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**Mathematical Concepts for Extracting Quantified Information from Complex Structures**

The project addresses both: (1) information recovery from *explicitly* given data as well as (2) approximation of *implicitly* defined objects described by mathematical models, such as solutions to partial differential or integral equations. The planned research concerns the following obstructions. Regarding (1), the sheer size of data sites, strong noise, damage, due to the measurement process, or restrictions on image acquisition may hinder the access to relevant hidden information. This line of reasearch is based on prior work on Mathematical Learning Theory and Imaging, with applications in electron microscopy. As for (2) major challenges are caused by the wide range of relevant scales or the dependence of solutions on additional parameters as encounterd with design or optimization problems. A central theme is to develop methods that can cope with problems in *high spatial dimensions - curse of dimensionality* - which is relevant in both scenarios (1) and (2). The theoretical goals are motivated by several ongoing interdisciplinary cooperations at RWTH Aachen. The main conceptual pillars are new developments for dealing with spatial uncertainty in imaging, for tree based classification algorithms, model reduction for transport dominated processes and tensor-methods for PDEs in high dimensional phase space. Long term goals concern a conceptual synthesis of methods for both scenarios (1), (2).