Solution of Binary Quadratic Problems via Hybrid Relaxations

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Abstract: *Binary Quadratic Problems* are those where one wants to maximize or minimize an arbitrary quadratic form on binary variables. Each such problem is equivalent to finding a cut of maximal value in a weighted graph. Solution algorithms (exact or with *ex-post* certified solutions) based on polyhedral relaxations have shown to be very successful for very large, but very sparse instances. To the contrary, semi-definite relaxations seem to be the methods of choice for small dense instances. Recently, algorithms based on hybrid (obtained by combining polyhedral and semi-definite) relaxations, have been shown to be quite successful in solving some medium sized (previously unsolved) instances. Unfortunately, the most common methods used to solve the semi-definite relaxation do not exploit the sparsity of the instance at hand. Consequently, the size of the problems that can be attacked is limited to a few hundred variables. However, very recently low-rank methods have been developed that solve the semi-definite relaxation by taking advantage of the instance sparsity. For example, the solution of the relaxation for sparse instances with a million variables has been reported with one of these methods. In the talk we discuss how low-rank methods impact on the above solution algorithms based on hybrid relaxations.

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