

Higher Order Semiparametric Frequentist Inference and the Profile Sampler

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We consider higher order frequentist inference for the parametric component of a semiparametric model based on sampling from the posterior profile distribution. The first order validity of this procedure established by Lee, Kosorok and Fine (2005) is extended to second order validity even in the setting that the nuisance parameter is not estimable at the \sqrt{n} rate. Specifically, we obtain higher order estimates of the maximum profile likelihood estimator and of the efficient Fisher information. Moreover, we prove that an exact frequentist confidence interval for the parametric component at level α can be estimated by the α level credible set from the profile sampler with an error whose order is dependent on the convergence rate of the nuisance parameter. As far as we are aware, these results are the first higher order frequentist results obtained for semiparametric estimation. A fully Bayesian interpretation is established under a certain data dependent prior. The theory is verified in the Cox model with right censored data, the Cox model with current status data, the proportional odds model with right censored data, and case-control studies with partially observed data.