

Multi-objective optimization for delivering perishable products with mixed time windows

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ABSTRACT

Perishable products generally have a short shelf life, and the freshness often depends on the postharvest time. The freshness of perishable products can ensure better customer satisfaction. Owing to the deterioration of perishable goods, the complexity of the corresponding vehicle routing problem (VRP) increases, because time delay will lead to serious costs. In this study, we are concerned with not only time-sensitive spoilage rates with mixed time windows, but also the delay costs in delivering perishable products. This study proposes a multi-objective VRP optimization model with mixed time windows and perishability (MO-VRPMTW-P) to minimize the distribution costs and maximize the freshness of perishable products. Then, in view of the fresh products orders space and time characteristics, we propose a heuristic algorithm (ST-VNSGA) composed of a variable neighbourhood search (VNS) method and a genetic algorithm (GA) considering the spatio-temporal (ST) distance to solve the complex multi-objective problem. The solution algorithms are evaluated through a series of experiments. We illustrate the performance and efficiency comparisons of ST-VNSGA with the method without spatio-temporal strategy algorithm and NSGA-II algorithm. It is demonstrated that the proposed ST-VNSGA algorithm can lead to a substantial decrease in the computation time and major improvements in solutions quality, thus revealing the efficiency of considering the spatio-temporal strategy with mixed time windows.

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