FINSEARCH

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

Timeline

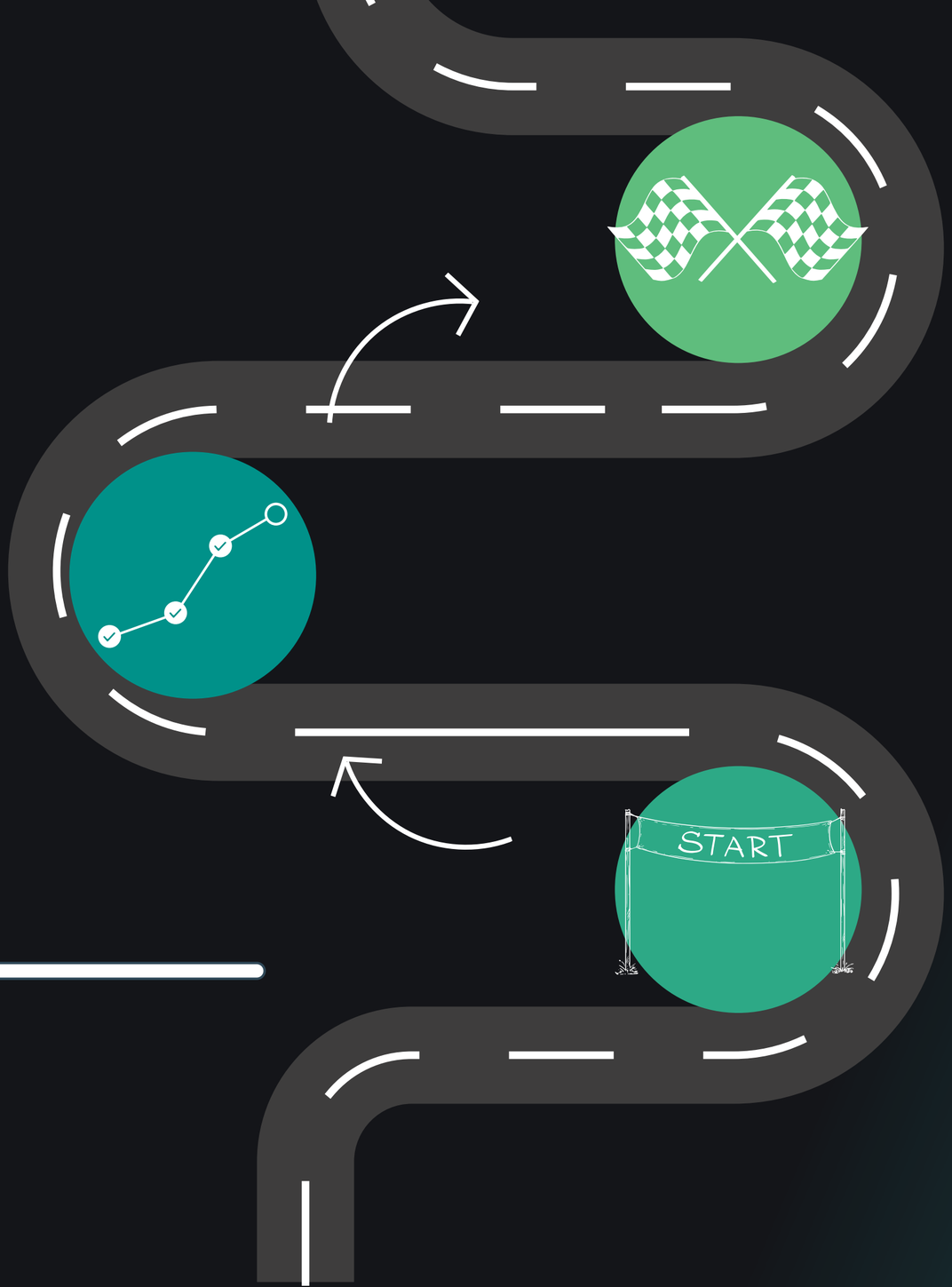
End-term Report Submission

1st week of Aug

Mid-term Report Submission

11 July

Start



Roadmap

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Checkpoint 1

Introduction to RL and DL

Checkpoint 2

Intro to some useful algorithms

Checkpoint 3

Application

Checkpoint 4

Data Collection and preprocessing

Checkpoint 5

Training, Testing, Fine Tuning, Comparision

Checkpoint 6

Testing our model on the week 6 data.

INTRO TO RL AND DL

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.
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.

Check Point 1

Reinforcement Learning: youtube video

Deep Learning:reading material:

Reinforcement Learning: Sutton & Barto book

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INTRO TO SOME USEFUL ALGORITHMS

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).

Check Point 2

Deep Q-Network(DQN)

YouTube Video:

Deep Deterministic Policy Gradient (DDPG):

YouTube Video:

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APPLICATION IN A PROBLEM

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.

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.

Check Point 3

Deep Deterministic Policy Gradient (DDPG). example

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DATA COLLECTION AND PREPROCESSING

Check Point 4

- **Collect the stock data of NIFTY50 stocks from Jan-2010 toJun-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.

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TRAINING THE MODEL, TESTING AND TUNING, COMPARING

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:

Check Point 5

Research paper for RL enviroment

Research paper for Variable Selection

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TEST PERFORMANCE OF YOUR MODELS

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.

Check Point 6

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THANK YOU