Strategic Budget Selection in a Competitive Autobidding World

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Abstract

We study a game played between advertisers in an online ad platform. The platform sells ad impressions by first-price auction and provides autobidding algorithms that optimize bids on each advertiser's behalf. Each advertiser strategically declares a budget constraint (and possibly a maximum bid) to their autobidder. The chosen constraints define an "inner" budget-pacing game for the autobidders, who compete to maximize the total value received subject to the constraints. Advertiser payoffs in the constraint-choosing "metagame" are determined by the equilibrium reached by the autobidders.

Advertisers only specify budgets and linear values to their autobidders, but their true preferences can be more general: we assume only that they have weakly decreasing marginal value for clicks and weakly increasing marginal disutility for spending money. Our main result is that despite this gap between general preferences and simple autobidder constraints, the allocations at equilibrium are approximately efficient. Specifically, at any pure Nash equilibrium of the metagame, the resulting allocation obtains at least half of the liquid welfare of any allocation and this bound is tight. We also obtain a 4-approximation for any mixed Nash equilibrium, and this result extends also to Bayes-Nash equilibria. These results rely on the power to declare budgets: if advertisers can specify only a (linear) value per click but not a budget constraint, the approximation factor at equilibrium can be as bad as linear in the number of advertisers.

Biography

Yiding Feng is a postdoctoral principal researcher at the University of Chicago Booth School of Business. Previously, he worked as a postdoctoral researcher at Microsoft Research New England from 2021 to 2023. He received his Ph.D. from the Department of Computer Science, Northwestern University in 2021. His primary research focuses on theoretical computer science, economics & computation, and operations research. In July 2024, Yiding will be joining HKUST as an assistant professor.