Multiobjective Evolutionary Computation, Decomposition and Regularity

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Many real world optimization problems have multiple conflicting objectives by nature. Unlike a single optimization problem, a multiobjective optimization problem has a set of Pareto optimal solutions (Pareto front) which could be required by a decision maker to make her final decision. Evolutionary algorithms are able to generate an approximation to the Pareto front in a single run, and many traditional optimization methods have been also developed for dealing with multiple objectives. Although there is not much work that has been done, combination of evolutionary algorithms and traditional optimization methods should be a next generation multiobjective optimization solver. Decomposition techniques have been well used and studied in traditional multiobjective optimization. It is well known that the Pareto optimal solution set of a continuous multiobjective problem often exhibits some regularity. In this talk, I will describe two multiobjective evolutionary algorithms: MOEA/D and RM-MEDA. Both of them borrow ideas from traditional optimization. MOEA/D decomposes a multiobjective problem into a number of single objective subproblems or simple multiobjective subproblems, and then solves these subproblems in a collaborative manner. RM-MEDA makes use of the regularity property to model the distribution of Pareto optimal solutions in the search space, and then generates new solutions from the model thus built. I will also outline some possible research issues in multiobjective evolutionary computation.

Hybrid Evolutionary Algorithms

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Evolutionary algorithms have been accepted as a major optimization method. However, evolutionary algorithms alone cannot solve hard optimization problems very efficiently. Over the last two decades, much effort has been made to hybridize evolutionary algorithms with other techniques. In this talk, I will mainly talk about some hybrid evolutionary methods developed in my group. These methods include orthogonal genetic algorithm, guided mutation, evolutionary algorithm with two different local search methods, and a hybrid method for problems with very complicated data structure.