

# ERCIM “Alain Bensoussan” Fellowship Scientific Report

Fellow: ORESTIS TELELIS

Visited Location : MASCOTTE, INRIA SOPHIA-ANTIPOLIS, FRANCE

Duration of Visit: 21 July 2010 – 31 August 2010

## **I - Scientific activity** **(1 page at maximum)**

During his stay with the MASCOTTE research team, at INRIA Sophia-Antipolis, the fellow continued and completed research in the field of Algorithmic Game Theory, under the subject of Keyword Auctions for internet advertising. The advent of the internet has spawned a novel advertising opportunity for enterprises; popular search engines allocate advertisement slots in their web pages, alongside search results for keywords issued by users. The allocation is performed most commonly by means of an auction, where advertisers bid for slots and the search engine ranks them and assigns them to slots according to their bid. The auction mechanism currently in use – referred to as Generalized Second Price Auction – encourages competitive strategic behavior by advertisers, that results in increased revenue for the auctioneer (search engine). Despite the recent characterization of socially efficient equilibria for this mechanism, many issues are not well understood; of particular importance are the questions “How and what kind of strategic behavior converges to a solution of the game (equilibrium)?” and “What is the incurred social welfare in the reached stable configurations”?

The fellow completed research on these themes that was initialized during his previous appointment, in the first part of his ERCIM “Alain Bensoussan” Fellowship. The research results were submitted (on July 30, 2010) to the International Workshop on Internet and Network Economics (WINE 2010) in the form of a research article.

## **II- Publication(s) during your fellowship**

*Please insert the title(s), author(s) and abstract(s) of the published paper(s). You may also mention the paper(s) which were prepared during your fellowship period and are under reviewing.*

**Title:** “Discrete Strategies in Keyword Auctions and their Inefficiency for Locally Aware Bidders”

**Authors:** Evangelos Markakis and Orestis Telelis

Submitted for review to *the 6<sup>th</sup> International Workshop on Internet and Network Economics* (WINE 2010)

**Abstract** We study formally two simple discrete bidding strategies in the context of iterative best response procedures, for the game induced by the Generalized Second Price keyword

auction mechanism. These strategies have seen experimental evaluation in the recent literature as parts of best response procedures, which have been shown not to converge. Here we give a detailed definition of iterative best response under these strategies and, under appropriate discretization of the players' strategy spaces, we find that the best response state space contains socially optimal pure Nash equilibria of the original game (in continuous strategies). We cast the strategies under a new light, arguing that they constitute natural choices for conservative myopic bidders, that need to act based on local information only. For this case we provide bounds for the worst-case ratio of the social welfare of the reached locally stable states, relative to the socially optimum welfare. Finally, we make several interesting observations regarding convergence of the studied strategies, present related experimental evidence and discuss challenging open problems.

### **III -Attended Seminars, Workshops, and Conferences**

*Please identify the name(s), date(s) and place(s) of the events in which you participated during your fellowship period.*

*5<sup>th</sup> Athens Colloquium on Algorithms and Complexity, 26-27 August,  
National Technical University of Athens, Athens, Greece, (ACAC'10)  
(website: <http://www.corelab.ece.ntua.gr/acac10/>)*

***Purpose:*** Presentation of the work with title: ``Discrete Strategies in Keyword Auctions and their Inefficiency for Locally Aware Bidders'' (by invitation).

### **IV – Research Exchange Programme (12 month scheme)**

*Please identify the name(s), date(s) and place(s) of your Research Exchanges during your fellowship period and detail them .*