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A Generic Multi-Agent Model for Resource Allocation Strategies in Online On-Demand Transport with Autonomous Vehicles

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Application domain: On-demand transport (ODT)

AV-OLRA model
Autonomous Vehicles Online Localized Resource Allocation
A generic model to ODT’s dynamic resource allocation problem in autonomous vehicle fleets with communication constraints
\( \langle R, V, G, T \rangle \)
- \( R \): a dynamic set of requests
- \( V \): a fleet of \( m \) vehicles
- \( G \): a graph defining the road network
- \( T \): the problem’s time horizon

Solution methods
Depends on the adopted coordination mechanism (CM)
\( CM := \langle DA, AC, AM \rangle \)
- \( DA \): level of decision autonomy centralized (C) / decentralized (D)
- \( AC \): agents’ cooperativeness level "sharing" (S) / "no-sharing" (N)
- \( AM \): the allocation mechanism

Implementation examples
- **Selfish**: \( \langle D, N, \text{Greedy} \rangle \) [3]
- **Dispatching**: \( \langle C, S, \text{MILP} \rangle \) [2]
- **Auctions**: \( \langle D, S, \text{Auction} \rangle \) [1]
- **Cooperative**: \( \langle D, S, \text{DCOP} \rangle \)
MGM-2 solver [4]
DSA solver [5] (variant A, \( p = 0.5 \))

Evaluation
<table>
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<tr>
<th>Coordination</th>
<th>QoS evolution with the increasing fee size</th>
<th>Metrics for scenarios with 10 vehicles</th>
</tr>
</thead>
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<tr>
<td>message size</td>
<td>max</td>
<td>avg</td>
</tr>
<tr>
<td>Selfish</td>
<td>140</td>
<td>88</td>
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<tr>
<td>Dispatching</td>
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<td>168</td>
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<tr>
<td>Auctions</td>
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References