Luc Anselin

Research Interests Statement

My research interests are primarily methodological, and deal with the development, implementation and application of techniques to analyze spatial and space-time data. These methods are referred to as geovisualization, exploratory spatial data analysis (or ESDA), spatial statistics or spatial econometrics. The common theme is that spatial data are typically correlated in a systematic fashion (spatial autocorrelation) as well as showing location-specific properties (spatial heterogeneity). This tends to make the application of standard statistical methods inappropriate and requires specialized techniques.

My methodological work has had two main foci. One aspect deals with new measures for local spatial autocorrelation (so-called LISA statistics) that allow for the identification of spatial clusters and spatial outliers. This is primarily an exploratory technique, useful in the first stages of an analysis, and typically carried out jointly with operations in a geographic information system. A second aspect is central to so-called spatial econometrics and includes the development of new estimation methods and specification tests that explicitly incorporate the spatial autocorrelation in the data. Currently, this work is being extended to handle patterns of space-time correlation, both in terms of visualizing these patterns, identifying clusters and outliers, as well as extending the methods of spatial econometrics to so-called panel data settings (where large cross-sections are combined with short time series) and situations where the observations are discrete (0-1 variables or counts of events).

A second aspect of my research pertains to the implementation of spatial data analytical methods in software. I was the original developer of SpaceStat, the first free-standing program to handle descriptive spatial statistics as well as spatial regression analysis (released by NCGIA in 1992). Currently I am the lead developer of GeoDa, a program designed to be an introduction to spatial data analysis, and also serve as the director of the CSISS software tools development program. As part of this, we have developed new open source software (using the Python language) to visualize the evolution of spatial autocorrelation over time, compute a range of descriptive spatial statistics and implement spatial econometric methods. I am also closely involved with the R community of open source statistical software developers, and the RGeo initiative to coordinate, streamline and disseminate spatial statistical software.

My empirical work is rather eclectic and tends to be characterized by an attention to the spatial aspects rather than the substantive nature of the problem. This has included analyses of data on house prices as well as tropical deforestation and international conflict, the study of violent crime as well as crop yields in precision agriculture experiments. My interest in health and disease has included studies of spatial patterns in stroke mortality, the clustering of cancer incidence and mortality, and the health impacts of variations in air quality on the incidence of respiratory diseases. These studies represent similar methodological challenges, such as the issues of scale (both across space as well as over time), how to deal with the inherent variance instability of rates as estimates of risk (smoothing approaches), and the difficulty to associate the location of environmental “hazards” with the location of diseased people in the presence of mobility. Most recently, I am involved in two studies where spatial analysis is central in the measurement of health effects: the spatial pattern of cancer incidence in the Appalachian region in light of differential access to screening and diagnostics (funded by NCI); and the effect of ozone and other pollutants on the spatial pattern of hospital admissions for asthma and related respiratory ailments in the Los Angeles basin (funded by NSF/EPA).