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EDITORIAL

Editorial

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This special issue of Algorithmica contains selected articles from the "Theory" track at the Genetic and Evolutionary Computation Conference (GECCO) 2020. All conference versions have been significantly extended and the articles published in this special issue have been rigorously reviewed by experts in the area of theory of evolutionary computation. We hope that the readers will enjoy reading these articles and we provide a short summary for each of them in the following.

A recent development is the $(1 + (\lambda, \lambda))$ EA, which utilizes hidden information from inferior solutions. It had been shown to give substantial runtime improvements for unimodal benchmarks, in which hillclimbing is required. The first article of this issue, "A Rigorous Runtime Analysis of the $(1 + (\lambda, \lambda))$ GA on Jump Functions" by Antipov, Doerr and Karavaev shows that the same ideas can also help in multimodal optimization problems, in which escape from local optima is important.

The second paper, "Tight Bounds on the Expected Runtime of a Standard Steady State Genetic Algorithm" by Oliveto, Sudholt and Witt, proves tight lower bounds on a steady-state genetic algorithm, the $(2+1)$ GA. This shows for the first time rigorously that larger population sizes improves the runtime of the standard GA on the most basic benchmark function OneMax.

In "Does Comma Selection Help to Cope with Local Optima?", Benjamin Doerr addresses the question whether comma selection can be helpful for escaping local optima. He shows that for the JUMP benchmark, this is not the case. Regardless of parameter configuration comma selection achieves at most insignificant runtime improvements over elitist selection, or vene performs significantly worse..

Self-adjusting evolutionary algorithms have gained significant attention in practice and recently in the theory of evolutionary algorithms community. The article "Self-Adjusting Evolutionary Algorithms for Multimodal Optimization" by Rajabi and Witt studies the classical $(1 + 1)$ EA with a stagnation mechanism which determines the mutation strength of the algorithm and shows that this approach is highly beneficial

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on the benchmark function JUMP. Furthermore, the authors explore the benefit of the mechanism when added to a $(1+\lambda)$-EA and also point out limitations of the proposed approach.

The article "Fast Mutation in Crossover-Based Algorithms" by Antipov, Buzdalov and Doerr shows that heavy tail mutations can be beneficial not only for mutation based algorithms but also for evolutionary algorithms using crossover. They prove this for the $(1 + (\lambda, \lambda))$ genetic algorithm for the classical function OneMax. Furthermore, these theoretical studies are complemented by experimental investigations on OneMax and on random planted Max-3SAT instances which share the feature of OneMax that they are relatively easy to solve.

The final article of this special issue entitled "Fixed-Target Runtime Analysis" by Buzdalov, Doerr, Doerr and Vinokurov contributes to the area of fixed budget and fixed target runtime analysis of evolutionary algorithms which has gained recent interest in the theory of evolutionary computation community. The authors show how to obtain fixed target runtime results based on classical results in the area of runtime analysis. They point out problems where obtaining fixed target results is not much more complicated but much more informative than obtaining classical runtime analysis results.

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(Guest Editors)