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Title: Robust Revenue Maximization Under Minimal Statistical Information

Abstract: We study the problem of multi-dimensional revenue maximization when selling m items to a buyer that has additive valuations for them, drawn from a (possibly correlated) prior distribution. Unlike traditional Bayesian auction design, we assume that the seller has a very restricted knowledge of this prior: they only know the mean μ_j and an upper bound σ_j on the standard deviation of each item's marginal distribution. Our goal is to design mechanisms that achieve good revenue against an ideal optimal auction that has full knowledge of the distribution in advance. Informally, our main contribution is a tight quantification of the interplay between the dispersity of the priors and the aforementioned robust approximation ratio. Furthermore, this can be achieved by very simple selling mechanisms.

More precisely, we show that selling the items via separate price lotteries achieves an $O(\log r)$ approximation ratio where $r=\max_j(\sigma_j/\mu_j)$ is the maximum coefficient of variation across the items.If forced to restrict ourselves to deterministic mechanisms, this guarantee degrades to $O(r^2)$. Assuming independence of the item valuations, these ratios can be further improved by pricing the full bundle. For the case of identical means and variances, in particular, we get a guarantee of $O(\log(r/m))$ which converges to optimality as the number of items grows large. We demonstrate the optimality of the above mechanisms by providing matching lower bounds.

This is joint work with Yiannis Giannakopoulos and Diogo Poças.

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