Project Two: Treasure Maze

CS-370 – Emerging/Current Trends in Computer Science

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* **Analyze the differences between human and machine approaches to solving problems.**
  + Describe the steps a human being would take to solve this maze.

The human mind approaches problems solving is dependent on heuristics. Heuristics is a process or method developed from experience that is applied to the most optimal option. Humans mainly use three factors in the decision-making process; insight, concept formation, establishing subgoals and invariant features (Pizlo 1994). These processes allow people to make decisions at a fast pace without having to process all the endless data the human minds receive at any given moment.

* + Describe the steps your intelligent agent is taking to solve this pathfinding problem.

The pirate intelligent agent from the Treasure hunt problem uses straight forward steps. First, the agent chooses a random direction as long as that direction is a valid choice, as in not out of bounds or into an off-limits spot. The agent then repeats this step until the puzzle is solved. This process gets repeated over and over until the optimized solution is found.

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

There is not much overlap between the two approaches to solving this problem. A human will base decisions on historical data coalesced from past experiences, even if they are unrelated. On the other hand, the machine will choose at random and do it over and over. Humans don’t have the time or capacity to iterate through all of the options, so they choose what seems the most optimal choice in the given state.

* **Assess the purpose of the intelligent agent in pathfinding.**
  + What is the difference between exploitation and exploration? What is the ideal proportion of exploitation and exploration for this pathfinding problem? Explain your reasoning.

Exploitation comes with negative connotations. But they can be defined in this problem as the maximal utilization of resources, while exploration does not get effected by resource utilization conceptually. Having a balance of both is important as they complement each other. Exploration allows for more resources to be discovered while exploitation decides what to do with the resource once it has been discovered.

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

One way that reinforcement learning can be utilized is to determine a path to a goal is to set up the environment so that the goal state is associated with a high reward. All other states are associated with lower rewards or penalties (SALLOUM 2021). The pirate agent then explored this environment and made actions and receives rewards or penalties in order to develop the best sequence of actions that lead to the goal.

* **Evaluate the use of algorithms to solve complex problems.**
  + How did you implement deep Q-learning using neural networks for this game?

Simple steps were followed to implement a deep Q-learning neural network for this problem. Firstly, the libraries needed were imported into the main program. Next the training environments were created, along with the reward system. Next, the learning agent was instantiated and used improved algorithms for further learning. Finally, the agent was tested in the environment.

Bibliography

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SALLOUM, Z. (2021, December 12). *Basics of reinforcement learning, the easy way*. Medium. Retrieved February 4, 2023, from https://zsalloum.medium.com/basics-of-reinforcement-learning-the-easy-way-fb3a0a44f30e