THE UNIVERSITY OF CHICAGO

COMPUTATIONAL AND APPLIED MATHEMATICS COLLOQUIUM

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An Automatic Finite-Sample Robustness Metric: Can Dropping a Little Data Change Conclusions?

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Via ZOOM

ABSTRACT

We propose a method to assess the sensitivity of data analyses to the removal of a small fraction of the data set. Analyzing all possible data subsets of a certain size is computationally prohibitive, so we provide a finite-data metric to approximately compute the number (or fraction) of observations that has the greatest influence on a given result when dropped. We call our resulting metric the Approximate Maximum Influence Perturbation. Our approximation is automatically computable and works for common estimators --- including (but not limited to) OLS, IV, GMM, MLE, and variational Bayes. We provide explicit finite-sample error bounds on our approximation for linear and instrumental variables regressions. At minimal computational cost, our metric provides an exact finite-data lower bound on sensitivity for any estimator, so any non-robustness our metric finds is conclusive.

We demonstrate that the Approximate Maximum Influence Perturbation is driven by the signal-to-noise ratio in the inference problem, is not reflected in standard errors, does not disappear asymptotically, and is not a product of misspecification. We focus on econometric analyses in our applications. Several empirical applications show that even 2-parameter linear regression analyses of randomized trials can be highly sensitive. While we find some applications are robust, in others the sign of a treatment effect can be changed by dropping much less than 1% of the sample even when standard errors are small.

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