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Survey on Stock Market Prediction Using Reinforcement Learning

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ABSTRACT

The stock market is a fascinating field to research. It comes in a variety of shapes and sizes. Many specialists have studied and researched the many patterns that the stock market experiences. The attempt to anticipate the stock values of various companies based on past data was one of the important research. Stock price predictions can tremendously assist people in determining where and how to invest in order to reduce the danger of losing money. Stock price forecasting is a difficult task due to its complexity and chaos, as well as the presence of a dynamic environment. According to behavioral finance, investors' decision-making processes are heavily influenced by their emotions and attitudes in response to certain news. Many models have been presented to encompass all of the primary elements influencing stock prices. The goal of this paper is to show how different machine learning algorithms, such as support vector machines, deep learning, random forests, boosted decision trees, ensemble methods, and a few hybrid methods, have been used to build prediction models and predict stock prices for various stock exchanges. This study focuses on illustrating the Reinforcement Learning approach and constructing an accurate forecast as a result.

*Keywords-*Stock market prediction, Machine learning, Reinforcement learning approach

I.   INTRODUCTION

Stock exchanges are financial institutions that facilitate the trade of various types of goods among stock broker participants. The method of determining the future value of a stock or other financial instrument traded on an exchange is known as stock market prediction. People frequently have the misunderstanding that buying and selling stocks/shares in the market is a form of gambling. This misperception can be changed by raising public awareness about it. Machine Learning can be a game changer when it comes to predicting stock prices. Machine learning techniques have the ability to uncover previously unseen patterns and insights, which can then be used to create impeccably correct predictions. Machine learning is expanding at a breakneck speed.

Stock markets have been granted the most important place in the financial schemes of the global corporate sector as a result of economic liberalization. Many factors have been discovered that influence stock prices, the most significant of which is historical data. However, it was discovered that relying simply on past data does not provide good projections. As a result, other elements were found as having a substantial impact on stock values, including people's attitudes and news events. As a result, in addition to historical data, financial news and user reviews become important sources of information that aid in the development of effective prediction models that can better predict stock market values than their predecessors.

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Due to the rising complexity of stock market trading, individual traders, portfolio managers, and financial institutions are increasingly focusing on automating trading processes. Furthermore, the growing availability of digitized stock market records (such as prices and trade volumes) has spurred and focused more research efforts toward automated trading. Despite the fact that projecting future prices is the most important challenge in stock markets, other issues are also important since they integrate future prices with the actions that must be made as a result.Optimizing share execution costs (also known as optimizing trading expenses) is an issue of significant importance and applicability in which a trader wishes to purchase a predetermined number of shares over a particular time horizon at the lowest possible cost . Several dynamic programming methods with escalating factors under consideration were presented for the OEC problem. Risks of various kinds were incorporated. Other methodologies, such as differential equations, have been used to investigate the OEC problem.

The dynamic programming approach has its own drawbacks, since it demands complete knowledge of the issue model (prices and actions), which rarely holds true in real-world settings, and it suffers from the dimensionality curse as the problem grows in size. However, when there is no equation-based model for market dynamics and we rely on historical

data, it is still the most effective way to model the OEC problem. As an alternative, reinforcement learning (RL) has been employed in computational finance. RL was used to train market problem-solving agents.

II. LITERATURE SURVEY

This survey required extensive research and analysis in topics such as Stock Markets, Criteria Affecting Stock Prices, and others. Various studies have proven that stock prices may be predicted based on a variety of factors. The paper explained several models and how they might be used to predict prices. This research showed us how selecting appropriate elements affecting stock price as variables can lead to some predictions

A. News Analysis

Many research groups are investigating how to predict stock market trends using social media analytics these days. The polarity of every excellent news/tweet has been discovered in order to determine its mood. The dictionary-based technique and the semi-supervised algorithm can both be used to determine the polarity of any news/tweet. The polarity of each word in the news is calculated using a dictionary-based algorithm by comparing it to words in a specified lexicon. Based on their prevalence in a manually generated lexicon, the supervised algorithm categorizes them as positive or negative.

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III. METHODOLOGY

A. User Interface

UI stands for **user interface**, which includes the screens, its pages, buttons, and all other visual elements that are used to help a user interact with a device.UI designers focus on user experience by designing easy-to-navigate software for all types of digital products like websites, applications, and other interactive devices.
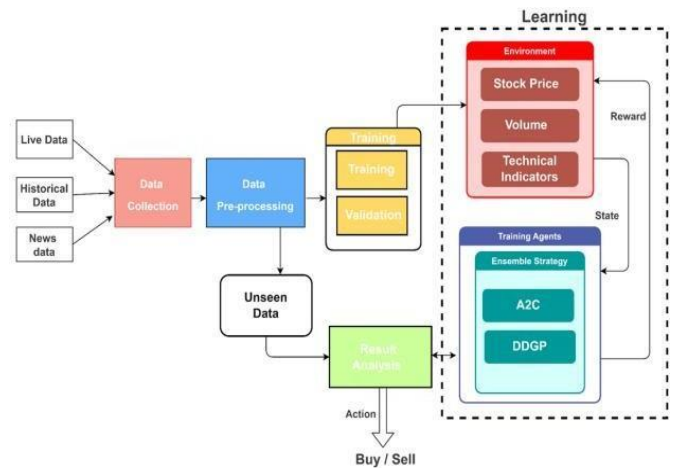

