

# Inference by Stochastic Optimization: A Free-Lunch Bootstrap

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## Abstract

Assessing sampling uncertainty in extremum estimation can be challenging when the asymptotic variance is not analytically tractable. Bootstrap inference offers a feasible solution but can be computationally costly especially when the model is complex. This paper uses iterates of a specially designed stochastic optimization algorithm as draws from which both point estimates and bootstrap standard errors can be computed *in a single run*. The draws are generated by the gradient and Hessian computed from batches of data that are resampled at each iteration. We show that these draws yield consistent estimates and asymptotically valid frequentist inference for a large class of regular problems. The algorithm provides accurate standard errors in simulation examples and empirical applications at low computational costs. The draws from the algorithm also provide a convenient way to detect data irregularities.

JEL Classification: C2, C3

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