

Unintrusive Customization Techniques for Web Advertising

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Overview

- Introduction
 - Ad targeting and current methods
 - Targeting with ADWIZ
- The ADWIZ System
 - Architecture and basic interaction
 - The learning process
 - Experimental results
- Conclusions

Ad Targeting

- Goal
 - Show advertisement only to desired target audience
- Means
 - Dynamically select different ad for each Web site visitor
- Targeting Parameters (Examples)
 - Browser, OS, time of day, country

Manual Ad Targeting

- Method
 - Manually define targeting parameters for each ad
- Advantages
 - Reaches only desired target audience
 - Predictable (How many ads will be shown?)
- Disadvantages
 - Laborious to setup and maintain

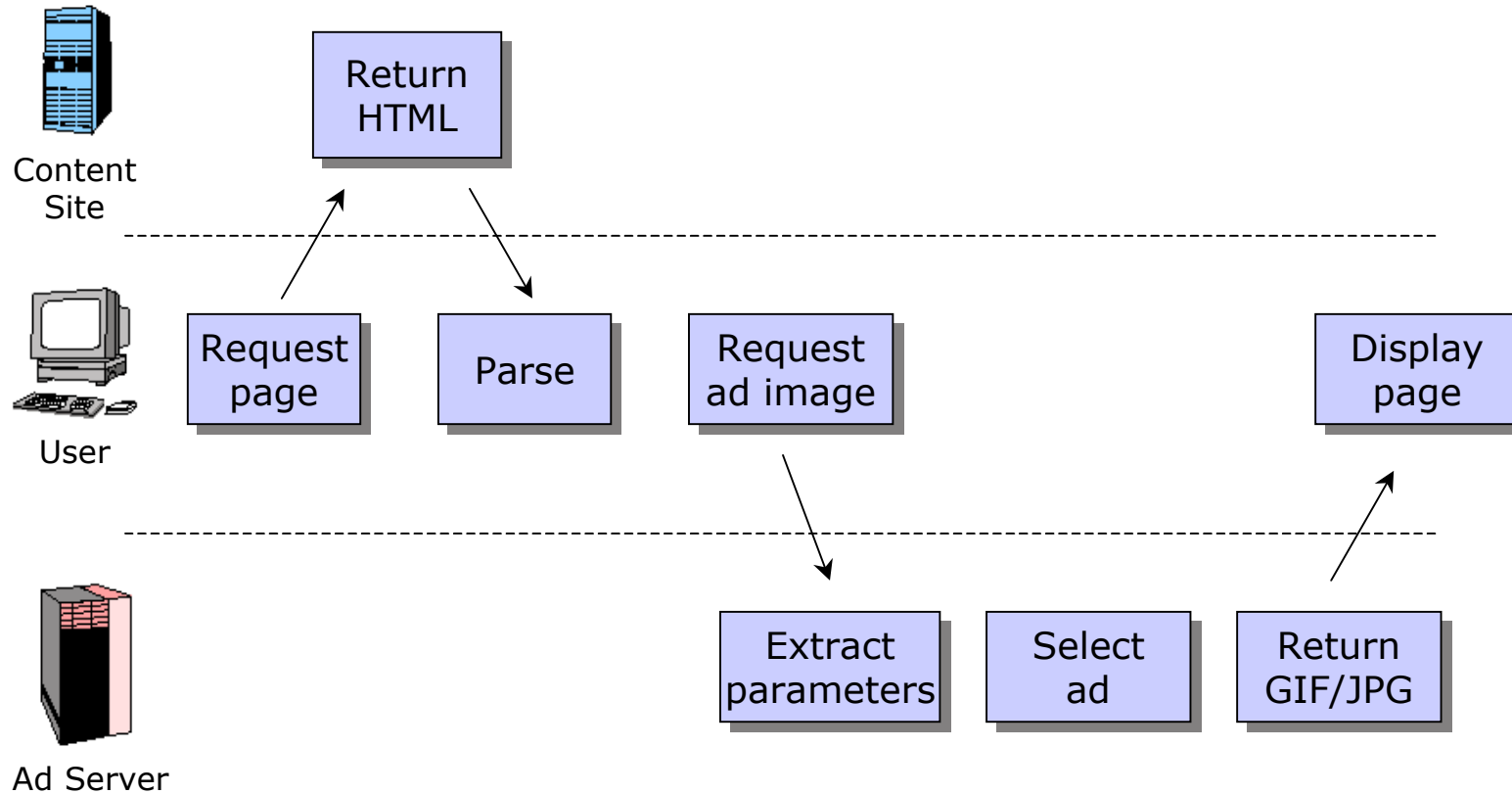
Automated Ad Targeting

- Method
 - Neural network learns user interests
- Advantages
 - Fully automated
- Disadvantages
 - User tracking violates privacy
 - Unable to predict number of times an ad is shown (contract constraints)

Targeting with ADWIZ

- Automated Targeting
 - based on search keywords or page URI
- Respects User Privacy
 - No user tracking necessary
- Handles Contract Constraints
 - Supports minimum number of displays and other constraints

Control & Data Flow



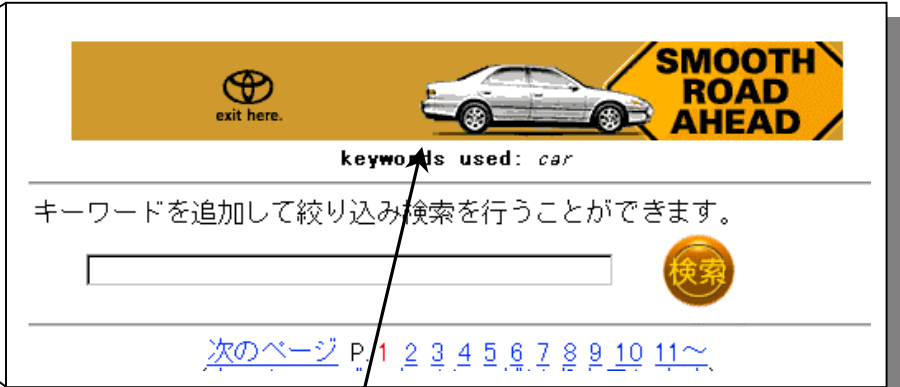
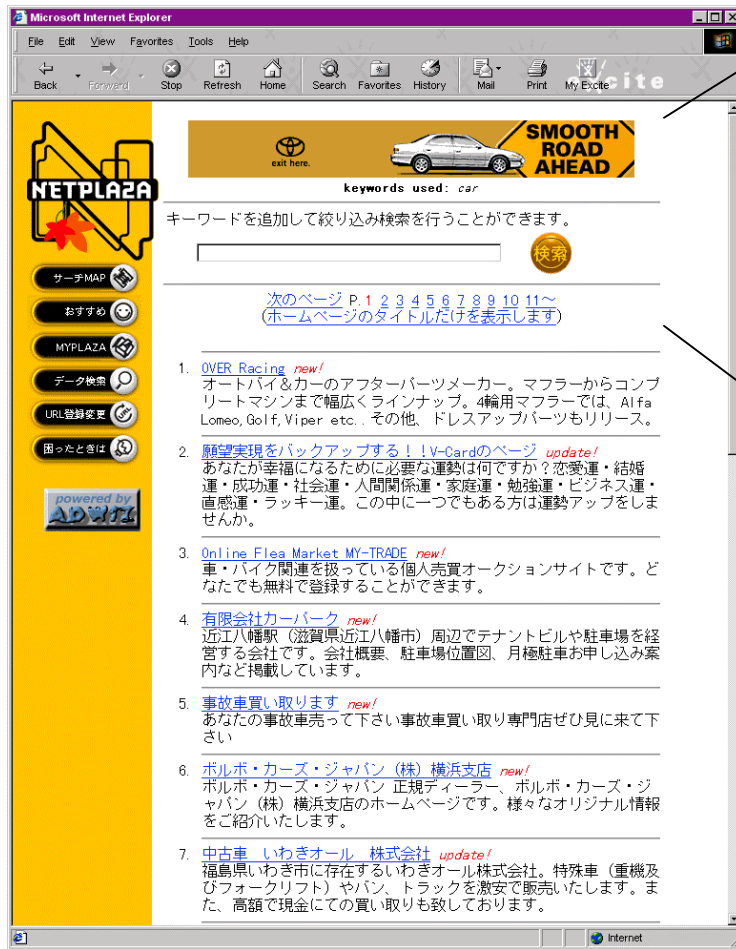
Basic Interaction



