Summary: We show that, if $W$ is an $N \times N$ matrix drawn from the gaussian orthogonal ensemble, then with high probability the degree 4 sum-of-squares relaxation cannot certify an upper bound on the objective $N - 1 \cdot x^\top W x$ under the constraints $x_i^2 - 1 = 0$ (i.e. $x \in \{\pm 1\}^N$) that is asymptotically smaller than $\lambda_{\text{max}}(W) \approx 2$. We also conjecture a proof technique for lower bounds against sum-of-squares relaxations of any degree held constant as $N \to \infty$, by proposing an approximate pseudomoment construction.

MSC:
90C22 Semidefinite programming
68Q25 Analysis of algorithms and problem complexity
68Q17 Computational difficulty of problems (lower bounds, completeness, difficulty of approximation, etc.)
82D30 Statistical mechanics of random media, disordered materials (including liquid crystals and spin glasses)
15B52 Random matrices (algebraic aspects)
82B44 Disordered systems (random Ising models, random Schrödinger operators, etc.) in equilibrium statistical mechanics

Keywords:
sum-of-squares; convex optimization; average-case computational complexity; semidefinite programming; spin glass

Full Text: DOI

References:


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