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Current/Emerging Trends

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Intelligent Pirate Agent: A Deep Q-Learning Approach to Maze Navigation

When I first started this project, I had no idea how complex solving a maze could be. What began as a simple programming assignment transformed into a fascinating exploration of intelligence and learning.

My Personal Maze-Solving Experience Standing at the entrance of a maze, I realize how my brain works differently from a computer. I don't just see a path, I see a challenge. My eyes dart across potential routes, unconsciously creating mental markers for promising directions and warning signs for potential dead ends. Growing up, I learned that the first attempt is rarely the best one. I remembered getting lost in corn mazes, understanding that navigation is about patience, strategy, and willingness to backtrack. These childhood experiences became my first lesson in problem-solving (Kaushik, 2023).

When I began developing the agent, I discovered something fascinating: computers navigate completely differently from humans. While I rely on intuition and past experiences, my computational agent transforms the maze into a mathematical puzzle.

Each maze cell became a data point a potential path or an obstacle. Where I might make an intuitive leap, the agent calculates probabilities with remarkable precision (Russell & Norvig, 2021).

Comparing human and machine approaches revealed surprising insights:

Similarities: Both seek the most efficient path

Both learn through repeated attempts

Both develop strategies over time

Differences: My approach is flexible and context-rich

The agent follows strict mathematical rules

I bring emotional intelligence

It brings pure computational logic

The Challenge of Exploration and Exploitation

Developing the learning strategy felt like teaching someone to navigate a new city. I realized learning follows a natural progression:

Initial phase: Extensive exploration (80%)

Middle phase: Balanced approach (50/50)

Final phase: Targeted navigation (80% exploitation)

This approach ensures comprehensive learning while progressively focusing on the most effective solutions (Sutton & Barto, 2018).

Understanding Reinforcement Learning

The most exciting part was implementing reinforcement learning. Imagine teaching navigation by only saying "warmer" or "colder" after each step. That's exactly how my agent learns:

Immediate, clear feedback

Learning directly from experiences

Constantly refining strategies

Building a mathematical model of success

Building the Neural Network

Designing the neural network was like creating a computational brain:

Input Layer: Capturing the maze's current state

Hidden Layers: Detecting complex patterns

Output Layer: Predicting optimal actions

I watched it learn by: Starting with no preconceived knowledge

Gathering experiences through maze attempts

Updating understanding based on success and failure

Becoming more precise with each iteration

What I Learned Beyond Code

This project taught me that intelligence isn't about having all the answers. It's about the ability to learn, adapt, and improve continuously.

My pirate agent became more than a programming project—it was a bridge between computational modeling and human problem-solving, demonstrating that learning is a universal language.

References

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