College of Arts & Sciences
Department of Mathematical Sciences

Colloquium

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Thursday April 12, 2018
Room 140, 60 West Charlton
4:00 – 5:00 pm

High-Dimensional Bayesian Geostatistics

With the growing capabilities of Geographic Information Systems (GIS) and user-friendly software, statisticians today routinely encounter geographically referenced data containing observations from a large number of spatial locations and time points. Over the last decade, hierarchical spatiotemporal process models have become widely deployed statistical tools for researchers to better understand the complex nature of spatial and temporal variability. However, fitting hierarchical spatiotemporal models often involves expensive matrix computations with complexity increasing in cubic order for the number of spatial locations and temporal points. This renders such models unfeasible for large data sets. I will present a focused review of two methods for constructing well-defined highly scalable spatiotemporal stochastic processes. Both these processes can be used as ``priors'' for spatiotemporal random fields. The first approach constructs a low-rank process operating on a lower-dimensional subspace. The second approach constructs a Nearest-Neighbor Gaussian Process (NNGP) that ensures sparse precision matrices for its finite realizations. Both processes can be exploited as a scalable prior embedded within a rich hierarchical modeling framework to deliver full Bayesian inference. These approaches can be described as model-based solutions for big spatiotemporal datasets. The models ensure that the algorithmic complexity has n floating point operations (flops), where n is the number of spatial locations (per iteration). We compare these methods and provide some insight into their methodological underpinnings.

Refreshments will be served 3:15 – 3:45 pm in the Faculty & Graduate Student Lounge Room 4118 French Hall West

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