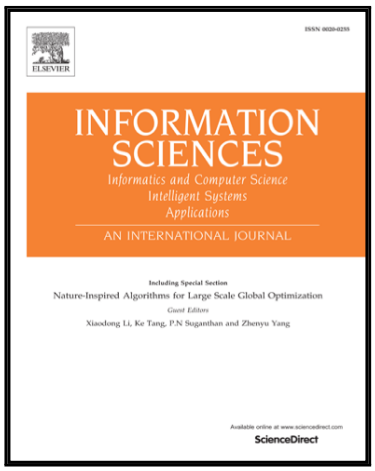

Developing a Cooperative Bidding Framework for Sponsored Search Markets – An Evolutionary Perspective

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PII: S0020-0255(16)30522-9
DOI: 10.1016/j.ins.2016.07.041
Reference: INS 12367

To appear in: *Information Sciences*

Received date: 28 August 2015
Revised date: 2 June 2016
Accepted date: 17 July 2016

Please cite this article as: Yong Yuan , Fei-Yue Wang , Daniel Zeng , Developing a Cooperative Bidding Framework for Sponsored Search Markets – An Evolutionary Perspective, *Information Sciences* (2016), doi: 10.1016/j.ins.2016.07.041

Developing a Cooperative Bidding Framework for Sponsored Search Markets - An Evolutionary Perspective

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***Abstract*:** Sponsored search advertising (SSA) markets have witnessed soaring bid prices from advertisers, which have been considered to be a potential challenge to the long-term stability, profitability and effectiveness of the SSA ecosystem. One approach to addressing this challenge is identifying cooperative and stable bidding strategies for competing advertisers with the objective of reaching socially optimal outcomes in repeated SSA auctions. Although useful in analyzing advertisers' bidding behavior in single auction sessions, static game-theoretic analysis and simulation studies in the extant SSA literature offer only limited insights for characterizing the long-term evolutionary dynamics and stability of advertisers' bidding behavior. In this paper, we address this problem by applying evolutionary game theory and coevolutionary simulation. Our key finding is that a group of "nice" and retaliatory (NR) strategies can promote stable cooperation among competing advertisers. Advertisers using NR strategies will never deviate from cooperation first (nice) and always punish their rivals' deviations using competitive bids (retaliatory). The NR strategies are shown to be able to encourage advertisers to decrease their bids to obtain revenue that is equal to that awarded under the Vickrey-Clarke-Groves (VCG) auction mechanism and are further shown to alleviate bid inflation effectively at the system level.

***Keywords*:** sponsored search, bid inflation, evolutionary game theory, coevolutionary simulation

1. Introduction

The last decade has witnessed the rapid growth of sponsored search advertising (SSA), which allows advertisers to bid for their keyword-specific advertisements to appear alongside the organic results on search engine result pages [1, 18, 19, 29, 39, 42]. Compared with other online advertising formats, SSA has the