**SNHU CS-370 Max Gilhespy Project Two**

**Design Defense**

**Differences between Human and Machine Approaches to Problem Solving:**

Human Approach: Humans often rely on intuition, past experiences, and pattern recognition to solve problems. They can interpret complex situations, apply creativity, and adapt their strategies based on context. Human problem-solving involves cognitive processes such as reasoning, deduction, and trial-and-error learning.

Machine Approach: Machines approach problem-solving through algorithmic and computational methods. They process data, analyze patterns, and make decisions based on predefined rules or learned models. Machine problem-solving can be more systematic, efficient, and scalable, but it may lack the intuition and adaptability of human cognition.

**Steps a Human Would Take to Solve the Maze:**

A human would visually inspect the maze, identifying the starting point and the goal (treasure).

They would mentally map out possible paths, considering obstacles and potential dead ends.

The human would plan a route, making decisions based on available information and intuition.

They would navigate through the maze, making adjustments as needed based on visual feedback and memory of previous attempts.

The process involves a combination of spatial reasoning, memory recall, and decision-making.

**Steps the Intelligent Agent (Pirate) is Taking to Solve the Maze:**

The intelligent agent receives input about the maze environment, including its current state and available actions.

It uses a neural network model to predict the best action to take based on the current state.

The agent explores the maze by taking actions and receiving feedback (rewards) based on its actions.

It learns from experience by updating its neural network model through reinforcement learning.

The agent aims to maximize its cumulative reward over time, ultimately reaching the goal (treasure) while avoiding obstacles.

**Similarities and Differences Between Human and Machine Approaches:**

Similarities: Both approaches involve perception of the environment, decision-making, and adaptation based on feedback. Both aim to achieve a specific goal within a given context.

Differences: Human approaches may rely more on intuition, creativity, and abstract reasoning, while machine approaches are more systematic, algorithmic, and data driven. Humans may excel in complex, unstructured environments, while machines excel in tasks requiring precision, scalability, and efficiency.

**Purpose of the Intelligent Agent in Pathfinding:**

The purpose of the intelligent agent (pirate) in pathfinding is to navigate through the maze environment to reach the goal (treasure) while optimizing its path to maximize rewards and so minimize penalties. The agent serves as an autonomous entity capable of making decisions based on its perception of the environment and past experiences.

**Exploitation vs. Exploration:**

Exploitation: Exploitation involves choosing actions that are estimated to yield the highest immediate reward based on current knowledge. It entails exploiting the agent's learned policy to make decisions.

Exploration: Exploration involves choosing actions that may not yield the highest immediate reward but provide valuable information about unknown states or actions. It entails exploring new paths or strategies to improve the agent's understanding of the environment.

Ideal Proportion: The ideal proportion of exploitation and exploration depends on the stage of learning and the complexity of the environment. Initially, more exploration is favored to discover optimal strategies. As the agent learns and gains more knowledge, exploitation becomes more prominent to exploit learned patterns effectively. In the case of this pathfinding problem, a balanced approach with a higher emphasis on exploration at the beginning of training and gradually shifting towards exploitation as the agent becomes more proficient may be suitable.

**Role of Reinforcement Learning in Pathfinding:**

Reinforcement learning plays a pivotal role in pathfinding by empowering the agent to discover the optimal route to the goal (treasure) through interactions with its environment. As the agent takes actions, it receives rewards or penalties, influencing its decision-making process towards actions that maximize long-term rewards. Through a cycle of exploration and exploitation, the agent refines its strategy, gradually uncovering the most effective path to navigate the maze and achieve the objective efficiently.

**Evaluation of Algorithms to Solve Complex Problems:**

Algorithms play a crucial role in solving complex problems by providing systematic, repeatable procedures for problem-solving. They enable efficient processing of data, optimization of resources, and automation of decision-making. However, the effectiveness of algorithms depends on various factors such as problem complexity, data quality, algorithm design, and computational resources. While algorithms like deep Q-learning offer powerful tools for solving complex problems, their performance can vary based on the specific problem domain and implementation details.

**Implementation of Deep Q-Learning using Neural Networks:**

The implementation of Deep Q-Learning harnesses neural network models to approximate the Q-function, which predicts the cumulative reward an action yields in a given state. The neural network receives the environment state as input and generates Q-values for available actions. Through iterative training, the agent engages with the environment, gathering experiences and adjusting the neural network weights using backpropagation and gradient descent. This optimization process minimizes the temporal difference error between predicted and actual Q-values, enabling the agent to acquire an optimal policy for navigating the maze and achieving the goal.

References

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