CAP 4053 Artificial Intelligence for Computer Games: Reinforcement Learning

CAP 4053 Artificial Intelligence for Computer Games: Reinforcement Learning Lecture Notes

Introduction

Reinforcement Learning (RL) is a type of machine learning algorithm that allows an agent to learn from its environment by taking actions and receiving rewards. It is a powerful tool for solving complex problems in artificial intelligence, and it has been used to create agents that can play games, control robots, and optimize decision-making processes.

Key Concepts

- **Agent**: The agent is the entity that interacts with the environment. It takes actions and receives rewards.

- **Environment**: The environment is the world in which the agent operates. It provides the agent with information about its state and rewards for taking certain actions.

- **State**: The state of the environment is the current configuration of the environment. It is the information that the agent uses to make decisions.

- **Action**: An action is a choice that the agent can make in the environment. It is a decision that affects the state of the environment.

- **Reward**: A reward is a numerical value that the agent receives for taking an action in the environment. It is used to evaluate the quality of the agent's decisions.

Algorithm

The basic algorithm for reinforcement learning is as follows:

1. Initialize the environment and agent.

2. Observe the current state of the environment.

3. Select an action based on the current state.

4. Execute the action and observe the reward.

5. Update the agent's policy based on the reward.

6. Repeat steps 2-5 until the goal is achieved.

Coding Example
```
Start of Code

import numpy as np

# Initialize the environment and agent

env = Environment()

agent = Agent()

# Loop until the goal is achieved
```

```
while not env.is_goal_achieved():
        # Observe the current state
        state = env.get_state()

        # Select an action
        action = agent.select_action(state)

        # Execute the action and observe the reward
        reward = env.execute_action(action)

        # Update the agent's policy
        agent.update_policy(state, action, reward)
# Goal is achieved
print("Goal is achieved!")
End of Code
```

Practice Multiple Choice Questions

Q1. What is the purpose of reinforcement learning?

A. To solve complex problems in artificial intelligence

B. To create agents that can play games

C. To control robots

D. All of the above

Answer: D. All of the above