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Pathfinding in AI is a super interesting concept that is ever changing and growing to improve and become faster and more efficient. This is because it has so many real-world applications in all sorts of different industries. From providing an optimal route to deliver a package in a city, to military applications with unmanned drones, etc. Being able to just scratch the surface of this technology and get a better understanding of how these things work has been an eye-opening experience and something I will continue to work on outside of this class.

I think a good place to start is talking about the differences between how humans process information and make decisions and how machine learning algorithms and AI approach the same process. One major difference is how humans approach intuition and what’s known as a “gut feeling” based on things like past experiences. Machines are more rigid and strict in their approach, although advancements have been made to give machines more flexibility and adaptability when it comes to making decisions, it still isn’t close to how humans behave in that capacity.

Humans are also very creative inherently. They can use critical thinking and visual perception to solve mazes in ways that machines and potentially even other humans would never think of just based off of a thought or a whim. Machines can only act in ways that are strictly programmed for them to act. In this way they are very limited and don’t have much creativity or thinking outside the box.

Just thinking about how I, personally would go about solving a maze is firstly visually observing the maze. This is often the first step anyone would take when doing really any sort of activity is to visually address the situation. Next, I would have to use my past experience and knowledge about how mazes work and what the goal is. Based on previous education and solving puzzle games as a kid, I inherently understand the goal of solving a maze is to reach the end. A machine wouldn’t necessarily know right off the bat what to actually do, this needs to be taught during multiple iterations of learning. Then I would start at the beginning of the maze and start moving. Based on my visual inspection of the board in the beginning I should have a pretty good route planned and be able to reach the end without too many issues.

In contrast, a machine would first need to be provided with the maze information upfront. We would then provide the machine with a reward system, so if it reaches the end of the maze we get a +1, if we run out of possible moves or get blocked we get -1. Letting the machine know that reaching the end of the maze is a good thing and is rewarded reinforces these actions and allows the machine to work on finding more and more optimal paths as iterations move forward. Providing the machine with this type of feedback is crucial to improvements and efficiency in the algorithm.

Exploitation is centered around getting the maximum amount of rewards from the system as quickly as possible. Exploration is about trying different new strategies to try to determine a better solution. Both strategies have their pros and cons, and should be considered when writing any machine learning algorithm. A good approach is to start with exploration to try out any and all strategies to gain some context for what works and what doesn’t. Then we shift over to exploitation to take what we learned during the exploration phase to maximize the rewards.

Using reinforcement learning for pathfinding algorithms is a good approach because there is a clear reward to give the machine when it finds the solution to the maze. It also allows for clear feedback for when the machine loses and allows it to learn from mistakes. Using Deep Q learning was also an improvement. Using state-action pairs to the expected rewards allows us to further fine tune and make our algorithm more efficient. Since there could be thousands of iterations, being able to learn from those past experiences is a huge benefit.

References:

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