Payment Rules for Combinatorial Auctions via Structural Support Vector Machines

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Abstract

Given an optimal winner determination algorithm for a combinatorial auction, standard approaches provide exact incentive compatibility, albeit subject to substantial economic concerns. For large combinatorial auction problems, however, winner determination can only be solved approximately due to its high computational complexity, and the design of appropriate payment rules for suboptimal winner determination remains a significant open problem. We advocate the use of structural support vector machines to solve this pricing problem. The output of a winner determination algorithm is viewed as training data for a classification problem with multiple classes, corresponding to the different bundles that can be allocated to an agent. The decision boundaries of a trained classifier are then used to construct a payment rule. An exact classifier produces a payment rule that together with the allocation rule defined by the original winner determination algorithm forms a dominant-strategy incentive compatible mechanism. Moreover, minimizing regularized empirical error in training corresponds to minimizing a regularized upper bound on ex post regret for truthful bidding, allowing the approach to extend to non-implementable allocation rules.

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