Dial-A-Ride Problem (DARP) Simulation

The objective is to propose a distributed strategy for the management of a vehicle fleet ensuring a dial and ride service. Email to flavien.balbo@emse.fr your works.

1 Problem description

The dial-a-ride problem (DARP) generalizes a number of well studied vehicle routing problems such as the Vehicle Routing Problem with Time Windows(VRPTW) in Toth and Vigo (2001) and the Pickup and Delivery Problem (PDP) in Parragh et al (2008). The DARP is a demand responsive transportation service, which arises for example in the context of patient transportation.

This is a dynamic resource allocation problem of traveler requests (resources) to vehicles (consumers). Your strategy to solve this problem is performed by agents, i.e. the vehicles, which have to process at least 90% of traveler requests. Agents are mobile, distributed. By hypothesis, at beginning the requests are randomly created and appears everywhere in the environment. Each request has a lifespan that is also randomly generated. A request is satisfied if a vehicle is at its location to serve it during the period validity of the request. The content of the request is the destination of the traveler. When a vehicle serves a request, it computes its new route to drive to the traveler destination. At destination, the vehicle is released. The strategy objective is to maximize the number of satisfied requests with the minimum of vehicles. Your strategy will be compared to a random strategy (vehicle moves randomly and serves requests when it is possible (at location and free)).

2 Formal multiagent model

Based on the AEIO approach, you propose formal multiagent models for this problem with a MAS based on cognitive agents (DARPC).

For simplification purpose: 1) Vehicles move in an Euclidian space; 2) Vehicle cannot satisfy simultaneously several requests (i.e. several client like in carpooling)

At minima (you can propose other questions), answer to these questions for DARPR and DARPC model.

1) Agents: what are agents and their behaviors?

   => basic behavior and decision process

2) Environment: What are its properties?

   => what belongs to the environment? what is perceptible? What is modifiable?

3) Interaction: How agents influence behaviors of other?

   => Which information is useful and how / when the information is exchanged? There is indirect interaction?

4) Organization: What rules the behavior of agents?

   => Agents have permissions, obligations, …?

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3 Repast Operational model

The objective in this practical session is to design a Repast simulation for DARPC with the following communication hypothesis: each Vehicle agent can communicate with all others. The practical session is decomposed in two parts, first the reading of the Repast tutorial "REPAST JAVA GETTING STARTED", secondly the improvement of a given basic version of the DARPC.

3.1 Repast Tutorial

The subject of this tutorial is similar to prey and predator example but with Zombies and Humans. The final project is already available at the address:

https://seafile.emse.fr/d/ff14db3a57af4cef817f/

1. Read the tutorial and the code in the project (you create a new project in Repast and copy/past the code when necessary)
2. The part of the tutorial related to the Repast Simulation interface has to be done (page 18 to the end)

Repast Symphony Reference

https://repast.github.io/docs/RepastReference/RepastReference.html#_introduction

Repast Symphony API

https://repast.github.io/docs/api/repast_simphony/index.html

3.2 Basic DARPC version

The sources of a basic version of the DARPC is available at the same address

The vehicle agents move randomly until they found a Client. Client asks once randomly a new destination. After the ride, he is declared as arrived and he cannot ask a new destination. The number of clients and vehicles are parameters of the simulation.

1. Create a new project and understand the code.
2. Improve the behavior of the simulation with communication and reasoning process following your proposal.