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A causal inference approach to spatial confounding

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Spatial confounding is well known to be a challenge for the study of environmental exposures, but many existing methods do not address the issue of confounding as it is understood in the field of causal inference. Furthermore, they can result in misleading effect estimates when the true effects are heterogeneous or nonlinear. In this work, we take a causal inference perspective to defining spatial confounding, describe the relationship between spatial confounding and spatial dependence, and advocate the use of more flexible models, specifically double machine learning (DML) methods, for estimating causal effects of environmental exposures in the presence of spatial confounding. We demonstrate the advantages of the DML approach analytically and via extensive simulation studies, and we apply the method to study the link between birthweight and air pollution exposure in the state of California.

Elizabeth Ogburn Associate Professor in the Department of Biostatistics at Johns Hopkins University and founder of the COVID-19 Collaboration Platform. Her research is in causal inference and epidemiologic methods. Broadly, she is interested in developing methods for and describing the behavior of traditional statistical machinery when standard assumptions are not met. She has worked on characterizing the bias that results from misclassification, i.e. violations of the assumption that variables were measured accurately. She has also worked on semiparametric estimation of instrumental variables models, as these models are useful for certain violations of "no unmeasured confounding" assumptions. Currently a major focus of my work is on analysis of social and other network data.

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