

# Computational Advertising: A Multi-Agent Systems Approach

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## 1. Summary

Computational advertising is a new scientific sub-discipline, at the intersection of information retrieval, machine learning, optimization, and microeconomics. Its central challenge is to find the best ad to present to a user engaged in a given context, such as querying a search engine ("sponsored search"), reading a web page ("content match" and "display ads"), watching a movie, IM-ing and so on. The information about the user can vary from scarily detailed to practically nil. The number of potential advertisements might be in the billions. Thus, depending on the definition of "best match" this challenge leads to a variety of massive optimization and search problems, with complicated constraints.

In an economic setting, an individual - or agent - is assumed to behave selfishly: agents compete with each other to acquire the most resources (utility) from their interactions. The combined selfish behavior of individual agents serves a particular purpose as an emergent property of the system: for example, the efficient allocation of scarce goods. Many computational problems can be cast as resource allocation problems.

Clearly, software agents in a multi-agent system must be intelligent and adaptive. If intelligent software agents are to work out the (local) solutions that are best for themselves, the rules of the system must be incentive compatible. That is, the rules should be such that as individual agents learn how to optimize their own reward, the system as a whole should work with increasing efficiency. The combination of intelligent software agents and well-designed mechanism (markets/auctions/negotiations) can lead to the desired behavior of the system as a whole, a kind of 'collective intelligence'.

This talk focuses on viewing computational advertising under the lens of competitive

multi-agent systems and its emergent properties. As an illustration we will describe the problem and the space of solutions to the ad serving problem in Yahoo!'s Non-Guaranteed Delivery (NGD) Exchange as well as the complex interactions that occur among participating entities and bidding agents throughout the process.

## 2. Biography

Joaquin A. Delgado is currently Sr. Principal Architect within the Display Advertising group at Yahoo! Inc. He currently leads the effort on the next-generation ad serving and unified marketplace. Previously, he was CTO and co-founder of Lending Club, an online lending community. Prior to joining Lending Club, he was the CTO and co-founder of TripleHop Technologies, an enterprise search company, until the company got acquired by Oracle in 2005 and then became a prominent member of Oracle's software architecture team. Joaquin is also a renowned expert in information filtering and recommender systems, and holds a Ph.D in computer science and artificial intelligence from Nagoya Institute of Technology, Japan.