

Faster SDP hierarchy solvers for local rounding algorithms

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Convex relaxations based on different hierarchies of linear/semi-definite programs have been used recently to devise approximation algorithms for various optimization problems. The approximation guarantee of these algorithms improves with the number of rounds r in the hierarchy, though the complexity of solving (or even writing down the solution for) the r 'th level program grows as $n^{\Omega(r)}$ where n is the input size.

In this work, we observe that many of these algorithms are based on local rounding procedures that only use a small part of the SDP solution (of size $n^{O(1)}2^{O(r)}$ instead of $n^{\Omega(r)}$). We give an algorithm to find the requisite portion in time polynomial in its size. The challenge in achieving this is that the required portion of the solution is not fixed a priori but depends on other parts of the solution, sometimes in a complicated iterative manner. Our solver leads to $\text{poly}(n) 2^{O(r)}$ time algorithms to obtain the same guarantees in many cases as the earlier $n^{O(r)}$ time algorithms based on r rounds of the Lasserre hierarchy. In particular, guarantees based on $O(\log n)$ rounds can be realized in polynomial time.

Joint work with Venkatesan Guruswami.