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香港中文大學
The Chinese University of Hong Kong

Institute of Theoretical Computer Science and Communications

ITCSC Seminar

Extreme-value Theorems for Optimal Multidimensional Pricing

By
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3:00pm – 4:00pm

Rm121, 1/F., Ho Sin Han Engineering Building, CUHK

Abstract: In his seminal paper, Myerson [1981] provides a revenue-optimal auction for a seller who is looking to sell a single item to multiple bidders. His design has been generalized to various related settings, but despite much research effort there is no optimal auction known to date for the multiple-item problem, known in the literature as the 'optimal multidimensional mechanism design problem'. In particular, even when there is only one bidder, namely the optimal multidimensional pricing problem, remains unsolved. We provide a Polynomial Time Approximation Scheme for this problem, when the buyer's values are independent (but not necessarily identically distributed.) For all epsilon>0, we obtain a (1+epsilon)-factor approximation to the optimal revenue in time polynomial, when the values are sampled from Monotone Hazard Rate (MHR) distributions, quasi-polynomial, when sampled from regular distributions, and polynomial in n^{poly(log r)}, when sampled from general distributions supported on a set [u_{min}, r u_{min}]. We also provide an additive PTAS for all bounded distributions.

Our algorithms are based on novel extreme value theorems for MHR and regular distributions, and apply probabilistic techniques to understand the statistical properties of revenue distributions, as well as to reduce the size of the search space of the algorithm. As a byproduct of our techniques, we establish structural properties of optimal solutions. We show that, for all epsilon > 0, g(1/epsilon) distinct prices suffice to obtain a (1+epsilon)-factor approximation to the optimal revenue for MHR distributions, where g(1/epsilon) is a quasi-linear function of 1/epsilon that does not depend on the number of items. Similarly, for all epsilon>0 and n>0, g((log n)/epsilon) distinct prices suffice for regular distributions, where n is the number of items and g() is a polynomial function. Finally, in the i.i.d. MHR case, we show that, as long as the number of items is a sufficiently large function of 1/epsilon, a single price suffices to achieve a (1+epsilon)-factor approximation.

Biography: He is a PhD student in the Theory of Computation group, Computer Science and Artifitial Intelligence Lab at MIT. His advisor is Prof. Costis Daskalakis ! He is interested in algorithmic game theory, applied probability and logic! He completed his undergraduate study in the EECS department at Peking University.

******* ALL ARE WELCOME *******

Hosted By: Prof. Lap Chi Lau
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