PREFACE

Evolutionary computation is an amazingly effective optimization paradigm, comprising a collection of stochastic techniques whose functioning is loosely based on metaphors of biological processes. Evolutionary algorithms (EAs) began their existence during the late 1960s and early 1970s. In these years, scientists from different parts of the world began almost simultaneously the task of putting Nature at work in algorithmics. The existence of these different primordial sources originated the rise of three major algorithmic families, namely, evolutionary programming, genetic algorithms, and evolution strategies. During the subsequent years, new models were defined, e.g., genetic programming, memetic algorithms, etc., and at the same time the boundaries between the different families became increasingly blurred.

In general, an EA performs its search by maintaining a pool of tentative solutions for the problem at hand. This pool is subject to processes of selection (promising solutions are picked from the pool), reproduction (new solutions are created by modifying selected solutions), and replacement (the pool is updated by replacing some existing solutions by the newly created ones). A fitness function measuring the goodness of solutions is used to drive the process. The algorithm relies on achieving some kind of balance between the exploration of new regions of the search space and the exploitation of regions known to be promising, so as to minimize the computational effort for finding the desired (optimal) solution. EAs constitute nowadays a killer approach for dealing with problems otherwise hard to solve, such as NP-hard combinatorial optimization problems, continuous-parameter optimization, etc. In this sense, the papers published in this special issue on evolutionary computation contain applications and theoretical results dealing with both discrete and continuous optimization problems.

Starting with papers focusing on theory and/or algorithm-oriented research, Karcz-Dulęba studies the phenotypic evolution and convergence rate of a certain class of continuous EAs, characterized as discrete dynamical systems; Obuchowicz and Prędki introduce a new type of mutation (Symmetric-Stable Mutation) for the continuous evolutionary algorithm. Such a mutation helps to avoid the "surrounding effect" improving offspring distribution in multidimensional domains; Alba, Luna and Nebro deliver some interesting new ideas concerning multi-deme, parallel algorithms for performing an effective global search in continuous domains; Miquélez, Bengoetxea and Larrañaga propose the hybridization of EAs with Bayesian classifiers in order to direct the search, and improve the performance of the algorithm on combinatorial optimization problems; Graván and Lahoz-Beltra analyze the evolution of morphogenetic fields using genetic algorithms and cellular automata.

As to application-oriented papers, Brabazon and O'Neill propose a novel data-driven, genetic computation model applied as an induction tool, inspired by the biological gene-to-protein mapping process; Lopes and Weinert introduce a system based on gene-expression programming for symbolic regression, and apply it to several identification problems; Julstrom shows an effective encoding for a constrained discrete problem (the Leaf- Constrained Minimum Spanning Tree Problem), as well as new genetic operators that generate only admissible chromosomes; Dridi and Kacem treat the regulation problem of an urban transportation network as both unconstrained and constrained (in the case of limited vehicle capacity) discrete optimization problems. A new encoding and specialized genetic operators are proposed; Balci and Valenzuela propose a hybrid of Particle Swarm Optimization and the Lagrangean relaxation for the scheduling of electric power generators; finally, Matteucci and Spadoni tackle model selection problems using a genetic algorithm with a Bayesian fitness function, with application to the evolution of rich neural networks.

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