Causal Inference when Intervention Units and Outcome Units Differ*

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Abstract

Methods to evaluate policies and interventions are increasingly challenged by the inherent interconnectedness of units that may interact in clusters (e.g., schools) or networks (e.g., social networks). This raises the problem of interference, that is, a unit's outcome might depend not only on their treatment but also on the treatments of other units.

We study causal inference in settings characterized by interference with a *bipartite* structure. There are two distinct sets of units: *intervention* units to which the intervention is applied and *outcome* units on which the outcome is measured. Examples of this setting can be found across many disciplines, whenever treatments applied to one intervention unit can affect multiple outcome units, and the outcome of a unit may depend on the treatments applied to multiple intervention units.

We discuss a variety of causal estimands for these bipartite settings. We propose weighting estimators and inference for these estimands from a design-based perspective, based on (partial) knowledge of the bipartite network. We also derive the variance and asymptotic behavior of estimators under specific regimes. We do not impose restrictions on the functional form of the exposure mapping and the potential outcomes, thus allowing heterogeneity, non-linearity, non-additivity and potential interactions in treatment effects.

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