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Title: Gene-pool Optimal Mixing Evolutionary Algorithms - From Foundations to Applications

Abstract:

In this talk I will introduce the Gene-pool Optimal Mixing Evolutionary Algorithm (GOMEA) and illustrate its advantageous properties over classical "blind" Evolutionary Algorithms (EAs), showing that under certain conditions GOMEA can scale to solve problems with millions of variables in less than an hour on a normal desktop computer. GOMEA belongs to the class of Model-Based EAs (MBEAs) and focuses particularly on efficiently learning and exploiting so-called linkage models that describe dependencies between the variables that are used to encode solutions to the optimization problem at hand. Recent work expands the GOMEA family as originally introduced for classical binary representations to other domains, including permutations, real values, and tree-based genetic programming for both single- and multi-objective optimization problems.

Besides the foundations of GOMEA, I will present the projects that my subgroup of Medical Informatics at CWI is currently involved in, outlining how our GOMEA research also fuels our research into real-world-applied optimization, machine learning, and explainable AI in the medical domain, in collaboration with hospitals and other academic partners. In particular, I will show how we can obtain better radiotherapy treatment plans for treating cancer faster, and more insightfully with GOMEA than is currently possible in clinical practice.

Speaker bio:

Peter A.N. Bosman is a senior researcher in the research group Life Sciences and Health at the Dutch national research institute for mathematics and computer science (Centrum Wiskunde & Informatica (CWI)) and professor of Evolutionary Algorithms at Delft University of Technology. Peter was formerly affiliated with Utrecht University, where he also obtained his M.Sc. and Ph.D. degrees in Computer Science, both on the design and application of model-based evolutionary algorithms (EAs). His research concerns the design of effective and efficient (model-based) EAs as well as their real-world application, primarily in the Life Sciences and Health (LSH) domain. In 2017, Peter was the General Chair of GECCO, the premiere conference on EAs. He has (co-)authored over 100 refereed publications on EA-related topics, out of which 4 received best paper awards.