Abstract:

We consider the goal of social welfare maximization where a single item is to be assigned to one of to n potential agents with interdependent values. That is, each agent has her own private signal, and the valuation of each agent is a known function of all n private signals. This captures settings such as valuations for artwork, oil drilling rights, broadcast rights, and many more. In the interdependent value setting, all previous work has assumed a so-called single-crossing condition. Single-crossing means that the impact of agent i's private signal, $s_i$, on her own valuation is greater than the impact of $s_{ii}$ on the valuation of any other agent. It is known that without the single-crossing condition an efficient outcome cannot be obtained. We study welfare maximization for interdependent valuations through the lens of approximation.

We show that, in general, without the single-crossing condition, one cannot hope to approximate the optimal social welfare any better than the approximation given by assigning the item to a random bidder. Consequently, we introduce a relaxed version of single-crossing, $c$-single-crossing, parameterized by $c \geq 1$, which means that the impact of $s_i$ on the valuation of agent $i$ is at least $1/c$ times the impact of $s_i$ on the valuation of any other agent ($c = 1$ is single-crossing). Using this parameterized notion, we obtain a host of positive results. We also consider interdependent settings when valuations are concave and give improved results.

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