**Design Defense**

Alexis Indick

Computer Science Department, Southern New Hampshire University

CS 370: Current/Emerging Trends

Dr. Mohammad Habibi

June 18th, 2023

**Differences Between Human and Machine Approaches to Solving Problems**

There are tons of different ways a human can try and solve a problem. For the Treasure Hunt Game problem, a human may try to scope out where the walls are, what dead ends they run into, what direction the entrance was, whether to go left or right, forward, or backward, etc. Humans learn from experience (JanardhananPS, 2020). For the same Treasure Hunt Game, a machine will try to find the best path possible as fast as possible through many different random paths and data they’ve obtained from playing the game. Machines learn from data gained (JanardhananPS, 2020). So, at each iteration of the game, the machine learns from it and builds new solutions until it gets the optimal end path. For the human approach, it is different from the machine’s approach since humans learn from the experiences they have. The machine has a different approach where it takes multiple paths and chooses the best one at the end.

**The Purpose of the Intelligent Agent in Pathfinding**

Exploitation and exploration are two different elements when used in the context of how machines process pathfinding. Exploitation is when the current agent’s estimate value is exploited for getting the greediest approach to the greatest reward possible (Khan, 2022). But, with exploitation the agent is greedy only with the estimate value and not the actual so, there’s a good chance it will not get the best reward (Khan, 2022). Exploration, however, involves longer term benefits where the agent is consistently learning through each action performed (Khan, 2022). In general, it’s a good idea to have a balance between the two. If the machine is always choosing the action that it thinks will lead to the most reward, it will never learn about other potential paths and greater rewards (Austin, 2022). But also, if the system always chooses random actions, it will never make use of its current knowledge and may end up making not optimal decisions (Austin, 2022). For this project on treasure hunting, I think that balance is optimal to use for it. Mainly because we want the most optimal/shortest path with the best rewards and learning but also want to tap into what the machine already knows and exploit that too for possible better paths. Reinforcement learning (RL) helps find the best path through maximizing the reward each time the agent (the pirate) gets to the goal (the treasure). Each time the machine finds the shortest path to the treasure/goal, the reward is therefore maximized as an initiative to do better in finding the most optimal path each time.

**Evaluating the Use of Algorithms to Solve Complex Problems**

For the implementation of the algorithm for the treasure hunting problem, I used deep Q-learning using neural networks and Python. Deep Q-learning is where each state is taken and the Q-value is approximated for each action and the Q-value is then taken and evaluated whether it’s the highest Q-value or not. The algorithm wants to take the highest Q-value possible since this means the highest reward possible. For the treasure hunt, I created an agent that is the pirate in this scenario and the goal is the treasure at the end that is gained. The agent tries to find the best path based on the highest Q-value produced.

**References:**

Austin, A. (2022, December 20). *AI anyone can understand: Part 5 - the exploration-exploitation trade-off*. Medium. Retrieved June 14, 2023, from https://medium.com/codex/ai-anyone-can-understand-part-5-the-exploration-exploitation-trade-off-f4871d717649

JanardhananPS. (2020, April 2). *Human learning and machine learning - how they differ ?*. Data Science Central. Retrieved June 14, 2023, from https://www.datasciencecentral.com/human-learning-and-machine-learning-how-they-differ/

Khan, T. (2022, January 2). *Reinforcement learning – exploration vs exploitation tradeoff*. AI ML Analytics. Retrieved June 14, 2023, from https://ai-ml-analytics.com/reinforcement-learning-exploration-vs-exploitation-tradeoff/