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Optimization Program Inverse Problems Workshop
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Lecture: ***Gaussian Scale Mixtures for Inverse Problems in Imaging***

Speaker: Dirk Lorenz

Abstract:

We investigate inverse problems in imaging from a probabilistic viewpoint. Images need special priors that respect the existence of edges and especially, Gaussian smoothness priors are not appropriate. We propose to use Gaussian scale mixtures which incorporate a new latent variable to encode the edge strength.

We investigate different algorithms to infer information from the corresponding posterior. Specifically, we derive an expectation-maximization method and show that this is equivalent to the lagged diffusivity algorithm for the Perona-Malik problem. We also discuss methods based on mean-field approximations and show that these lead to adaptions of the lagged diffusivity scheme that better capture the uncertainties in the restoration process. Finally, we derive sampling methods for Gaussian scale mixtures which allow to calculate, for example, conditional mean estimates. Our methods rely on the formulation of the posterior as a so-called exponential pair, slightly generalizing the notion of the exponential family.