Local max-cut in smoothed polynomial time

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Abstract

In 1988, Johnson, Papadimitriou and Yannakakis wrote that "Practically all the empirical evidence would lead us to conclude that finding locally optimal solutions is much easier than solving NP-hard problems". Since then the empirical evidence has continued to amass, but rigorous proofs of this phenomenon have remained elusive. A canonical (and indeed complete) example is the local max-cut problem, for which no polynomial time method is known. In a breakthrough paper, Etscheid and Roglin (2014) proved that the smoothed complexity of local max-cut is quasi-polynomial, i.e., if arbitrary bounded weights are randomly perturbed, a local maximum can be found in n^O(logn) steps. Building on their ideas, we prove smoothed polynomial complexity for local max-cut, replacing the O(log n) in the exponent by 15. This confirms that finding local optima for max-cut is much easier than solving it.

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See https://arxiv.org/abs/1610.04807v1