Zachary Nicholas

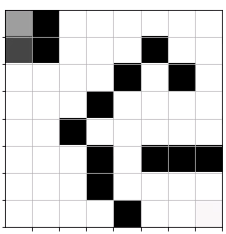
April 18, 2024

CS 370 Current and Emerging Trends in CS

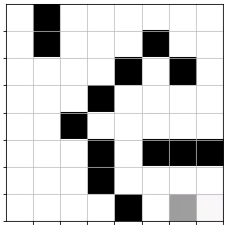
Project Two

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

Starting position maze



Ending position maze



* + Describe the steps a human being would take to solve this maze.

The way that most humans would go about doing this maze is to first locate the exit, after finding the exit we would try to get there using the least amount of moves this is found to be easier for the human as they aren’t only focused solely on the square that they are on but rather considering all of the squares and using their intuition and improved visibility in order to make a better move.

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

For an intelligent agent they most times don’t know where the exit is so they first try by making a move and seeing if they are rewarded or punished for that action (Some examples of why they would be punished is if they make a move that cannot be done in the current square such as trying to go left or up from the original starting position) once they have made a move they only consider the current square they are on and look based off of the next possible position they can move to.

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

One of the main similarities of these two approaches is how they begin their first move as it could be sort of random at first but as they move further in the maze it will further differ as these two actor move. The main difference between these approaches is how they will determine their next move, where a human will use their ability to look into their further actions to continue forward deeper into the maze and the intuition of doing that is lacking from the intelligent agent counterpart who can only look at their current action or space they are currently in and the next space they could go to through the 4 cardinal directions.

* **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.

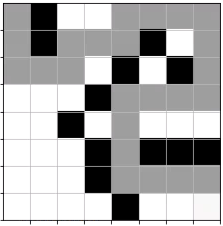
Exploitation is described as the “action of making use of and benefiting from resources” where Exploration is defined as the “action of traveling in or through an unfamiliar area in order to learn about it”. How this is shown in machine and reinforcement learning is the idea of having the Agent explore their surroundings to try and understand what the rules of their area is while exploiting would be taking the information they learned during exploration and using it to better further themselves through the scenario, in the treasure hunt scenario example we start off with a heavy emphasis on the exploration aspect allowing the agent to try and fail through a lot of the maze while eventually using the information it gained during to figure out how exactly to solve the maze it was given. Given the perspective that I’ve seen during this project I think that the exploitation vs exploration balance is a constantly changing balance between the two where we start heavily with exploration (as our agent doesn’t have any information besides the rules we set out for them) and gradually increase the importance of exploitation as they begin to make their way through the maze and know that they can ignore portions or squares of the maze since they aren’t useful for them to move forward. Basically what I think with this example is that in the beginning to right before the middle mark we have about 100% for exploration for the first move and as it figures out where it can’t go it gradually increases in its use of exploitation until it doesn’t need as much exploration so the skew becomes something more of a 40% exploration 60% exploitation then finally at the end when it has the path found out it becomes something more like 20% of exploration 80% exploitation as it optimizes the path that it makes.

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

As I was explaining above, The agent starts out with a very limited understanding of what the goal is and how to solve that scenario, but with reinforcement learning it fast tracks say a baby to a full grown adult just by using the environment around them to make them a subject matter expert in this particular scenario. Basically, how this type of system will work in order to make the agent get to the goal is through interacting with environment around them and seeing how they are treated such as giving a reward or punishment.

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

The Solved maze:



The way that this scenario uses Deep Q-Network is to solve the maze like I’ve shown above. It was designed to have the agent predict the q-values based on the future actions, with that the agent will chose an action to take, the environment of the maze will then update based on the action the agent took, the rewards or punishment will be given to the agent based on the action taken, and finally the next state will be evaluated until the maze is solved. For exploitation the agent was given the ability to seek out high rewards, with exploration it gives the agent enough freedom to make multiple scenarios maps of the maze and compare them based on the knowledge they have gained through their exploration while also factoring in the exploitation.

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