Spatial Measurement Error in Air Pollution Epidemiology

Adam Szpiro, Department of Biostatistics, University of Washington

Abstract:

A significant challenge in air pollution epidemiology is that we cannot directly measure exposures for study subjects. In cohort studies, ambient concentrations at subject locations can be predicted from measured data at different monitoring locations by means of a land-use regression model with spatial smoothing. This induces a complex form of measurement error that can be decomposed into components analogous to classical and Berkson error. I present two parallel treatments of this problem. In a parametric framework, I model the exposure surface using geostatistics, assuming a correctly specified mean model and a spatially correlated residual field. In an alternative semi-parametric framework, I model the exposure surface as deterministic, but with a misspecified mean model. I first argue that the semi-parametric analysis is more true to the underlying science and then discuss the consequences of analyzing the data within this framework. The semi-parametric approach provides some nice simplifications when employing fixed rank methods to predict the exposure surface, but incorporating full-rank smoothing methods such as kriging introduces analytic challenges that have so far proven intractable.