



Impact of Machine Learning on Stock Market

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ABSTRACT

This study seeks to understand the problem with stock market forecasting. Two primary models for stock market forecasting may be constructed based on the technical and fundamental analysis. The technical analysis method uses regression machine learning (ML) algorithms to forecast the stock price trend at the end of a business day based on prior price data. AI has a big role to play. To assess the accuracy of AI's stock market predictions, various research publications have created ML techniques. The ML algorithms used for this purpose mostly seek to identify patterns in the data, estimate investment risk, or forecast the future of investments. On the other hand, in the basic analysis, the public attitude based on news and social media is classified using machine learning algorithms. Based on this study, it seems that ML is not close to the prediction of the stock market with reliable accuracy.

Keywords: Stock market prediction, Technical analysis, Machine Learning (ML), Artificial Intelligence (AI), Classification model, Financial indicators, Fundamental analysis, Support vector machine (SVM)

I. Introduction

Financial exchanges are generally an attractive investment method for developing capital. In recent decades, the stock markets have become increasingly popular with individual investors as a result of advancements in communication technology. Even though there are more shareholders and businesses participating in stock markets every year, many people still look for ways to forecast the direction of the market. This is a difficult problem with numerous complex factors influencing price hikes. In order to measure AI's ability to predict stock market outcomes, numerous research papers use ML techniques. The majority of the ML algorithms used for this purpose attempt to identify data patterns, measure investment risk, or forecast investment outcomes. The goal of this research is to examine the use of AI, and more specifically machine learning (ML), for stock market prediction. In this study, the effectiveness of ML algorithms in forecasting market movements is evaluated using both technical and fundamental stock market analysis.

Expert analysts and investors are paying close attention to developments in stock market forecasting. Due to the chaotic environment in the market, it is quite challenging to analyse price actions and stock market movements. The complexity of stock prices affects a variety of variables, including quarterly earnings reports and market headlines. Hence, we use technical analysis to study the stock prices. Technical analysis is the study of stock prices with the intention of generating income or improving investing choices [1]. Technical analysis uses technical indicators to examine financial time series data and anticipate stock prices by predicting the direction of future price movements of equities based on their past data. Meanwhile, it is presumptive that the price has velocity and travels in a trend [2]. Technical analysis, which is mostly utilized by short-term investors, makes use of price charts, certain formulas, and patterns to forecast future stock values. When the time points are daily, weekly, monthly, or yearly, the price would be considered high, low, open, or closing price of the stock. Dow theory outlines the fundamental ideas for technical analysis. The three major aspects of technical analysis put forward by the Dow theory are that prices move in trends, the market price discounts everything, and historical trends typically repeat themselves [3]. A number of technical indicators are available, including the Moving Average (MA), Moving Average Convergence/Divergence (MACD) etc. According to, one of technical analysis's, [3] obvious weaknesses is that it relies on expert judgement to establish rules that are hard-and-fast and hard to modify. Different factors that influence stock prices are overlooked.

2. Literature Survey

2.1 Sachin Jadhav, Vrushal Chaudhari, Pratik Barhate, Kunal Deshmukh, Tarun Agrawal, "Review paper on: algorithmic trading using artificial intelligence", International Research Journal of Engineering and Technology (IRJET), Volume: 08 Issue: 04 | Apr 2021

In today's world, the country's economic growth is largely influenced by its stock markets. Additionally, numerous studies have demonstrated that the conventional method of trading must contend with numerous challenges due to these markets' high liquidity. As a result, the purpose of this paper is to provide a framework that can be used to apply a variety of trading strategies to predict the stock market. In this context, artificial intelligence is frequently used to reduce risk and attempt to maximize net return profit through a variety of trading algorithms. This paper explains how to collect the dataset,

analyze the data and stocks, and briefly describes these techniques along with some test cases. The result, which demonstrates the most effective approach for AT utilizing machine learning algorithms to maximize return, is significant [1].

2.2 Sohrab Mokhtari, Kang K Yen, Jin Liu, “Effectiveness of Artificial Intelligence in Stock Market Prediction Based on Machine Learning”, *International Journal of Computer Applications*, 2021

Utilizing AI strategies, the aim of this paper is to address the issue of stock market prediction. Technical and fundamental analysis are the two primary types of analyses that can be used to model stock market forecasts. Regression machine learning (ML) algorithms are used in the technical analysis approach to use historical price data to predict the stock price trend at the end of a business day. In contrast, classification ML algorithms are used in the fundamental analysis to classify public sentiment based on news and social media. The results show a median performance, indicating that it is premature to assert that AI can outperform stock markets with the current technology. Fundamental analysis evaluates a sector's or company's true value and establishes the price at which a share of that company should trade. It is assumed that, given enough time, the business will adjust its costs to match the forecast. Market value of a company that is undervalued should increase, and vice versa if a company is overpriced, the market price should decrease. [2]

