



The University of Chicago
Department of Statistics

Seminars for First Year Ph.D. Students

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**Covariance Tapering for Likelihood Based
Estimation in Large Spatial Datasets**

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ABSTRACT

Maximum likelihood is an attractive method of estimating parameters in spatial models based on Gaussian process. However, calculating the likelihood can be computationally infeasible for large datasets, requiring $O(n^3)$ calculations for a data set with n observations. This article proposes the method of covariance tapering to approximate the likelihood in this setting. In this approach, covariance matrices are “tapered”, or multiplied element-wise by a sparse correlation matrix. The resulting matrices can then be manipulated using efficient sparse matrix algorithms. We propose two approximations to the Gaussian likelihood using tapering. One simply replaces the model covariance with a tapered version; the other is motivated by the theory of unbiased estimating equations. Focusing on the particular case of the Matérn class of covariance functions, we give conditions under which estimators maximizing the tapering approximations are, like the maximum likelihood estimator, strongly consistent.