# Department of Applied and Computational Mathematics and Statistics Colloquium


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## *On Some New Classes of Disease Mapping Models*


Hierarchical models for regionally aggregated disease incidence data commonly involve region specific latent random effects that are modelled jointly as having a multivariate Gaussian distribution. The covariance or precision matrix incorporates the spatial dependence between the regions. Common choices for the precision matrix include the widely used intrinsic conditional autoregressive model, which is singular, and its nonsingular extension which lacks interpretability. We propose a new parametric model for the precision matrix based on a directed acyclic graph representation of the spatial dependence. Our model guarantees positive definiteness and, hence, in addition to being a valid prior for regional spatially correlated random effects, can also directly model the outcome from dependent data like images and networks. Theoretical and empirical results demonstrate the interpretability of parameters in our model. Our precision matrix is sparse and the model is highly scalable for large datasets. We also derive a novel order-free version which remedies the dependence of directed acyclic graphs on the ordering of the regions by averaging over all possible orderings. The resulting precision matrix is available in closed form. We demonstrate the superior performance of our models over competing models using simulation experiments and a public health application.

(Joint work with Abhirup Datta and James S. Hodges)


**Monday, October 29, 2018**
**4:15 PM – 5:15 PM**
**127 Hayes-Healy Center**

**Colloquium Tea 3:45 PM to 4:15 PM 101A Crowley Commons Room**