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MADALGO seminar by Christian Knauer, Freie Universität Berlin

The curse of dimensionality (somewhat) explained

Abstract:

Parameterized complexity aims to design exact algorithms whose running times depend on certain parameters of the input data that are naturally related to the problem at hand and in a way capture its complexity. A problem is called fixed-parameter tractable (FPT) with respect to a parameter *k* if there is an efficient algorithm to solve the problem for the cases where the parameter *k* is small. Another objective of this theory is to show that such algorithms are unlikely to exist for certain problems (and parameters).

Not many geometric problems have been studied from the parameterized complexity point of view. Most research has focused on special (combinatorial) parameters for geometric problems, like, e.g., the number of inner points (i.e., points in the interior of the convex hull) for the TSP problem or for the problem of computing minimum convex decompositions. Also, on the negative side, only few connections between geometric problems and known hard parameterized problems are known to date. We provide a brief tour of results from parameterized complexity theory for various geometric problems (e.g. hyperplane depth, clustering) with a focus on the dimension as the parameter. Our results indicate that all these problems are inherently difficult in higher dimensions.

Joint work with:

Sergio Cabello
Panos Giannopoulos
Günter Rote