iMLCA: Machine Learning-powered Iterative Combinatorial Auctions with Interval Bidding

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We study the design of iterative combinatorial auctions for domains with a large number of items. In such domains, preference elicitation is a major challenge because the bundle space grows exponentially in the number of items. To keep preference elicitation manageable, recent work has employed machine learning (ML) algorithms that identify a small set of bundles to query from each bidder. However, a major limitation of this prior work is that bidders must submit *exact* values for the queried bundles, which can be quite costly for them. To address this, we propose *iMLCA*, a new ML-powered auction with *interval bidding* (i.e., where bidders submit upper and lower bounds for the queried bundles). To steer the auction towards an efficient allocation, we introduce a new price-based activity rule, asking bidders to tighten bounds on relevant bundles only. The activity rule is designed such that the auctioneer receives enough information about bidders' preferences to achieve high efficiency and good incentives, while minimizing elicitation costs. Our experiments show that iMLCA, despite only eliciting interval bids, achieves almost the same allocative efficiency as the prior auction design that required bidders to submit exact values. Finally, we show that iMLCA beats the well-known combinatorial clock auction in a realistically-sized domain.

Full paper: https://arxiv.org/abs/2009.13605

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CCS Concepts: • **Computing methodologies** → **Artificial intelligence**; • **Theory of computation** → **Algorithmic game theory**.

Additional Key Words and Phrases: Market Design, Combinatorial Auctions, Machine Learning

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