**Project Two**

**Brandon Goller**

**Southern New Hampshire University**

**Computer Science**

**CS-370: Current/Emerging Trends in CS**

**Obafemi Balogun**

**February 19, 2024**

**Pirate Design Defense**

**Differences between human and machine approaches to solving problems:**

Humans generally rely on intuition, experience, and reasoning to solve problems. They often use trial and error, learning from mistakes, and gradually building up a mental model of the problem (Bishop, 2006). Machines, on the other hand, use algorithms and computational power to solve problems. They follow predefined instructions and rules to process information and make decisions (Nilsson, 1998).

**Steps a human being would take to solve this maze:**

A human would likely start by exploring the maze, trying different paths to see which one leads to the treasure. They would use their memory to remember which paths they have already tried and which ones are promising. They would also use their spatial reasoning skills to understand the layout of the maze and plan their route accordingly (Kuipers, 1989).

**Steps your intelligent agent is taking to solve this pathfinding problem:**

The intelligent agent uses a combination of exploration and exploitation to find the optimal path. It starts by exploring the maze, trying different actions and learning from the feedback it receives. As it explores, it builds up a model of the maze and uses this model to make decisions about which actions to take. Over time, it becomes more efficient at finding the optimal path (Sutton and Barto, 2018).

**Similarities and differences between these two approaches:**

Both humans and machines use a combination of exploration and exploitation to solve problems. However, humans rely more on intuition and reasoning, while machines rely on algorithms and computational power. Humans also have the ability to learn from their mistakes and adapt their strategies, while machines follow predefined instructions (Nilsson, 1998).

**Purpose of the intelligent agent in pathfinding:**

The purpose of the intelligent agent is to find the optimal path from the starting point to the goal (the treasure) while maximizing the reward (the total score). The agent uses reinforcement learning to learn from its experiences and improve its performance over time (Sutton and Barto, 2018).

**Difference between exploitation and exploration:**

Exploitation refers to using the information the agent already has to make decisions, while exploration refers to trying new actions to gather more information. The ideal proportion of exploitation and exploration depends on the problem and the agent's goals. In this pathfinding problem, a higher proportion of exploration may be beneficial in the early stages of learning, while a higher proportion of exploitation may be more effective once the agent has a good understanding of the maze (Sutton and Barto, 2018).

**How reinforcement learning helps to determine the path to the goal:**

Reinforcement learning uses a trial-and-error approach to learn the optimal path. The agent receives feedback in the form of rewards or penalties based on its actions, and it uses this feedback to update its model and improve its performance. Over time, the agent learns which actions lead to higher rewards and which ones lead to penalties, allowing it to find the optimal path (Sutton and Barto, 2018).

**Evaluation of the use of algorithms to solve complex problems:**

Algorithms are powerful tools for solving complex problems. They allow us to break down a problem into smaller, more manageable parts and solve each part separately. In this case, deep Q-learning with neural networks is an effective approach for solving the maze pathfinding problem. It allows the agent to learn from its experiences and improve its performance over time (Sutton and Barto, 2018).

**Implementation of deep Q-learning using neural networks for this game:**

The implementation of deep Q-learning using neural networks involves several steps. First, the maze environment is represented as a matrix, with each cell representing a state. The agent's goal is to find the optimal path from the starting point to the goal (the treasure) while maximizing the reward (the total score). The agent uses a combination of exploration and exploitation to learn the optimal path. It starts by exploring the maze, trying different actions and learning from the feedback it receives. As it explores, it builds up a model of the maze and uses this model to make decisions about which actions to take. Over time, it becomes more efficient at finding the optimal path (Sutton and Barto, 2018).

**References**

Bishop, C. M. (2006). Pattern recognition and machine learning. Springer. https://www.cs.uoi.gr/~arly/courses/ml/tmp/Bishop\_book.pdf

Kuipers, B. (1989). The cognitive map-opportunistic reasoning. In Proceedings of the National Conference on Artificial Intelligence (Vol. 4, pp. 934-939).

Nilsson, N. J. (1998). Artificial intelligence: A new synthesis. Morgan Kaufmann. https://dl.acm.org/doi/pdf/10.5555/2974990

Sutton, R. S., & Barto, A. G. (2018). Reinforcement learning: An introduction. MIT Press. https://inst.eecs.berkeley.edu/~cs188/sp20/assets/files/SuttonBartoIPRLBook2ndEd.pdf