2.3 Deepak Kumar , Pradeepta Kumar Sarangi , Rajit Verma , “Systematic review of stock market prediction using machine learning and statistical techniques”, *ELSEVIER*, November 2020

The stock market prediction patterns are regarded as significant and more effective activities. As a result, decisions will result in lucrative profits from stock prices. In light of the stale and boisterous information, financial exchange related figures are really difficult for financial backers. As a result, investors face a significant obstacle when trying to maximize their profits by forecasting the stock market. Predictions of the stock market are made with learning tools and mathematical strategies. Calculation methods, machine learning algorithms, performance parameters, and outstanding journals are all discussed in detail in 30 research papers in this article. The research questions are used to select the studies. As a result, these selected studies contribute to the identification of ML techniques and their datasets for stock market prediction. The most common methods for making accurate stock market predictions are ANN and NN. Even though a lot of work has been done, the most recent prediction method for the stock market has many limitations. In this study, it can be assumed that stock market forecasting is an integrated process and that distinct parameters for stock market forecasting should be considered more accurate. 2020 Elsevier Ltd. Reserved all rights. The scientific committee of the National Conference on Functional Materials is in charge of selection and peer review: Materials Science's Emerging Technologies and Applications. [3]

3. Methodology

By investing some money in the stock market, the investor in the stock market expresses interest in making money. The stock market has attracted investor attention as a result of cutting-edge applications where anticipating the future of the market might be profitable. Accurate stock market movement forecasting [4] requires on prior knowledge. The stock market forecasting tools can monitor and manage the market, allowing users to take appropriate decisions.

Four primary processes are involved in the prediction of the stock market using ML tools: [2]

- Dataset creation
- Data engineering
- Model training
- Prediction

3.1 Dataset Creation:

Having access to a dataset is necessary for developing an ML model in the first place. Some features in this dataset are used to train the ML model. The target values set of labelled data can be used with or without the training procedure. The training process is referred to as supervised learning if it is based on a set of labelled data, as opposed to unsupervised learning, which does not require any target values and seeks to uncover any hidden patterns in the training dataset. Most datasets in the stock market prediction challenge are labelled. For instance, the dataset includes variables such as RSI and MACD, two financial indicators, and uses the stock's closing price as the technical analysis approach's target value. It is clear that the time-series data used for the technical analysis is continuous data. On the other hand, in the fundamental analysis strategy, the features are certain assertions like financial reports or investor attitudes, and the target value is the signal of decision-making in purchasing or selling the stock. The data used in this form of analysis often consists of alphabetic inputs like reports and sentiments. Hopefully, the majority of the crucial information needed to solve this issue is accessible online, such as historical stock prices or audience views of the event.

3.2 Data Engineering

Before using the data from the given datasets to train a model, pre-processing is necessary. The most important indicators used in either technical analysis or fundamental analysis during the model training process are discussed in the next section.

3.2.1 Technical Analysis:

In order to construct the input features of an ML training model, appropriate financial indicators like the simple moving average (SMA), exponential moving average (EMA), RSI and MACD are calculated using the historical stock prices. The following provides an explanation of these indicators:

EMA

One of the fundamental indicators in technical analysis, moving averages come in a variety of forms. The simplest moving average to create is the SMA. Simple terms, it represents the average price throughout the given time frame.



Fig. 1 Various Indicators

The EMA is a moving average that gives the most recent data points more weight and significance. This technical indicator, like all moving averages, generates buy and sell signals based on crosses and divergences from the historical average. Moving averages of varying lengths, such as 10-day, 50-day, and 200-day averages, are frequently used by traders.

RSI

A momentum indicator known as the relative strength index (RSI) examines the speed and variety of price movement. The RSI has a value between 0 and 100. Its goal is to monitor shifts in price momentum. A security is regarded as overbought when its RSI is above 70 and oversold when it is below 30 (Fig 1). The relative strength index in the stock market alerts investors to buy or sell. It is used in technical analysis to spot market crossovers, failure swings, divergences, double tops, and bottoms. A momentum oscillator that gauges the rate and volatility of share prices is the RSI. When the index drops below 30 and reaches the oversold area, a buy signal is generated. Sell signals are sent when the RSI reaches the overbought region (>70). (or hold if you are keeping it as a long-term investment). Utilizing the formula $RSI = 100 - (100 / [1 + 14\text{-Day Average Gain} / 14\text{-Day Average Loss}])$, the RSI is determined.

