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Title: Fundamental limits in structured PCA, and how to reach them

Abstract: I will present recent results concerning the Bayesian estimation of low-rank matrices corrupted by structured noise, namely rotational invariant noise with generic spectrum. Using the replica method we derive the optimal performance limit. This is possible by exploiting the low-rank structure of the matrix signal implying that we can reduce the model to an effective quadratic model of the Ising type. Secondly, we show that the Approximate Message Passing (AMP) algorithm currently proposed in the literature for Bayesian estimation is sub-optimal. Exploiting the theory of Adaptive Thouless-Anderson-Palmer equations by Opper et al. we explain the reason for this sub-optimality and as a consequence we deduce an optimal Bayesian AMP algorithm with a rigorous state evolution matching the replica prediction.