Fairness Aspects of Selective Customer Acceptance Mechanisms in Dynamic Vehicle Routing

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Abstract

In many logistics service applications, customers request service dynamically during the service time horizon and may be served on the same day. For the service provider, these requests are stochastic and due to working hour limitations, usually not all customer requests can be accepted for same-day service. The problem to be discussed in this presentation is a dynamic vehicle routing problem with stochastic customer requests. Decisions are made about service acceptances and routing. The objective is to maximize the expected number of customers accepted for same-day service. Solution approaches can be classified as being either selective regarding the customer acceptance or as being non-selective. Non-selective approaches accept every feasible request. Selective approaches may decline same-day service although an acceptance would be feasible to save time for further acceptances later and enable more overall acceptances. In this presentation, we analyze the impact of the customer acceptance mechanism on the objective function and the coefficient of variation of rejection probabilities ("unfairness") within the service area. To this end, we model the underlying dynamic vehicle routing problem with stochastic requests as a Markov decision process and compare two solution methods. While the non-selective approach accepts requests if they can be feasibly inserted in the tour, the selective approach applies methods of approximate dynamic programming to anticipate future requests and the impact of current decisions. We show that selective customer acceptance mechanisms improve the objective value at the cost of a higher unfairness compared to non-selective customer acceptance mechanisms.

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