Hindawi Publishing Corporation
Applied Computational Intelligence and Soft Computing
Volume 2010, Article ID 360796, 2 pages
doi:10.1155/2010/360796

Editorial

Theory and Applications of Evolutionary Computation

Tzung-Pei Hong,[1] Chuan-Kang Ting,[2] and Oliver Kramer[3]

[1] *Department of Computer Science and Information Engineering, National University of Kaohsiung, Kaohsiung 811, Taiwan*
[2] *Department of Computer Science and Information Engineering, National Chung Cheng University, Chia-Yi 621, Taiwan*
[3] *Department of Computer Science, Dortmund University of Technology, 44221 Dortmund, Germany*

Correspondence should be addressed to Tzung-Pei Hong, tphong@nuk.edu.tw

Received 25 May 2010; Accepted 25 May 2010

Evolutionary computation is a powerful problem solver inspired from natural evolution. It models the essential elements of biological evolution and explores the solution space by gene inheritance, mutation, and selection of the fittest candidate solutions. The dialects of evolutionary algorithms include genetic algorithms, evolutionary strategies, genetic programming, particle swarm optimization, ant colony optimization, artificial immune systems, estimation of distribution algorithms, differential evolution, and memetic algorithms. These evolutionary methods have proven their success on various hard and complex optimization problems.

This *special issue* on Theory and Applications of Evolutionary Computation is dedicated to latest developments in the area of evolutionary computation. Eight articles from researchers around the world contribute to further steps into the understanding and application of evolutionary computation. The special issue covers a broad bandwidth of research, from theoretical investigations to real-world applications, and comprises articles in active research areas like multiobjective and constrained optimization.

Toward improving evolutionary algorithms based on theoretical finding, the paper by Pepper investigates the selection efficiency of threshold selection, stochastic proportionate selection, and deterministic proportionate selection. The next paper, by Browne and dos Santos, introduces flexible adaptive genome representations for gene expression programming that allow parallelization and maintenance of population diversity. The ability of parallelization is the most important advantage of evolutionary approaches in comparison to many other optimization heuristics.

In the applications of evolutionary computation, the paper by Kawabe presents an evolutionary controller for the receding horizon control problem—an advanced method of process control that has been used in the process industries such as chemical plants. The simulation results prove that stochastic optimizers are strong problem solvers for complex practical problems. The paper by Shi et al. devises a twin-screw coded evolutionary algorithm for the multilevel production scheduling problem. The comparative study shows that the proposed method outperforms genetic algorithm and tabu search in solution quality. The paper by De Falco et al. proposes a distributed differential evolution algorithm to address the multisite grip mapping problem. According to the experimental results, this method can minimize the consumption of grid resources.

This special issue includes two review papers. The article by Kramer gives a survey of constraint handling techniques that have developed in the field of evolution strategies in the last years, in particular concentrating on the prevention of premature step size stagnation that can often be observed at the boundary of the infeasible solution space. In addition, the work by Gong et al. gives a comprehensive overview of evolutionary gait optimization. The authors reviewed several success stories of evolutionary methods in evolving programs for legged robots and concluded that the domain is still a fruitful field of research.

We thank all the authors and reviewers for their great contributions to this special issue. We would also like to thank Professor Hsien-Chung Wu, the editor-in-chief, for his full support.

Tzung-Pei Hong
Chuan-Kang Ting
Oliver Kramer