Pointwise Inference in the High-Dimensional Additive Model

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Abstract

We consider the construction of pointwise confidence intervals for a single function in the additive nonparametric regression model, in which the conditional mean of the response is the sum of a large number of covariate effects of unspecified form. We allow the number of covariates to grow along with the sample size while assuming that only a small but growing number of the covariates have an influence on the response. Estimation in this setting is well-studied, but there exists almost no machinery for inference, as estimators typically involve Lasso penalization and have very complicated distributions. We introduce an estimator which is asymptotically normal by adapting “desparsified Lasso” techniques recently introduced in the linear regression setting to the nonparametric regression setting. Moreover, we develop a two-step presmoothing-resmoothing estimator which yields asymptotically optimal pointwise confidence intervals for a single function in the sense that our estimator achieves, asymptotically, up to first order terms, the same bias and variance as the oracle estimator, for which only the function of interest is unknown.