THE UNIVERSITY OF CHICAGO

Department of Statistics

STATISTICS COLLOQUIUM

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Targeted Minimum Loss Estimation with the Highly Adaptive Lasso: Applications in Causal Inference

MONDAY, March 4, 2019 at 4:30 PM

Eckhart 133, 5734 S. University Avenue

Refreshments before the seminar at 4:00PM in Jones 111

ABSTRACT

We review targeted minimum loss estimation (TMLE), which provides a general template for the construction of asymptotically efficient plug-in estimators of a target estimand for infinite dimensional statistical models. TMLE involves maximizing a parametric likelihood along a so-called least favorable parametric model through an initial estimator (e.g., ensemble super-learner) of the relevant functional of the data distribution. The asymptotic normality and efficiency of the TMLE relies on the asymptotic negligibility of a second-order term. This typically requires the initial estimator to converge at a rate faster than n-1/4. We have proposed a new class of estimators, the Highly Adaptive LASSO (HAL) Minimum Loss Estimator (HAL-MLE), of the data distribution and functionals thereof that converge at a sufficient rate regardless of the dimensionality of the data/model, under almost no additional regularity. We generalize this estimator to a smoothness adaptive HAL-MLE involving higher order splines, while the above HAL-MLE uses a 0-order spline-basis. This allows us to propose a general TMLE (HAL-TMLE) that is asymptotically efficient in great generality. We demonstrate the practical performance of HAL-MLE and its corresponding TMLE for the average causal effect for dimensions up till 10. We also establish a nonparametric bootstrap method for inference taking into account the higher order contributions of the HAL-TMLE, and demonstrate excellent finite sample coverage. Finally, we will discuss a general method for super-efficient HAL-TMLEs that appears to be particularly powerful in dealing with instrumental variable type confounders and weakly identifiable target estimands.

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