An Efficient Affine-scaling Algorithm for Hyperbolic Programming

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Hyperbolic programming (HP) is a generalization of semidefinite programming. Hyperbolicity cones, however, in general are not symmetric, limiting the number of interior-point methods that can be applied. For example, the variants of Dikin's affine-scaling algorithm that have been shown to run in polynomial time depend heavily on the underlying cone being symmetric, and thus do not apply to HP. Until now, that is.

We present a natural variant of Dikin's algorithm that applies to HP, and establish a complexity bound that is no worse than the best bound known for interior-point methods (``$ O(\sqrt{n}) $ iterations to halve the duality gap"). Interestingly, the algorithm is primal, but the analysis is almost entirely dual (and provides new geometric insight into hyperbolicity cones).