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Approximate non-dominated sorting for evolutionary many-objective optimization

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Abstract

Non-dominated sorting has widely been adopted and shown to be very effective in dominance based evolutionary multi-objective optimization where the number of objectives is two or three. In dealing with many-objective optimization problems, where the number of objectives is more than three, however, the effectiveness of dominance based evolutionary algorithms will seriously degrade and the computational complexity of non-dominated sorting will considerably increase. In this paper, we propose an approximate non-dominated sorting algorithm for many-objective optimization, where the dominance relationship between two solutions is determined by a maximum of three objective comparisons on top of a sorted population according to one of the objectives. The time complexity of the proposed approximate sorting is independent of the number of objectives, which significantly enhances the time efficiency, in particular when the number of objectives is large. To examine the influence of inaccurate sorting on the search performance, the proposed approximate sorting method is embedded in three popular dominance based evolutionary many-objective optimization algorithms. Our experimental results on 16 widely used many-objective optimization benchmark problems suggest

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