COLLOQUIUM ANNOUNCEMENT

"Inference for Size Demography from Point Pattern Data using Integral Projection Models"

Presented by

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Thursday, January 26, 2012
300 Seitz
3:30 p.m.

Abstract: Population dynamics with regard to evolution of traits has typically been studied using matrix projection models (MPMs). Recently, to work with continuous traits, integral projection models (IPMs) have been proposed. Imitating the path with MPMs, IPMs are handled first with a fitting stage, then with a projection stage. Fitting these models has so far been done only with individual-level *transition* data. This data is used to estimate the demographic functions (survival, growth, fecundity) that comprise the *kernel* of the IPM specification. Then, the estimated kernel is iterated from an initial trait distribution to project steady state population behavior under this kernel. When trait distributions are observed over time, such an approach does not align projected distributions with these observed temporal benchmarks.

The contribution here, focusing on size distributions, is to address this issue. Our concern is that the above approach introduces an inherent mismatch in scales. The redistribution kernel in the IPM proposes a mechanistic description of population level redistribution. A kernel of the same functional form, fitted to data at the individual level, would provide a mechanistic model for individual-level processes. Resulting parameter estimates and the associated estimated kernel are at the wrong scale and do not allow population-level interpretation.

Our approach views the observed size distribution at a given time as a point pattern over a bounded interval. We build a three-stage hierarchical model to infer about the dynamic intensities used to explain the observed point patterns. This model is driven by a *latent* deterministic IPM and we introduce uncertainty by having the operating IPM vary around this deterministic specification. Further uncertainty arises in the realization of the point pattern given the operating IPM. Fitted within a Bayesian framework, such modeling enables full inference about all features of the model. Such dynamic modeling, *optimized* by fitting data observed over time, is better suited to projection.

Exact Bayesian model fitting is very computationally challenging; we offer approximate strategies to facilitate computation. We illustrate with simulated data examples as well as well as a set of annual tree growth data from Duke Forest in North Carolina. A further example shows the benefit of our approach, in terms of projection, compared with the foregoing individual level fitting.

Hosted by the

Department of Statistics

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Top of the Stairs (217 College Ave.)