Predict the Buying or Selling of Stock using Deep Reinforcement Learning

Project for CMPE 297 sec 47 Reinforcement Learning

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1 GOAL AND PURPOSE

Develop an application that can predict the buying and selling of stock for an organization. This document outlines the proposal with a high-level view of the project for Reinforcement Learning (RL) and will be developed using state-of-the-art algorithms and techniques used in RL. The agent will be given the history of the stock price over the past decade and an additional neural network may be provided to further enhance the predictions.

2 OBJECTIVES

Following are the key objectives that is expected from the project:

   a. An agent trained on RL techniques (DQN or Actor-Critic or something similar)
   b. The agent needs to be able to generate high reward output
   c. The agent needs to be incorporated as an application for prediction
   d. An application which can predict the stock performance of an organization
   e. Application to suggest options about whether to buy or sell a stock

3 BACKGROUND AND MOTIVATIONS

   i. What is the setting and history behind this project?
      a. The future prediction of stock price for gaining more benefits was a challenge in the stock market from the beginning of the financial market establishment. There is a lot of research to find the best way to predict the stock market price trend. One of the ways is using reinforcement learning. In this way, we have some observation of the stock market, and we want to decide when is the best time to buy or sell stocks. If buying stocks happens before the price rises, the profit (reward) will be positive; otherwise, it will be a negative reward. The goal of this reinforcement learning approach is to get as much profit as possible.
   ii. What is the problem to be addressed?
      a. The problem to be addressed is to predict future stock price movements to decide when to buy and when to sell stocks.
   iii. What are some current approaches to this problem?
      a. In general, there are two main methods to analyze and predict the stock market price. These methods are technical examinations and fundamental evaluations. The technical examinations reflect just the historical data of the market to predict the future. However, the fundamental evaluations look at other data such as news, financial reports, economic status, etc.
   iv. Why is this problem worth solving or worth solving better?
      a. The prediction of the stock price offers good chances to gain more profit and this is the main reason to research in this field. Knowledge of stock changes even by a millisecond.
   v. How will this product be better than previous approaches?
      a. The main problem of supervised learning algorithms (like SVM) is that they are not dealing with time-delayed rewards. Supervised learning algorithms concentrate only on the accuracy of the prediction at the current position without reflecting the delayed penalties or rewards. Most supervised machine learning algorithms can only provide recommendations on actions but using reinforcement learning gives us a decision to buy, hold, or sell the stock.
   vi. Where is there more information on this problem?

a. The following links provide more information related to this problem:
   - Stocks Trading Using RL https://learning.oreilly.com/library/view/deep-reinforcement-learning/9781838826994/Text/Chapter_10.xhtml#_idParaDest-155
   - Quang-Vinh Dang. Reinforcement Learning in Stock Trading. 2019. hal-02306522f https://hal.archives-ouvertes.fr/hal-02306522/document

4 SCOPE

Following is the scope of the project:

   a. The project will be limited to the data of one company's stock to be validated.
   b. The Actor Critic Model will be used.
   c. Our model will be trained on publicly available data through API.
   d. Although the application will be tested, it may not have extensive testing. (Preferably unit tests).
   e. The environment used for training the agent will be a preconfigured environment. (Preferably OpenAI Gym).

5 DELIVERABLES

Following are the key deliverables for the project:

   a. A Jupyter notebook with agent trained on RL techniques
   b. Environment details and configurations
   c. Dataset details (If any used)
   d. Performance report
   e. Source code of web application
   f. Project report
   g. Installation instructions
   h. GitHub access
   i. Testing reports

6 RISKS AND REWARDS

6.1 RISKS
   a. Completing the project in the given timeline and understanding RL concepts in parallel will be rewards of doing this project.
   b. The risk is losing profits because of inaccurate prediction. The inaccurate prediction may be a result from a lack of accurate data or detailed information.

6.2 REWARDS
   a. Gaining more profit on stock market trading.

7 REQUIREMENTS AND DEPENDENCIES

Following are the key requirements and dependencies for the project:

a. A HPC machine will be required for training the agent
b. Environment for agent to learn (Preferrable Open AI gym)
c. Environment extension by adding a potential Deep Learning Model

8 PROJECT TIMELINES AND MILESTONES

Milestones	Timeline
Environment Setup	30th October 2020
Agent Training	2nd November
Agent fine tuning for reward maximization	6th November 2020
Application development	27th November 2020
Integrating agent with application	3rd December 2020
Final Presentation	4th December 2020