Advertising Engines

A Guide to Web Research: Lecture 1

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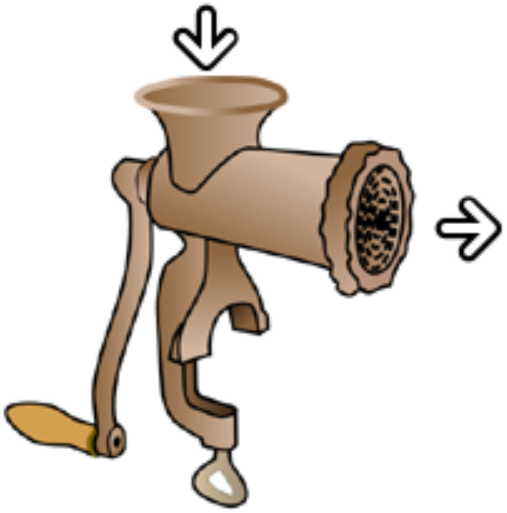
YAHOO! SEARCH MARKETING

Microsoft adCenter

Google AdWords

Google AdSense



new algorithmic problems

new models and notions

Talk Objective

Industrial solutions

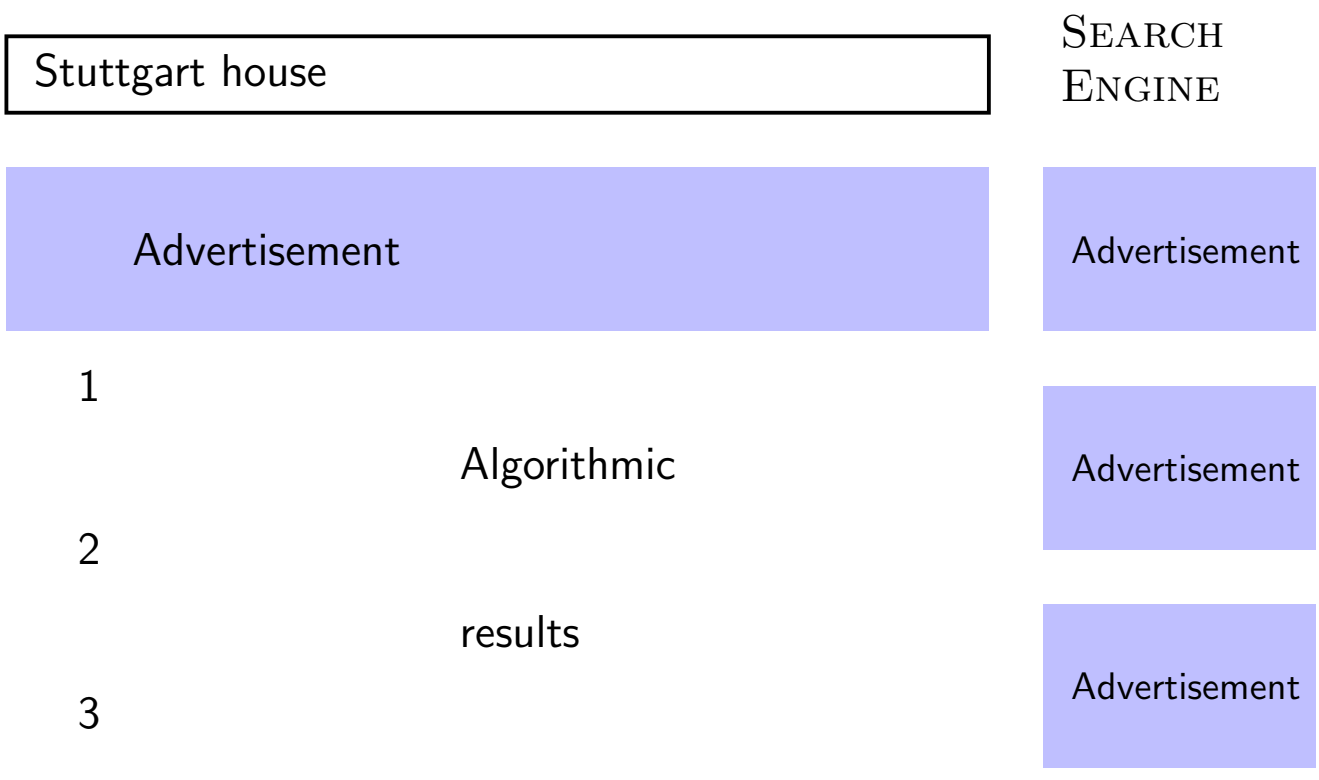
- Google AdWords
- Google AdSense
- Yahoo! SearchMarketing
- Microsoft adCenter
- Amazon recommendations
- Coming soon: personalized ads for webmail, social networks, blogging platforms, phones, computer games, supermarket bills etc.

