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
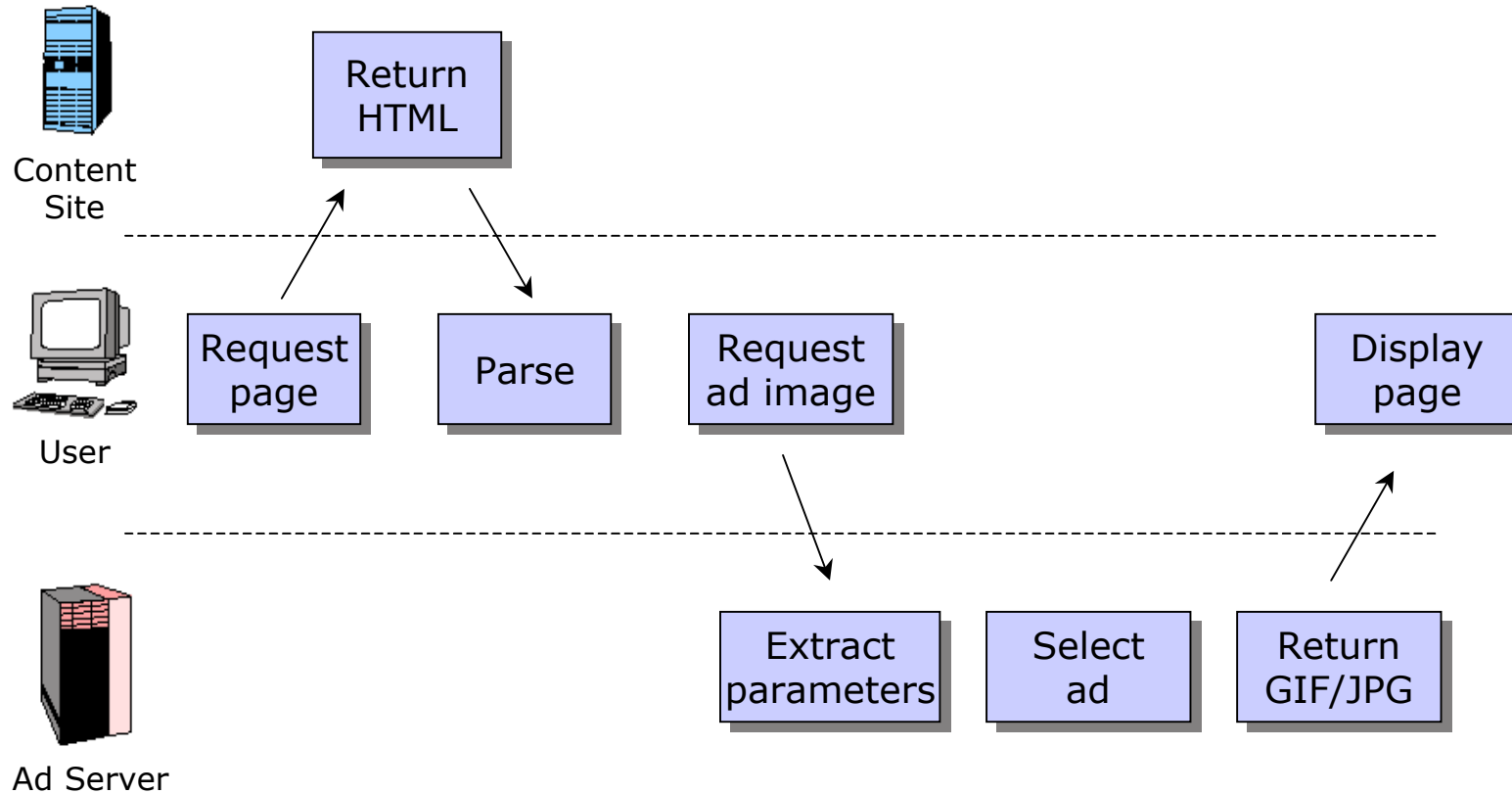 - Laborious to setup and maintain

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
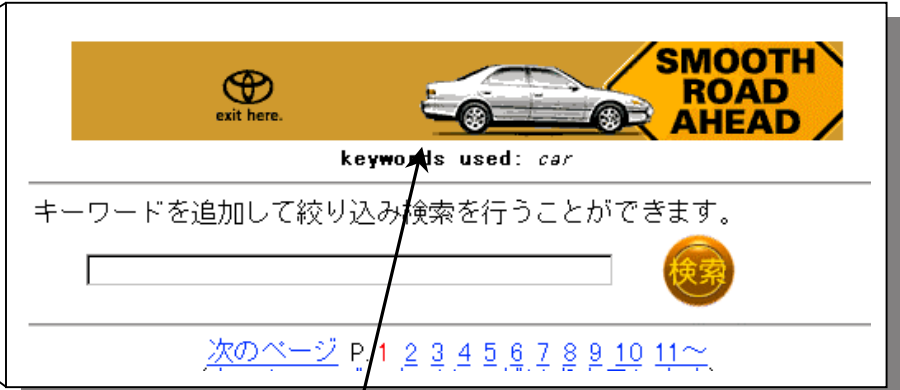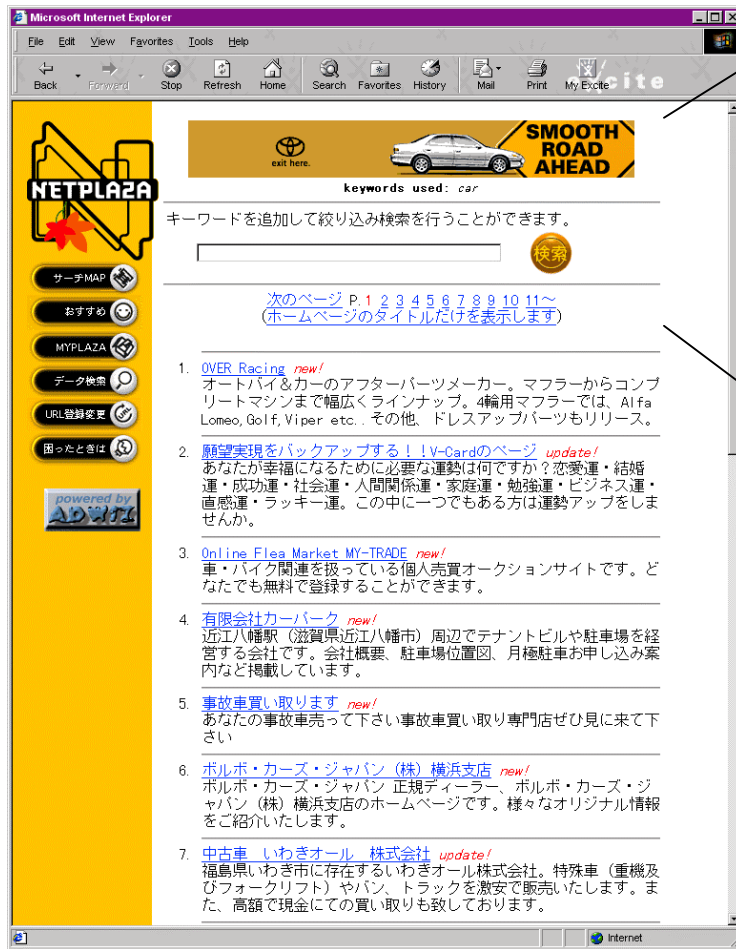 - Supports minimum number of displays and other constraints

