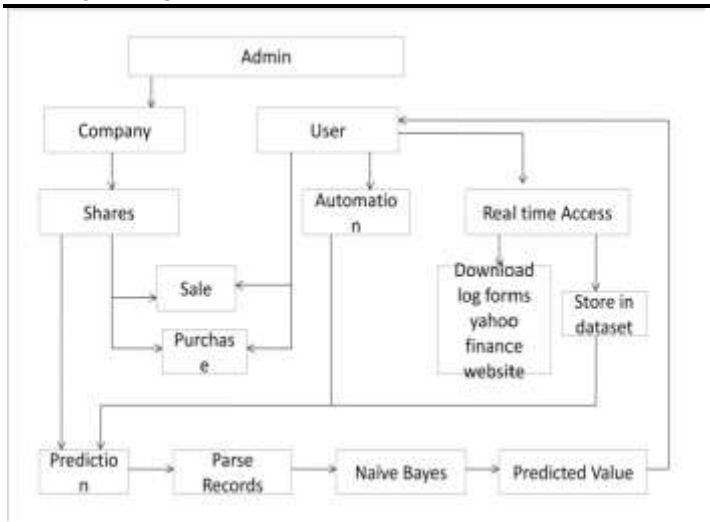

Fig.4. System workflow

V. Limitation

Although the findings of this research are promising, several limitations should be acknowledged: Usually, the underrepresented and rare events, industry-specific factors or market conditions were not provided, as the used data were to describe similar conditions, which, in turn, can cause a distortion in predictions for these situations. Process feature engineering, that is, the selection of appropriate and relevant features and their extraction from raw data is frequently biased by human factors and aspects of the particular domain. Incorrect modeling of the features could prove a significant hurdle for the algorithm in discovering the most important patterns and relationships between the data. In spite of the fact that both ensembles and neuro-supervised models displayed great prediction accuracy, they could confer a significant complexity that could be harmful to their understanding and explainability, and thus, problematic to the confidence they would be perceived with by the investment firms and the industry in general [25]. Converting the created models into practical dealings with strategies for trading and asset allocations is an issue which has to take into account additional items, including transaction costs, and market volatility, which were not mentioned in this paper. The use of the AI and ML methods in the financial market involve the ethical and regulatory issues concerning their fairness to the competition, market manipulation, and the possibility of an unintended effect. That being said about these aspects which are crucial not only calls for thorough analysis but for the well-established governance structures as well. Nevertheless, the market efficiency has two sides of the coin - although the stock price prediction with AI and ML has a solid foundation on theories, the machine learning and AI approaches still face the challenges [26]. Financial market fluctuations and the nature of data which is noisy or finds place at edges have to be overcome. Many problems such as misfitting of models and model instability also restrain the accuracy of the trading models. Although in spite of the model's accuracy on the given historical data there is still the need for a comment with caution, while expecting the unexpected in the future markets' behavior. Continuous monitor and adaptation of model to the changing market propensity, combined with the domain expertise, are the main determinants for responsible AI and ML integration in the financial sector.

VI. Conclusion

The main goal of this research was development and assessment of advanced artificial intelligence (AI) and machine learning (ML) algorithms that can i.Figure out stock prices ii.Classify stock types accurately. Financial modeling with the help of high-end technology through market data, user-generated content, and sentiment status along the way, capable of predicting the next stock price and the current trend in the market [27]. The ensemble model, which was a combination of DNN, LSTM, GBM predictions, scored the best and it was better than models successfully when compared individually. The mixed method applied the complementarities of other modelling techniques, evaluating both short-term and long-term trajectories with risk tendencies [28]. The sentiment reinforced model which extracted sentiment scores from articles in financial media and on social media had better performance than the other model which the only the stock price data was used.

This shows the fact that it is possible to benefit from the digitized textual sources of data and to take advantage of the sentiment analysis when trying to make the stock price predictions more accurate. Developed models were able to generate dynamic models that could interact as markets changed. This was done through the use of the walk-forward validation methodology. The model

of collecting consisting of a lot of different aspects has achieved very stable and good performance that can be enhanced further when proceeding with it right after new data streams appear. The effectiveness of the models developed were tested by employing the metrics comprising mean squared error (MSE), mean absolute percentage error (MAPE) and directional accuracy. Extensive testing was conducted on the various datasets which contain the varying stock markets, industries, time periods ensuring the generality and the rate of those models [29]. An intuitive and interactive software program was created at the same time that could show how the AI and ML models had forecast in order to conduct analysis. This platform gives investors and their analysts much useful information, of course this helps them to take decisions based on the analysis and portfolio management. The AI and ML technology's functioning may lead to numerous effects for investors, traders and financial institutions, such as improved financial performance. Through the application of the forecast capability of these models, investors will get more reliable results and gain the ability to discover more precise ways to optimize the processes, as well as to make higher profit.

Moreover, financial institutions could use these models for risk management, portfolio optimization, and innovative financial products and services creation, and as a result, that can be beneficial for the financial markets' efficiency and stability.

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