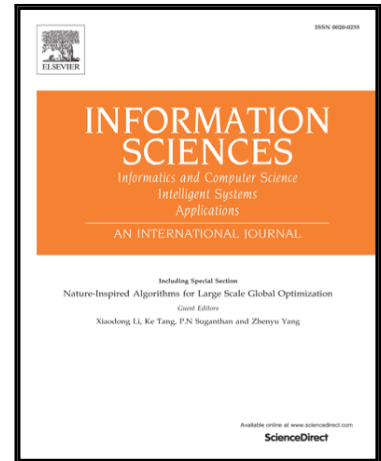


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Enhanced Discrete Bacterial Memetic Evolutionary Algorithm - An efficacious metaheuristic for the Traveling Salesman optimization

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Enhanced Discrete Bacterial Memetic Evolutionary Algorithm - An efficacious metaheuristic for the Traveling Salesman optimization

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Abstract— In this paper we present a novel universal metaheuristic, Discrete Bacterial Memetic Evolutionary Algorithm (DBMEA), which is based on the combination of the Bacterial Evolutionary Algorithm and local search techniques, used for solving NP-hard optimization problems. The algorithm was tested on a series of symmetric Traveling Salesman Problems (TSP) and Traveling Salesman Problem with time windows (TSPTW) benchmarks.

The size of the symmetric TSP benchmarks went up to 5 000 cities. In all cases the DBMEA algorithm produced optimal or near-optimal solutions and the difference from the known best values was within 0.16%. While for large size problems it was much faster than the Concorde solver, it was found to be slower compared to the Helsgaun-Lin-Kernighan heuristic, which is the most efficient TSP solver method.

With some slight modifications the same algorithm was also tested on TSP with time windows (TSPTW) benchmark instances. In most cases the DBMEA procedure found the known best solutions, and it was again the second fastest method compared with the state-of-the-art techniques for the TSPTW.

DBMEA is called efficacious because it is a universal method. It can be efficiently applied to various NP-hard optimization problems and, as in all cases, it results in the optimal or a very near-optimal solutions, while its runtime is very predictable in terms of the size of the problem, and the topology of the instance does not affect its runtime significantly. Even though heuristics developed for a particular type of problem might perform better for that restricted class, our novel method proposed here is universally applicable and may be deployed successfully for optimizing other discreet NP-hard graph search and optimization problems as well.

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