User searches for "car"

Keyword-Based Ad Customization

Basic Interaction



System selects a car related advertisement

Keyword-Based Ad Customization

Basic Interaction

2.2 Basic Interaction

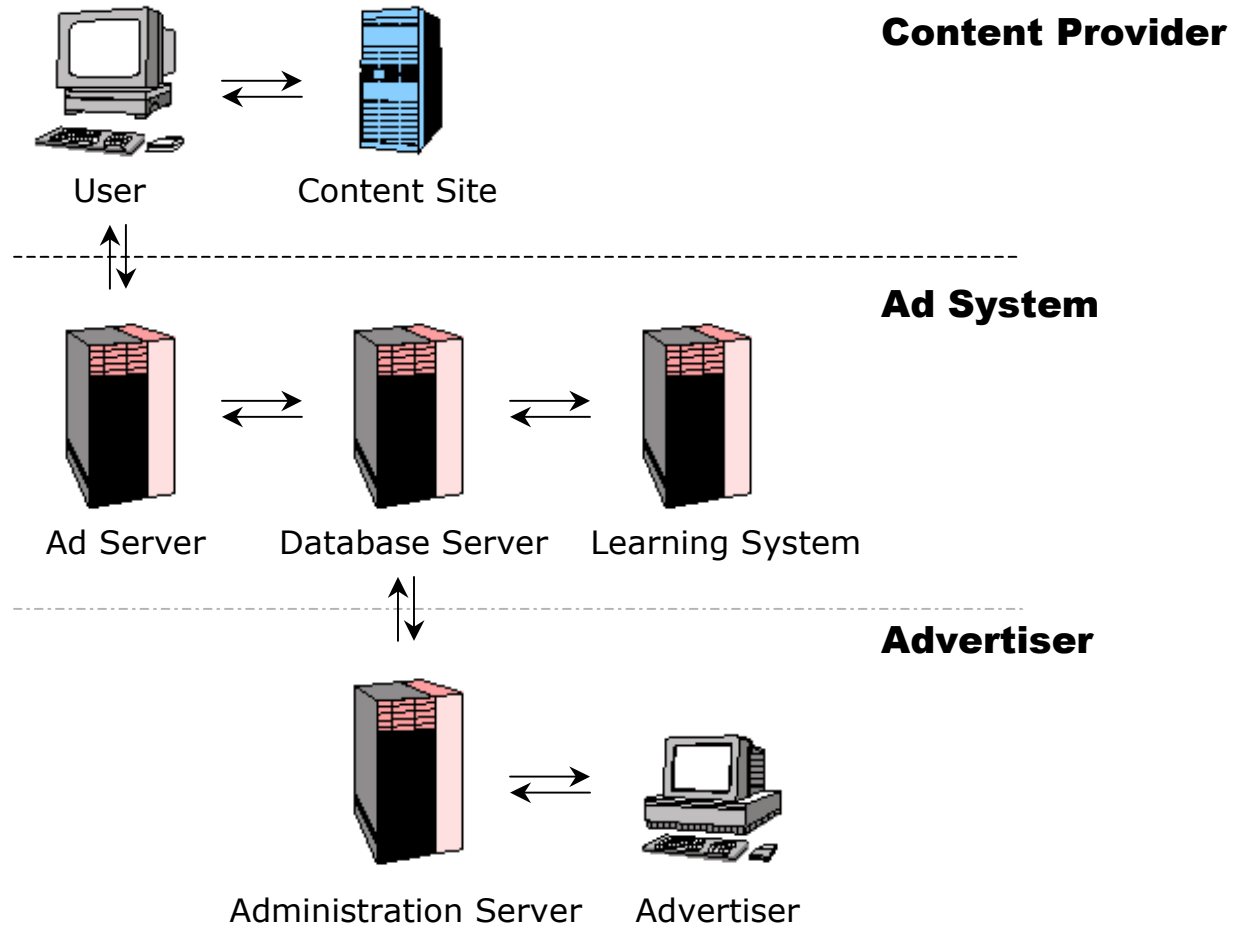


User browses sports section in directory

System selects a sports related advertisement

Page-Based Ad Customization

System Components



Scheduling Ad Displays

ADWIZ Administration System - Edit Campaign

File Edit View Favorites Tools Help

ADWIZ Ad Management by NEC User: demo

Edit a Campaign

UPDATE
CANCEL

Status active

Information

Advertiser: Toyota

Advertisement: Toyota Camry
Toyota Corolla

Campaign Name: Spring Campaign

Targeting Constraints

Minimum Displays: 110 000

Begins: 03/01/1999

Ends: 11/01/1999

Rented Keywords:

Demonstration System Administration Server Login Logout ADjust

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C&C Media Research Laboratories

Internet

1. Select advertisement graphic to display

2. Set minimum number of necessary displays

3. What is the timeframe for showing the ad?

4. Any special keyword you want to reserve?

Updating Display Weights

ADWIZ Administration System - Adjust

File Edit View Favorites Tools Help

ADWIZ Ad MANAGEMENT by NEC

User: demo

Learning Engine (ADjust)

ADjust Status Report (v2.5)

Local Time: Fri, Apr 23rd 1999, 20:15:32
[\[refresh display\]](#)

Mode:	<input checked="" type="radio"/> Automatic <input type="radio"/> Manual
Update:	every <input checked="" type="radio"/> 3 <input type="radio"/> 10 <input type="radio"/> 30 min
Status:	Processing Finished
Last Update:	2 hours, 3 seconds ago
Last Runtime:	28 seconds
ADWIZ	<input checked="" type="radio"/> on <input type="radio"/> off [check]

