Dynamic Reserve Prices for Repeated Auctions: Learning from Bids*

Working Paper

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A large fraction of online advertisement is sold via repeated second price auctions. In these auctions, the reserve price is the main tool for the auctioneer to boost revenues. In this work, we investigate the following question: Can changing the reserve prices based on the previous bids improve the revenue of the auction, taking into account the long-term incentives and strategic behavior of the bidders?

In order to set the reserve price effectively, the auctioneer requires information about distribution of the valuations of the bidders. A natural idea, which is widely used in practice, is to construct these distributions using the history of the bids. This approach, though intuitive, raises a major concern with regards to long-term (dynamic) incentives of the advertisers. Because the bid of an advertiser may determine the price he or she pays in future auctions, this approach may result in the advertisers shading their bids and ultimately in a loss of revenue for the auctioneer.

To understand the effects of changing reserve prices based on the previous bids, we study a setting where the auctioneer sells impressions (advertisements space) via repeated second price auctions. We demonstrate that the long-term incentives of advertisers plays an important role in the performance of these repeated auctions by showing that under standard symmetry and regularity assumptions (i.e., when the valuations of advertisers are independently and identically distributed according to a regular distribution), the optimal mechanism is running a second price auction with a *constant* reserve and changing the reserve prices over time is not beneficial. However, when there is *uncertainty* in the distribution of the valuations and competition among the bidders, we show that there can be substantial benefit in learning the reserve prices using the previous bids. To this end, we propose a simple dynamic reserve mechanism called the *threshold* mechanism that achieves near optimal revenue, while retaining (approximate) incentive compatibility.

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