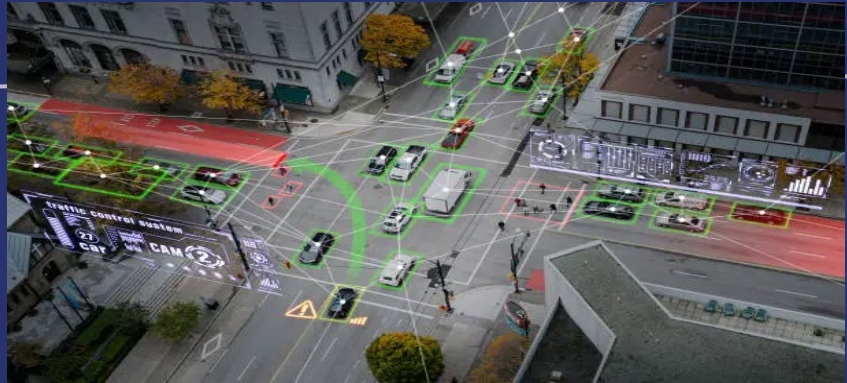




Università
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Practical extensions of the electric autonomous dial-a-ride problem

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Abstract:

The decarbonization of urban passenger transport and the rapid maturation of autonomous vehicle technology have brought renewed attention to demand-responsive transport operated by electric autonomous fleets. In the Electric Autonomous Dial-A-Ride Problem (E-ADARP), a homogeneous fleet of electric autonomous vehicles is routed to serve a set of passenger requests, each defined by pickup and drop-off locations, time windows, and a maximum user ride time. Minimum state-of-charge constraints may require detours to charging stops, where partial charging is allowed. The aim is to minimize a weighted combination of total routing costs and excess user ride time. We extend a compact event-based mixed-integer linear programming formulation for the E-ADARP, in which vehicle capacity, passenger pairing, and precedence constraints are encoded implicitly in the graph structure, along two practically motivated dimensions. First, we replace the conventional linear charging model with a nonlinear charging function, which is embedded in the event-based model through a piecewise linear approximation. We compare different problem formulations and analyze the impact of considering non-linear charging on the feasibility of available solutions under linear charging assumptions. Second, we adopt a congested street network setting to capture the stochastic nature of urban travel. Speed scenarios are generated to be network-consistent, i.e., correlated across road links. The resulting stochastic E-ADARP is formulated as a two-stage stochastic program, penalizing ride time and time window violations and allowing for scenario-dependent detours to charging stops as a recourse action. First results point to potential as well as limitations of the event-based approach.