Control & Data Flow

Content
Site

Return
HTML

User

Request
page

Parse

Request
ad image

Display
page

Ad Server

Extract
parameters

Select
ad

Return
GIF/JPG

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Basic Interaction

User searches
for "car"

Keyword-Based Ad Customization

Basic Interaction

System selects a car related advertisement
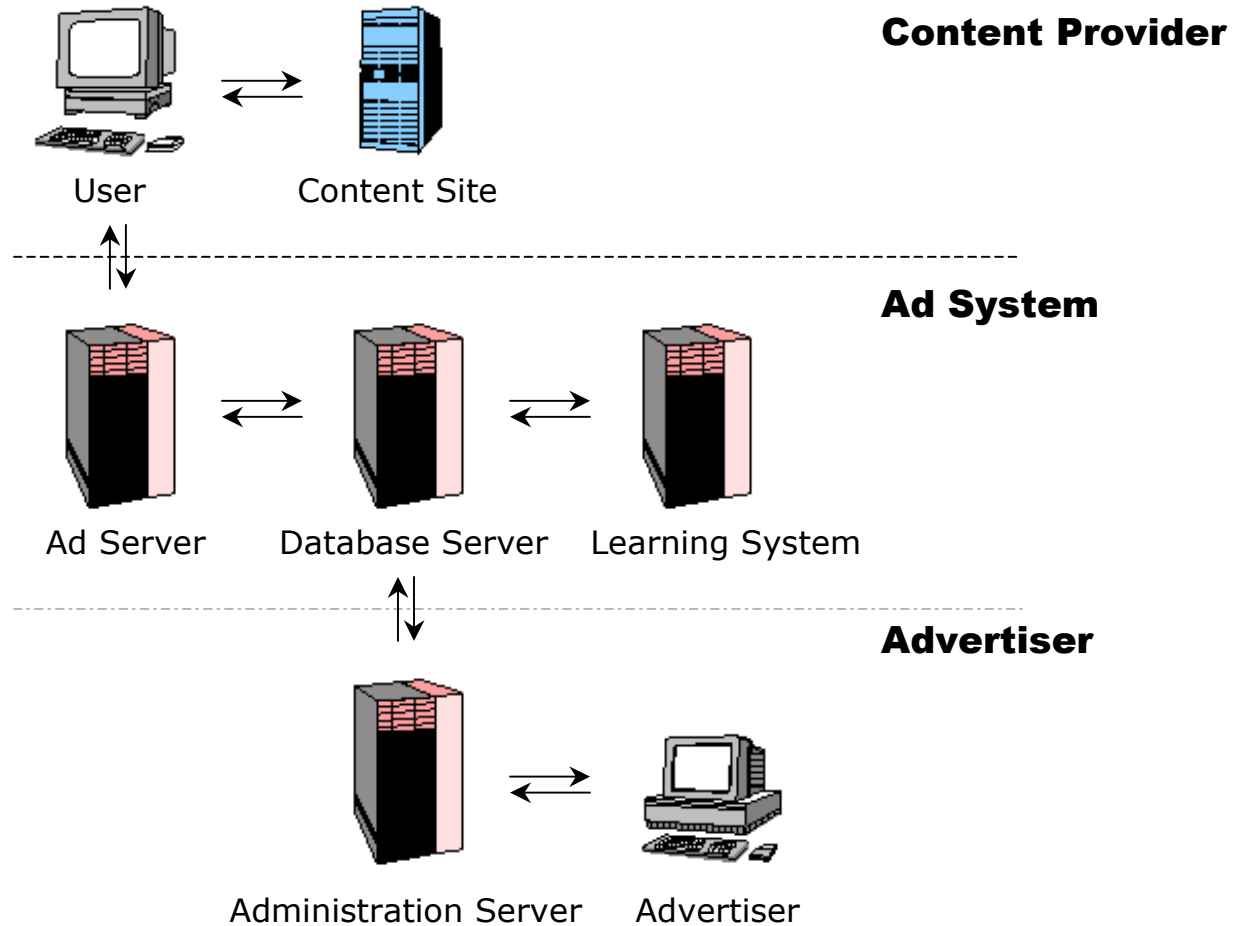
Keyword-Based Ad Customization

Basic Interaction

User browses sports section in directory

System selects a sports related advertisement

Page-Based Ad Customization

System Components

Content Provider

User　　Content Site

Ad System

Ad Server　Database Server　Learning System

Advertiser

Administration Server　Advertiser

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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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

