Strategy and Mechanism Lessons from the First Ad Auctions Trading Agent Competition

by: Alpha Chau
Recall: Purpose

- Explore strategies for bidders (the advertisers)
- Explore optimal reserve score settings
- Find an *empirical* equilibrium
Recall: The Competition - Roles

- Simulation of ad auction with simplified rules
- Roles:
  - Advertisers
  - Users
  - Search Publisher
Recall: The Competition - Auction

- 60-day Ad Campaign
- Advertisers bid each day for each of 16 keywords
Recall: The Competition - Bidders

- For each campaign, an advertiser has a distribution capacity \{LOW, MID, HIGH\} and a product specialty.
Recall: The Competition - Reserve Score

- Two Reserve Scores {Regular, Promoted}
And now, a short word from our sponsor...
Strategies are programs.
Simulations fill in the payoff matrix.

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Empirical Game Analysis: Our Goal

- Set of players and strategies (ad agents) define profiles in a game
  1. Average payoffs for one profile over many runs
  2. Fill cells of payoff matrix with such estimates
  3. Find Nash Equilibrium
Empirical Game Analysis: El Problemo

- But this is very tedious!
  - Even given a symmetric game, to get good estimates, still have many a calculation to do...
    - \((\text{#profiles} = \text{#strats}^{\text{#players}})\)
  - It takes 3,000 processor-hours per profile simulation. UGH!
Empirical Game Analysis: Our Plan

Game Theoretical Analysis $\rightarrow$ Optimize empirical mechanism by narrowing down simulation space
Game Theoretical Work-around I

- **Variance Reduction**
  - Adjust for the noise that you know about (in our case, randomized dist. capacities)
  - This way we can get away with smaller sample size for estimates!
Game Theoretical Work-around II

● 4-Player Reduction
  ○ Pair players up under a decision-maker
  ○ Hope that computing payoffs for decision-makers similar to actual individual payoffs
  ○ Used to narrow down focus to top three agents for 8-player analysis
Game Theoretical Results

- From this analysis, we learned...

  Support of a sample NE will contain, at most, the top three agents from the tournament:
  
  TacTex, AstonTAC, and Schlemazl
Finally, le main course...
Bidder Strategies

Figure 3: Adjusted profits versus the percentage of MS clicks.
Bidder Strategies

Better clicks, Better money

(In other words, focus on MS queries b/c of capacities)
Slot Scheduling

- Publisher needs to account for advertiser spend limits → Need to determine how to allocate and price ad slots, e.g. sequence of queries
- Under optimized reserve price, compared common slot scheduling algorithms with a Baseline one
Slot Scheduling

Chill...

(Approaching as before can be detrimental to publisher revenue when reserve scores are set optimally)
Reserve Prices

Drumroll please...
Reserve Prices
Reserve Prices

- Reserve prices affect the equilibrium of the game → effectiveness of strategies
- Presence of reserve scores dramatically increases publisher revenue
- Setting reserve scores optimally can be much better than adding another advertiser
For Further Discussion...

- Do their findings extend to more complex real-life ad auctions?
- What kind of model were the common slot scheduling algorithms assuming when they were devised? What can we learn from the difference between their model and ours?