AASMA Project Proposal

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Abstract

This project addresses the challenge of designing an Autonomous Agents and Multi-Agent Systems (AAMAS) framework for a dynamic grid world where agents collect apples to survive. The grid world dynamically regenerates apples based on nearby apples and is also able to simulate natural disasters by destroying a great amount of apples, creating a complex environment for agents to navigate. Our approach involves developing a multi-agent system with decentralized decision-making to efficiently collect apples. We expect this research to contribute to the understanding of multi-agent coordination in dynamic environments.

1 Introduction

Motivation: Autonomous Agents and Multi-Agent Systems play a crucial role in various real-world applications, including robotics, transportation, and distributed computing. Understanding how agents cooperate and make decisions in dynamic environments is essential for designing efficient and robust systems. The proposed project aims to explore these concepts in a simplified grid world scenario.

Related Work: Previous research in AAMAS has investigated various aspects of multi-agent coordination, including communication protocols, task allocation, and decentralized decision-making. However, few studies have focused on dynamic environments with regenerative resources, such as the one proposed in this project.

Problem Definition and Relevance: The project addresses the challenge of designing an AAMAS framework capable of efficient resource collection in a dynamic environment. The relevance lies in its applicability to real-world scenarios where agents must adapt to changing conditions to achieve their objectives.

Objectives:
1. Design a multi-agent system for apple collection.
2. Implement decentralized decision-making algorithms.
3. Evaluate system performance.

2 Approach

Environment Specification: The grid world consists of a two-dimensional grid where agents and apples are placed. Apples regenerate over time based on the number of nearby apples and might also be erased in large scale, simulating natural disasters

Multi-Agent System: Agents are autonomous entities with the objective of collecting apples to avoid starvation. Each agent has sensors to perceive the environment and actuators to perform actions such as moving and collecting apples. The multi-agent system employs decentralized decision-making algorithms to enable agents to coordinate their actions.

System Architecture: The system architecture comprises three main components: perception, decision-making, and action execution. The perception module processes sensory inputs to extract relevant information about the environment. The decision-making module utilizes decentralized algorithms to generate action plans based on the perceived information. The action execution module executes the planned actions, updating the state of the environment accordingly. The design choices are adequate to address the problem as they enable agents to autonomously navigate the dynamic environment, adapt to changing conditions, and coordinate their actions to achieve the collective goal of resource collection.

3 Empirical Evaluation

Efficiency: Measure the average time taken by agents to collect a certain number of apples.
Robustness: Evaluate the system's performance under varying environmental conditions, such as different rates of apple regeneration.
Scalability: Assess how the system's performance scales with an increasing number of agents and apples in the environment.