Automatically updates every 3, 10 or 30 Minutes

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Inspecting the Weights

ADWIZ Administration System - ADjust

File   Edit   View   Favorites   Tools   Help

ADWIZ Ad Management
User: **demo**
by **NEC**

Display Probabilities (Weights)

Show weights by: ○ Advertisement ⊙ Keyword ○ Page

Keyword:
car
card
cd
chat

List of ads and their probabilities of being displayed for a certain keyword
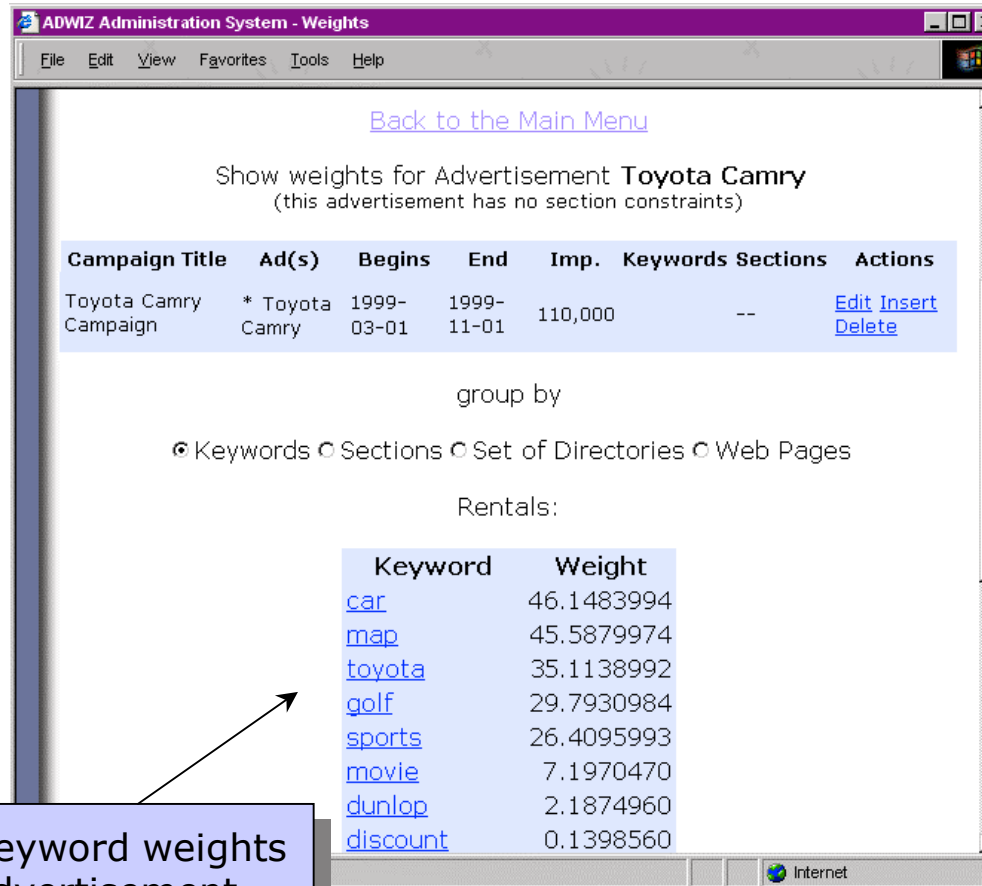
Show weights for Keyword **car**
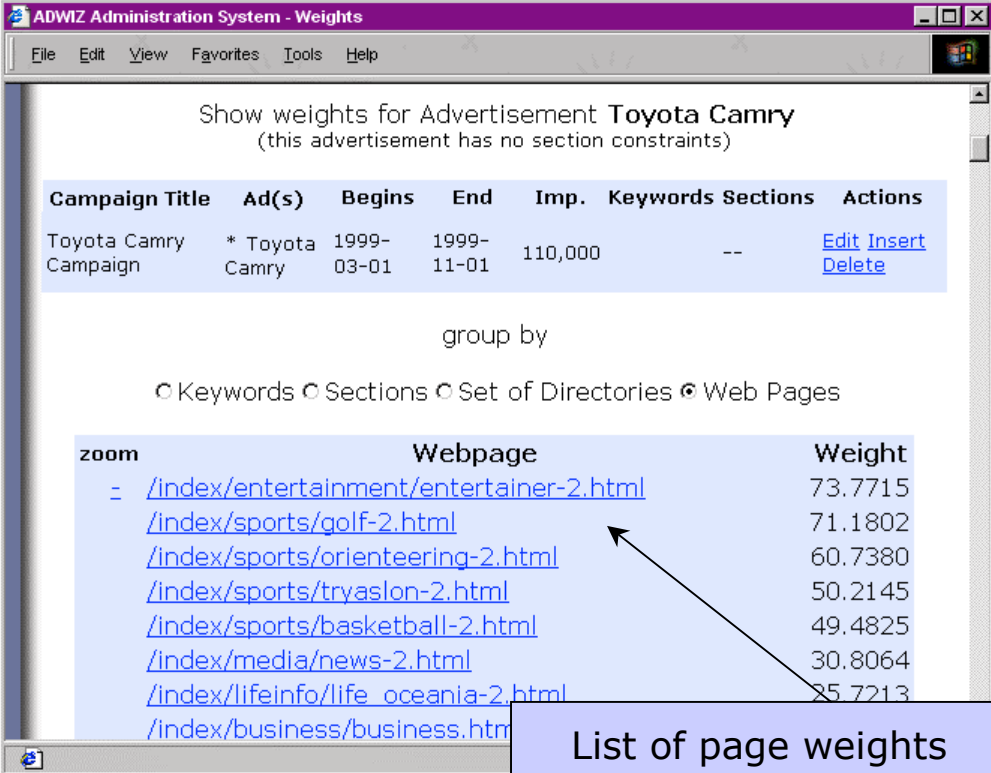
Advertisement	Weight
Toyota Camry	41.1802
Toyota Corolla	32.5702
Skinet	8.4863
Subaru Japan	2.4656
Biglobe Infonext Service	2.4473
ASCII News 1	1.4310