> Demonstration System > Administration Server > Login > Logout > ADjust

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Automatically updates
every 3, 10 or 30 Minutes

Inspecting the Weights

ADWIZ Administration System - Adjust

File Edit View Favorites Tools Help

ADWIZ AD MANAGEMENT by NEC

User: demo

Display Probabilities (Weights)

Show weights by: Advertisement Keyword Page

Keyword:

Show weights for Keyword car

Advertisement	Weight
Toyota Camry	41.1802
Toyota Corolla	32.5702
Skynet	8.4863
Subaru Japan	2.4656
Biglobe Infonext Service	2.4473
ASCII News 1	1.4310
...	1.4310

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List of ads and their probabilities of being displayed for a certain keyword

Inspecting the Weights

ADWIZ Administration System - Weights

File Edit View Favorites Tools Help

[Back to the Main Menu](#)

Show weights for Advertisement **Toyota Camry**
(this advertisement has no section constraints)

Campaign Title	Ad(s)	Begins	End	Imp.	Keywords	Sections	Actions
Toyota Camry Campaign	* Toyota Camry	1999-03-01	1999-11-01	110,000	--	--	Edit Insert Delete

group by

Keywords Sections Set of Directories Web Pages

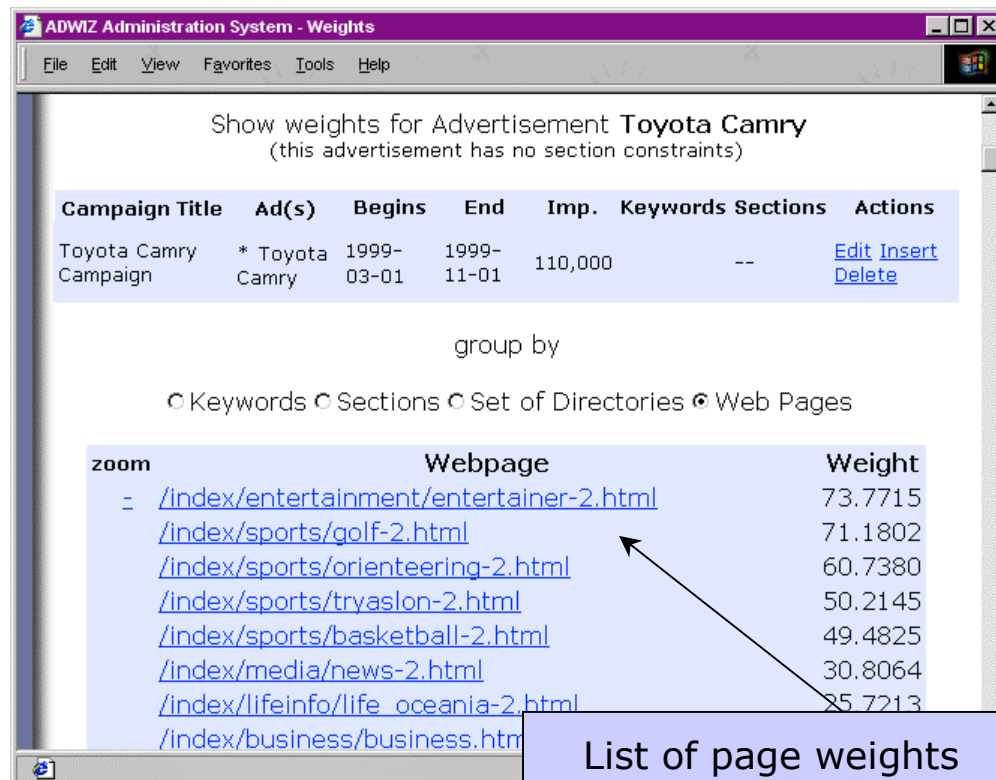
Rentals:

Keyword	Weight
car	46.1483994
map	45.5879974
toyota	35.1138992
golf	29.7930984
sports	26.4095993
movie	7.1970470
dunlop	2.1874960
discount	0.1398560

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List of keyword weights per advertisement

Inspecting the Weights



ADWIZ Administration System - Weights

File Edit View Favorites Tools Help

Show weights for Advertisement **Toyota Camry**
(this advertisement has no section constraints)

Campaign Title	Ad(s)	Begins	End	Imp.	Keywords	Sections	Actions
Toyota Camry Campaign	* Toyota Camry	1999-03-01	1999-11-01	110,000		--	Edit Insert Delete

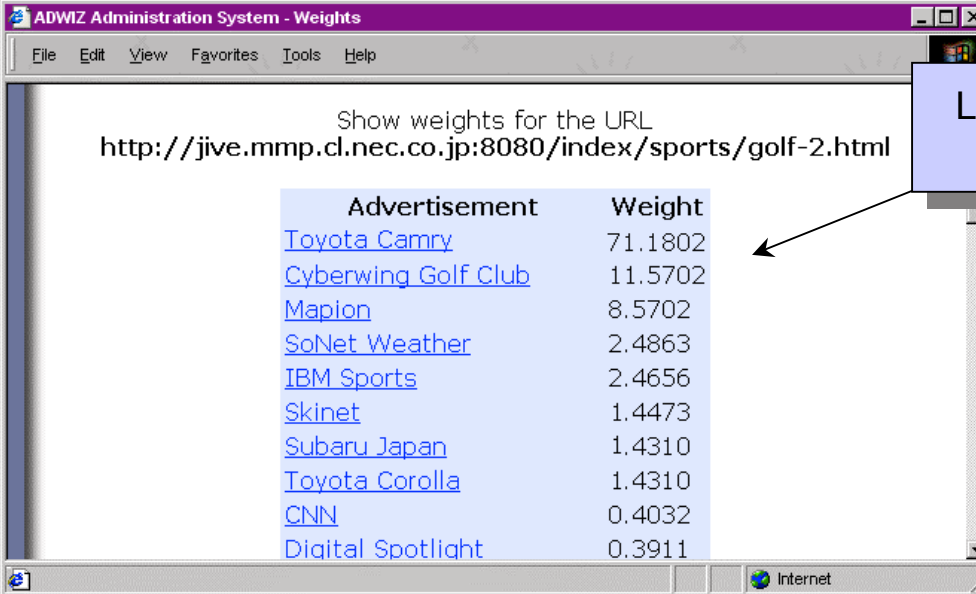
group by

Keywords Sections Set of Directories Web Pages

zoom	Webpage	Weight
-	/index/entertainment/entertainer-2.html	73.7715
	/index/sports/golf-2.html	71.1802
	/index/sports/orienteering-2.html	60.7380
	/index/sports/tryaslon-2.html	50.2145
	/index/sports/basketball-2.html	49.4825
	/index/media/news-2.html	30.8064
	/index/lifeinfo/life_oceania-2.html	25.7213
	/index/business/business.htm	