Fig 1.System design

B. Data Collection

1)Live Data:

Nse tools is a library for collecting real time data from National Stock Exchange (India). It can be used in various types of projects which requires fetching live quotes for a given stock or index or building large data sets for further data analytics.

And another alternative method for live data collection is by webscrapping. The data for stock market prediction is gathered via a web scraping approach. For this reason, the site is yahoo finance, and the python package 'beautiful soup' is used. It is an effective web scraping tool. It's useful if you only need a small amount of information. The data is then utilized to create a graph that shows the closing rate of data vs. the day.

2) Historical Data:

Historical data can be collected with the help of TradingView Chart data/Yahoo Finance.This provides Historical Data with 1 min, 5 min,30 min,1 hr,4 hr.. Interval Historical data for Training Purposes.

3) News Data:

MoneyControl API is used to fetch real time news for sentimental analysis data.

C. Data Preprocessing

Data is present in a raw format and is not feasible for analysis. Data contains highest value, lowest value, opening value, closing value and volume of traded stocks for a given particular date. Using the closing value of a stock we calculate two more parameters 'Momentum' and 'Volatility' for each company For each company in the dataset, the corresponding stock momentum, sector momentum and index momentum are considered.

D . Training

Data is divided into two :
Training and validation, for tuning of parameters. Finally, we test our agent's performance on trading data.

E. Learning

1)***Markov Decision Process***:
The mathematical approach for mapping a solution in reinforcement Learning is known as a Markov Decision Process.
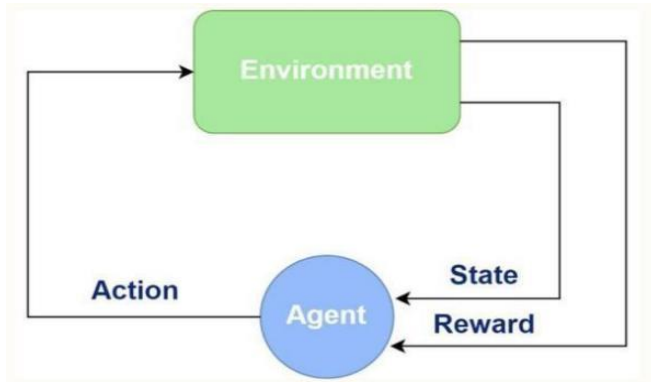

Fig 2. Markov Decision Process

Components of Markov Decision Process are Agent, Environment, States and Reward

2)***Deep Q-learning:***
In deep Q-learning, we use a neural network to approximate the Q-value function. The state is given as the input and the Q-value of allowed actions is the predicted output.

2)***Various Algorithms for training agent***
A2C Algorithm: This is a typical actor-critic algorithm which we use as a component in the ensemble method. Combines two types of Reinforcement Learning algorithms (Policy Based and Value Based together

DDPG : This an actor-critic based algorithm which we use as a component in the ensemble strategy to maximize the investment return. DDPG combines the frameworks of both Q-learning and policy gradient, and uses neural networks as function approximators.

F. Decision Making

Decision making is done by comparing the unseen data. Accurate results are given for action which is the prediction. Variations are taken back for learning. Thus we continue training our agent while in the trading stage, since this will help the agent to better adapt to the market dynamics

V. CONCLUSION

Predicting the stock market prices and trends is not an easy task, as it involves incorporating many distinct factors that affect the stock market immensely. No stock market prediction model till now has predicted the accurate prices/trend. While going through the literature, it was found that there are many challenges/hindrances that the researchers had to face, which prohibited them from developing a perfect model.

In today's environment, stock market forecasting is a highly sought after skill. Many academics have developed a variety of models in order to obtain high accuracy in stock price forecasting. Because the stock market is influenced by a variety of elements, most studies concentrate on a single feature to produce a prediction, but just a few attempt to include many factors. Our suggested system employs deep reinforcement learning and the ensemble approach to forecast stock price increases and decreases based on factors such as historical data, real-time data, and sentiment analysis of linked news. When compared to other machine learning techniques, reinforcement learning produces more efficient, accurate, and better results. The margin of error was tiny in these, making it very ideal for predicting the real stock price.

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