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Generic Pareto local search metaheuristic for optimization of targeted offers in a bi-objective direct marketing campaign

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Abstract

Cross-selling campaigns seek to offer the right products to the set of customers with the goal of maximizing expected profit, while, at the same time, respecting the purchasing constraints set by investors. In this context, a bi-objective version of this NP-Hard problem is approached in this paper, aiming at maximizing both the promotion campaign total profit and the risk-adjusted return, which is estimated with the reward-to-variability ratio known as Sharpe ratio. Given the combinatorial nature of the problem and the large volume of data, heuristic methods are the most common used techniques. A Greedy Randomized Neighborhood Structure is also designed, including the characteristics of a neighborhood exploration strategy together with a Greedy Randomized Constructive technique, which is embedded in a multi-objective local search metaheuristic. The latter combines the power of neighborhood exploration by using a Pareto Local Search with Variable Neighborhood Search. Sets of non-dominated solutions obtained by the proposed method are described and analyzed for a number of problem instances.

Keywords: Direct marketing campaign, Sharpe ratio, Cross-selling, Metaheuristics, Multi-objective optimization, Pareto Local Search

1. Introduction

In this paper, we consider a bi-objective metaheuristic for choosing sets of clients in direct-marketing campaigns. We call this problem the Targeted Offers Problem in Direct Marketing (TOPDM) promotional campaigns. Solving the proposed bi-objective problem involves searching for the sets of customers that maximize both the

promotion campaign profit and the risk-adjusted return (reward-to-variability index). Candidate solutions should respect campaign operational requirements related to the investors' minimum desired profit, available budget, viability of the product offers and customer constraints.

Since there is uncertainty concerning whether a client will positively react to a new offer, a low-risk cross-selling campaign is sought. In the examples in this paper, we consider instances in which customers with high expected profits are the ones with higher volatility. To handle the reward-to-

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