Anticipation of Stochastic Travel Times Matrices Changes for Dynamic Vehicle Routing Induced by Emission-Driven Traffic Management

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Abstract

Many European cities have experienced an increase in congestion and pollution through the growth of urban traffic. To reduce pollution and to meet a new pollution limiting EU regulation, cities can install dynamic emission-driven traffic management systems (TMs). If the air pollution at a supervised pollution hotspots exceeds a threshold, the TMs changes settings for traffic infrastructure, e.g. traffic lights to reduce traffic around the particular hotspot. The coordination of settings for a hotspot exceedance is called a "strategy". Each strategy changes the traffic flows in the city and has an individual traffic situation.
Courier, express and parcel services (CEP) route vehicles to deliver parcels to urban customers and are therefore influenced by traffic management decisions. For CEP's delivery routing, a TMs strategy induces a set of travel times between the customers. This research looks into the possibility of improving CEP routing efficiency, if information about the strategy can be acquired from a cooperative traffic management. A dynamic adaption of the routing to the new set of travel times and anticipation of future strategy changes is necessary for cost-efficient deliveries.
The test instance for this VRP is modeled after the emission-driven traffic management system of Brunswick with real life emission data. To solve this problem, we introduce a rollout algorithm, which is combined with a commercial solver. The anticipation of future traffic strategy is done by sampling future emission developments. Results show that anticipation and a cooperative traffic management is beneficial for CEP and leads to more efficient routes.

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