

Semiparametric adaptive estimation under informative sampling

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Abstract

In probability sampling, sampling weights are often used to remove the selection bias in the sample. The Horvitz-Thompson estimator is well-known to be consistent and asymptotically normally distributed; however, it is not necessarily efficient. This study derives the semiparametric efficiency bound for various target parameters by considering the survey weights as random variables and consequently proposes two semiparametric estimators with working models on the survey weights. One estimator assumes a reasonable parametric working model, but the other estimator requires no specific working models by using the debiased/double machine learning method. The proposed estimators are consistent, asymptotically normal, and can be efficient in a class of regular and asymptotically linear estimators. A limited simulation study is conducted to investigate the finite sample performance of the proposed method. The proposed method is applied to the 1999 Canadian Workplace and Employee Survey data.

Keywords: Adaptive estimation; Double/debiased machine learning; Semiparametric efficiency