

## 1 Introduction

The lab is part of the course *Artificial Intelligence*(AI), DT8012 at Halmstad University. The report is split into two parts; the first part of the lab covers the implementation of four different AIs for operating the robot using VREP[1] software. The second part of the lab contains three other AIs implemented to play 3 card poker. Both are written using **Python 3.10.5 64-bit**.

## 2 Task-1

In this task, we get the implementation of the Pioneer P3-DX robot in a virtual robot simulator(V-REP). We right four different agents and simulated the behaviour. The robot is supposed to navigate through the environment using two different sensors:

1. **Ultrasonic Sensors:** There are 16 sensors evenly spread throughout the robot
2. **Energy Sensors:** It can sense the direction and calculates the distance from the nearest energy block

The actuators available for the task are the following:

1. **Left Motor:** Controls the speed of the left tyre.
2. **Right Motor :** Controls the speed of the right tyre.
3. **Energy Block Collector:** Picks up the nearest energy block available

### 2.1 Random Agent

The random agent implementation ignores the sensors' input and only operates the actuators. Both motors are assigned random speeds between -3 and 3; the speed values are updated every 2.4 seconds of simulation time.

### 2.2 Fixed Agent

Like the previous agent, the fixed agent ignores all the sensor inputs and only operates the actuators. It follows a predefined path which we determine by observing the robot environment. In a best-case scenario, the robot will collect four energy blocks if the blocks are spawned in the exact location at the time of programming.

## **2.3 Reflex Agent**

Unlike the first two agents, the reflex agent uses the sensor input to change the actions by adapting to the environment and operates the actuator to avoid being stuck. There are two ways to implement the code:

1. We use the energy sensors to align the heading direction of the robot towards the nearest energy block and pick up the block.
2. We use the inputs from ultrasonic sensors and navigate the environment while picking up any block that comes in our way.

## **2.4 Memory Agent**

The memory agent uses the data from the additional four side sensors to drive parallel to the wall. If the memory block is behind a wall, it follows the wall until it reaches the detect block or detects a new block. The agent is built upon the reflex agent; this agent also saves the distance to the closest block. This agent takes action from the sensor's input and refers to the past perception of the closest energy block.

## **3 Task-2**

In this task, we play 3 card poker where the dealer deals three cards, three rounds of bidding are conducted, and finally, each player's cards are revealed before a winner is decided based on the hand. The player, in this case, are three different AI agents:

1. Random Agent
2. Fixed Agent
3. Reflex Agent

### **3.1 Game Environment**

The game environment for poker contains the following classes:

1. Deck: The class is used to create a 52-card deck, shuffle the deck and deal three cards.
2. Hand : The class is used to analyse the hand dealt to the poker players.
3. Game : This provides a poker game environment where the game is played. It also stores the winnings of each round of a player.

### 3.2 Fixed vs Random Agent

The comparison between fixed and random agent are drawn, and the data from the game is used to measure the agents' performance.

$$\text{Performance} = \frac{\text{MoneyWon}}{\text{GamesWon}} \quad (1)$$

The winnings of the agents depend on the random factor of dealing cards. The agent should also maximise the amount of money won each game to ensure it is not losing money.

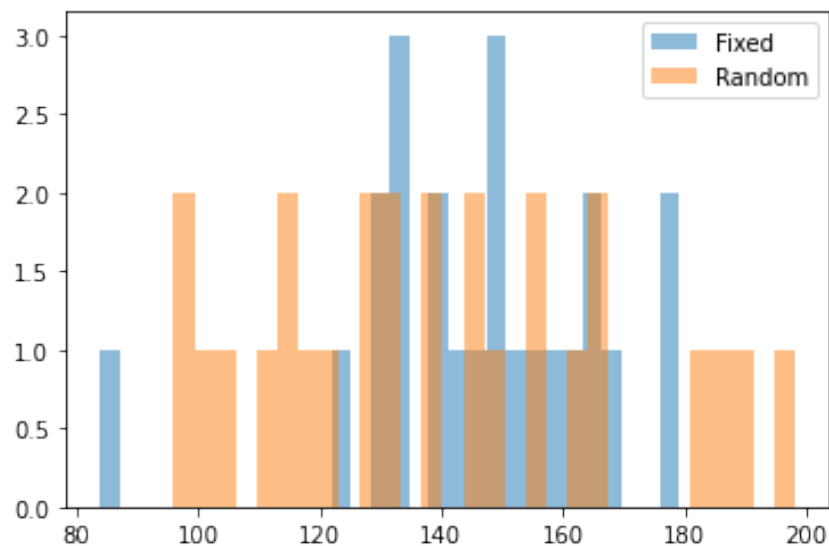


Figure 1: Winnings for Fixed vs Random Agent

For this test, the agents faced off for 50 rounds then the performance of the agents was measured and stored in a JSON file. The data is then used to plot the winnings for each agent where both agents perform pretty closely overall, but the fixed agent was more consistent in winning money above 120.

### 3.3 Reflex vs Random Agent

The reflex agent calculates its bid using the following formula.

$$betAmount = (cardsWithSameRank - 1) * 19 + (HighestValueCard - 2) \quad (2)$$

The reflex agent cannot bet more than 12 coins on a high card, it will increase by 19 for pair and 38 for three of a kind.

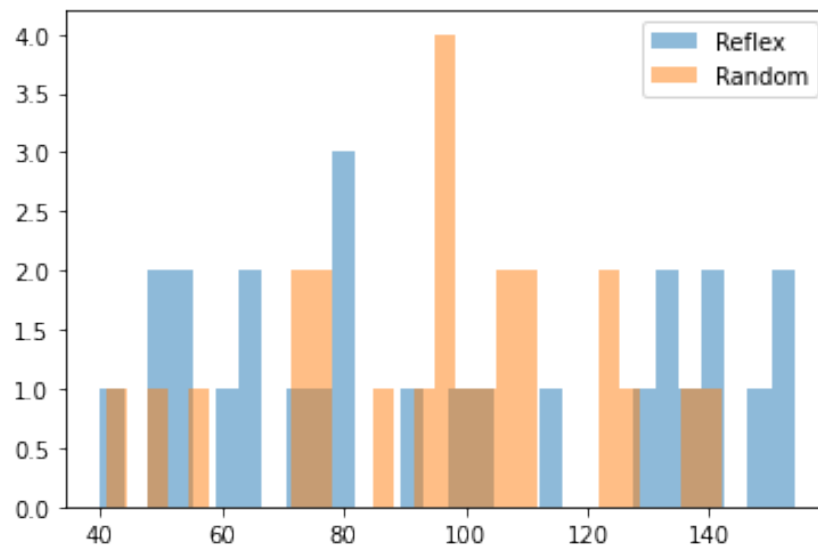


Figure 2: Winnings for Reflex vs Random Agent

The reflex agent wins more money per game. Hence it performed better than random agent.

## References

- [1] *Coppelia Robotics*. <https://www.coppeliarobotics.com/previousVersions>. [Online; accessed 18-June-2022].