


Market Design in Display Advertising

R. Preston McAfee
Yahoo! Research



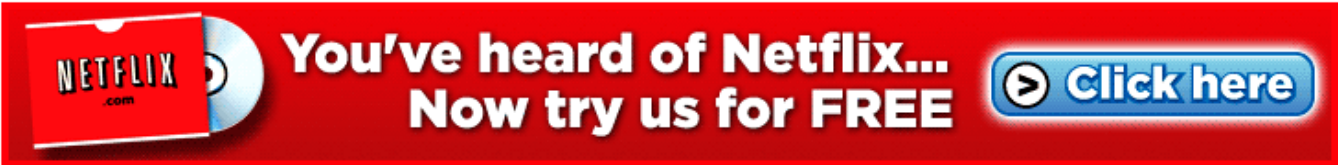
Display Advertising Impressions

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PERSONAL HEALTH


Growing Older, and Adjusting to the Dark

By JANE E. BRODY
Published: March 13, 2007

How well do you see at night? If you're over 50, probably not as well as you think, no matter how many carrots you eat. The typical 50-year-old driver needs twice as much light to see as well after dark as a 30-year-old. Yet few of us compensate adequately for the reduction in nighttime acuity that occurs in the aging eye.

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Display Advertising

- Contracts purchased in advance
- Typically guarantee number of impressions
- Set types of eligible opportunities
 - 30-40 year old males
 - Californians on auto pages
- Supply random
- Excess sold on spot market
- Two main problems
 - Cream-skimming
 - Orphan categories



Objective Function Requirements

- Flexibility in serving
- Spot revenue
- Insuring quality of booked campaigns
- Risk of under and over delivery
- Handling orphan inventory categories
- Scarcity pricing



Objective Function

Serving Representativeness

Lost Spot Revenue

$$\min \Phi = \gamma \left\{ \frac{1}{2} \sum_j V^j Y^j \sum_{i \in B^j} \frac{\sum_{k \in B^j} x_k}{x_i} \left\{ \frac{x_i}{\sum_{k \in B^j} x_k} - \frac{y_i^j}{Y^j} \right\}^2 \right\} - \sum_i [r_i z_i]$$

$$x_i \geq \sum_{j|i \in B^j} y_i^j$$

$$Y^j = \sum_{i \in B^j} y_i^j$$

Y^j : Requested demand for contract j
 B^j : Eligible impressions for contract j

x_i : Available supply for impression i
 r_i : Opportunity cost for impression i
 z_i : Slack for impression i

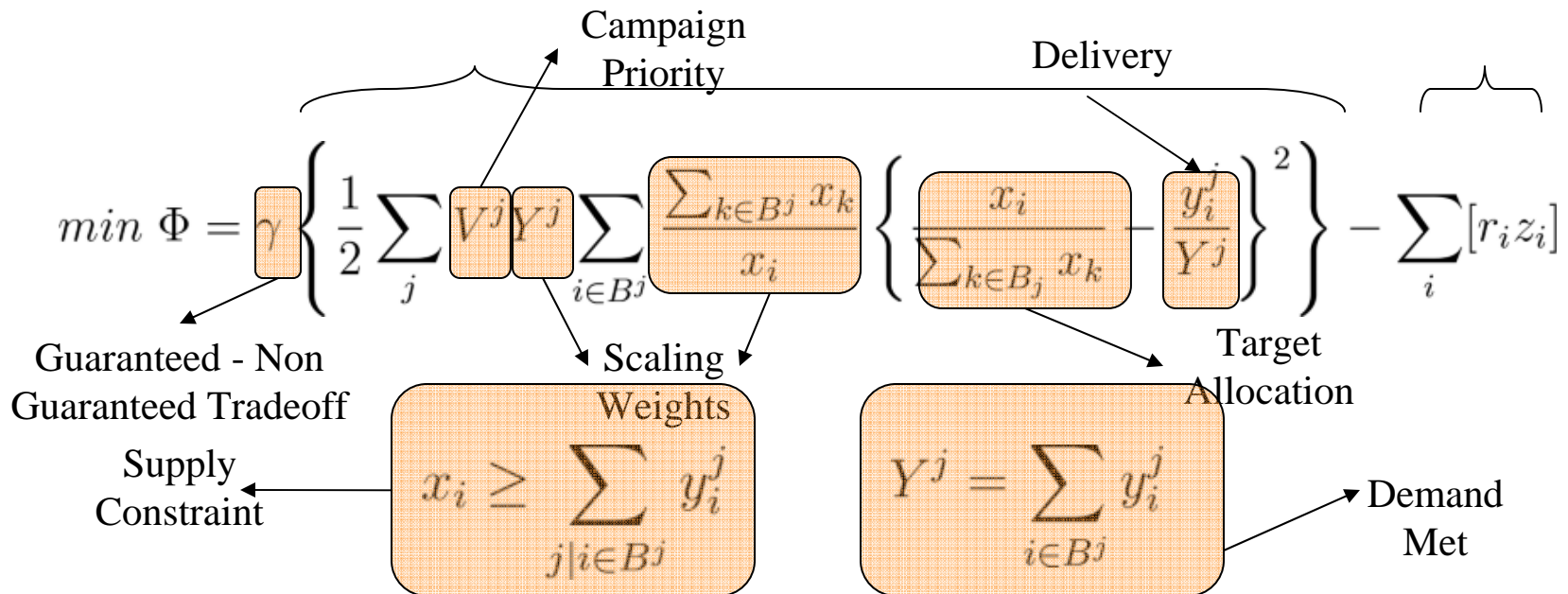
y_i^j : Amount of impression i supply allocated to contract j



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Theorem

- There is an implementation using randomized bidding into an exchanges
- Distribution of bids is uniform
- Bidding distributions do not depend on type of inventory
- Bidding distributions have closed forms
- Can approximate without pricing orphaned categories!



Key Innovations

- **Entire system designed to meet overall objective**
- **Fine-grained targeting**
 - Forecasting, admission control and serving
- **Integrated pricing and allocation**
 - Price based on expected allocation
- **Business knobs control all trade-offs**

Addresses
Current
Problems

- **Inventory allocation across guaranteed and spot demand**
 - Unified marketplace
- **User modeling**

Forward
Looking
Innovations



Thank you!

