Understanding Evolutionary Algorithms

Opening the Black Box

By Carsten Witt

ABSTRACT:

Many real-world optimization problems are so-called black-box problems where the quality of a - possibly non-optimal - solution is hard to evaluate.
This applies to a variety of design problems, optimization in simulated environments and even hot topics from artificial intelligence like finding the optimal topology of a deep neural network. A common approach to solve black-box problem are nature-inspired metaheuristics and especially evolutionary algorithms (EAs).

Until recently, the working principles of EAs were poorly understood and there was little fundamental research in this area. In my lecture, I will highlight recent advances in the theory of EAs.
In particular, I will show how EAs cope with different types of combinatorial optimization problems and how theory can help design better EAs. Finally, I will draw an unexpected connection between the theory of EAs and the analysis of classical randomized algorithms.