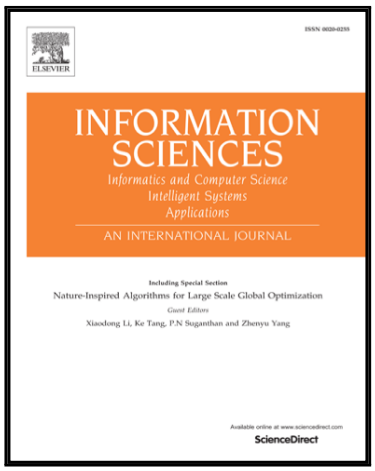

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Efficiently Solving the Traveling Thief Problem using Hill Climbing and Simulated Annealing

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Abstract

Many real-world problems are composed of multiple interacting sub-problems. However, few investigations have been carried out to look into tackling problems from a metaheuristics perspective. The Traveling Thief Problem (TTP) is a new NP-hard problem with two interdependent components that aim to provide a benchmark model to better represent this category of problems. In this paper, TTP is investigated theoretically and empirically. Two algorithms based on a 2-OPT steepest ascent hill climbing algorithm and the simulated annealing metaheuristic named *CS2SA** and *CS2SA-R* are proposed to solve the problem. The obtained results show that the proposed algorithms are efficient for many TTP instances of different sizes and properties and are very competitive in comparison with two of the best-known state-of-the-art algorithms.

Keywords: Interdependence, Combinatorial Optimization, Large-scale Optimization, Traveling Thief Problem, Simulated Annealing, Local Search

1. Introduction

Tackling real-world optimization problems is often more complex than solving the Traveling Salesman Problem or finding the chromatic number of a graph. Most real-world problems are constrained and often made of multiple sub-problems which on their own are hard to solve. These problems have the following properties:

- **Composition:** The overall problem is composed of multiple sub-problems, such as each sub-problem being hard to solve on its own.
- **Interdependence:** The sub-problems are related to each other. Therefore, they cannot be solved in isolation.

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