Parameter Identification and Sparsity Constraints with Applications in Imaging

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Abstract: The task of retrieving biological/physical or technical parameters from measured data is as universal as the quest to determine system parameters for controlling/steering complex processes. Accordingly, parameter identification is at the core of multiple applications in all fields of natural sciences, engineering, life sciences and industrial applications. The demand for tackling ever more complex models in terms of non-linearity, sensitivity, coupling of systems or for including specific expert information as side constraints, provides numerous challenges in mathematical modelling and for designing, analysing and implementing appropriate algorithms.

This talk focuses on retrieving sparse parameters, which in terms of mathematical modelling leads to non-convex, non- differentiable functionals. We will shortly review the history of sparse models for parameter identification, which has been a most dynamic field over the last ten years. This approach requires to model operator equations in certain Banach spaces, i.e. the classical regularization theory for parameter identification in Hilbert spaces cannot be applied. Instead techniques from convex analysis and non-linear functional analysis are used in the theoretical investigations.

We then apply this to parameter identification for parabolic differential eqution, which for example are applied to image sequence interpolation. And to MALDI Imaging.

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