Shawn Millin

CS-370

Design Defense

October 18th 2025

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**The difference between human and machine approach to solving problems:**

For solving the pathfinding game a human can see the entire game board immediately and is able to use perception to choose open squares, building a path in their brain before making a decision. Each time a human does the maze they will use problem-solving and learn from previous tries. Each time is also influenced by emotions, cognitive limitations, and attention span so a human may get distracted thinking about something else if they get bored doing the maze or mentally fatigue out.

The intelligent agent for this pathfinding game used reinforced learning with Deep Q-learning. This algorithm based learning approach has the agent explore the environment for finding a clear path to the goal and exploiting the environment for finding the most rewards, rewards being a positive numerical value and penalty a negative numerical value, in total while making path to the goal.

Both humans and the AI generated agent learns by exploration of the environment and finding the best way to win. Agent are trained on the simple task of playing the game with data only being from that task where as humans are processing immense amounts of information from not only the game but their surroundings and whatever else they are thinking of.

**Assess the purpose of the intelligent agent in pathfinding:**

The agent for this pathfinding game is tasked to find the treasure before a human player does by navigating through the maze in only open squares. The use of exploration and exploitation allow the agent to learn to prioritize an efficient route to the treasure where exploration is for long-term rewards and searching while exploitation is for immediate rewards and believed highest reward outcome. Exploration is utilized heavily early on in the training to learn about the environment by trying different paths and gradually decreased as optimal paths are learned. Exploitation is increased as exploration decreases for the agent to exploit known paths but still randomly using exploration as to not get stuck in an optimization loop. This balance of exploration to exploitation is the Epsilon-Greedy algorithm

The use of reinforcement learning helps the agent to find the treasure by trail and error method. The agent chooses an action that is allowed in the rules to explore the environment until it reaches the treasure or can no longer make an allowed action. The explored information is stored and the neural network is updated for the next trail through the maze, this becomes the agent’s learned experience. Through the experience the agent learns optimal paths to the treasure

**Evaluate the use of algorithms to solve complex problems:**

For this pathfinding game deep Q-learning was implemented to train the agent. The deep Q-learning takes the state, in this case the position of the agent in the environment, and calculates a Q-value for all possible actions (for this game actions are up, down, left, and right) to predict the next best possible action. The agent is rewarded with numerical value rewards given to actions in the form of -0.04 for a valid action, -0.75 for invalid actions, -0.25 for repeated actions (trying the same square the agent already used in the same game), and +1 for finding the treasure. The higher reward paths are labeled as optimum and the game is won, the game is over if rewards fall below the minimum reward amount or no valid action is available. This is repeated many multiple times with each episode adding to the batch of sample games the agent can call on for evaluation. The performance is tracked with a win rate and training stops up on having a win rate above 0.9. This repeated iterations of training allows the reinforced learning algorithm to solve complex problems.

Resources:

Khurana, Rahul. (2023). *Differences Between Artificial Intelligence and human Intelligence.* Scaler. <https://www.scaler.com/topics/differences-between-artificial-intelligence-and-human-intelligence/>

MindMap AI. (2025). *Goal-Based Agents & Pathfinding Explained.* [*https://mindmapai.app/mind-mapping/goal-based-agents-and-pathfinding*](https://mindmapai.app/mind-mapping/goal-based-agents-and-pathfinding)