

VORTRAG

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DeProLo

Large-scale Logistic Problems Decomposition

Philippe Waelti, [†]Eric D. Taillard, Laura E. Raileanu
School of Business and Engineering Vaud, SiM-TIC Institute, IICT Institute, Switzerland
{philippe.waelti,eric.taillard,laura.raileanu} at heig-vd.ch

Problematic

The practical approach for solving large logistic problems is to decompose them into subproblems, in order to decrease the complexity of their resolution. To carry out these decompositions, relatively elaborate methods should be used in order to obtain compact and well structured subproblems. The DeProLo project has been realized to improve our competences in this context. A convivial and robust software to solve problems of classification has been developed. This has been used thereafter for the resolution of large logistic problems.

The p-Median clustering problem

The p-Median clustering problem is to find p centers among a given set of n entities such that the sum of the distances between entities to their nearest center is minimal. When trying to solve large-scale problems instances, basic heuristic methods are quickly insufficient and decomposition methods like PopMusic metaheuristic have been introduced in order to reduce complexity without significant loss of solutions quality. Previous work in this domain have shown that the PopMusic framework is very efficient when used in conjunction with efficient heuristic.

p-Median decomposition and the Vehicle Routing Problem

The Vehicle Routing Problem (VRP) is a well-known distribution problem that often arises in real-life situations. When large-scale instances must be solved, it is required to find rapidly an initial solution

that is appropriately built before running specialized heuristics or metaheuristics. A clustering problem with capacity constraints is solved to find an initial solution to large VRPs with good properties. Basically, the initial VRP problem is treated as a clustering problem with additional Lagrangian relaxations to add inherited VRP constraints like capacities to the p-Median problem definition. In a first phase, we create p clusters. Each cluster contains a subset of customers, asking for a total demand q and served by a subset of vehicle with a total capacity Q . According to these values, we can compute Lagrangian coefficient in relation with the constraint violation and introduce this coefficient in the distance measure between customers. Method will iterate until no more cluster introduce constraint violation (or maximum iteration reached). Then, each cluster is solved independently, using efficient methods.

Results and perspectives

Based on real VRP datas from the Department of Business Administration of the University of Vienna, a cluster decomposition of the given problem has been successfully realized using a p-Median solver. Tests on some large well-known VRP instances have also shown that efficient results may be obtained in good computation times.