Today we show
(1) single model for distributing personalized ads
(2) open algorithmic problems motivated by such systems

Outline

Part I: Architecture of Advertising Engines

Example: Sponsored Search



Example: Context Ads

Stuttgart Estate Agency

Advertisement

Main

Advertisement

content

Advertisement

Three Components: Event, Advertiser, Engine

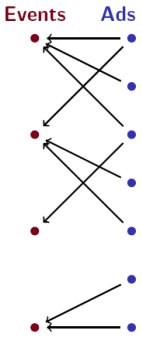
Event

Person
Media
Action

Advertiser

Ad
$$$
Targeting

Advertising Engine



Choosing procedure

Pricing mechanism

Component 1: Event

Collect all available information:

- Person: What do we know about him/her?
  - Age, geographic location, previous actions, interests etc
- Media: What is situated around the ad placement?
  - Content and typical audience of website, tv program, newspaper
- Action: Current relations between person and media?
  - Current search query, purchasing a book, signing up to a service

Component 2: Advertiser

Setting new campaign:

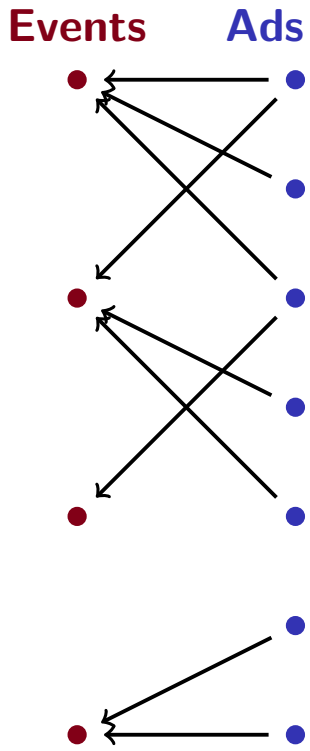
- Ad: What will be displayed?
  - Text, image, video, hyperlink, phone number, advertiser's website
- $$$: Size of campaign?
  - Monthly/daily budget, maximal admissible price (bid) for click/impression
- Targeting: Who is target audience?
  - Location, specific query keywords, category of landing page

Targeting in general: any subset of event space $P \times M \times A$

Component 3: Advertising Engine

Basic routine of advertising engine:

1. Get all available info about current event
2. Keep only ads that include this event to their target
3. Rank ads according to their bids and their relevance to the event
4. Display (several) best ones
5. In case of click compute discount (actual price for advertiser)



Objectives

- User
  - Maintain privacy
  - Receive only relevant ads
- Advertiser
  - Cheap clicks
  - Get "relevant" clicks (high conversion rate)
  - Transparent pricing and targeting mechanisms
- Advertising Engine
  - Organize enough relevant clicks for any budget and any target
  - Keep prices high
  - Keep users/advertisers happy

More objectives?

Part II: Algorithmic Challenges

Disclaimer: my style is

1. At first, think independently (e.g. pose new problems)
2. **Only after that** look into literature

Hence, the following problems might be already known and heavily studied!

Target optimization (1/4) — Informally

Advertiser sets target audience. **Advertising engine should help:**

- Some potentially interested people are missed
- Exclude people who will be offended by this ad
- Proper setting of target audience is difficult
- Advertising engine knows much more about event space

Target optimization (2/4) Formalization

Events are vectors

Advertiser provides some **sample** events $S = \{e_1, \ldots, e_k\}$ from the target

Advertising engine produces an effective membership procedure for **optimized target** $\bar{S}$

How to define **optimized target**?

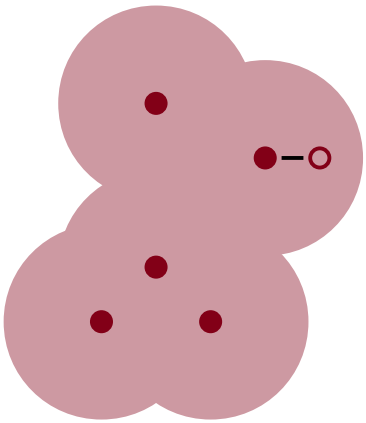
Target optimization (3/4) Solution

Let $B(e, r)$ be the ball in event space with center e and radius r

$New\ target = \bigcup_k B(e_k, r)$

Effective membership for e_{new}:

1. Find nearest representative $e_i \in S$
2. Check whether $Dist(e_{new}, e_i) < r$



Target optimization (4/4) Questions Around

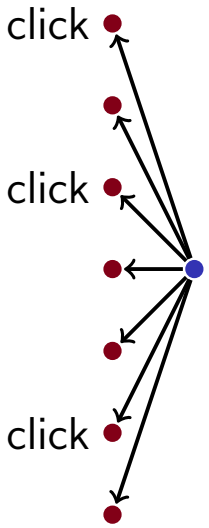
- Other definitions for optimized target?
- Exploiting historical information for target optimization
- Target construction based on advertisement content

Click Volume (1/4) Informally

Assume we show the same ad at all events. Then average daily amount of clicks is **click volume** for the given ad

Motivation

- Understand how much can we sell
- Evaluate the effectiveness of current engines
- The first step towards recognizing interested audience
- Use different strategies for (supply$<$demand) and (supply$>$demand)



Click Volume (2/4) Basic Formula

Take daily history **event-ad-?click**:

$$(e_1, a_1, b_1) \dots (e_n, a_n, b_n)$$

Use similarity-between-ads function S for computing click volume V:

$$V(a_{new}) = \sum S(a_{new}, a_i) \cdot b_i$$

Any comments/objections?

