Project Two Intelligent Pirate

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As we discover the differences between humans and machines it's important to understand the different learning methods and how we intuitively think compared to code put in a machine. Humans often rely on cognitive processes and reasoning, while machines employ algorithms and computational methods to get to their solutions. Humans can employ creative and flexible thinking, drawing on their experiences and intuition to solve problems, which will help us think outside the box on issues that can seem like a dead end (Khurana, 2023). On the other hand, machines follow predefined rules and instructions encoded in algorithms to reach solutions, which essentially leaves the machine inside that said box and therefore stuck on an issue (Khurana, 2023).

When solving a maze, a human would typically rely on their perception of the maze's structure and use spatial reasoning. They would mentally map out possible paths, consider different options, and make decisions based on their understanding of the maze's layout (Khurana, 2023). For example, a human would know what routes look like dead ends before making a move into a certain path. Humans might employ strategies like instead moving the pirate and figuring out how to get to the treasure, they might look at it the other way around and see how the treasure can get to the pirate. These are just some of those out of the box solutions that an AI might not have the ability to do.

In contrast, an intelligent agent designed to solve the pathfinding problem in a maze would use an algorithmic approach. The agent would typically employ techniques such as algorithms like Q-learning, which leverage a reward-based learning framework. The agent would iteratively explore different paths, evaluating the rewards or penalties associated with each action, and adjusting its strategy accordingly (Khurana, 2023). It will not stop till it has reached a dead end or won the game in the case of this maze. So, the AI will go through the maze multiple times until it has found a solution to the maze and then use that in future applications (Khurana, 2023).

The similarities between the human and machine approaches lie in their goal of finding the optimal path to the goal. Both approaches involve exploring the maze and evaluating the outcomes of different choices. However, the differences arise in the methods employed and the underlying decision-making processes. Humans rely on cognitive abilities and adaptability, while intelligent agents utilize algorithms and computational methods.

Exploitation and exploration are two fundamental concepts in reinforcement learning. Exploitation refers to utilizing the knowledge gained so far to make decisions that maximize immediate rewards (Rocca, 2021). Exploration, on the other hand, involves taking actions that may have uncertain outcomes but have the potential to discover new, possibly better paths essentially getting a higher future reward (Rocca, 2021).

The ideal proportion of exploitation and exploration for this pathfinding problem depends on the specific scenario and environment (Rocca, 2021). Initially, the agent may need to explore various paths to gather information about the maze and estimate the rewards associated with different actions. As the agent learns and accumulates knowledge, it can gradually shift towards exploitation to exploit the paths with higher expected rewards. Striking the right balance between exploration and exploitation is crucial for achieving optimal performance in pathfinding. As such it is important to distinguish between when to find the best times to switch between being a spectator to an actor, usually around the time when the AI has sufficient information to win a game without too much difficulty. It does not have to be the best, but it as goes on then hopefully the exploration is able to find a better path.

Reinforcement learning can help the agent determine the path to the goal by utilizing a reward-based learning framework (Bajaj, 2023). The agent interacts with the environment, taking actions and receiving rewards or penalties based on its decisions (Bajaj, 2023). In the context of pathfinding, algorithms like Q-learning offer effective solutions by leveraging intelligent search and reinforcement learning techniques. In the event the pirate can find the treasure then it is likely that it will re-run the event again to find the optimal path in the future. As it plays more and more it will learn the patterns of the maps giving it the ability to weigh each tile more accurately to allow itself to solve it quicker and find out what is the best way to treasure.

To implement deep Q-learning using neural networks for this maze game, the neural network architecture must approximate the Q-values associated with different state-action pairs. The neural network takes the maze state as input and outputs the Q-values for each available action (Kerner, 2023). The Q-values guide the agent's decision-making process by giving each path a weight. By training the network using a combination of exploration and exploitation, the agent learns to approximate the optimal Q-values and make informed decisions to navigate the maze effectively (Kerner, 2023). In conclusion, the deep Q-learning algorithm is a useful learning algorithm as it helps to analyze the best path to win the pirate treasure game.

References

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