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Markov chain Monte Carlo methods for large-scale Bayesian inverse problems

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Beethovenstrasse 51, 38106 Braunschweig

Inverse problems formalize the process of learning about a system through indirect, noisy, and often incomplete observations. Casting inverse problems in the Bayesian statistical framework provides a natural framework for quantifying uncertainty in parameter values and model predictions, for fusing heterogeneous sources of information, and even for optimally selecting experiments or observations. Markov chain Monte Carlo (MCMC) is an enormously flexible workhorse approach for posterior simulation in the Bayesian setting, but the associated computational expense is a major bottleneck for complex posteriors and large-scale models.

This lecture will discuss modern MCMC algorithms for inverse problems. We will discuss methods that expose and exploit low-dimensional structure in inverse problems, that attempt to mitigate the computational cost of repeated forward model evaluations, and that exhibit discretization-invariant performance.

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