**7-3 Project Two Submission**

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SNHU

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Design Defense:

An intelligent agent was built in this project to handle a pathfinding challenge in a maze setting. The agent uses deep Q-learning, a reinforcement learning technique, to learn the best policy for navigating the maze. Deep Q-learning combines Q-learning and deep neural networks, allowing the agent to apply its knowledge in new contexts. The agent begins with no understanding of the maze, but through interacting with it and earning incentives, it progressively learns the ideal navigation strategy. In addition, deep Q-learning's neural network component assists the agent in generalizing its knowledge and applying it to new scenarios.

The intelligent agent investigates and applies what it has learned through trial-and-error interactions with the environment. Starting at the top-left corner of the maze, the agent attempts to reach the bottom-right corner while avoiding occupied cells and reducing cell movement penalties. The agent's mission is to locate the shortest path through the maze. The agent can move in any direction and retrace if necessary to change its path. The number of steps to attain the goal is used to evaluate the agent's performance.

A Human-Centered Approach to Maze Solving:

To solve this maze, a human would visually examine the environment and construct a path to the target. Humans would recognize the maze's layout, identify dead ends, and avoid spots that would lead to failure. Finally, pupils would navigate the maze using their memory, experience, and reasoning abilities. They would also employ trial and error to determine the optimal path, which can be helpful in issue-solving. Humans would also identify patterns in their surroundings and utilize that information to make judgments.

Maze-solving can be used to teach analytical skills, decision-making skills, and problem-solving skills. In addition, it can enhance spatial awareness and logical reasoning skills. Furthermore, it promotes creativity and teaches the value of endurance, as finding a solution requires patience and tenacity. Finally, it also aids in developing self-confidence and self-esteem, as the sense of success gained from completing the maze is highly fulfilling.

Intelligent Agent Methodology:

The intelligent agent uses deep Q-learning to learn the optimum actions to take in each situation. It begins with a basic understanding of its surroundings and gradually learns the optimal path forward through exploration and exploitation. The agent balances experimenting with what it already knows to make the best selections possible. This method enables the agent to generalize and apply knowledge to decision-making in previously unexplored situations. It also enables the agent to adjust to environmental changes and learn more efficient techniques as it gains experience.

Differences and similarities:

Humans and intelligent beings learn from their experiences and apply their knowledge to solve problems. On the other hand, humans rely on their intuition, memory, and cognitive talents, whereas the intelligent agent makes decisions using a deep Q-learning algorithm and a neural network. This enables the intelligent agent to respond swiftly to changing circumstances and learn from failures. As a result, the intelligent agent has an advantage over humans in many tasks because of its capacity to learn and make decisions rapidly and accurately.

The Pathfinding Goal of the Intelligent Agent:

The intelligent agent's pathfinding aims to locate the best path to the goal in the maze while avoiding obstacles and minimizing penalties. The number of successful completions and the rate at which the agent learns to navigate the environment determine the agent's success. The agent is rewarded for choosing the best path and penalized for choosing the wrong one. As a result, the agent learns to locate the ideal path faster over time.

Exploration and extraction:

The most well-known activity is chosen for exploitation in order to maximize the predicted cumulative gain. On the other hand, exploration is choosing the least well-known activity to maximize the expected cumulative benefit. On the other hand, exploration is the selection of a lesser-known activity to learn more about one's surroundings. An epsilon-greedy strategy is used in this pathfinding problem to obtain an optimal proportion of exploitation and exploration. The agent first investigates more to obtain information, but as it gains confidence in its understanding, it switches toward exploitation to maximize rewards. This equilibrium ensures that the agent learns to navigate the maze effectively and efficiently.

Reinforcement Learning Pathfinding:

Reinforcement learning aids the agent's learning by delivering feedback through rewards and penalties for each action made. As it interacts with the environment, the agent's knowledge of the projected future benefits of each action is updated, allowing it to make better decisions and, ultimately, attain the goal more successfully.

The agent can take action and get feedback through rewards and penalties via reinforcement learning. This feedback enables it to learn more about its surroundings and make decisions leading to its goal. The agent's understanding of predicted rewards and penalties is constantly updated, enabling it to make more correct judgments and increase its chances of success.

Deep Q-learning Implementation Using Neural Networks:

Deep Q-learning was achieved by teaching a neural network to mimic the Q-function, which links state-action pairings to expected future rewards. The agent interacts with its surroundings, accumulating experience episodes in a replay buffer. The agent then applies these discoveries to train the neural network, which improves its grasp of the right behaviors to execute in each condition. If the AI employs a neural network to generalize its expertise to previously unanticipated conditions, it may be able to navigate the maze more effectively.

Finally, the intelligent agent developed for this work shows the utility of deep Q-learning in coping with challenging pathfinding tasks. Furthermore, the agent may efficiently construct an optimal policy to navigate the maze by applying exploration and exploitation, revealing the potential for reinforcement learning and deep neural networks to address similar issues.