List of page weights per advertisement

Inspecting the Weights



ADWIZ Administration System - Weights

File Edit View Favorites Tools Help

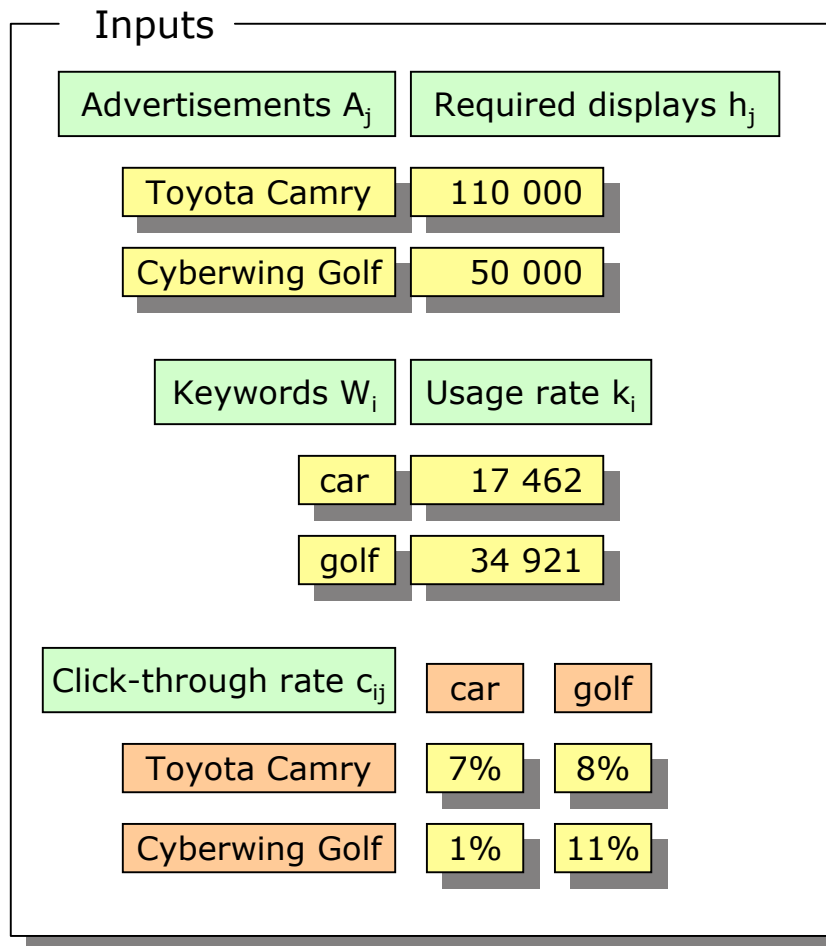
Show weights for the URL
<http://jive.mmp.cl.nec.co.jp:8080/index/sports/golf-2.html>

Advertisement	Weight
Toyota Camry	71.1802
Cyberwing Golf Club	11.5702
Mapion	8.5702
SoNet Weather	2.4863
IBM Sports	2.4656
Skinet	1.4473
Subaru Japan	1.4310
Toyota Corolla	1.4310
CNN	0.4032
Digital Spotlight	0.3911