Click Volume (3/4) Corrected Formula

Problem: click volume is underestimated since not all chosen ads are similar to a_{new}

First step: prediction of click-through rate for a given **event-ad** pair

$$CTR(e, a_{new}) = \frac{\sum_{e_i=e} S(a_i, a_{new}) b_i}{\sum_{e_i=e} S(a_i, a_{new})}$$

Second step: using click rates

$$V(a_{new}) = \sum_{1 \le i \le n} CTR(e_i, a_{new})$$

Click Volume (4/4) Questions Around

- Computing ad volume (the amount of advertisements that can get positive response at the given event)
- Fast algorithm for predicting click volume for all ads in the system
- Exploiting metric inside event space

AdRank Computing (1/2) Informally

Input: event e_{new}, set of all ads A. **Choosing-ads principles:**

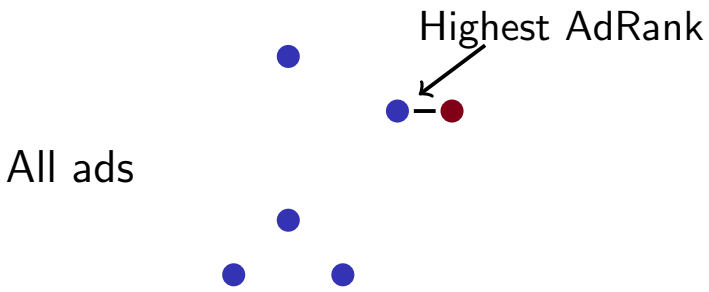
- Take the most content-relevant
- Take the ones with best click-through rate
- Take ads with maximal bids

$$AdRank(e_{new}, a) = Bid(a) \cdot (ContRel(e_{new}, a) + CTR(e_{new}, a))$$

AdRank Computing (2/2) Questions Around

Actually, finding content-closest ads to the given input is just the nearest neighbor problem. **We need:**

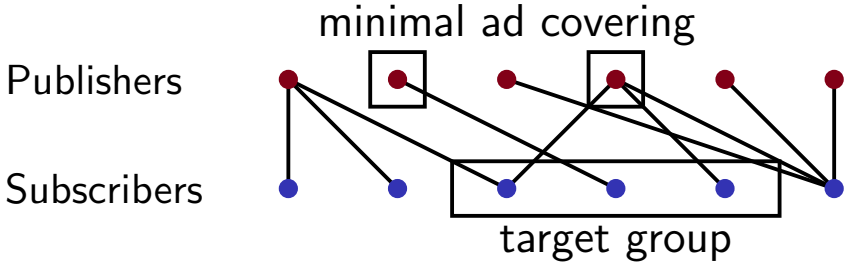
- Data structure for A for fast computing of best $AdRank(e_{new}, a)$ values
- Accurate and fast prediction for $CTR(e_{new}, a)$



Ad Coverings Informally

Consider any **publishers-subscribers** graph (say, RSS feeds):

- What is the minimal amount of placements to cover all (target) audience?
- Given fixed amount of placements how many subscribers can we cover twice?



Other Directions in Advertising Engines

- Optimal ad distribution in case when interested audience is larger than budget
- Machine learning for advertising engines
- Weighted targeting (some events are preferable to others)
- Advertising engines for social networks
- Auction design for sponsored search
- Click fraud

Call for participation

Know a relevant reference?

Have an idea?

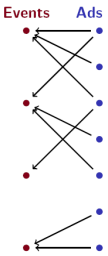
Find a mistake?

Solved one of these problems?

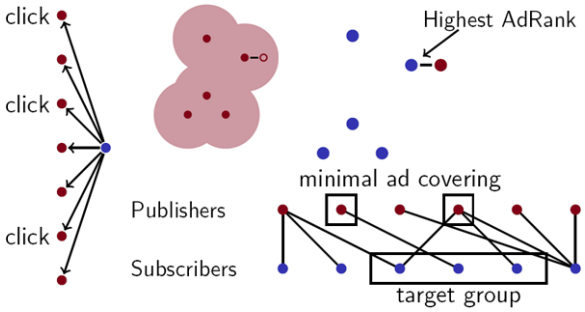
- Knock to my office 1.156
- Write to me `yura@logic.pdmi.ras.ru`
- Join our informal discussions
- Participate in writing roadmap-paper

Summary

Three components:



Four problems:



Vielen Dank für Ihre Aufmerksamkeit! Fragen?

Sources

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