
Revisiting the Balanced VRP: A Comparative Study of Alternative Workload Metrics

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Abstract

Real-life optimization problems often have conflicting objectives, and so there has been growing interest in multi-objective models and methods for tackling such problems. Objectives concerning equitable workload allocation and/or balanced resource utilization in VRP contexts have been considered by researchers and practitioners alike. Despite many practical applications reported in the literature, there has been only limited discussion about relevant metrics for modeling workload, and about functions for measuring its equitable allocation. Based on a recent survey and analysis, we observed that the theoretical literature has thus far focused almost exclusively on a narrow and problematic definition of equitable workload, modeled by the range of tour lengths. Yet papers reporting on applications include interesting cases in which other definitions of workload are more appropriate, e.g. the number of stops in the small package delivery sector, service times in service technician routing, and load/demand in groceries delivery. Various equity functions have also been proposed besides the range of workloads.

In this contribution we discuss a comparative study of alternative workload metrics beyond tour length. We also consider the impact of different equity functions for measuring balanced allocation of these workloads. By analyzing Pareto-optimal solution sets of bi-objective VRP models, we provide insights into how the choice of workload metric and equity function affects the trade-off solutions identified. Our observations also generalize to constraint-based approaches. We hope that by placing more emphasis on broader definitions of workload and equity, existing theory and methodology can be generalized to a wider range of balanced VRPs.

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