Internet

List of advertisement weights per page

Keyword based Learning



Maximize expected total click-through rate

$$\sum_{i=1}^m \sum_{j=1}^n c_{ij} k_i d_{ij}$$

1. Show all required displays

$$\sum_{i=1}^n k_i d_{ij} = h_j$$

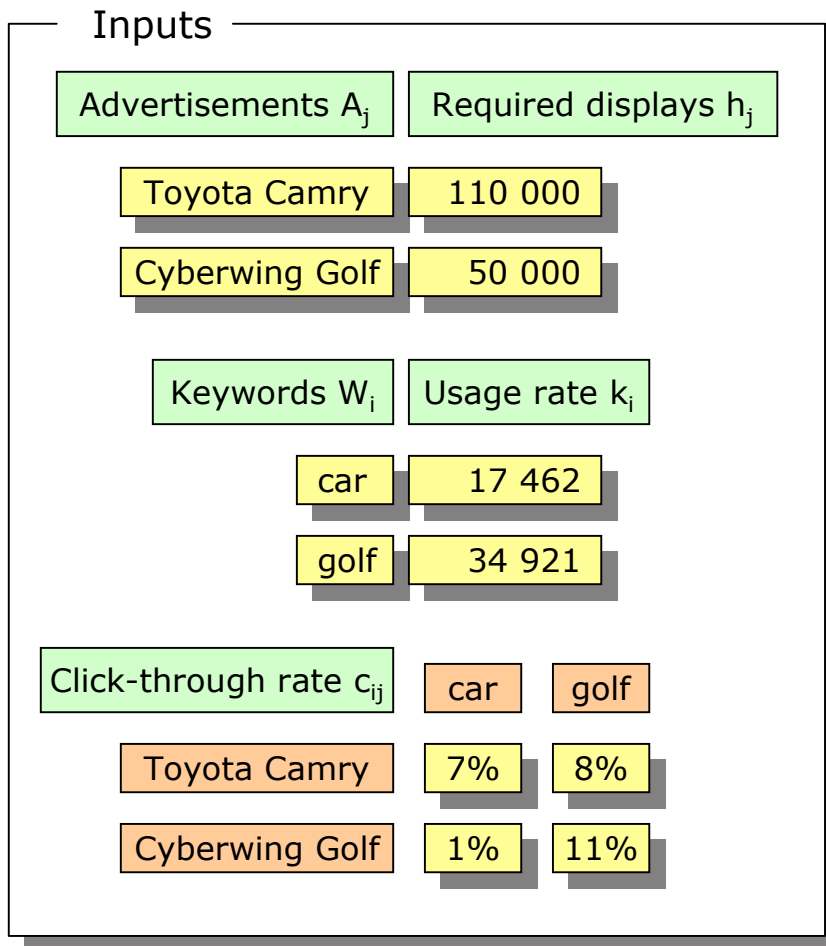
2. Weights sum up to 100%

$$\sum_{j=1}^m d_{ij} = 1$$

3. No negative weights allowed

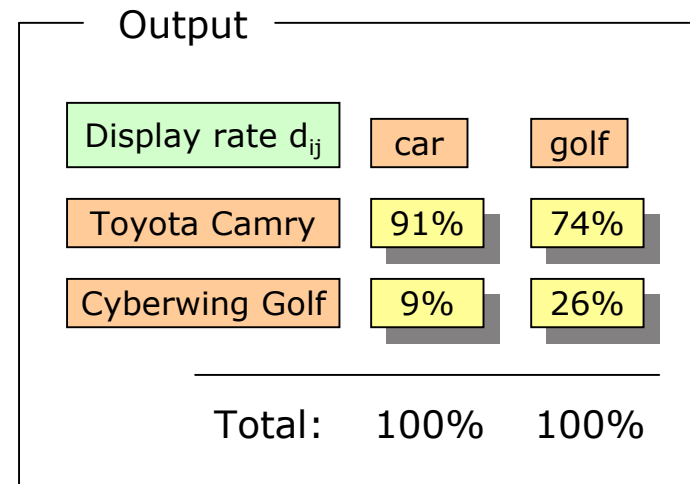
$$d_{ij} \geq 0$$

Keyword based Learning

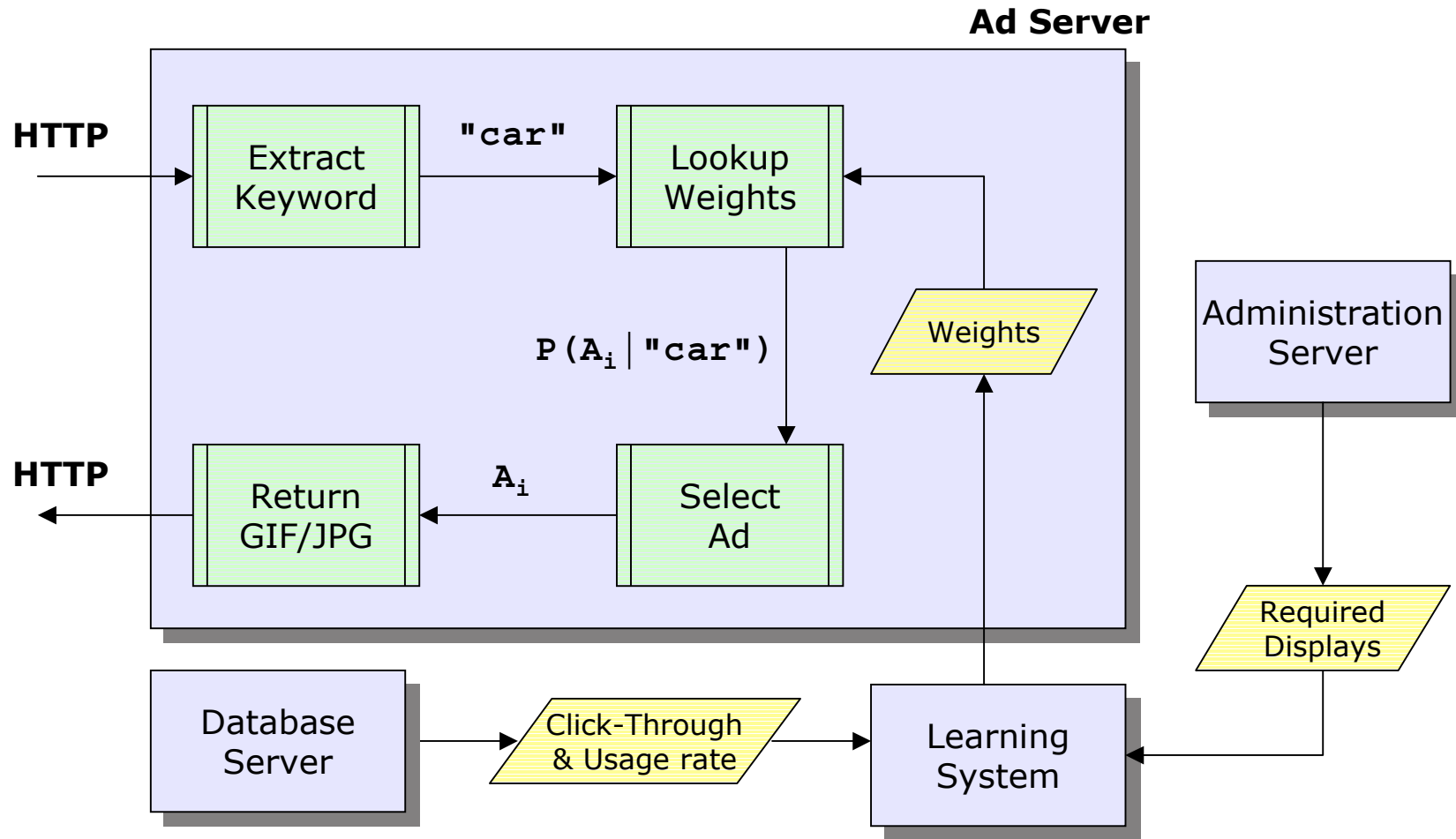


Maximize expected total click-through rate

$$\sum_{i=1}^m \sum_{j=1}^n c_{ijk} d_{ij}$$



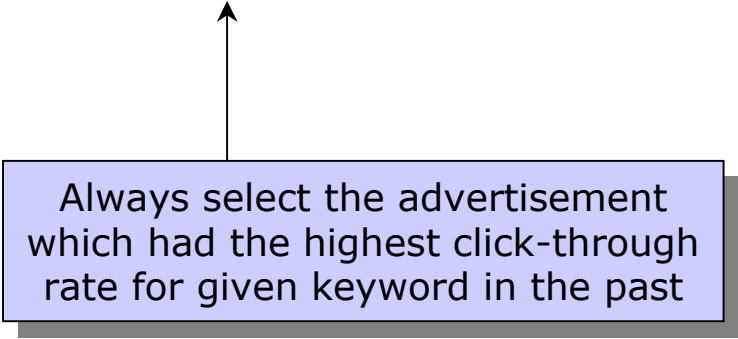
Ad Selection Process



Experimental Setup

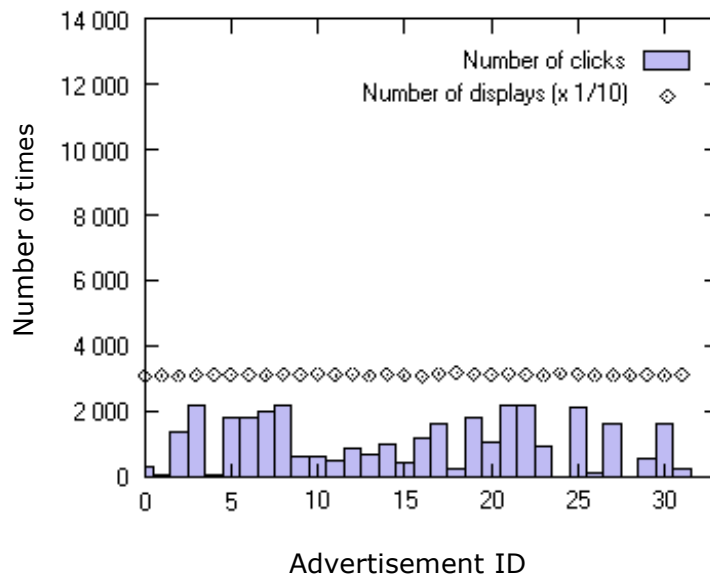
- Keyword based
 - 32 Ads
 - 128 Keywords
- Setup
 - Simulated keyword search
 - Artificial User Interest Models
 - Repeated 1 million times
 - Averaged over 5 runs
- Methods compared
 - Random Selection
 - Constraint-based Learning
 - Max-Click Method

