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Nonparametric Causal Inference through Targeted Maximum Likelihood Estimation: Options for Using Machine Learning in Causal Inference

Unbiased causal estimation inevitably relies on data-specific assumptions. In addition to these 'causal assumptions', the consistency of some estimators relies on the parametric specification of a full likelihood or of nuisance models. Researchers have sought to minimize model-dependence through the usage of nonparametric methods. Targeted Maximum Likelihood Estimation (TMLE) is a statistical framework that allows for nonparametric estimation of a causal effect using flexible modelling of the nuisance models, opening the door for machine learning and prediction methods. I will present the fundamentals of TMLE and demonstrate how inference can be consistently improved with machine learning. I will also describe some of the challenges in causal variable selection and how machine learning methods should and should not be used.