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A Hierarchical Framework for Ad Inventory Allocation in Programmatic Advertising Markets

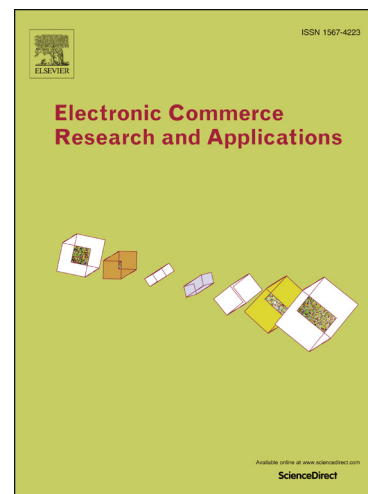
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# A Hierarchical Framework for Ad Inventory Allocation in Programmatic Advertising Markets

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## Abstract

Enabled by the big data driven user profiling and precision bidding techniques, online programmatic advertising markets have evolved from the traditional website-buying or ad-slot-buying models to a fine-grained and real-time trading model at the level of ad impressions (i.e., ad inventory). As a result, Web publishers are now facing a challenging decision of allocating the ad inventory across multiple advertising models, which has a direct and important influence on both their individual revenues, and the market-wide supply-demand balance. In this paper, we propose a novel hierarchical ad inventory allocation framework (AIAF), taking into consideration the possible scenarios of ad inventory allocation in programmatic advertising markets. AIAF explicitly captures the specific features of ad inventory allocation in each of three levels (i.e., channel level, market level and platform level), and also their influence-feedback effects. We present the general solution process for solving this model on the basis of its property analysis. An illustrative instantiation of our AIAF model is formulated to demonstrate its applications in supporting publishers' decision-making on the ad inventory allocation. We also conduct experiments based on empirical data so as to validate the model and analysis. Our research findings indicate that 1) our AIAF model outperforms other single-level and two-level allocation strategies; 2) the fine-grained optimization is superior to that of the coarse-grained level; 3) allocation decisions should be made on the basis of the comparative marginal revenue instead of the absolute marginal revenue.

**Keywords:** Programmatic advertising, Ad inventory, Real-time bidding, Private marketplace, Header bidding

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