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CS-499: Computer Science Capstone

4-2 Milestone Three: Enhancement Two: Algorithms and Data Structure

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The artifact I selected for this enhancement is a reinforcement learning model that uses the Q-Learning algorithm to enable an intelligent agent to make decisions in a grid-based environment. The original version of this artifact was created for Current and Emerging Trends in Computer Science, where I configured the model for pathfinding and reward-based decision-making in a simulated environment. The artifact demonstrated how an agent could learn to navigate toward a goal by maximizing its expected future rewards through trial and error.

I included this artifact in my ePortfolio because it exemplifies my ability to apply algorithmic principles. The Q-learning algorithm itself relies on the use of a Q-table, a two dimensional data structure that updates values based on actions and states. My enhancement involved refactoring the update logic to improve convergence efficiency and introducing dynamic epsilon decay to balance exploration and exploitation during training. I also added modularity to the code, which separates training, evaluation, and environment configuration into distinct components. These changes reflect my understanding of data structure manipulation and the trade-offs involved in learning rate tuning and policy optimization.

With these improvements, I successfully met the course outcomes I planned to address in Module One. Specifically, I demonstrated the ability to design and evaluate computing solutions using algorithmic principles appropriate to the problem at hand, while also making decisions about performance trade-offs and maintainability. At this point I do not hve updates to my outcome-coverage plans, but I have discovered and built the framework for the integration of a Q-Algorithm into the appointment setting application enhanced for Artifact 1.

During the enhancement process, I deepened my understanding of reinforcement learning mechanisms, and the importance of structuring code for scalability and future adaptation. One challenge I encountered was maintaining the integrity for the learning process while introducing improvements to the data structure logic. I had to ensure that changes to the Q-table format and update function did not compromise the agent’s ability to learn effectively. Testing and debugging these updates was a beast, requiring multiple iterations and extensive logging, which in turn sharpened my skills in both analytical reasoning and algorithm testing.

Overall, enhancing this artifact improved its efficiency and clarity as well as reinforcing my skills in applying algorithms and data structures to solve real-world problems. It shows my ability to combine theoretical knowledge with practical implementation, as well as my growth in this area of computer science.