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Inspecting the Weights

List of keyword weights per advertisement

Inspecting the Weights

List of page weights per advertisement

Inspecting the Weights

List of advertisement weights per page

Keyword based Learning

Inputs

Advertisements A_j	Required displays h_j
Toyota Camry	110 000
Cyberwing Golf	50 000

Keywords W_i	Usage rate k_i
car	17 462
golf	34 921

Click-through rate c_{ij}	car	golf
Toyota Camry	7%	8%
Cyberwing Golf	1%	11%
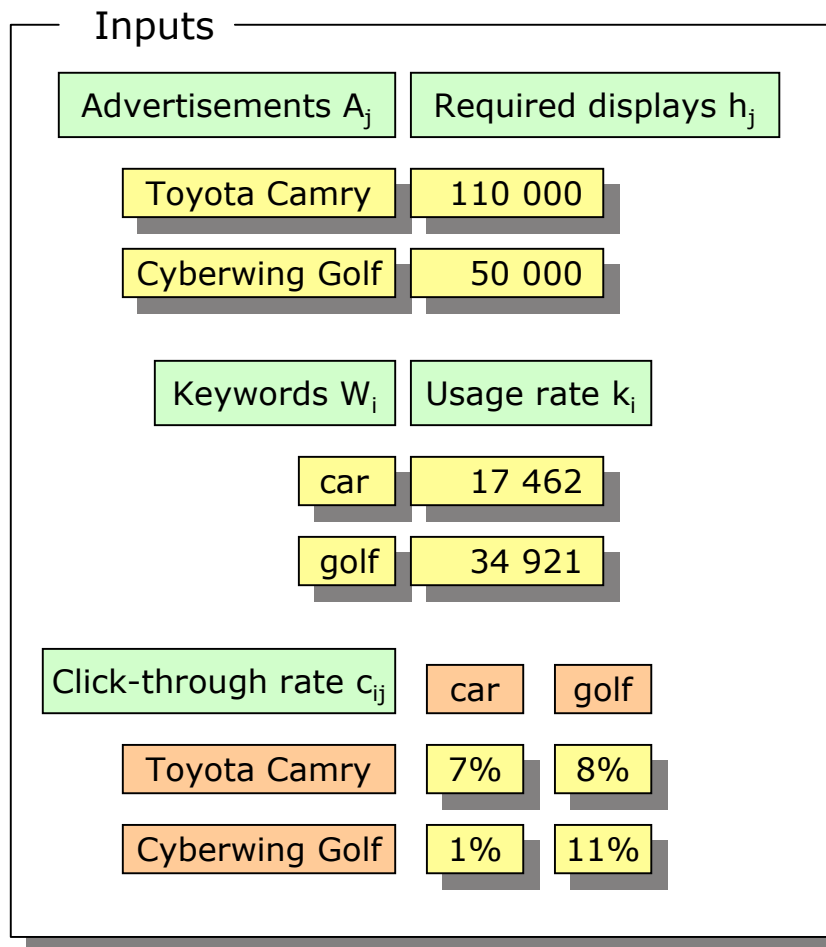
Maximize expected total click-through rate

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

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

$$d_{ij} \geq 0$$

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Output

Display rate d_{ij}	car	golf
Toyota Camry	91%	74%
Cyberwing Golf	9%	26%
Total:	100%	100%

