Algebraic Compressed Sensing

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Abstract:

Compressed Sensing is the field dealing with sparse or compressed representation of signals. A central question is how much data is needed to represent, compress, or reconstruct a class of signals. A re-occurring such statement is "a signal of size/complexity n can be reconstructed from $O(n^k logn)$ random measurements", under given sampling assumptions.

We show that a statement of this kind is always valid in the general case where the measurement process can be given as an algebraic projection, explaining previous findings in literature.

We obtain a number of sufficient random measurements of the form $O(\operatorname{coh}(n)\log n)$, where $\operatorname{con}(n)$ is the so-called coherence, which is an invariant of the signal space and does not depend on the particular signal.

As a consequence, we improve known reconstruction bounds for matrix completion, and we derive novel bounds for the case of distance or kernel matrices, solving an open question in rigidity theory: A general $n \times n$ matrix of bounded rank, or a distance matrix, is determined by $O(n \log n)$ random entries.

Joint work with Louis Theran.

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Keywords

fusion frames, distributed processing, sensor networks