BOSTON UNIVERSITY

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An alternating l_1 relaxation for the compressed sensing problem

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Mathematics and Computer Science (MCS) Building, Room 149
111 Cummington Street, Boston

Tea and Cookies at 3:30pm in MCS 153

Abstract: Lagrangian relaxation is a general methodology for approximating hard combinatorial problems and has been applied with success to various instances such as the Max-Cut problem. The compressed sensing problem of recovering the sparsest solution to a system of linear equations is known to be NP-hard and is often relaxed by means of l_1 minimization, i.e. a simple linear program. The goal of this talk is to present an approximate Lagrangian relaxation of the compressed sensing problem leading to a better relaxation scheme than l_1 minimization. The resulting iterative algorithm is called Alternating l_1. One of the standard features of the Lagrangian approach for hard combinatorial problems is to provide provably efficient approximation schemes. In the case of l_1 minimization, E. Cands, T. Tao and their collaborators were able to to show that with high probability, l_1 minimization does in fact better in that it recovers the solution of the original sparsest recovery problem exactly. We will show that the Alternating l_1 algorithm allows to recover the sparsest solution with fewer observations than l_1 norm minimization. As many recent proposals for the compressed sensing problem, an additional parameter has to be tuned in order to obtain significant improvements over the plain l_1 strategy. A nice feature of our approach is that this additional parameter is nothing but a Lagrange multiplier and the best value is simply the one that optimizes the dual function. We will also show how to circumvent the difficult task of computing the dual optimizer exactly by proposing a meaningful value of this parameter allowing for significant improvements in the first two steps of the method, hence avoiding fastidious empirical tuning as is usually done in the case of other methods such as the Reweighted l_1 algorithm.

For directions and maps, please see *http://math.bu.edu/research/statistics/statseminar.html.*