Multi-objective Record-to-Record Travel (MRRT) Algorithm for solving Multi-objective Optimization Problems

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Abstract

Multi-objective optimization is used to support multiple criteria decision making where trade-offs between two or more conflicting objectives need to be considered. To solve these problems, various multi-objective metaheuristic methods have been developed, but the balance between computation efficiency and solution quality remains as a challenging issue. Moreover, the complex algorithm structure and excessive number of parameters make many metaheuristics difficult to adapt to different problems. In this study, we develop a simple-structured metaheuristic called Multi-objective Record-to-Record Travel (MRRT) that outputs high-quality solutions with relatively low computation complexity. We examine the performance of the algorithm on a series of benchmark testing problems and compare the solutions with other metaheuristics from previous studies. By evaluating performance indicators including generational distance, inverted generational distance, spread, and spacing, we demonstrate that MRRT has strong capability in approximating the true Pareto fronts in terms of closeness, coverage, and solution distribution. In particular, we find that as the test problem becomes more difficult, the MRRT algorithm performs even more competitively (i.e., equivalent or better) when compared to other existing multi-objective metaheuristics. Across multiple experiment runs, MRRT also shows consistency in performance that outperforms many multi-objective metaheuristics. All these attributes make MRRT a very promising, competitive metaheuristic for further development and real-life applications.

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