Stable Matching-Based Selection in Evolutionary Multiobjective Optimization

Multiobjective problems are always aroused in our daily life in that we have to make decisions based on many different objectives. Recently, Multiobjective evolutionary algorithm based on decomposition (MOEA/D) decomposes a multiobjective optimization problem into a set of scalar optimization subproblems and optimizes them in a collaborative manner. This approach has been proved to be the state of the art method in solving multi-objective/many objective problems. In MOEA/D, subproblems and solutions are modelled as two sets of agents for matching. Thus, this kind of selection of promising solutions for subproblems can be regarded as a matching between subproblems and solutions. This problem could be viewed as a Stable matching problem as for school admission, hospital residents problems. Also, it can effectively resolve conflicts of interests among selfish agents in the economic market. In this talk, I will advocate the use of a simple and effective stable matching (STM) model to coordinate the selection process in MOEA/D. In this model, subproblem agents can express their preferences over the solution agents, and vice versa. The stable outcome produced by the STM model matches each subproblem with one single solution, and it tradeoffs convergence and diversity of the evolutionary search. In addition, a two-level stable matching-based selection is proposed to further guarantee the diversity of the population. More specifically, the first level of stable matching only matches a solution to one of its most preferred subproblems and the second level of stable matching is responsible for matching the solutions to the remaining subproblems. Experimental studies demonstrate that the proposed selection scheme is effective and competitive comparing to other state-of-the-art selection schemes for MOEA/D.

Adaptive Operator Selection with Bandits for Multiobjective Evolutionary Algorithm Based on Decomposition

Evolutionary Algorithms (EAs) are stochastic optimization algorithms inspired by the Darwinian evolution theory. EAs have already shown their efficiency on many application domains. However, the performance of EAs is very sensitive to the settings of their intrinsic parameters, and even worse, there are no general guidelines for an efficient setting. The paradigm, referred to as Adaptive Operator Selection (AOS), provides the on-line autonomous control of the operator that should be applied at each instant of the search, i.e., while solving the problem. This paper proposes a bandit based AOS method, Fitness-Rate-Rank-based Multi-Armed Bandit (FRRMAB). In order to track the dynamics of the search process, it uses a sliding window to record the recent fitness improvement rates achieved by the operators, while employing a decaying mechanism to increase the selection probability of the best operator. Not much work has been done on AOS in multiobjective evolutionary computation since it is very difficult to measure the fitness improvements quantitatively in most Pareto dominance based multiobjective evolutionary algorithms. Multiobjective Evolutionary Algorithm based on Decomposition (MOEA/D) decomposes a multiobjective optimization problem into a number of scalar optimization subproblems and optimizes them simultaneously. Thus, it is natural and feasible to use AOS in MOEA/D. We investigate several important issues on using FRRMAB in MOEA/D. Our experimental results demonstrate that FRRMAB is robust and its operator selection is reasonable. Comparison experiments also indicate that FRRMAB can significantly improve the performance of MOEA/D.