Always select the advertisement which had the highest click-through rate for given keyword in the past



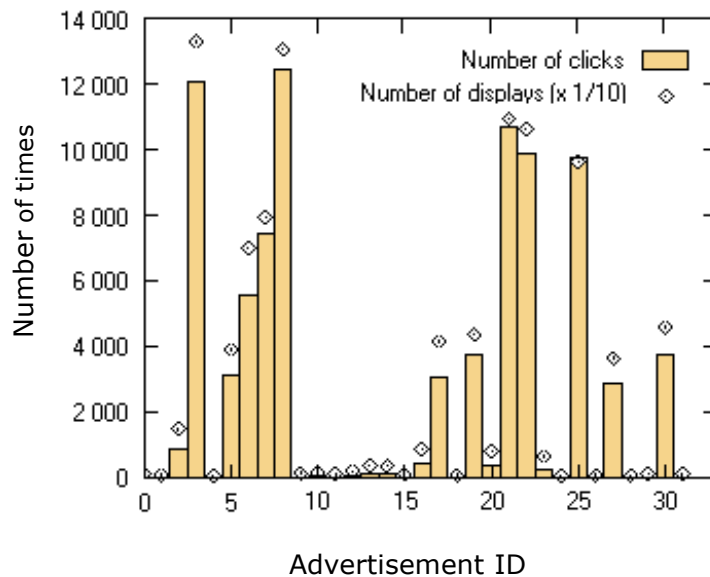
Experimental Results

- Random Selection



Experimental Results

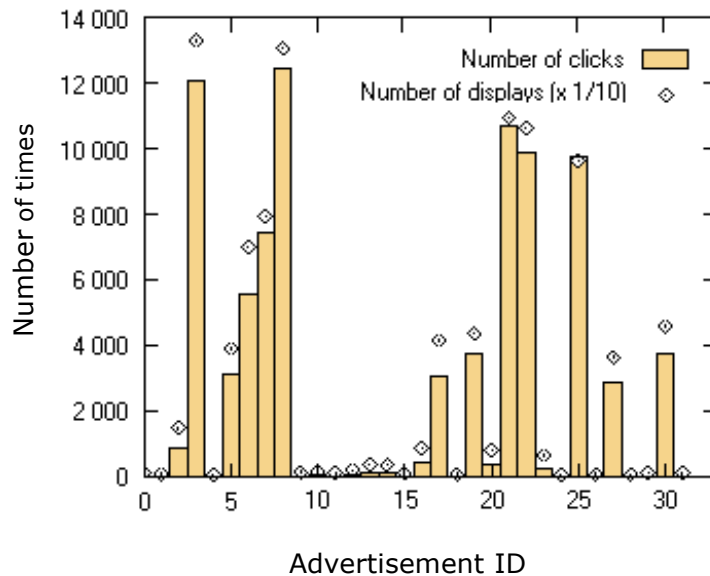
- Max-Click Method



- More *total* clicks
- Fails to show more than half of the ads

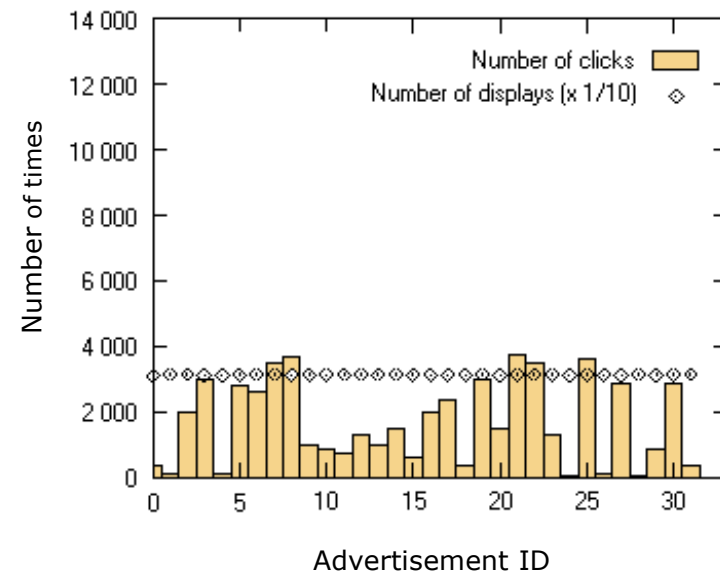
Experimental Results

Max-Click Method



- More *total* clicks
- Fails to show more than half of the ads

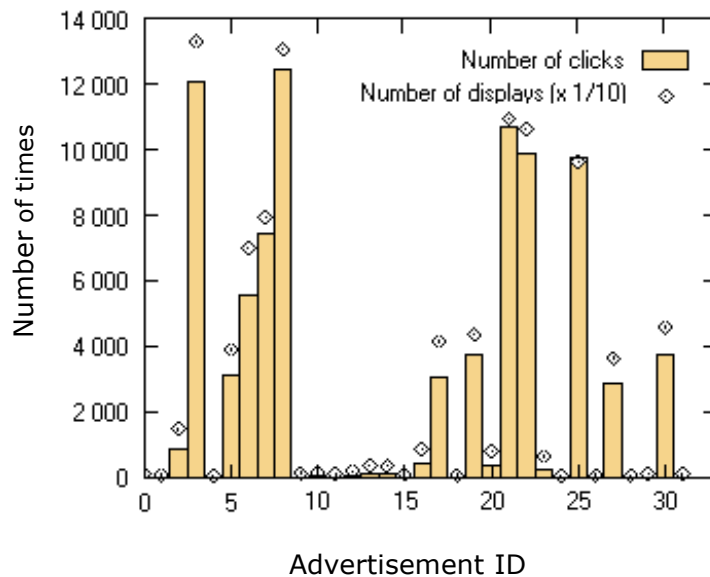
Constraint-based Learning



- Increases click-through for **all** ads
- Shows minimum number of required displays

