Wang, Yong; He, Wen; Van Hui, Yer; Leung, Lawrence C.

A two-echelon neighborhood search algorithm for a forwarder’s job assignment in a multi-agent logistics network.


Summary: Freight forwarders plan shipping logistics for client shipments based on available transport networks where logistics agents move commodities from origins to destinations. Forwarders typically have the option of assigning shipments to in-house agents or to sub-contracting agents. When making such assignment decisions, consolidation of shipments is a plausible cost-saving consideration. In this paper, we consider assignments of shipments to agents as well as shipment routing choices on a network. We formulate the problem as a nonlinear program where unit costs charged by agents are described as nonlinear functions. The special case with piecewise constant unit costs is formulated as a mixed integer program. We then develop a two-echelon heuristic algorithm to solve the nonlinear program. The upper echelon of the heuristic assigns shipments to suitable agents by adopting a set of neighborhood policies, while the lower echelon improves the routing plan by consolidating jobs along (sub) paths. The feasibility and validity of the heuristic are examined based on randomly generated instances. Computational results show that the heuristic is able to obtain good solutions in manageable computation time. The effects of network density and iteration limits on the performance of the heuristic are also characterized.

Keywords: transport logistics network; multi-agents; job assignment; neighborhood search algorithm; job consolidation

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