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Ad Selection Process

Ad Server

HTTP → Extract Keyword → **"car"** → Lookup Weights

$P(A_i \mid \text{"car"})$

Weights

Administration Server

HTTP ← Return GIF/JPG ← A_i ← Select Ad

Required Displays
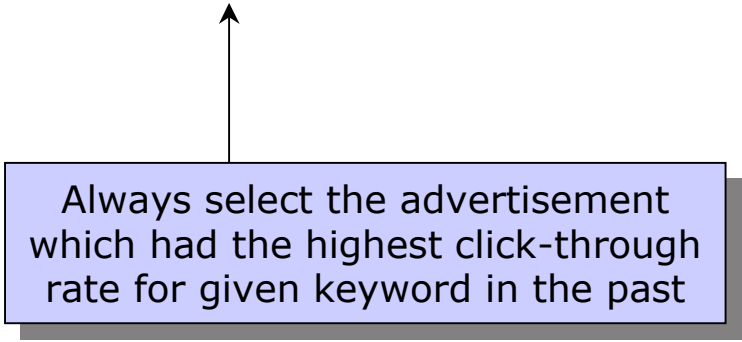
Database Server → Click-Through & Usage rate → Learning System
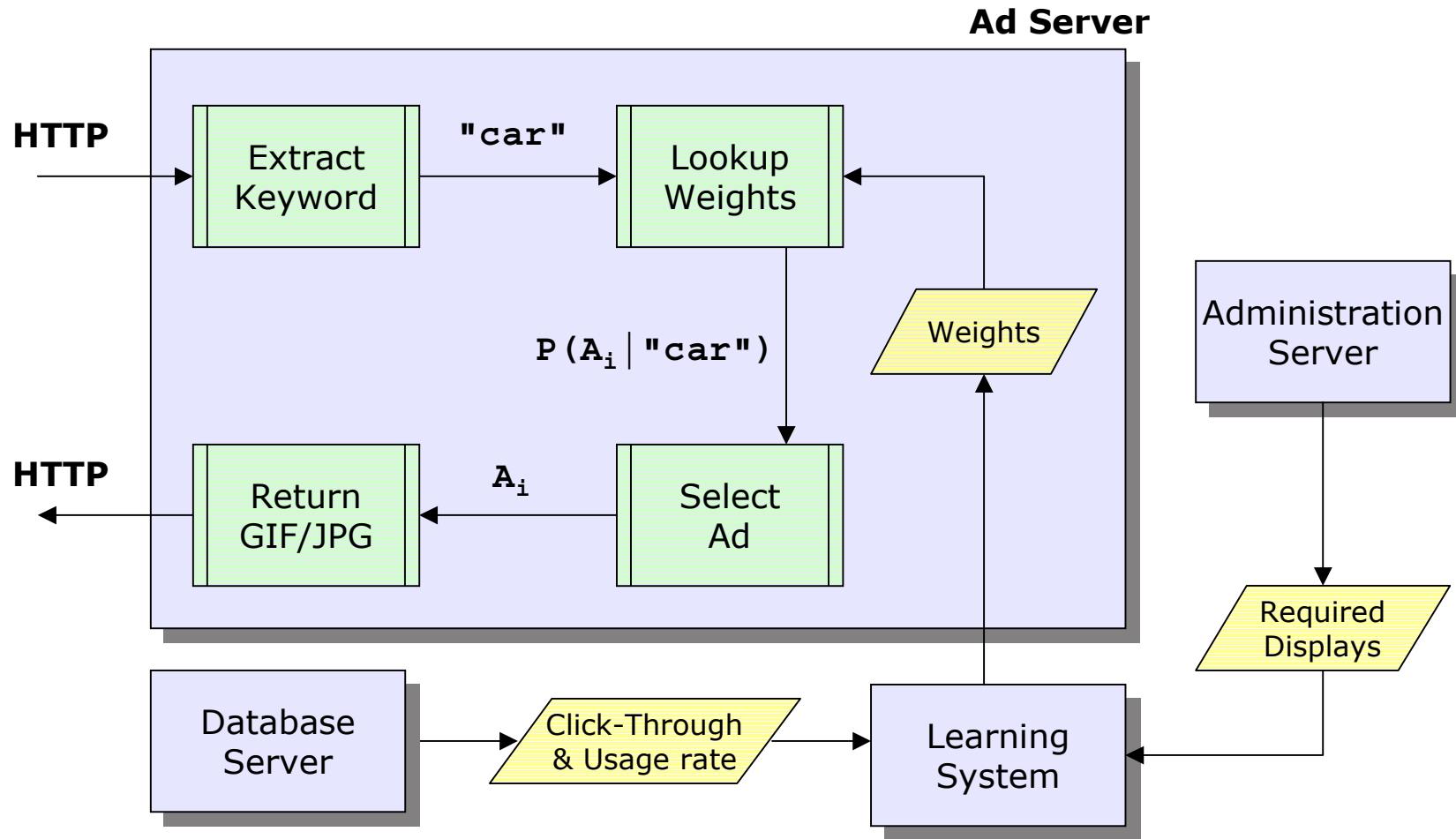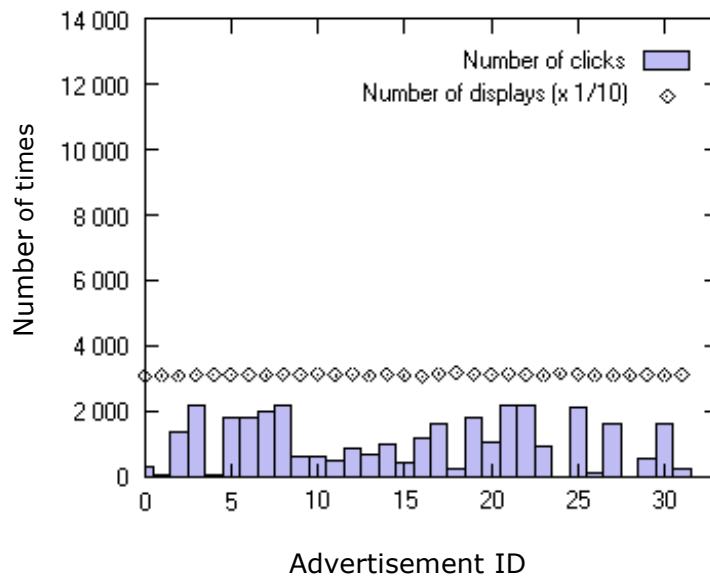
Experimental Setup

- 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
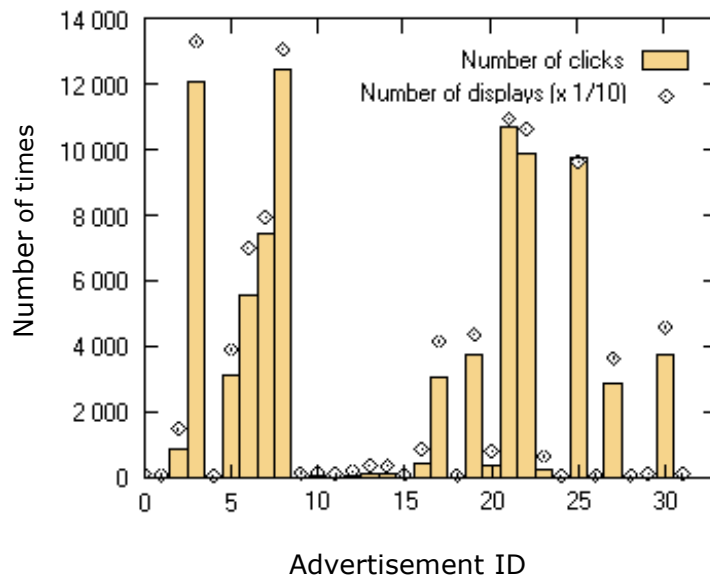
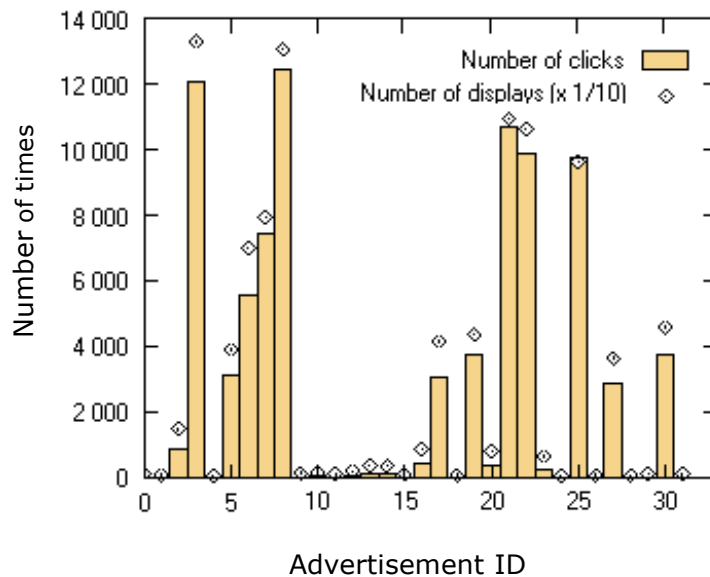# Experimental Results

