``Hierarchical Bayesian Models and their Implementation in Multivariate Disease Mapping''

Presenter: Sudipto Banerjee

Co-authors: Xiaoping Jin and Brad Carlin.

Abstract:

With the increasing popularity of Geographical Information Systems (GIS) and spatial databases, statisticians increasingly encounter multivariate spatial data. Modelling of such data require accounting for associations of more than one type and issues regarding their validity arise. From the modeler's perspective spatial data can be classified as {\em point referenced} or {\em areal}, depending upon whether it is referenced by points or areal regions or units, and their modeling presents different issues and challenges. While flexible modeling of multivariate point-referenced data have recently been addressed using a {\em linear model of coregionalization} (LMC), existing methods for multivariate areal data continue to suffer from unnecessary restrictions of less rich covariance structures (such as separability) or in undesirable dependence on the conditioning order of the variables. In this work, we address these issues and propose a flexible joint modeling approach that obviates some of these drawbacks in existing multivariate areal models. We propose a Bayesian hierarchical framework for analyzing multivariate lattice data, which permits modeling of correlations both between variables. Our framework encompasses a rich class of multivariate conditionally autoregressive (MCAR) models that are computationally feasible and can be compared using statistical model comparison metrics. We illustrate the strengths of our approach over existing models using simulation studies and also offer a real-data application of our proposed approach that models lung, larynx, and esophagal cancer death rates between 1990 and 2000 in Minnesota counties.