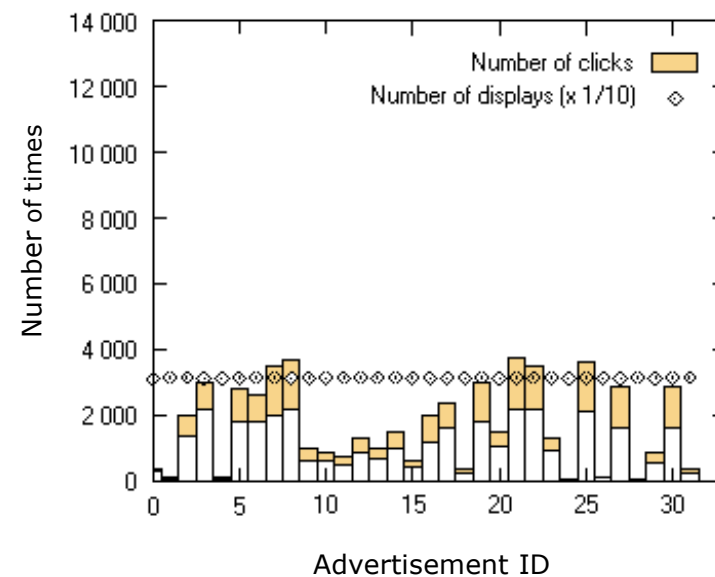
Experimental Results

Max-Click Method



- More *total* clicks
- Fails to show more than half of the ads

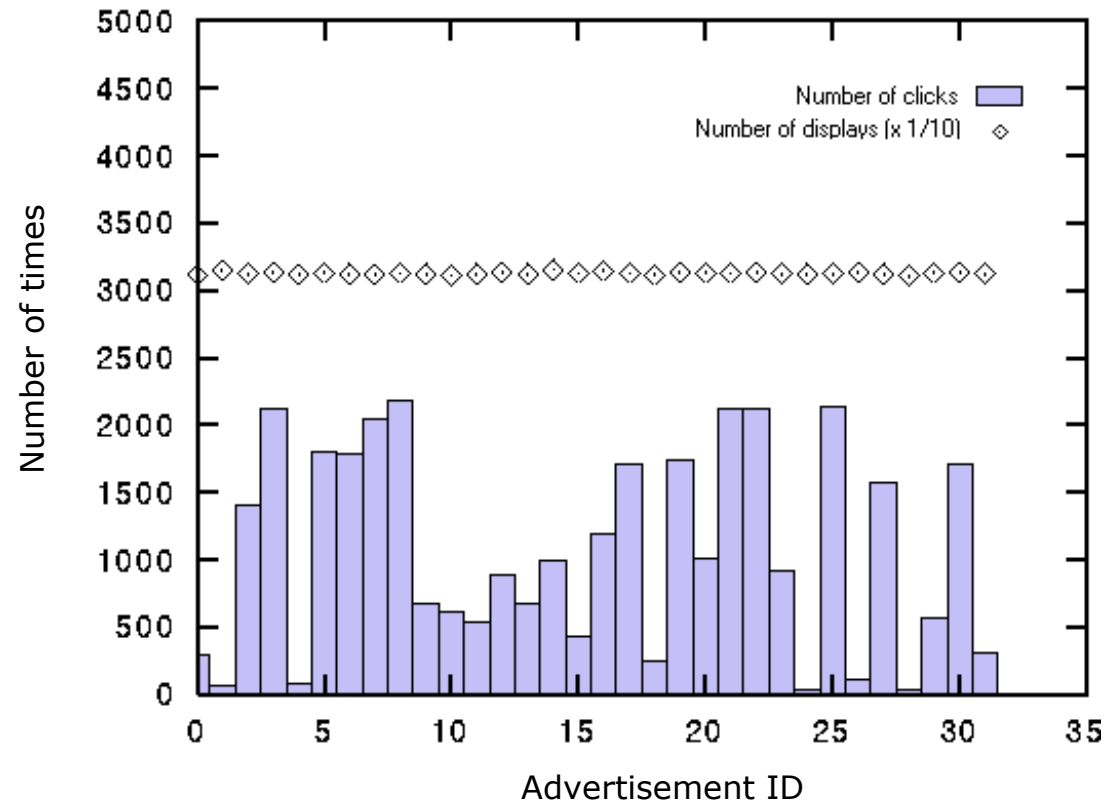
Constraint-based Learning



- Increases click-through for **all** ads
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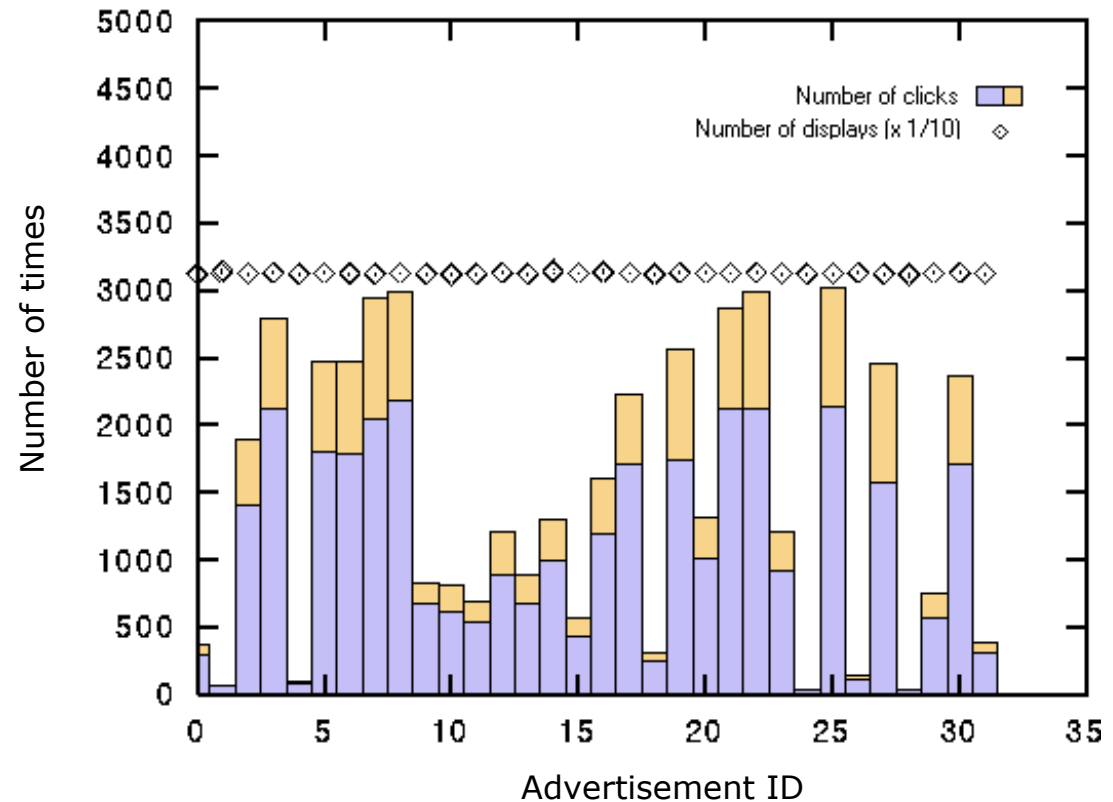
Experimental Results II