- Random Selection

Advertisement ID

Experimental Results

- ## Max-Click Method

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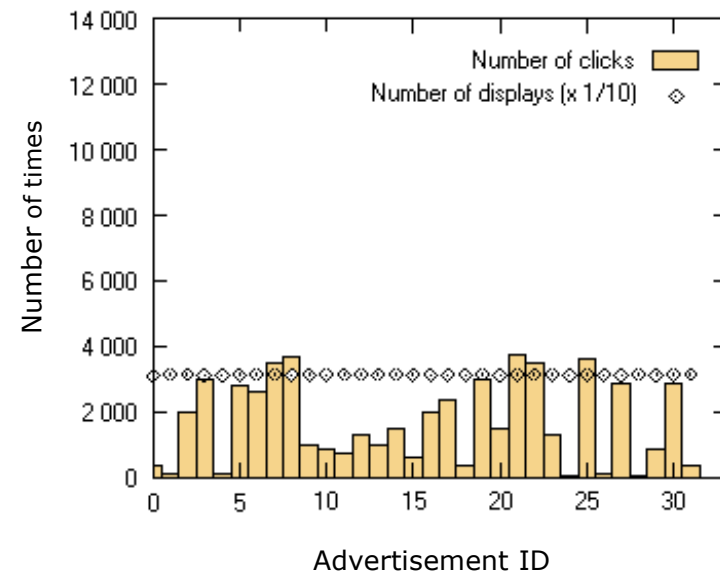
2.6 Experiments

Experimental Results

- Max-Click Method

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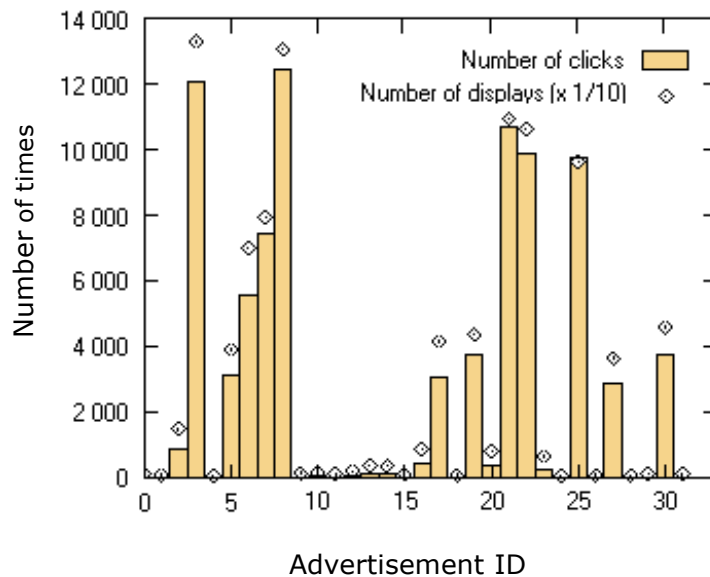- Fails to show more than half of the ads

