**7-3 Project Two Submission**

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**Design Defense**

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

Human beings and machines learn very differently. Humans can draw from many different things in order to learn and adapt. Humans draw from pattern recognition, experience, and even intuition in order to solve complex issues. While a human may encounter a situation they have never been in before, they can use their prior experience and intuition to guide them towards success. If needed, a person can choose to make attempts using trial and error which is something I personally do all the time whether it’s in my academic life, personal life, or professional life. We adapt quickly which has always given us a leg up against problems and other forms of life throughout time. Machines do not have the same learning capabilities that humans do but they have similar processes. Machines can be taught by feeding them massive amounts of data, they can be tested through trial and error situations, or they can be given tools such as algorithms in order to ensure their preparedness for tasks to come.

When it comes to this project, humans and machines would act differently because of the differences in their nature and how they learn. A human working towards solving this maze may look for patterns and use the trial and error technique. If they were placed in a real maze, trial and error would definitely be the main method of solving the problem ahead along with intuition. If you enter a maze and know the general direction of the exit you can use that information to make your traversal through the maze much easier. A machine on the other hand, in this case my AI “pirate” agent, relied on structured inputs and algorithms. Using predefined rules this agent was able to learn iteratively and improve their performance over time.

For humans, this maze would be solved much easier. Steps taken to solve the maze would likely include: first examining the design of the maze and taking note of the starting position and the treasures position, looking for the most obvious or straight forward path to the goal, and use backtracking as necessary through trial and error. The agent in this case would move very differently. This AI agent starts with no knowledge of its environment and instead begins by taking random actions and seeing how that pans out for it. The agent is rewarded for moving closer to the treasure, and this is the bulk of how the agent learns to solve the maze. With each iteration the agent updates its Q-values (or weights within its neural network) and learns which actions produce the higher reward. Over time, the agent will learn the most optimal way to traverse the maze and attain the treasure at the end.

Both humans and machine would use trial and error in this problem as well as rewards. While the reward system for the machine will help it learn the most optimal path, the humans rewards would entail either a pass or fail state based on their actions. The goal of both groups here is to finish the maze in the most optimal way. The difference between these two groups though is that human intuition and our ability to observe our environments in many different ways gives us a huge advantage. While the agent may produce great results, it will take much longer for it to reach that point compared to a human player. The agent also begins by going in random directions in order to learn its environment while humans can see it all from the beginning (in the case of this maze specifically, because as I said previously, a physical maze in real life would be more difficult). Humans can adapt quickly with experience and intuition, the AI agent learns iteratively and fairly slow.

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

The purpose of the intelligent agent here was to navigate an environment it has no information on with minimal help. This was done with both exploration and exploitation. Exploration is exactly as it sounds, the agent exploring its environment, and from this we get exploitation. Exploitation in this case is the agent's new found knowledge of its environment through iterations and receiving of rewards. The agent chooses the best possible actions based on what it has learned so far. In this case, the ideal proportion of exploration to exploitation is to have a higher degree of exploration. More exploration means a higher degree of understanding of the agent's environment. Much like human learning, experience can better help guide our actions. By using a reward system the agent can learn the optimal path by taking in all of its experience and find the most rewarding pathway. This is reinforcement learning!

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

Implementing deep Q-learning was done in this project by providing an environment for the agent to explore, developing the agent itself with the intention of fostering learning through exploration and in turn exploitation, and by rewarding the agent for completing moves within their environment that led them closer to their ultimate goal. Promoting exploration above anything else along with rewarding the agent allowed it to learn to traverse its environment efficiently. Over time the agent was able to learn the most optimal path to the treasure which was the goal of the “pirate” agent! Utilizing reinforcement learning and fostering an environment that prioritizes exploration allowed me to develop an efficient agent that could navigate an environment with no prior coaching or information on said environment.

**Sources:**

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