

## Project Two – Design Defense

The goal of our project was to create a pirate intelligent agent that can navigate a maze and find treasure before a human player. The problem addresses the common *pathfinding problem*. For my project, I created the algorithm for the pirate intelligent agent and in the process was able to evaluate the different approaches to problem solving that humans and intelligent agents take.

It can be a challenging task to problem solve effectively as a human. I would like to say that typically a human doesn't step back before making any decision in life and formulate some algorithm to ensure that each step in their life is optimal. Although, there are theories about how a human effectively problem solves. One theory is mentioned on the web page CCMIT and there is a whole slide show about how to effectively problem solve. The ideal problem-solving map that is shared on one of the beginning slides is literally given the acronym "IDEAL". The steps are identify, define, explore, action and look back. I like this map because I think that it is a good representation of how a human would problem-solve to navigate through the maze to find the treasure before the pirate. Using the map as a guide to find the treasure, a human would first identify the goal of finding the treasure. Next, a human would define the context of the problem. The context of this problem is that the human must navigate through the obstacle of the maze to get to the treasure before the pirate does. After defining the problem, it would be best for the human to explore the best possible strategies to solve the problem and win. After exploring

options, the human will act and then after the goal is reached or not reached the human can look back and evaluate the results and make any corrections to their options to succeed if necessary. Another difference between human and machine problem solving that should be noted is the tendency for humans to let emotions affect or dictate their problem-solving skills. This could be an advantage or disadvantage to completing a goal. (CCMIT, 2024)

The way that a machine learns or solves problems is like a human because machine learning intelligence is designed with the intent to imitate human learning behaviors. The first thing that a machine needs to learn, or problem solve, is a sufficient amount of data. The more data that a machine has the better the program will be at solving problems. A model is created, and the computer model then trains itself by finding patterns or making predictions. The better the model, or at least the parameters in the model, the better the training will be. In the article “Machine learning, explained” Sara Brown mentions three different functions of machine learning that can be used to help solve problems: descriptive, predictive, and prescriptive. She also mentions three subcategories that are used; supervised, unsupervised and reinforcement. The model that is used for the problem-solving in the Treasure Hunt project is reinforcement learning and deep Q-learning. Reinforcement machine learning trains machines through trial and error. (Brown, 2021)

I think that a good description of the steps that a human would take to solve the maze is the IDEAL process that I discussed earlier. By initially identifying the problem or task at hand, the human would have a clear idea about what the result or goal should be rather than jumping into a task and later figuring out that the goal wasn't clear and that the time spent was unproductive. The task at hand is to find the shortest path to the treasure through the maze and to find the shortest path as quick as possible. Next, defining the context of the problem would

ensure that the human hasn't left out any details that could hinder him/her in the future. The human will know that there is a maze with random unknown obstacles that is blocking him/her from reaching the treasure. He/she also knows that there is a pirate that is trying to do the same thing and that the pirate must be beaten to be successful. Exploring all the possible foreseeable options could help the human determine the best possible way to finish the maze successfully before the pirate and avoid any unnecessary failures or uncertainties. The only option for the human to consider in this step is to act, move through the maze and if there are any blocks in the maze, to note the path that was taken and do not take the path again. Acting would of course be the next step and most importantly and finally the human would reflect on his/her process and based on the results make do or don't make changes to correct their initial approach.

The steps for an intelligent agent to conquer the maze and find the treasure and more measured and technical by design. The first step for the agent is initialization, meaning that the maze environment should be defined as well as the starting point for the agent. Next the agent receives input from the environment to perceive the current state of the maze. Then the agent decides by using an algorithm and the observed state. The agent then acts by observing the state and potential rewards. Based on the outcome of the actions and received rewards the agent's knowledge of the maze and correct path is updated. The process is repeated, and the agent continues to learn until performance is desirable. For the agent to successfully find the treasure and do so quickly and balance of exploration and exploitation is necessary. First, the agent must use exploration to select actions that it believes will yield the highest rewards based on current knowledge and then it will need to exploit the knowledge gained and optimize its route to the treasure.

Reinforcement learning is a helpful way to determine the path to the treasure by the pirate. The best way for the pirate to learn to navigate through the maze is by trial and error which leads to favorable rewards or outcomes so that it can adjust its behavior accordingly. Updating Q-values based on the observed rewards helps the agent gradually optimize its decision making process which also leads it to the optimal path to the treasure.

### References

Brown, S. (2021). Machine learning, explained. *MIT Management: Sloan School*, <https://mitsloan.mit.edu/ideas-made-to-matter/machine-learning-explained>

*Introduction To Problem Solving Skills*. <https://ccmit.mit.edu/>. Retrieved 3/1/24, from <https://ccmit.mit.edu/problem-solving/>