THE UNIVERSITY OF CHICAGO | DEPARTMENT OF STATISTICS

Statistics Colloquium

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"A Non-asymptotic Framework for Approximate Message Passing Algorithm"

MONDAY, March 27, 2023, at 4:30 PM
Jones 303, 5747 S. Ellis Avenue
Refreshments before the seminar at 4:00 PM in Jones 304.

ABSTRACT

Approximate message passing (AMP) emerges as an effective iterative paradigm for solving high-dimensional statistical problems. However, prior AMP theory --- which focused mostly on high-dimensional asymptotics --- fell short of predicting the AMP dynamics when the number of iterations surpasses o(\log n/\log\log n) (with n the problem dimension). To address this inadequacy, in this talk, we introduce a non-asymptotic framework for understanding AMP. Built upon a new decomposition of AMP updates and controllable residual terms, we lay out an analysis recipe to characterize the finite-sample convergence of AMP.

As concrete consequences of the proposed analysis recipe: (i) when solving Z2 synchronization, we predict the behavior of randomly initialized AMP for up to O(n/poly(\log n)) iterations, showing that the algorithm succeeds without the need of a careful spectral initialization and also a subsequent refinement stage (as conjectured recently by Celentano et al.); (ii) we also characterize the non-asymptotic behavior of AMP in sparse PCA (in the spiked Wigner model) for a broad range of signal-to-noise ratio.

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