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Title: Debiasing regularized linear estimators with ``spectrum-aware adjustments"

Abstract: Debiasing methodologies have emerged as a solid toolbox for producing inference in high-dimensional problems. Since its original introduction, the methodology witnessed a major upheaval with the introduction of debiasing with degrees-of-freedom adjustments that arises from Onsager correction terms in high dimensions. In this talk, we study such degrees-of-freedom corrected debiasing formula for rotationally invariant designs rigorously, building upon the statistical mechanics insights from Takahashi and Kabashima (2018). We name this class of corrections ``spectrum-aware adjustments" to capture their dependence on spectral properties of the design. We demonstrate the utility of such formulae with regard to statistical problems in high-dimensional linear regression such as hypothesis testing, signal-to-noise ratio estimation, etc. Further, we observe the superiority of such corrections over previous Gaussian-based formulae in the context of challenging scenarios where one might encounter dependent observations, multivariate-t-distributions, and noisy low-rank matrices. Finally, this approach integrates seamlessly with the principal components regression (PCR) methodology yielding a new perspective on PCR. This is based on joint work with Yufan Li.