Hanah Deering

Project Two

CS 370 Current/Emerging Trends

Southern New Hampshire University

**Design Defense**

**Human and Machine Approach**

Through artificial intelligence, humans and machines are starting to approach solving problems in very similar ways. However, the actual approach will never be the exact same no matter how much we are able to teach machines. Humans are adaptive by nature and can think outside the box (algorithm). Humans tend to approach problems through stimulation and physical reasoning, rather than just an algorithm. Trial and error learning is a method of learning described as being any attempts at meeting a situation in various ways until the correct responses are found accidentally. (Mondal, 2020) We have all been through a maze before. We talk down the wrong way, only to be content with turning around to try the other path, until eventually we can make our way out of the Maze. Humans rely on trial and error to make it out of the maze, knowing that eventually we will make it out.

Machines on the other hand solve problems in an automated problem-solving process. All the possible paths will be used as input into the machine (intelligent agent). The paths to get out of the maze will be analyzed from the beginning to the end of the maze. The path that the machine determines to be the most optimal and most rewarding (end point) is the path that the machine will be outputted as the path to get out of the maze.

As we see, there are some differences and similarities between the two approaches. The starting point and end point along with the objective (finding the right path) are the same for the two approaches. However, the machine will solve the pathfinding problem a bit more methodically while a human being will use the trial-and-error method.

**Intelligent Agent Pathfinding**

The purpose of intelligent agents in pathfinding is to find the shortest route than can be taken between two specific points (the starting point and the end point). Exploitation and exploration are two concepts that used in reinforcement learning. Having a balance between the two is what reinforcement learning strategies aim to achieve. Exploration allows the agent to learn and to improve its existing knowledge. This can have potentially long-term benefits but does require more time for the agent to learn better potential solutions. Exploitation uses what the agent already knows and only seeks the biggest possible reward based off current knowledge. This is only based off estimation however, not actual values. We can either use risk and reward (exploitation) or use learning (exploration) for a much larger reward.

Though both functions are necessary for an AI to function an even balance between the two needs to be made as too much exploration and the agent takes too long to find the solution. Alternatively, too much exploitation and the AI never learns from exploration. (Butvinik, 2022) Reinforcement learning helps to determine the path to the goal (treasure) by the agent (pirate) by finding the shortest path that the agent can take to the treasure (the maximum reward). Each state that the agent moves into can be tested for possible solutions to maximize the reward for the agent.

**How Algorithms Solve Complex Problems**

Algorithms are used to solve complex problems. Implementing deep Q-learning using neural networks for this pathfinding puzzle allowed the correct and shortest path from start to finish to be taken. The first thing that needed to be done to use Q-Learning was to ensure that the correct libraries were imported to the code in Python. An environment was created for the neural network and a learning agent was created. The learning agent was created to follow the reward system and was trained based off an algorithm. The learning agent was then tested against the rules and restrictions of the environment to see if it could find the path out of the maze.

References

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