MACD

The relationship between two exponential moving averages (EMAs) of the price of a securities is displayed by the trend-following momentum indicator known as moving average convergence/divergence (MACD, or MAC-D). The 26-period EMA is subtracted from the 12-period EMA to calculate the MACD line.

3.2.2 Fundamental Analysis:

A more precise stock market prediction is now possible thanks to the development of AI, which makes it possible to use data from the Internet for this purpose. This information may relate to a company's financial report or to investor mood. Financial reports from businesses literally have an immediate impact on public opinion and manifest themselves on social media, particularly Twitter. So, examining publicly available tweets is one method of assessing how fundamental data affects market patterns. Stock market sentiment analysis is the name of this tactic. The input data for training a model in sentiment analysis is essential.

3.3 Machine Learning Model Training

In research studies, numerous ML algorithms have been used to predict stock markets. There are basically two main types of models that can be used to solve this problem: Regression models that attempt to predict stock price movements, such as the closing price of a stock, and classification models that attempt to assist investors in the decision-making process of buying, selling, or holding stock. Classification models account for more than 90% of the

algorithms used in research studies to predict the stock market. However, very few studies have attempted to use regression models to accurately predict stock prices. (Fig. 2)

The decision tree (DT), support vector machine (SVM), and artificial neural network (ANN) are the most frequently used ML algorithms for stock market prediction

SVM

A supervised machine learning method that improves geometric margins and reduces error is the SVM. [7] provided a pattern categorization and regression algorithm. In comparison to other classifiers, the SVM is a significant linear separation technique in terms of accuracy [6].

With the help of emotions and historical data for the banking, mining, and oil industries, the authors in [5] created a daily and monthly SMP model. Yahoo Finance provided the historical prices, and a year's worth of news and tweets were used to construct a sentiment dataset. The sparse dataset taken into consideration for the sentiment analysis was subjected to PCA with several variables. In this study, the accuracy was utilised as a performance parameter to assess three algorithms: Decision-Boosted Tree, SVM, and Logistic Regression.

The SVM and Logistic Regression were defeated by the Decision-Boosted Tree. For the bank, mining, and oil sectors, the Decision Boosted Tree obtained accuracy levels of 54.8%, 76%, and 76.9%, respectively. SVM accuracy was 65.4%, 61%, and 44.2% for the log regression, and accuracy was 61%, 44.2%, and the SVM achieved accuracy rates for the corresponding sectors of 51%, 59%, and 44.2%. The study's last recommendation was to take into account how intraday price fluctuations will affect the stock price the next day in order to increase accuracy.

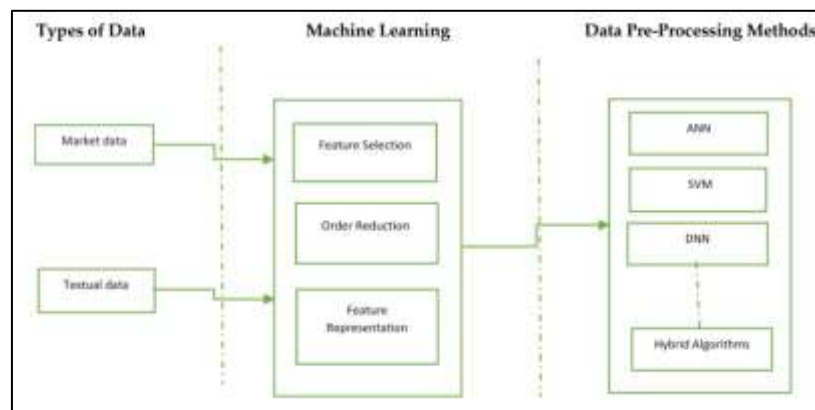


Fig 2. Framework of Model Training

4. Conclusion

The goal of this project is to use ML algorithms to solve the stock market forecast problem. Technical and fundamental stock market analyses are taken into consideration in order to achieve this. Based on both of these categories, the effectiveness of ML systems for forecasting the stock market is examined. To do this, supervised learning algorithms are trained on labelled datasets, and evaluation metrics are used to assess how well the algorithms perform predictions. These findings suggest that while AI can forecast stock price patterns or public opinion regarding the financial markets, its accuracy is not sufficient. In addition, while the linear regression can reasonably estimate the closing price with a range of error, it cannot predict the same value with accuracy. As a result, long-term investments cannot be made using this model.

According to this study, it appears that AI is not yet capable of accurately forecasting the stock market. A more accurate stock market prediction model may become available in the future with the advancement of AI and particularly with increased computing power. However, there is currently no respectable model that can outperform the stock market.

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