Anticipatory Route Selection
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Abstract

Mobile communication technologies enable communication between dispatchers and drivers and hence can enable fleet management based on real-time information. We assume that such communication capability exists for a single pick-up and delivery vehicle and that we know the likelihood, as a function of time, that each of the vehicle’s potential customers will make a pick-up request. We then model and analyze the problem of constructing a minimum expected total cost route from an origin to a destination that anticipates and then responds to service requests, if they occur, while the vehicle is en route. We model this problem as a Markov decision process and present several structured results associated with the optimal expected cost-to-go function and an optimal policy for route construction. We illustrate the behavior of an optimal policy with several numerical examples and demonstrate the superiority of an optimal anticipatory policy, relative to a route design approach that reflects the reactive nature of current routing procedures for less-than-truckload pick-up and delivery.

Key words: Vehicle routing, real-time decision making, Markov decision processes.