A Non-Convex Optimization Approach to Network Localization: Polynomial-Time Computability and Rigidity-Theoretic Implications

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The successful deployment and operation of location–aware networks, which have recently found many applications, depends crucially on the accurate localization of the nodes. Currently, a powerful approach to localization is that of convex relaxation. In a typical application of this approach, the localization problem is first formulated as a rank–constrained semidefinite program (SDP), where the rank corresponds to the target dimension in which the nodes should be localized. Then, the non–convex rank constraint is either dropped or replaced by a convex surrogate, thus resulting in a convex optimization problem. In this talk, we consider using a non–convex surrogate of the rank function, namely the so–called Schatten quasi–norm, in network localization. Although the resulting optimization problem is non–convex, we show that a first–order critical point can be approximated to arbitrary accuracy in polynomial time by an interior–point algorithm. Moreover, we show that such a first–order point is already sufficient for recovering the node locations in the target dimension if the input instance satisfies certain established uniqueness properties in the literature. Lastly, we demonstrate the viability of our approach by simulations.