Improved estimation of partially-specified models

Ioannis Kosmidis
ioannis.kosmidis@warwick.ac.uk
http://www.ikosmidis.com
IKosmidis_

Reader in Data Science
University of Warwick & The Alan Turing Institute

November 18, 2020

Many popular methods for the reduction of estimation bias rely on an approximation of the bias function under the assumption that the model is correct and fully specified. Other bias reduction methods, like the bootstrap, the jackknife and indirect inference require fewer assumptions to operate but are typically computer-intensive, requiring repeated optimization. We present a novel framework for reducing estimation bias that:

1. can deliver estimators with smaller bias than reference estimators even for partially-specified models, as long as estimation is through unbiased estimating functions;
2. always results in closed-form bias-reducing penalties to the objective function if estimation is through the maximization of one, like maximum likelihood and maximum composite likelihood;
3. relies only on the estimating functions and/or the objective and their derivatives, greatly facilitating implementation for general modelling frameworks through numerical or automatic differentiation techniques and standard numerical optimization routines.

The bias-reducing penalized objectives closely relate to information criteria for model selection based on the Kullback-Leibler divergence, establishing, for the first time, a strong link between reduction of estimation bias and model selection. We also discuss the asymptotic efficiency properties of the new estimator, inference and model selection, and present illustrations in well-used, important modelling settings of varying complexity.

This is joint work with Nicola Lunardon, University of Milano-Bicocca, Milan, Italy, and the related preprint is available at http://arxiv.org/abs/2001.03786 (Kosmidis and Lunardon, 2020).

References

Kosmidis, I. and N. Lunardon (2020). Empirical bias-reducing adjustments to estimating functions. arXiv: 2001.03786.