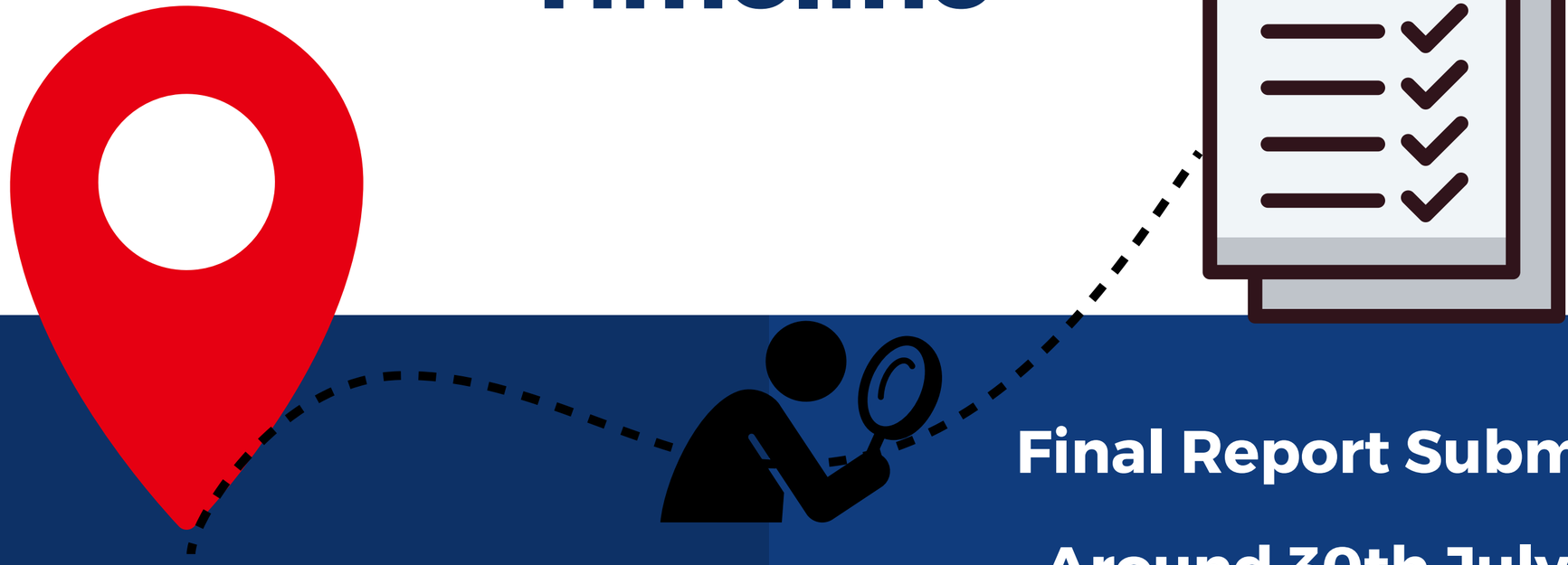
FINANCE CLUB

USE DEEP REINFORCEMENT LEARNING (RL) TO OPTIMISE STOCK TRADING STRATEGY AND THUS MAXIMISE INVESTMENT RETURN

Timeline



Check Point 1

25th June 2024

Final Report Submission

Around 30th July 2024

RoadMap

01

Introduction to RL and DL

02

Intro to some useful algorithms

03

Application

04

Data Collection and preprocessing

05

Training, Testing, Fine Tuning, Comparision

06

Testing our model on the week 6 data.

INTRO TO RL AND DL

CHECKPOINT 1:

Reinforcement Learning:
Reinforcement learning is a type of machine learning where an agent learns to make decisions by performing actions in an environment to maximize cumulative rewards. It involves trial-and-error interactions and learning from the outcomes of actions to improve future performance.

Here is some reading material:
https://www.analyticsvidhya.com/blog/2021/02/introduction-to-reinforcement-learning-for-beginners/

Deep Learning:
Deep learning is a subset of machine learning that uses neural networks with many layers (deep neural networks) to model complex patterns in large datasets. It is particularly effective in tasks such as image and speech recognition, natural language processing, and autonomous driving.

Here is some reading material:
https://www.geeksforgeeks.org/introduction-deep-learning/

INTRO TO SOME USEFUL ALGORITHMS

CHECKPOINT 2:

There are various RL and DL algorithms such as:
Q-Learning, Deep Q-Network (DQN), Policy Gradient Methods, Proximal Policy Optimization (PPO), Advantage Actor-Critic (A2C), Deep Deterministic Policy Gradient (DDPG), Twin Delayed Deep Deterministic Policy Gradient (TD3), Soft Actor-Critic (SAC).

Here is an introduction to 2 of the algorithms that might be useful:

Deep Q-Network(DQN)

YouTube Video:
https://www.youtube.com/watch?v=x83WmvbRa2I

Reading Material:
https://medium.com/@shruti.dhumne/deep-q-network-dqn-90e1a8799871

Deep Deterministic Policy Gradient (DDPG):

YouTube Video:
https://www.youtube.com/watch?v=oydExwuuUCw

Reading Material:
https://towardsdatascience.com/deep-deterministic-policy-gradient-ddpg-theory-and-implementation-747a3010e82f

APPLICATION IN A PROBLEM PREPARING YOU FOR THE TASKS COMING UP!

CHECKPOINT 3:

We are trying to solve the classic **Inverted Pendulum** control problem. In this setting, we can take only two actions: swing left or swing right.

The classic inverted pendulum problem aims to stabilize an upright pendulum (inverted position) by controlling its base in such a way that it remains balanced. Specifically, the question being addressed is how to control the movement of the base of the pendulum (often a cart) so that the pendulum stays upright against the force of gravity and any disturbances.

This example uses Deep Deterministic Policy Gradient (DDPG).

https://keras.io/examples/rl/ddpg_pendulum/

The code given involves a lot of python and ML concepts, ChatGPT is your best friend if you need to understand what is going on in the code.

DATA COLLECTION AND PREPROCESSING

CHECKPOINT 4:

Collect the stock data of NIFTY50 stocks from Jan-2010 to Jun-2019

Read up on how to fetch stock data using Yahoo finance or Alpha Vantage

Define the state representation to capture market conditions
A state representation is a set of variables or features that describe the current state of the environment comprehensively enough for the agent to make decisions.

Design the action space for buying, selling and holding stocks
The action space is a set of possible actions that the RL agent can select from at each step of interaction with the environment.

Create a reward function based on desired stock return optimization
A reward function R(s, a, s′) maps the current state s, action a, and resulting next state s′ to a real number representing the immediate reward received by the agent.

TRAINING THE MODEL, TESTING AND FINE TUNING, COMPARING PERFORMANCES

CHECKPOINT 5:

Train the RL agent using historical data and an RL algorithm

Evaluate the agent's performance using a separate testing dataset

Fine-tune the model and parameters to improve performance

Exercise caution when applying RL agents to real-time trading scenarios.

Create RL and the benchmark models (ARIMA or LSTM based) and compare the performance

Your comparison must include both returns and risk. It may be helpful to think about different ways to segment the data into train and test. (the following paper may help in creating the RL environment and variable selection:

https://dl.acm.org/doi/abs/10.1145/3383455.3422540

https://neptune.ai/blog/arima-vs-prophet-vs-lstm

TEST THE PERFORMANCE OF YOUR MODELS ON THE WEEK 6 DATA

CHECKPOINT 6:

Code (use any programming language) and create a write-up that includes the relevant literature (at least 8-10 references), methodology used, data description and findings.

THANK YOU