The central path as a set of analytic centers in semidefinite optimization.

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Abstract:

The convergence of the central path to the analytic center of the optimal set is a basic result in the theory of interior point methods. For semidefinite optimization this result was established by Goldfarb and Scheinberg in 1998 (SIAM J. Opt. 8: 871-886). Their proof follows the idea well-known from linear optimization: the central path can be represented as a set of analytic centers of level sets and it keeps this property even at its limit points. Although the result by Goldfarb and Scheinberg is widely cited in the recent literature, we have found gaps in their proof. This fact prompted us to study the properties of the central path in more detail. We applied two particular proof techniques of convergence from linear optimization to semidefinite programs and analyzed why these techniques are unsuccessful for the semidefinite programs when no strictly complementary solution exists. Finally, we returned to the idea of analytic centers: we have used this idea in a different way to obtain a more insightful view to the properties of the central path. This view has risen a doubt about the validity of the result itself. Finally, we have found an example for which the central path does not converge to the analytic center of the optimal set.