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Preface

Genetic and Evolutionary Computation

The Genetic and Evolutionary Computation Conference (GECCO) of 2012 took place in Philadelphia, USA from 7th to 11th July. The papers in this Special Issue are based on those presented as part of the Theory Track at that conference. All the papers have been substantially extended and re-written, and contribute significantly new material.

The papers cover a broad range of current interests in the theoretical analysis of Evolutionary Algorithms, including run-time analysis, genetic operators, landscapes, genetic programming, and black box complexity.

The first two papers are in the classic run-time analysis area. "On the Runtime Analysis of the Simple Genetic Algorithm" by Oliveto and Witt looks at the problems arising from the use of proportional selection for population-based algorithms. The effect of the selection–mutation balance makes it hard for the optimum to be discovered, and this effect is examined rigorously. "The Choice of the Offspring Population Size in the $(1, \lambda)$ Evolutionary Algorithm" by Rowe and Sudholt also considers a population, but examines the effect of size when using a 'comma' type of strategy. Improvements on previous results are given, primarily through use of better drift theorems.

A completely novel view of run-time analysis is introduced in "Performance Analysis of Randomised Search Heuristics Operating with a Fixed Budget" by Jansen and Zarges. Here the emphasis is not on how long it might take to find the optimal solution, but rather what is the best that you can do given a fixed budget of evaluations.

The relationship between fitness landscapes, operators and the algorithms that use them has been of interest for some time. "The Component Model for Elementary Landscapes and Partial Neighborhoods" by Whitley, Sutton, Ochoa and Chicano revisits this concept and considerably extends what is known about how neighborhoods (including partial ones) can be efficiently evaluated using a landscape analysis. "Exact Computation of the Expectation Surfaces for Uniform Crossover along with Bit-flip Mutation", by Chicano, Whitley and Alba, looks in detail at how the effect on fitness of applying genetic operators can be calculated efficiently.

Rigorous results in the area of Genetic Programming are few and far between. "The Max Problem Revisited: The Importance of Mutation in Genetic Programming" by Kötzing, Sutton, Neumann and O'Reilly provides an important step forward by looking at the effectiveness of mutation-based GP algorithms in solving the Max-problem, in which ones seeks a program that returns the largest possible output value from a given input set, with limited arithmetic operators.

Finally, taking a more abstract approach, the field of Black Box complexity looks at how difficult black box optimization problems are in principle, under various constraints. "Reducing the Arity in Unbiased Black-Box Complexity", by Doerr and Winzen, considers the effect of requiring the algorithmic operators to apply to a limited number of previously seen search points (that is, the 'arity' of the operators are restricted) such as mutation (arity-1) and crossover (arity-2). It is shown how the Black Box complexity of OneMax is affected by such restrictions.

The Guest Editors would like to thank the authors for their considerable effort in producing these papers, which we believe make a significant contribution to the field. We also gratefully acknowledge the hard work of all the reviewers in ensuring the high quality of the finished work.

Tobias Friedrich
Jonathan Rowe

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