March 26, 2004 at 12.00 Noon
Zimmer Lounge, Maxcy Hall

Spatial Structure in the Social Sciences Colloquium Series

Bayesian Factor Analysis for Spatially Correlated Data, with Application to Summarizing Area-Level Material Deprivation Using Census Data

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Abstract: This talk addresses the problem of quantifying area-level material deprivation using data from the US Census. A factoranalytic approach is used, framed in a Bayesian context and elaborated to allow spatial correlation. The latent factor is interpreted as an index of material deprivation.

An existing and widely-used measure of the same construct is the Townsend index, an unweighted sum of four census variables standardized as Z-scores. The Townsend and many related indices are computed as linear combinations of measured census variables, which motivates the factor-analytic structure adopted here. Our model-based approach allows several improvements over the Townsend and similarly constructed indices: (1) the index can be represented as a weighted sum of (standardized) census variables, with data-driven weights; (2) by using posterior summaries, the indices can be reported with corresponding measures of uncertainty; and (3) information from neighboring areas can be used to inform a specific area's index, which improves precision and can be useful for sparsely-populated areas.

Using data from Rhode Island census tracts, we use our model to summarize variations in material deprivation across the state. Our analysis entertains a number of possible spatial covariance specifications, including marginal and conditional (CAR) parameterizations. We summarize the relative contributions of each census variable to the latent index, suggest ways to report material deprivation at the area level, and compare our model-based summaries to those found by applying the standard Townsend index.

Joint work with Rusty Tchemis, Health Care Policy, Harvard Medical School.