Algorithmic Game Theorists Ponder Hong Kong Game of Monopoly

In this talk, the chief scientist in Baidu, Dr. Chung, raised some open problems in the industry.

Search as Media

- A media company's business is to help other businesses build brands, and a brand is the total loyalty of the company's customers. A "new media company" does this by leveraging the interactive nature of the Internet to enable users to communicate with one another ... .
- Media companies typically give away valuable content
- Search advertising may be a derivative business.

(over 10 million small businesses; 900,000 with annual revenue >$1 million)

Some high-level problems

- How to predict customer's and end user's (often apparently irrational) behavior?
- Ad matching/ranking rules/algorithms change too fast for equilibria to develop.
- Natural seasonality and news events change traffic pattern and advertiser participation, complicating matters.
- "Goal is not GSP, but getting customers to bid true value"
- Quantum mechanics? "Moves" (of customers/click/keyword...) are statistical.
- How to recognize hidden goals?
- How to discover hidden risk signals?
- How to anticipate phase transitions?
- How to conduct experiments more cheaply (than losing revenue)?
- Rank-dependent CTR prediction
- Ad selection/ranking as a combinatorial optimization problem

Continued Problems, more related to theory

- How to make advertisers bid higher, if bids are hidden?
- Can theory demonstrate, (hidden bids, broad match) beats (open bids, exact match) on degree of thruthfulness and rate of convergence.
- What should the criteria be, for top-left ad placement?
- Since conversion depends on type of traffic (such as due to different queries in broad match), should a search engine
  1) Allow advertiser to specify different bids for different queries;
  2) Adjust bids for the user, dynamically;
  3) Discount the CPC?
- Should a search engine give "clickers" less stringently relevant ads (considering long-term effect)?
- More optimized (in terms of CTR) but less predictable ad targeting may hurt custormer confidence resulting in lower bids and revenue, how to avoid that?

Beyond GSP (generalized second-price Auction, “google second-price”)

- The “unreasonable effectiveness” of GSP in industry

- GSP is not truthful
- GSP is not common-sense “fair and just”
- GSP has singularities, discontinuities, non-smoothness
- Unless one changes the model from all/none to allocation

- A simple but surprising observation: revenue-preserving switch:

- Swap two ads i, i+1, charge original ad i as if it were i+1, charge i+1 its bid

- A simple characterization of revenue-preserving permutations:

- No ad is promoted more than one place
- 1-to-1 correspondence with bit-vectors

- Given a set of bids and CTRs, calculate GSP and set position prices, then allocate positions