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CS370 Project Two

Week 7 Assignment 12/2023

**Design Defense: Intelligent Agent for Treasure Hunt Game**

**Introduction:**

In the context of developing an intelligent agent for a treasure hunt game, the approach involves utilizing deep Q-learning, a form of reinforcement learning, to navigate a maze and reach the treasure. This design defense aims to analyze the differences between human and machine approaches to problem-solving, outline the steps involved in both, and assess the purpose and effectiveness of the intelligent agent.

**Human vs. Machine Approaches:**

Humans traditionally approach maze-solving with visual analysis, pattern recognition, and strategic planning (Russell & Norvig, 2010). In contrast, the intelligent agent relies on deep Q-learning, where it learns by experience through exploration and exploitation (Mnih et al., 2015). Unlike humans, the agent lacks inherent visual recognition but compensates through algorithmic learning.

**Steps for Human vs. Intelligent Agent:**

1. **Human Approach:**

* Observe maze visually.
* Plan a route based on spatial intelligence.
* Execute movements based on visual memory.
* Adapt strategy through trial and error.

1. **Intelligent Agent:**

* Observe maze through state representation.
* Learn actions through deep Q-learning.
* Explore new actions probabilistically.
* Exploit learned actions for efficiency (Silver et al., 2016).

**Similarities and Differences:**

While both entities aim to reach the treasure efficiently, humans rely on visual perception and cognitive reasoning, whereas the agent learns from experiences and makes decisions based on learned Q-values. The agent's decision-making is algorithmic, lacking the depth of human cognition.

**Assessment of Intelligent Agent's Purpose:**

The intelligent agent's purpose is pathfinding, achieved through learning and optimizing a policy for making decisions. Its ultimate goal is to efficiently navigate the maze to reach the treasure. The agent adapts its strategy based on rewards (positive for reaching the treasure, negative for obstacles).

**Exploitation vs. Exploration:**

The agent balances exploitation (choosing known actions) and exploration (choosing new actions). The ideal proportion shifts over time, favoring exploration initially to discover diverse paths and gradually favoring exploitation as the agent learns and refines its strategy (Sutton & Barto, 2018).

**Reinforcement Learning in Pathfinding:**

Reinforcement learning enables the agent to associate actions with rewards, adjusting its strategy to maximize cumulative rewards. The agent learns from positive and negative feedback, reinforcing actions that lead to success and avoiding those that result in failure.

**Implementation of Deep Q-Learning:**

The agent's neural network model consists of dense layers with PReLU activation functions. Training involves epochs, where the model learns from experiences stored in the replay memory. Exploration and exploitation are achieved through random and learned action selection.

**Conclusion:**

In conclusion, the intelligent agent's design leverages deep Q-learning to autonomously learn and adapt its pathfinding strategy in the maze. While the approach differs significantly from the human cognitive process, it demonstrates the application of machine learning in solving complex problems. The agent's ability to balance exploration and exploitation showcases its adaptive nature in navigating the maze effectively.

**References:**

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