香港浸會大學理學院
HKBU Faculty of Science

DEPARTMENT OF COMPUTER SCIENCE

PhD Degree Oral Presentation

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Venue:	RRS732, Sir Run Run Shaw Bldg., HSH Campus

"Many Objective Optimization: Objective Reduction and Weight Design"

Abstract

Many-objective optimization problems (MaOPs), in which the number of objectives is greater than three, are common in many applications, and have drawn many scholars' attention. Evolutionary multiobjective optimization algorithms (EMOAs) have been successfully applied to solve bi- and tri-objective optimization problems. However, the performances of most existing EMOAs generally deteriorate over the number of objectives. This thesis presents a weight design method to modify classical decomposition-based EMOAs, and a novel objective extraction method for solving MaOPs.

The decomposition-based EMO algorithms have demonstrated the effectiveness in dealing with MaOPs. Nevertheless, for all of such algorithms, one needs to design the weight vectors, which have a great effect on the performance of the algorithms. Especially, when the Pareto front of the problem is incomplete, these algorithms cannot obtain a set of uniformly distributed solutions using the conventional weight design methods. Thus, this thesis proposes a novel weight design method based on self-organizing map for decomposition-based EMOAs, then integrates it into an EMOA for dealing with MaOPs.

It is desirable to reduce the number of the objectives for the MaOPs with redundant objectives. However, the Pareto solution of the reduced MaOP obtained by most of the existing objective reduction methods based on objective selection may not be the Pareto solution of the original MaOP. This thesis proposes an objective extraction method for MaOPs. It formulates the reduced objective as a linear combination of the original objectives to maximize the conflict between the reduced objectives. Subsequently, the Pareto solution of the reduced MaOP obtained by the proposed algorithm is that of the original MaOP, and the proposed algorithm can thus preserve the dominance structure as much as possible.

In order to make it easier to compare the performance of the objective reduction methods, this thesis presents a direct performance metric featuring the simplicity and usability of the objective reduction algorithms. Meanwhile, we propose a novel framework for many-objective test problems, which features both simple and complicated Pareto set shape, and is scalable in terms of the numbers of the objectives and the essential objectives. Also, we can control the importance of essential objectives. The numerical studies show the effectiveness and robustness of the proposed approaches.

***** ALL INTERESTED ARE WELCOME *****