**Project Two CS-370**

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**Analyze the differences between human and machine approaches to solving problems.**

Human beings often rely on cognitive processes, intuition, and learning from experience to solve problems. Humans can adapt quickly to new situations, generalize knowledge, and make decisions based on complex reasoning. On the other hand, machines, including intelligent agents, follow predefined algorithms and models. They lack the innate flexibility and adaptability of human thinking but can process vast amounts of data quickly and consistently. A human would visually inspect the maze, identify the goal (treasure), and plan a path based on spatial reasoning. The person would likely use a combination of memory, logic, and trial-and-error to navigate, adjusting their strategy based on feedback from each step. The intelligent agent starts by randomly placing the pirate in the maze. It then iteratively takes actions based on a balance between exploration and exploitation. The agent learns from experience using deep Q-learning, updating its knowledge of state-action pairs to optimize its pathfinding strategy.

**What are the similarities and differences between these two approaches?**

Similarities:

* Both human and machine approaches involve starting from an initial state and taking actions to reach a goal.
* Both may use a trial-and-error process to refine their strategies over time.

Differences:

* Humans use complex cognitive processes, intuition, and spatial reasoning, while the agent relies on predefined algorithms and neural network models.
* Humans have a more adaptive and generalized problem-solving ability, while the machine strictly follows the programmed strategy.

**Assess the purpose of the intelligent agent in pathfinding.**

The intelligent agent aims to find an optimal path to the treasure in the maze. Its purpose is to learn from experience and adjust its strategy over time, ultimately achieving a high win rate by minimizing penalties and maximizing rewards. Exploitation involves choosing actions that are currently believed to be the best, while exploration involves trying new actions to discover potentially better ones. The ideal proportion depends on the learning stage. Initially, exploration is crucial to discover the maze and learn the consequences of actions. As learning progresses, a shift towards exploitation is necessary to capitalize on the acquired knowledge.

**7. How can reinforcement learning help to determine the path to the goal (the treasure) by the agent (the pirate)?**

Reinforcement learning enables the agent to learn from interactions with the environment by associating actions with rewards or penalties. The agent adjusts its strategy based on the outcomes of its actions, gradually learning an optimal path to reach the goal while avoiding penalties. Algorithms, especially machine learning algorithms like deep Q-learning, can effectively solve complex problems by leveraging computational power and data processing capabilities. They provide a systematic approach to learning and decision-making, enabling agents to adapt to dynamic environments and optimize their strategies over time.

**How did you implement deep Q-learning using neural networks for this game?**

The implementation involves defining a neural network model to approximate the Q-function. The model is trained using experience replay, where the agent learns from a replay buffer containing past experiences. The loss is computed based on the temporal difference between predicted and target Q-values. This process iterates over multiple epochs, refining the agent's strategy and improving its ability to navigate the maze.

It's important to note that the success of the implementation depends on appropriate hyperparameter tuning, neural network architecture, and the quality of the experience replay. The algorithm's performance is assessed through metrics such as win rate, loss, and training time.