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A Semidefinite Programming Approach to D-Optimal Designs

In statistics, a D-Optimal Design Matrix is used to construct efficient experiments. One such matrix is the circulant type D-Optimal Design Matrix, which is characterized by binary, circulant matrix variables satisfying the so called periodic autocorrelation constraint. The problem can easily be reduced from the space of $n \times n$ matrices to a combinatorial feasibility problem over n-vectors. It has become well known that combinatorial optimization problems may be 'lifted' to semidefinite programs and in turn provide strong approximations. In this talk we present an approach to the D-Optimal Design problem utilizing semidefinite programming (SDP). We use both the first and second SDP liftings, then use facial reduction to break symmetries in the feasible set, and solve the reduced problem using the Douglas-Rachford (DR) method and the Alternating Direction Method of Multipliers (ADMM).