**REINFORCED TRADING USING AI**

**Team Members:**

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**Report submitted for the**

**First Project Review of**

**Course Code: CSE3013 – Artificial Intelligence**

**Slot: F1 + TF1**

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**1. Abstract:**

This project is made for the J-Component of Artificial Intelligence course, the main objective of doing this project is to implement a program for real-life problems with AI and understand it’s working.

The aim of our project is to train an AI over a standard stock market dataset and allow him to trade in order to get most profit over time. The financial market in real is very uncertain and possess high risk factors, therefore the implementation of this project can’t be used in real-life trading. The main purpose is to get familiar and learn, with the implementation of this project, about the flow work of Artificial Intelligence and usage of different approaches along with the various libraries to obtain desired applications.

We’ll be focusing on the S&P 500 index dataset to train our agent with reinforcement learning through Keras API (which uses TensorFlow in its backend) to predict the Stock Market prices over time and take appropriate trade decisions in order to obtain maximized profit.

More details about the project will be further discussed in the document.

**Keywords:** AI, Reinforcement Learning, DQN, Keras

**2.** **Introduction**:

To have a better grasp on this project, we first should know the basic aspects of it. Starting from the question: What’s trade? Trade involves the transfer of goods or services from one person or entity to another, often in exchange for money. Economists refer to a system or network that allows trade as a market.

A stock market is the aggregation of buyers and sellers (a loose network of economic transactions, not a physical facility or discrete entity) of stocks (also called shares), which represent ownership claims on businesses; these may include securities listed on a public stock exchange, as well as stock that is only traded privately, such as shares of private companies which are sold to investors through equity crowdfunding platforms.

The AI agent will be focusing on the trade of stock markets to gain profit. Reinforcement learning will be used to achieve so. RL is an area of machine learning concerned with how software agents ought to take actions in an environment in order to maximize some notion of cumulative reward. Reinforcement learning is one of three basic machine learning paradigms, alongside supervised learning and unsupervised learning. The agent will use several approaches like DQN and time series forecasting to predict the future prices of the stock and then take appropriate decisions accordingly whether to Hold, Sell, or Buy a stock.

The agent will be trained on S&P 500 index dataset using Python and Keras API through Reinforcement learning. Several related papers on this domain and more details about the proposed method will be discussed further.

**3. Literature Review Summary Table (Kindly do this alone in landscape orientation)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *Authors and Year (Reference)* | *Title (Study)* | *Concept / Theoretical model/ Framework* | *Methodology used/ Implementation* | *Dataset details/ Analysis* | *Relevant Finding* | *Limitations/ Future Research/ Gaps identified* |
| *Aleksandar Rakićević*  *Vlado Simeunović*  *Bratislav Petrović*  *Sanja Milić: 2018* | *An Automated System for Stock Market Trading Based on Logical Clustering* | *Interpolative Boolean Algebra* | *Clustering* | *Belgrade Stock Exchange data* | *Interpolative Boolean algebra, used as a basic logical framework, enables to model complex logical relations and expressions in a consistent manner (preserving traditional laws of thought).* | *Incorporating transaction costs and then testing the proposed method in Daily trading with short selling allowed.* |
| *Shin, Hong-Gi*  *Ra, Ilkyeun*  *Choi, Yong-Hoon: 2019* | *A Deep Multimodal Reinforcement Learning System Combined with CNN and LSTM for Stock Trading* | *CNN-FG structure* | *CNN, LSTM* | *Korea KOSPI* | *Using few indicators like MA, DMI, and SSO showed positive Sharpe ratios for all the test experiments.* | *More indicators can be further used to enhance performance.* |
| *Jae Won Lee: 2002* | *Stock price prediction using reinforcement learning* | *Temporal Difference (TD) algorithm* | *MDP* | *Korean Stock Market* | *The experimental result shows that the*  *proposed method might be utilized as a more useful*  *indicator for stock trading.* | *Reward definition can be improved by applying TD(λ) RL algorithm.* |
| [C. Gold](https://ieeexplore.ieee.org/author/37563658300): 2003 | *FX trading via recurrent reinforcement learning* | *Simple price model* | *RRL* | *Worldwide currencies* | *Performance is substantially decreased*  *and the dependence on the fixed parameters is altered when*  *the the traders cannot automatically transact at any price*  *which appears in the quote series* | *In-depth analysis of properties of different currency markets.* |
| Li, Y. Zheng, W. Zheng, Z.:  *2019* | *Deep Robust Reinforcement Learning for Practical Algorithmic Trading* | *Deep Reinforcement Learning* | *LSTM, SDAEs* | *Thomson Reuters History*  *(TRTH)* | *The proposed framework increases robustness by adopting SDAEs and provide better practical applications.* | *The proposed method can be extended to handle multiple assets simultaneously.* |

**4. Proposed work and implementation**

Methodology adapted: The proposed work will be using an actor-critic model for the implementation of our AI Trading agent. The agent will have 3 possible actions: Hold, Sell, and Buy. In hold action, the agent will do nothing and hold a stock, whereas in Buy and Sell action the agent will Buy more stocks and Sell the stocks respectively. The motive will be to gain as much profit as possible and the same will be used as Reward for RL.

To form the neural network for our model, we’ll be using Keras package for the same as it is quite user friendly and provide better functionality. The actor-critic model will use two interactive network models in which the actor will analyse the environment and take the decision to make an action. Then the set of observations and the action performed on the actor-network will be forwarded to the critic-network, which will evaluate the decisions of the actor and provide with feedback.

The critic computes an approximation, which is used to update actor in the direction of its gradient over time to make better decisions. This is more advanced approach to the tradition DQN method. Over time, the Q-value prediction of critic will improve, further allowing the actor to make better decisions. To support the requirements, we will incorporate the time series forecasting method with our model.

Hardware requirements: CPU: i5 9300H

HDD: 1.5 TB

RAM: 16 GB

GPU: GTX 1050

**5. Dataset used / Tools used:**

1. TOOLS: Python, TensorFlow, Keras Library
2. DATASET: S&P 500 Index

**6. Expected Results**

An AI based trading bot that is capable of making adequate decisions on financial stock markets, by using the methods of RL to obtain the patterns and predictions, in order to maximize the profit of the investor. This implementation can be then used in real-life applications to provide a better insight to the user for investment in financial markets.

**7. References**

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