The University of Chicago
Department of Statistics

Seminar Series

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Point Pattern Modeling for Degraded Presence-Only Data Over Large Regions

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133 Eckhart Hall, 5734 S. University Avenue
Refreshments following the seminar in Eckhart 110.

ABSTRACT

Explaining species distribution using local environmental features is a long standing ecological problem. Often, available data is collected as a set of presence locations only thus precluding the possibility of a presence-absence analysis. We propose that it is natural to view presence-only data for a region as a point pattern over that region and to use local environmental features to explain the intensity driving this point pattern. This suggests hierarchical modeling, treating the presence data as a realization of a spatial point process whose intensity is governed by environmental covariates. Spatial dependence in the intensity surface is modeled with random effects involving a zero mean Gaussian process. Highly variable and typically sparse sampling effort as well as land transformation degrades the point pattern so we augment the model to capture these effects. The Cape Floristic Region (CFR) in South Africa provides a rich class with such species data. The potential, i.e., nondegraded presence surfaces over the entire area are of interest from a conservation and policy perspective.

Our model assumes grid cell homogeneity of the intensity process where the region is divided into $\sim 37,000$ grid cells. To work with a Gaussian process over a very large number of cells we use predictive process approximation. Bias correction by adding a heteroscedastic error component is implemented. The model was run for a number of different species. Model selection was investigated with regard to choice of environmental covariates. Also, comparison is made with the now popular Maxent approach, though the latter is much more limited with regard to inference. In fact, inference such as investigation of species richness immediately follows from our modeling framework.

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