Smoothing Algorithms for Computing the Projection onto a Minkowski Sum of Convex Sets

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Abstract: In this talk, the problem of computing the projection, and therefore the minimum distance, from a point onto a Minkowski sum of general convex sets is presented. Our approach is based on the minimum norm duality theorem originally stated by Nirenberg and the Nesterov smoothing techniques. It is shown that projection point onto a Minkowski sum of sets can be represented as the sum of points on constituent sets so that, at these points, all of the sets share the same normal vector which is the negative of the dual solution. The proposed algorithm improves the theoretical bound on number of iterations from $O(\frac{1}{\epsilon})$ by Gilbert [SIAM J. Contr., vol. 4, pp. 61–80, 1966] to $O\left(\frac{1}{\sqrt{\epsilon}}\ln(\frac{1}{\epsilon})\right)$, where ϵ is the desired accuracy for the objective function. Moreover, the algorithm also provides points on each component sets such that their sum is equal to the projection point.

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