THE UNIVERSITY OF CHICAGO

Departments of Computer Science, Mathematics, Statistics, and the Computation Institute

SCIENTIFIC AND STATISTICAL COMPUTING SEMINAR

YOUSSEF MARZOUK

Department of Aeronautics and Astronautics

Massachusetts Institute of Technology

Bayesian Inference and Data Assimilation with Optimal Maps

THURSDAY, February 14, 2013, at 4:30 PM

Eckhart 133, 5734 S. University Avenue

ABSTRACT

We present a new approach to Bayesian inference that entirely avoids Markov chain simulation, by constructing a map that pushes forward the prior measure to the posterior measure. Existence and uniqueness of a suitable measure-preserving map is established by formulating the problem in the context of optimal transport theory. We discuss various means of explicitly parameterizing the map and computing it efficiently through solution of a stochastic optimization problem. The resulting algorithm overcomes many of the computational bottlenecks associated with Markov chain Monte Carlo. Advantages include analytical expressions for posterior moments, automatic evaluation of the marginal likelihood, clear convergence criteria, and the ability to generate independent uniformly-weighted posterior samples without additional model evaluations. We also discuss extensions of the map approach to hierarchical Bayesian models and to problems of sequential data assimilation, i.e., nonlinear filtering.

Numerical demonstrations include parameter inference in ordinary and partial differential equations and in spatial statistical models, as well as state estimation in nonlinear dynamical systems.

Organizers:

Lek-Heng Lim, Department of Statistics, lekheng@galton.uchicago.edu,

Ridgway Scott, Departments of Computer Science and Mathematics, ridg@cs.uchicago.edu,

Jonathan Weare, Department of Mathematics and the Computation Institute, weare@math.uchicago.edu.

SSC Seminar URL: `http://www.stat.uchicago.edu/seminars/SSC_seminars.shtml`

If you wish to subscribe to our email list, please visit the following website:
`https://lists.uchicago.edu/web/arc/statseminars.`