

Research on some evolutionary computation algorithms and their application to multi-objective optimization problems

Le Ngoc Ha

Abstract: This thesis investigates several evolutionary computation algorithms and their application to multi-objective optimization problems. As real-world engineering and scientific challenges often involve conflicting objectives, traditional single-objective methods are insufficient. This research focuses on enhancing the performance of evolutionary algorithms, specifically Genetic Algorithms and Particle Swarm Optimization, to effectively handle Pareto-based optimization. Key algorithmic improvements are proposed to address critical issues such as maintaining population diversity, ensuring convergence to the true Pareto front, and achieving a well-distributed set of non-dominated solutions. The study implements and compares various state-of-the-art multi-objective evolutionary algorithms (MOEAs), including NSGA-II and MOPSO, on a suite of standard benchmark functions. Experimental results demonstrate the effectiveness of the proposed modifications in terms of convergence speed and solution quality. Furthermore, the applicability of these algorithms is validated through their successful deployment on a representative engineering design problem, confirming their practical utility in solving complex multi-objective optimization tasks.

Keywords: Evolutionary algorithm, multi-objective optimization, evolutionary computation, optimization problem