Multivariate Algorithmics: On Interactions with Heuristics

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Parameterized and, more generally, multivariate algorithm design is mainly tailored towards identifying "tractable" special cases for "intractable" (that is, typically NP-hard) problems. Ideally, this leads to efficient algorithms providing optimal solutions. The central observation herein is that if some problem-specific parameters are small, then certain problems can be solved efficiently by confining exponential running time growth to the parameters only. In real-world scenarios, most computationally hard problems are attacked with heuristic approaches, that is, often simple (in particular, greedy) algorithms that are efficient but do not guarantee optimal solutions, or algorithms without provable running time guarantees.

A long-term goal of Theoretical Computer Science (analysis of algorithms and computational complexity) should be to contribute to a better understanding of the effectiveness of heuristics. In this talk, through some case studies including examples from graph-based data clustering, graph anonymization, matching in graphs, and computational social choice, we discuss some fruitful interactions between heuristics and parameterized algorithm design and analysis. We also discuss challenges for future research.

This talk is based on several results achieved during the last few years with various co-authors.