LITHUANIAN COMPUTER SOCIETY
VILNIUS UNIVERSITY INSTITUTE OF DATA SCIENCE AND DIGITAL TECHNOLOGIES
LITHUANIAN ACADEMY OF SCIENCES

14th Conference on

DATA ANALYSIS METHODS
for Software Systems

November 30 – December 2, 2023

Druskininkai, Lithuania, Hotel "Europa Royale"
https://www.mii.lt/DAMSS

VILNIUS UNIVERSITY PRESS
Vilnius, 2023

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https://doi.org/10.15388/DAMSS.14.2023
ISBN 978-609-07-0985-6 (digital PDF)

Population-Based Algorithm for Discrete Facility Location With Ranking of Candidate Locations

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Facility location problems are mathematical optimization problems that involve finding the best locations for facilities (e.g., factories, warehouses, stores) to serve customers within a given geographic area. The goal is typically to minimize costs, maximize efficiency, or optimize other objectives. Facility location problems can vary in several ways, including customer behavior rules, the type of location space, which can be continuous or discrete, constraints on locations for facilities, and much more. These variations impact the complexity of the problem and the appropriate solution methods.

This research is focused on the discrete competitive facility location problem for an entering firm, which is important to firms that are entering a market and need to choose optimal locations for their facilities from a predefined set of candidate locations. Importantly, the firm must consider. The goal is to maximize the market share obtained by the new locations, considering the competition from other facilities owned by other firms in the market.

A new heuristic algorithm based on the ranking of location candidates and handling of the population of the best solutions found so far has been developed and applied to solve this facility location problem. The algorithm extends its precursor, based on a single-agent random search with the ranking of candidate locations, by including strategies to handle the population of the best solutions found so far and new strategies for ranking candidate locations, considering features of the solutions in the population.

The developed algorithm has been experimentally investigated by solving the discrete competitive facility location problem with the Pareto-Huff customers behavior rule, considering that the whole buying power of customers is proportionally divided among facilities that are Pareto optimal by distance and attractiveness.