Multiagent Coordination In On-demand Transport with Connected Autonomous Vehicles A decentralized resource allocation approach
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Multiagent Coordination In On-demand Transport with Connected Autonomous Vehicles
A decentralized resource allocation approach

Deploying autonomous vehicle fleets, with limited communication ranges, in order to provide ODT service requires a careful choice and evaluation of solution methods for resource allocation problems.

Our Multiagent Approach

► **Generic Modeling (AV-OLRA)** – Autonomous Vehicles Online Localized Resource Allocation: A generic model to ODT’s dynamic resource allocation problem in connected autonomous vehicle fleets, taking into account the limited connectivity and communication constraints.

► **Behavior Abstraction (AV Agent)** – Each Autonomous vehicle is an agent whose behavior consists of 3 sub-behaviors: (Acting, Communicating and Planning).

► **Solution Abstraction (CM)** – A coordination mechanism defines the characteristics of a solution methods and requirements to implement the corresponding planning sub-behavior.

► **Evaluation Testbed (AV-SIM)** – A multiagent simulator based on “Plateforme Territoire” with a set of evaluation criteria (QoB, QoS, Communication load, Connectivity).

► **A new solution method (ORNInA)** – A Decentralized, Auction-based, coordination approach with run-time optimization.

Experimental evaluation with AV-SIM on real-world data (NYC-TLC trip records)

► The problem is split into sub-problems (per CS), the global solution is an aggregation of the sub-solutions.

► Consequences of increasing the number of vehicles (enlarging the fleet size):
  - More requests are served (better QoS) with more operational cost (a decrease in QoS after some threshold)
  - Trade-off (QoS vs. QoB)
  - More connectivity between vehicles (larger connected set sizes)
  - More coordination messages and communicational cost

► The centralized (Dispatching) is optimal for (fleet size / QoS), the greedy method (Selfish) is the worst, while decentralized coordination methods (MOM-2, DSA, ORNInA) are good alternatives in the middle.

References
- Plateforme Territoire: https://territoire.emse.fr/

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