- 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
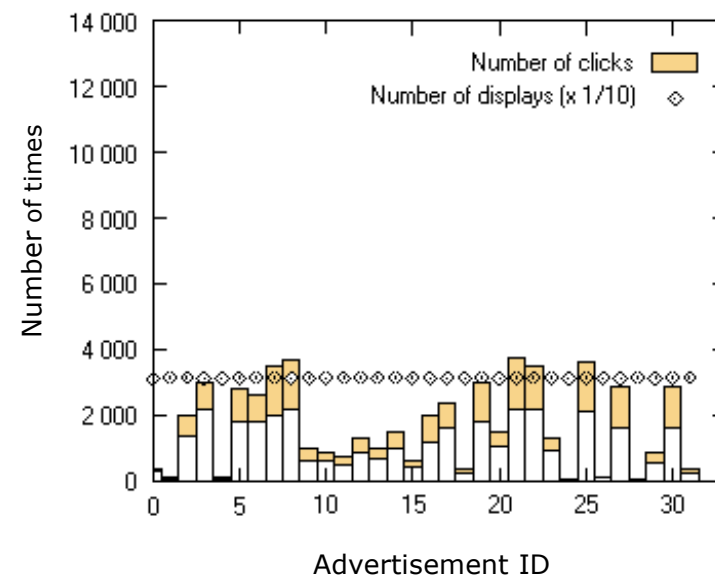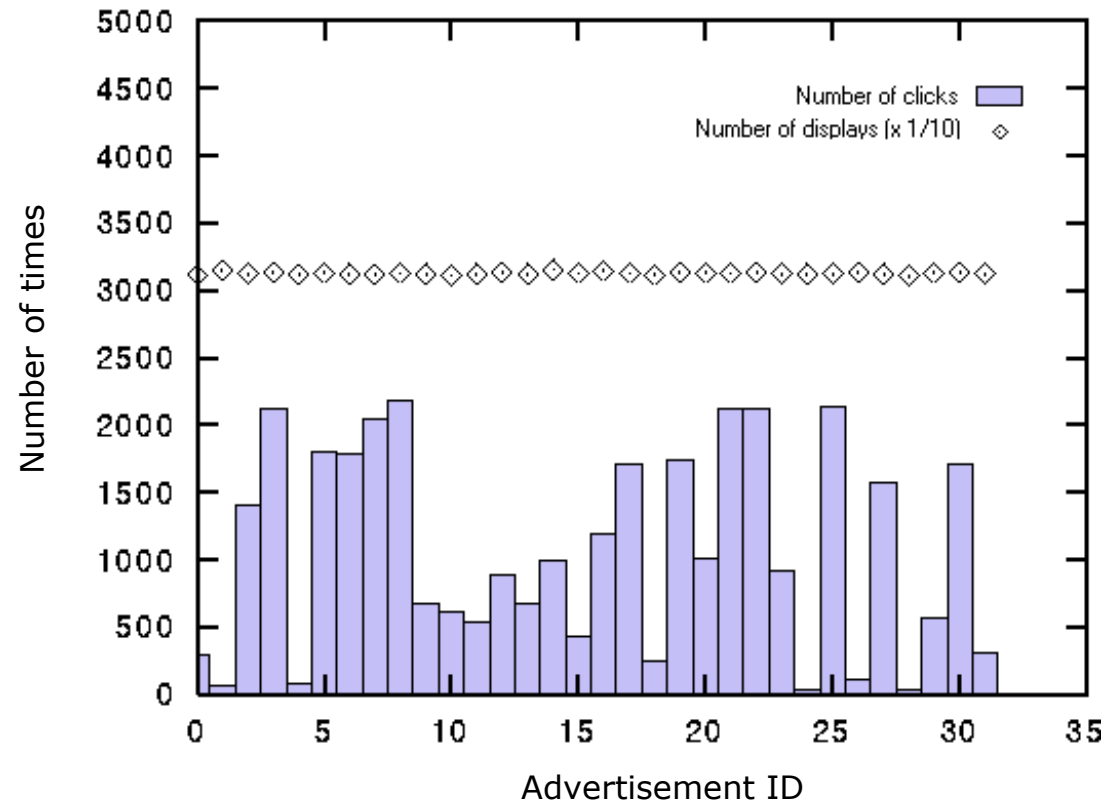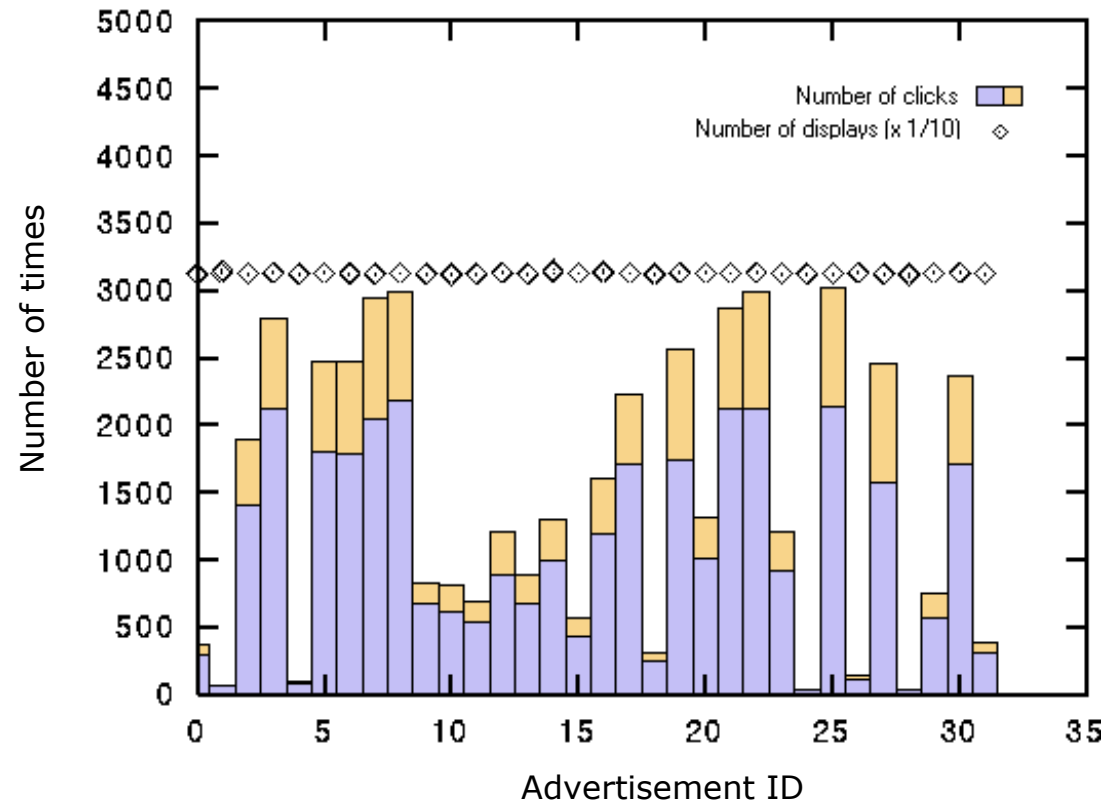- Shows minimum number of required displays

