Stochastic and Dynamic Pickup and Delivery Problem with Time-Dependent travel times

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Abstract. We study the delivery problem where a third-party logistics (3PL) company receives the customer requests stochastically throughout the day and dispatches these requests to available vehicles, using a fleet of dedicated vehicles and a fleet of crowd-sourced vehicles. The same provider can manage the delivery of items of different nature, both perishable and non-food items. We model the problem as a Markov decision process (MDP) over finite, discrete-time horizon. We consider two aspects of the logistical design of a delivery system: cost and service. As labor costs represent a major component of operating costs, we consider a formulation that prioritizes these. Along the service dimension, we focus on on-time delivery with particular modeling of time-dependent travel times. To address these challenges, we present a parametrizable cost function approximation (CFA) that assigns the request to the vehicles with the aim of saving time and of allowing more flexibility in the response to the new requests. To benchmark our solution mechanisms, we develop a myopic approach based on the adaptive large neighborhood search (ALNS) heuristic of Ropke and Pisinger [2006]. Preliminary computational results are presented for some instances from Ulmer et al. [2020].

Keywords: Stochastic and Dynamic Pickup-and-Delivery Problem; Time-Dependent Travel Times; Approximate Dynamic Programming;

References

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