abstract

COMPUTER SCIENCE/DISCRETE MATH
Topic:

Speaker:

Affiliation:

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Submodular functions are a key concept in combinatorial optimization. Algorithms that involve submodular functions usually assume that they are given by a (value) oracle. Many interesting problems involving submodular functions can be solved using only polynomially many queries to the oracle, e.g., exact minimization or approximate maximization.
In this paper, we consider the problem of approximating a monotone submodular function f on a ground set of size n everywhere, after only poly(n) oracle queries. Our main result is a deterministic algorithm that makes poly(n) oracle queries and derives a function g such that, for every set S, g(S) approximates f(S) within a factor alpha(n) , where alpha(n)=sqrt(n+1) for rank functions of matroids and alpha(n)=O(sqrt(n) log n) for general monotone submodular functions. Our result is based on approximately finding a maximum volume inscribed ellipsoid in a symmetrized polymatroid, and the analysis involves various properties of submodular functions and polymatroids. Our algorithm is tight up to logarithmic factors. Indeed, we show that no algorithm can achieve a factor better than Omega(sqrt(n) / log n) , even for rank functions of a matroid. This is joint work with Michel Goemans (MIT), Satoru Iwata (Kyoto) and Vahab Mirrokni (Google).