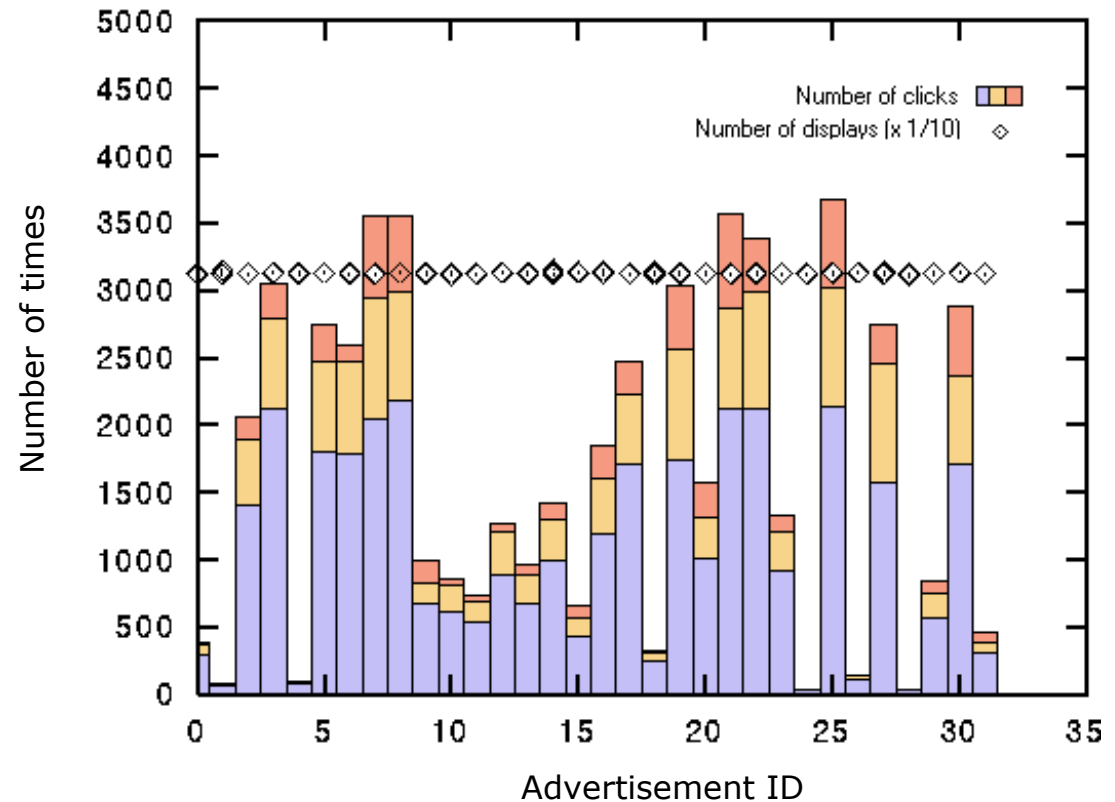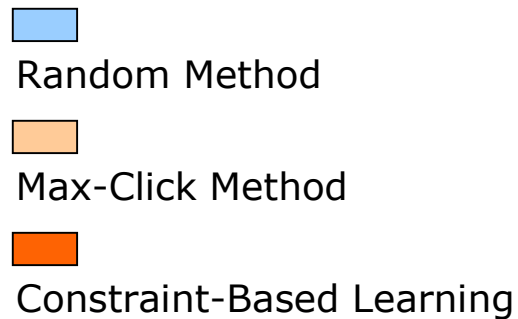# Experimental Results II

Random Method

Experimental Results II

Random Method

Max-Click Method

Experimental Results II

Random Method

Max-Click Method

Constraint-Based Learning

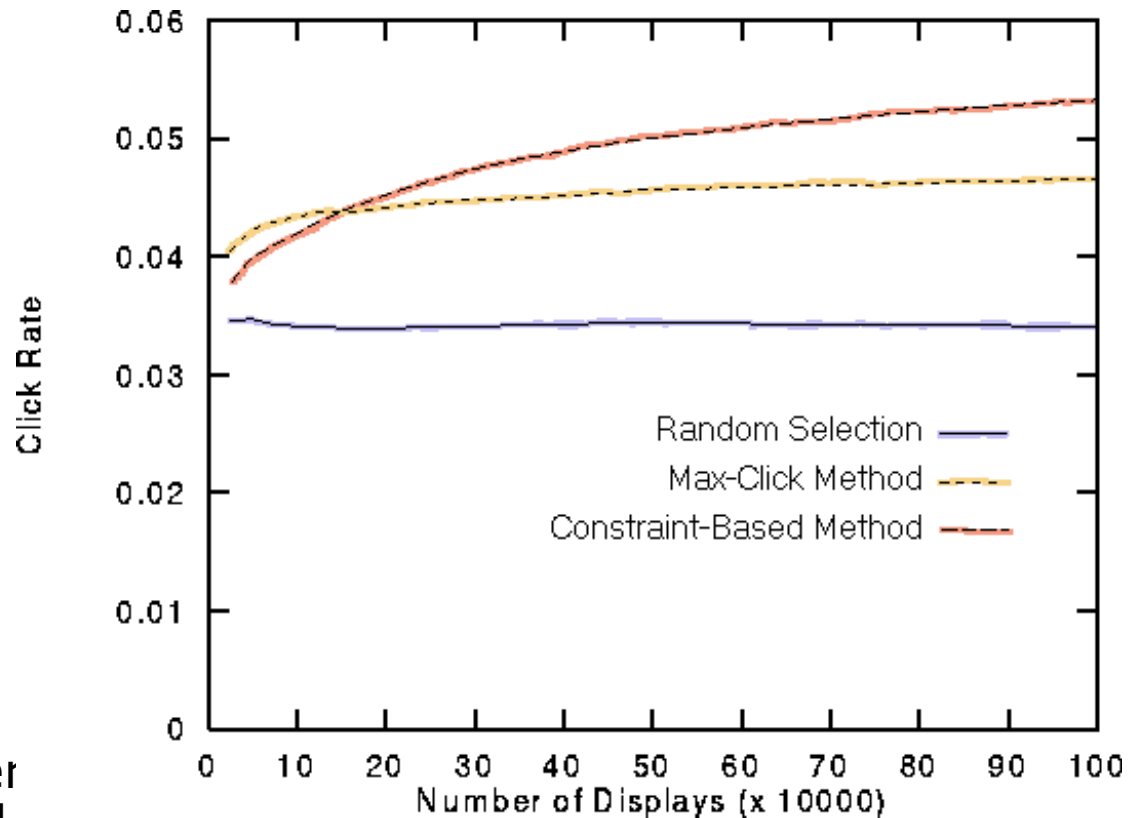**2.6 Experiments**

Experimental Results II

□ Random Method

□ Max-Click Method

■ Constraint-Based Learning

- More than 15% improvement over Max-Click Method

2.6 Experiments

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

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