THE UNIVERSITY OF CHICAGO | DEPARTMENT OF STATISTICS

Master's Thesis Presentation

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"Rerandomization under Interference"

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Abstract

Covariates are widely used in randomized experiments to improve precision. However, in the presence of interference, where outcomes may depend on the treatment assignments of other units, standard covariate adjustment methods may fail to preserve desirable properties such as the no-harm property, meaning that incorporating covariates does not worsen estimator performance. Existing approaches that incorporate covariates under interference typically rely on specifying a particular interference structure, and their guarantees can be sensitive to misspecification. In this paper, we study how to incorporate covariate information in a way that preserves a no-harm type property while remaining largely agnostic to the underlying interference structure.

We focus on the estimation of the expected average treatment effect (EATE) using the Hájek estimator. To incorporate covariates, we consider rerandomization, a design-stage approach that enforces covariate balance by restricting attention to treatment assignments with small imbalance in settings with interference. We show that, even under interference, rerandomization can improve precision asymptotically relative to standard randomization, relying only on mild conditions on the dependence structure across units. We further develop an optimization-based conservative variance estimator for inference under rerandomization.

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