Optimal Contracts for Intermediaries in Online Advertising

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Preliminary, please do not circulate

November 2014

Abstract

In online display advertising, the prevalent method advertisers employ to acquire impressions is to contract with an intermediary. These contracts involve upfront payments made by the advertisers to the intermediary, in exchange for running their campaigns on their behalf. This paper studies the optimal contract offered by the intermediary in a setting where advertisers’ budgets and targeting criteria are private. This problem can naturally be formulated as a multi-dimensional dynamic mechanism design problem, which in general is hard to solve. We tackle this problem by employing a novel performance space characterization technique, which relies on delineating the expected cost and value achievable by any feasible (dynamic) bidding policy. This technique provides a convex optimization formulation of the optimal contract design problem. Using this formulation, we obtain a closed-form characterization of the optimal contract, when advertisers have identical value distributions. Conversely, when advertisers are heterogeneous, we provide a novel duality-based approach, which reduces the optimal contract design problem to a simpler convex optimization problem. The intermediary’s bid in the optimal contract is obtained by first using the optimal dual solution to compute a weighted average of the values associated with different types (to guarantee that the advertiser reports her type truthfully), and then shading this quantity (to account for budget constraints). Our results indicate that an intermediary can profitably provide bidding service for budget-constrained advertisers, and at the same time increase the utility of its advertisers and the ad exchange.

Keywords: Intermediary problems, mechanism design, internet advertising.