1-Bit Compressed Sensing

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Abstract

In classical *compressed sensing*, one usually considers linear measurements of the form $y = Ax$, where $A \in \mathbb{R}^{m \times n}$ and $m \ll n$. Under the additional assumption of *sparsity*, it has be shown that it is indeed possible to efficiently recover all s-sparse vectors x by only $m \gtrsim s \log(en/s)$ measurements; for instance, an appropriate measurement matrix A can be generated by choosing its entries iid standard Gaussian.

One challenging question is whether we can still efficiently recover sparse vectors when almost all information of the measurement has been lost; say, we only know its signs $y = \operatorname{sign}(Ax)$. This leads to the problem of *1-bit compressed sensing* which we will investigate in this talk. Surprisingly, only $s \log^2(2n/s)$ measurements are needed to guarantee an accurate recovery by a convex optimization approach. In the proof, we will see that the underlying question is equivalent to the purely geometric problem of *hyperplane tessellations*.

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