HENRY WOLKOWICZ, University of Waterloo

Hard Combinatorial Problems, Doubly Nonnegative Relaxations, Facial Reduction, and Alternating Direction Method of Multipliers

Semi-definite programming, SDP, relaxations have proven to be extremely successful both in theory and practice for many hard combinatorial problems. We show that the Slater constraint qualification, strict feasibility, fails for many of these problems. Rather than resulting in theoretical and numerical difficulties we show how to use facial reduction, FR, to regularize while reducing the dimension of the problem. We see that FR fits perfectly with an alternating directions method of multipliers, ADMM. We show empirically that solving these relaxations solves many of the original hard combinatorial problems to optimality.