

ALGORITHMIC TRADING SYSTEMS USING REINFORCEMENT LEARNING

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Abstract - Algorithmic trading is the release of orders using automated and pre-programmed trading instruction to account for variables such as price, timing, and volume. The stock market is very volatile as well as dynamic and assessment of the stock price can become a concern. Proper assessment and prediction can result in high returns of profit. The system can be created which will help in the prediction of stock prices based on deep learning. Another Automation subsystem can be created using Reinforcement Learning which will facilitate buying and selling of stocks. The proposed system uses a Machine Learning algorithm, GRU and LSTM to predict the patterns of stock prices using the stock data and scraped headlines from the news data. The proposed system is a fully automated device that is capable of operating without any human intervention.

Key Words: Deep Learning, Reinforcement Learning, GRU, LSTM

1. INTRODUCTION

Trading with traditional methods is not enough fast for the modern financial system. A great increase in data amount and computation powers of computers force trading methods to keep up with contemporary circumstances. Therefore, algorithmic trading becomes a new and necessary, even mandatory, field in the intersection point of the computer and finance world. Algorithmic trading, also called algo trading, is the use of electronic platforms for entering trading orders with an algorithm that executes pre-programmed trading instructions whose parameters may include timing, price, or quantity of the order. May include, or in many cases automate computer programs by initiating orders.

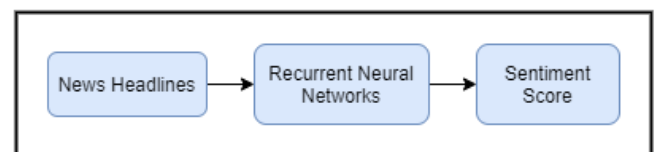
For this system, training is required i.e., Stock Data, News Headlines from inshorts. The news headline scrapped are used to calculate the sentiment score per minute of that particular stock. Stock prices can be predicted by training the data and taking inputs from the stock data and sentiment score per minute.

If there is any possibility of sudden changes in the stock data, then the system will indicate the user to either sell the stock or buy the stock. Also, the output will be displayed to the

user in statistical manner and also it would display whether to buy or sell that particular stock.

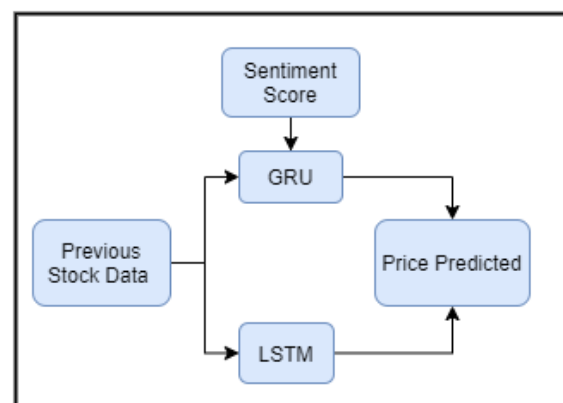
1.1 Sentiment Score Analysis:

Financial news could impose on further volatility on the stock market. Advanced prediction of the sentiment score can determine future conditions of the stock market. By scrapping the news headlines from inshorts, the GRU help segregate the data into positive, negative or neutral sentiment score.



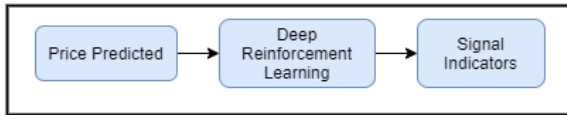
1.2 Price Prediction:

Stock Price Prediction can be implemented using Sentiment score per minute and LSTM model. By using closing price, opening price, low price, and the high price of a particular stock, future prices can be predicted on daily basis. The average of the price predicted by GRU and LSTM will facilitate determine the final predicted price which will be displayed in the statistical form.



1.3 Buying/Selling Decisions:

The system will indicate the user to buy or sell stocks. The goal is to maximize returns while avoiding risks. Based on predicted future prices deep Reinforcement learning will indicate the action to be taken by the user.



2. Literature Survey

Using Neural Network to forecast stock Market prices. The paper proposes a survey that is based on the implementation of neural networks in predicting stock market values. The proposed system can locate complex specimens and forecast market momentum and sudden upheavals more accurately. Common market analysis techniques such as technical analysis, time series forecasting, and market hypothesis fundamental analysis are compared with the performance of neural networks [1]. LSTM Neural Network with Emotional Analysis for Prediction of Stock Prices predicts stock prices using previous stock market data. It explores a more promising method using LSTM where the neural networks outperform the other models [2].

In Sentiment Analysis for Effective Stock Market Prediction, the idea is to successful stock market prediction is not only achieving the best results but also to minimize the inaccurate forecast of stock prices. It claims that news feeds have an impact on stock market values. Using algorithms, the paper has established a correlation between stock market values and sentiments in news feeds collected [3]. Sentiment Analysis using Recurrent Neural Networks uses a model to analyze Sentiments. The model was tested through experiments. They used two classifications (positive and negative). In Sentiment Analysis Using Recurrent Neural Networks news headlines are scrapped from inshorts and are further processed using NLP. Recurrent Neural networks are used to convert these headlines into positive, negative, or neutral sentiment scores [4].

In Deep Robust Reinforcement Learning for Practical, Algorithmic Trading Deep Q Learning is used to adapt to a real trading environment. Deep reinforcement learning (DRL) is used to solve complex real-time problems with a more human-like point of view. The way to use Deep Reinforcement Learning in indicating trading signals is to procure maximum rewards from the learning agent, which is to study the patterns for a long time [5]. An Application of Deep Reinforcement Learning to Algorithmic Trading, the paper puts forward Deep Reinforcement Learning agent in trading decisions and predicting the future prices of the stock market on daily basis. The paper also proves the

reliability and advantages of Deep Reinforcement Learning by comparing it with other traditional models [6].

Table -1: Comparison Table

Paper Title	Year	Seed Idea
Using Neural Networks to Forecast Stock Market Prices	1997	- Effectiveness of Neural Networks in prediction stock market Prices
LSTM Neural Network with Emotional Analysis for Prediction of Stock Prices	2017	Using LSTM on the behavior data along with the actual stock market data
Sentiment Analysis for Effective Stock Prediction	2017	-Importance of sentimental analysis in stock market prediction
Sentiment Analysis Using Gated Recurrent Neural Networks	2020	-To convert long textual data into negative, positive sentiment score.
An Application of Deep Reinforcement Learning to Algorithmic Trading	2020	-Importance of Deep Q in adapting to real-world problems in stock market.
Deep Robust Reinforcement Learning for Practical Algorithmic Trading	2019	-Gain profits in dynamic financial markets -To design trading agents more practical to real trading environment

3. CONCLUSIONS

Using the Machine Learning technique and sentiment analysis for prediction purposes is inexpensive compared to other models. LSTM and GRU provide to be the most efficient and feasible model in predicting the stock price value. The collection of news headlines and classification of the news as positive, negative, and neutral gives a good overview of the public mood. The proposed system will produce efficient and accurate results that help the stock investor in making informed decisions.

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