Random Method

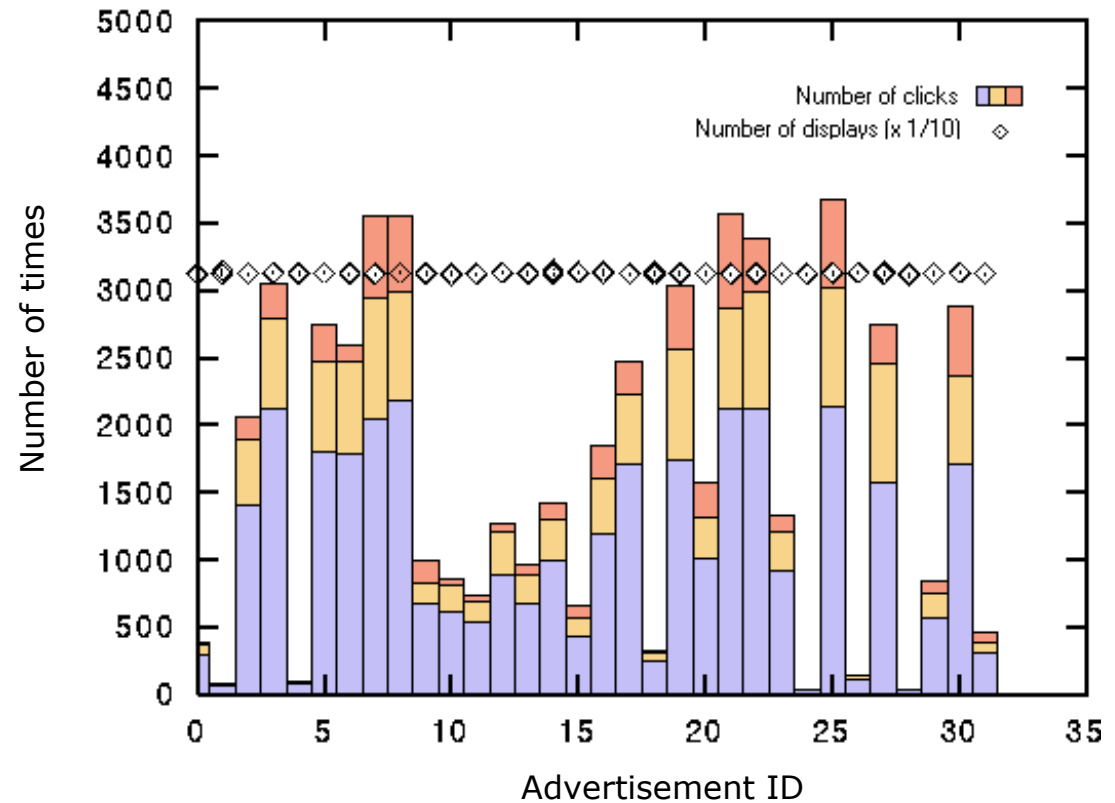
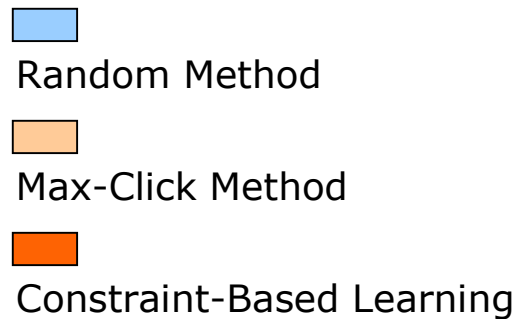


Experimental Results II

Random Method
Max-Click Method



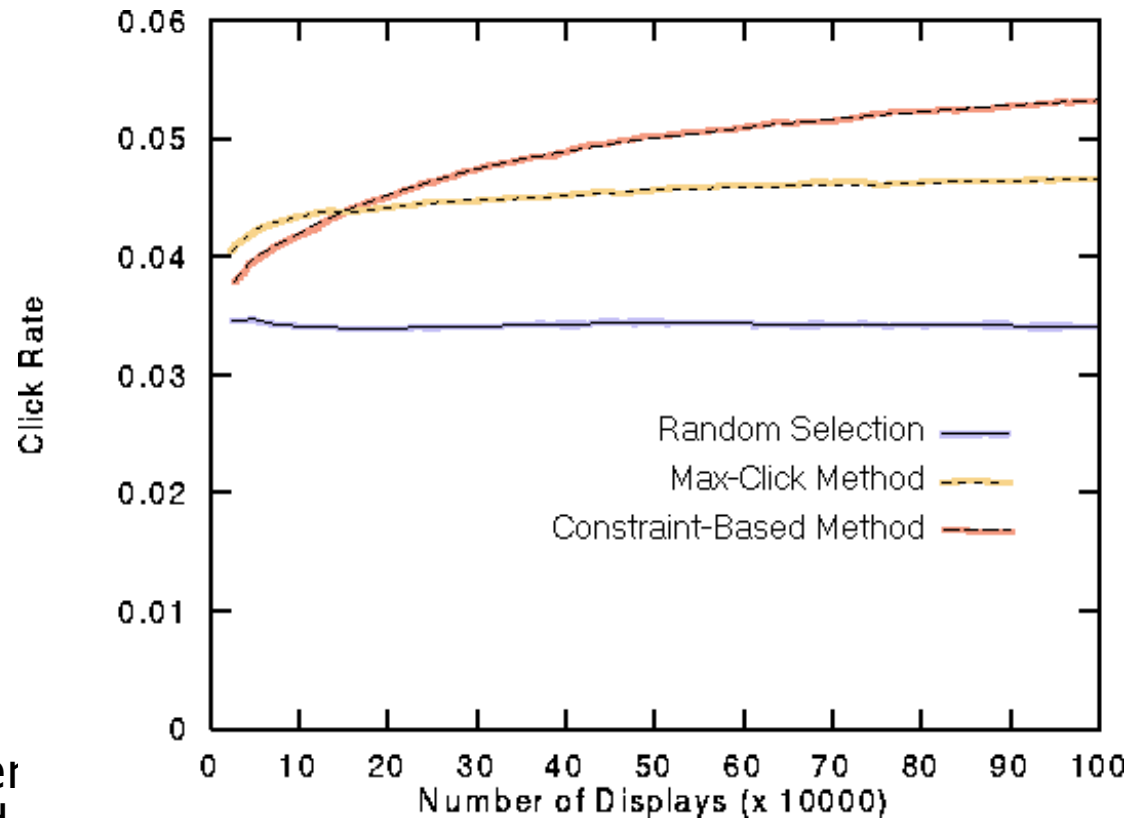
Experimental Results II



Experimental Results II

- Random Method
- Max-Click Method
- Constraint-Based Learning

- More than 15% improvement over Max-Click Method



Conclusions

- Current Ad Targeting Solutions
 - Manual:
 - Laborious
 - Automated:
 - Threatens privacy
 - Difficult to incorporate contract constraints
- ADWIZ
 - Offers Automated Targeting
 - Respects User Privacy
 - Handles Contract Constraints

Future Work

- Scaling Up
 - Thousands of keywords, pages, ads
 - Clustering techniques
- Faster Learning for New Ads
 - How to reuse previously learned parameters for new advertisements
- Real-World Deployment
 - "Real" experiments

Related Work

- Web Advertisement
 - effectiveness [Risden98]
 - alternative forms [Kohda96, Briggs97]
 - customization [Baudisch97]
- Privacy
 - user surveys [Rogers98, Cranor99]
 - cookies & profiling
 - FTC reports, EU Directive

ADWIZ Homepage

For More Information

<http://www.ccrl.com/adwiz/>