ISPGAYA
instituto superior politécnico

IA – Inteligência Artificial
Trabalho Grupo e Setup Ambiente Desenvolvimento

António de Castro

Joaquim Gonçalves

Agenda

- Trabalho de grupo:
  - Apresentação do trabalho e forma de avaliar
  - Definição de grupos
- Jade Crash Course
- Guia de Instalação do Python e Spade

Trabalhos de Grupo

- Grupos de 3/4 alunos

- Um trabalhos de grupo:

    - Agentes, Sistema Multi-agente e Aprendizagem Máquina

- Devem entregar:

    - Código fonte

    - Relatório

- Apresentação dos trabalhos:

    - Apresentação Intermédia: aula prática 15/11 (noturna) 16/11 (diurna)

    - Apresentação Final: aula prática 10/01 (noturna) 11/01 (diurna)

Avaliação do Trabalho

- Avaliação
  - Apresentação intermédia – 20%
  - Apresentação final:
    - Demonstração (10%)
    - Código (40%)
    - Relatório (30%)
- Escrita do relatório *ao estilo de artigo científico*
    - Sumário
    - Introdução
    - Estado da arte
    - Descrição do problema
    - Descrição da solução
    - Experiências
    - Resultados e análise comparativa
    - Conclusões e referências.

Trabalho Prático

Intelligent Multi-Agent Traffic Control System

Overview

The aim is to design and implement a multi-agent system to manage traffic at an intersection or across multiple intersections efficiently. The agents should communicate with each other and coordinate to manage traffic signals, aiming to minimize waiting times and enhance traffic flow. On the second part of the project, the disruption management agent should be introduced and a model that predicts disruptions should be included.

Objectives
- Implement intelligent traffic light agents that can adapt to real-time traffic conditions.
- Use vehicle agents that generate simplified but realistic traffic patterns.
- Integrate these agents to work in a coordinated way to optimize traffic flow.
- Predict disruptions on the traffic flow so that the other agents can adapt to avoid them.

Features

1. **Traffic Environment:** The environment where the agents live should be represented. The agents should be able to perceive and act on the environment.
2. **Traffic Light Agent(s)**: Each traffic light at an intersection is controlled by an agent. The agent's goal is to manage the light timings (Red, Green, Yellow) based on the current traffic conditions.
3. **Vehicle Agents:** Simulate vehicle agents that approach the intersections and react to the traffic lights. They can report waiting times, and perhaps even make requests for green lights if waiting time exceeds a certain limit.
4. **Central Coordination Agent:** This agent gathers data from Traffic Light Agents and perhaps also the Vehicle Agents to manage larger traffic patterns or to intervene in special circumstances (like emergency vehicles coming through).
5. **Disruption Management Agent:** This agent is responsible for predicting any disruptions that might affect the traffic flow, for example, due to bad weather conditions, construction works, etc. For that the agent implements a prediction machine learning model and, based on the predictions, issues warnings to the other agents, so that they can react or adapt their behaviors.
6. **Emergency Vehicle Priority:** Implement a feature where emergency vehicles (ambulance, fire brigade, police) have the highest priority and can interact with the Traffic Light Agents to ensure they get a green light.
7. **Real-Time Adjustments:** Traffic light agents could adapt to traffic conditions, perhaps changing the time the light stays green or red based on the volume of traffic.
8. **Performance Metrics:** Implement metrics to measure the efficiency of the traffic management in terms of waiting time, the number of vehicles passed, etc.

Milestones

Week 1-2: Project Kickoff and Planning

- **Week 1**: Project overview, and expectations, setting up the code environment.

- **Week 2**: Form project teams and assign roles. Begin project planning, including defining roles and responsibilities, setting up communication channels, and outlining the project timeline.

Week 3-4: Environment Setup and Basic Agent Design

- **Week 3**: Set up the traffic environment simulation. Create a basic framework for agents and the environment.

- **Week 4**: Design and implement basic Traffic Light Agents and Vehicle Agents. Establish communication channels between agents.

Week 5-6: Traffic Light Agent Improvement

- **Week 5**: Enhance Traffic Light Agent logic to adapt to real-time traffic conditions.

- **Week 6**: Implement real-time adjustments for Traffic Light Agents based on traffic volume. Start tracking performance metrics.

Milestones

Week 7-8: Vehicle Agent Behavior and Interaction

- **Week 7**: Improve Vehicle Agent behavior, including responding to traffic lights and reporting waiting times.

- **Week 8**: Introduce emergency vehicle priority feature and implement interaction with Traffic Light Agents.

Week 9-10: Disruption Management and Prediction

- **Week 9**: Develop the Disruption Management Agent. Implement a prediction machine learning model for disruptions.

- **Week 10**: Integrate the Disruption Management Agent with other agents. Test disruption predictions and warnings.

Week 11-12: Central Coordination and Final Testing

- **Week 11**: Create the Central Coordination Agent. Implement coordination logic for larger traffic patterns and interventions.

- **Week 12**: Conduct comprehensive testing of the entire multi-agent system. Collect performance data and analyze metrics. Prepare final presentations and reports.

Tools and Programming Languages

Each group must choose one:

- Java and Jade (OR)
- Python and Spade

Java + Jade

1. Install JAVA and Setup the environment properly

2. Jade Crash Code

Python + Spade

1. Python and Spade Installation Guide available to download

2. Spade tutorial to be performed