

Web Dynamics

Part 7 – Human Behaviour on the Web

7.1 Recommendation

7.2 Personalized Search

High-Level View of Recommendation

Input: Collected data on *behavior of users*

- Items (books, dvds, cds,...) purchased
- Items (books, movies, hotels, ...) rated
- Web sites browsed or bookmarked
- Searches and clicked search results
- Sequence of activities (browsing, searching, ...)
- Mails, Documents read and written
- Profile in social networks (contacts)

⇒ build extensive *user models*

High-Level View of Recommendation

Output: Items of *potential interest* to user

- Items (books, movies, hotels,...) to purchase/view/visit/...
- Web sites to visit
- Improved search results
- Potential query expansions/refinements
- People to meet in social networks

Three orthogonal approaches

User-centric approach („nearest neighbors“):

User A likes/buys/visits item X
(model of) user B similar to
(model of) user A

} user B may like
item X as well

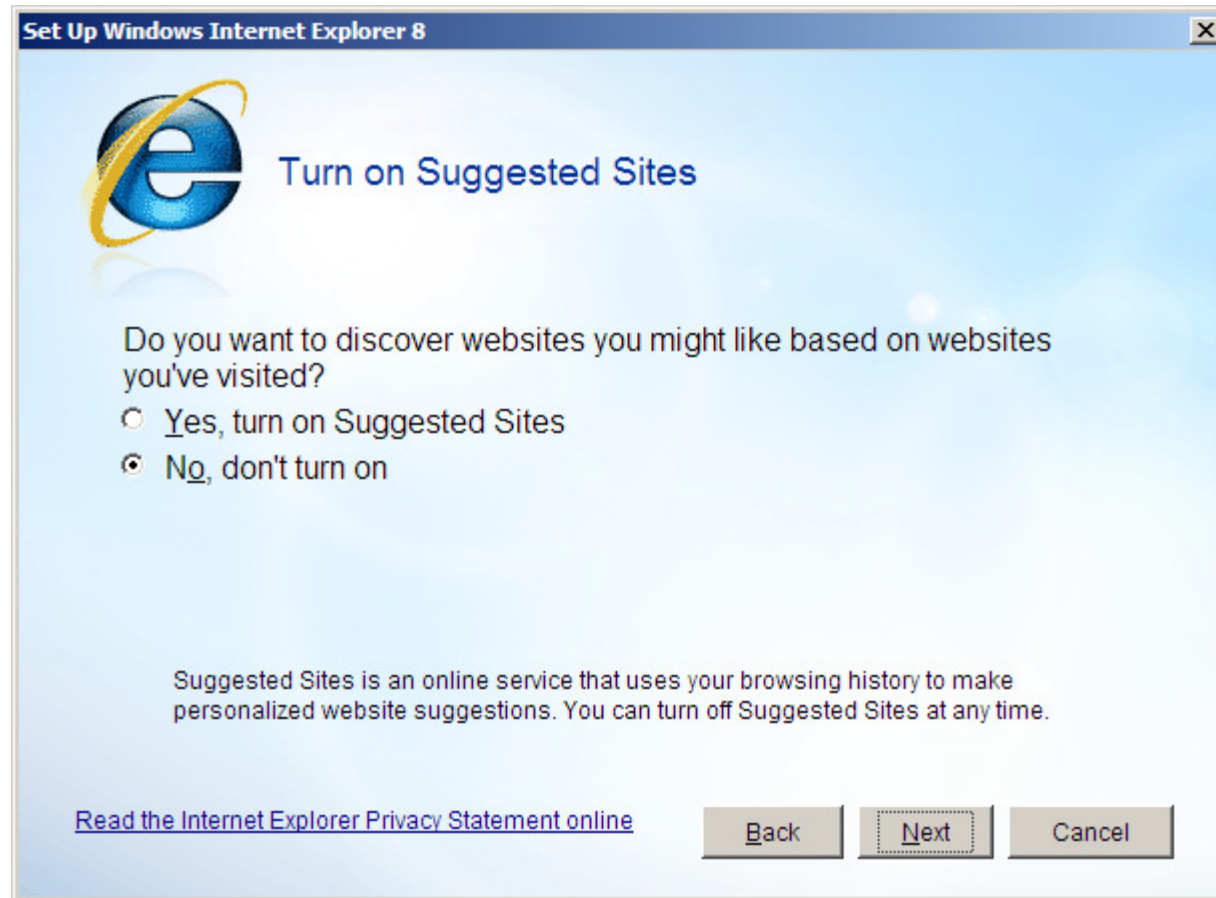
Item-centric approach:

User A likes/buys/visits item X
Item X similar to item Y

} user A may like
item Y as well

[*Static approach*: Many people buy X]

Example 1: Web site suggestion




Example 1: Web site suggestion

Vorgeschlagene Sites

Personen, die Folgendes
angesehen haben


Mochten auch

 [Kompetenzzentrum Informatik
der Universität des Saarlandes](#)

 [Aktuelle News && Events — ZBI](#)

Umzug der Zentrums für Bioinformatik. Ab 01. Dezember ist das Zentrum für Bioinformatik mit Geschäftsführung sowie Prüfungsamt in einem eigenen Gebäude zu finden: Gebäude E ...

<http://www.zbi.uni-saarland.de>

 [E-Government-Akademie des IFIB - Institut für Informationsmanagement ...](#)

Die vom Institut für Informationsmanagement Bremen (ifib) organisierte E-Government-Akademie veranstaltet Seminare u Workshops für Entscheider und Gestalter. Wir schlagen die ...

<http://www.egovernment-akademie.de/academy/content/sections/>

 [Forwiss Index](#)

Develops knowledge-based systems on the basis of mathematical models. Features current and completed projects and contact information.

<http://www.forwiss.uni-passau.de>

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⇒ **item-centric approach, (seemingly) no user model used**

Example 2: Product Recommendations

Most Popular in Desktop Computers



[Apple iMac MB417LL/A 20...](#)
\$1,194.00



[HP Pavilion A6700F Desktop PC](#)
\$731.00 \$429.79



[Datenbanksysteme: Eine Einführung](#)
von Alfons Kemper (April 22, 2009)
Auf Lager.

Preis: EUR 39,80
[62 Angebote](#) ab EUR 39,80

☐ Gehört mir ☐ Kein Interesse x|☆☆☆☆☆ Diesen Artikel bewerten
Diesen Artikel haben wir empfohlen, weil Sie **Übungsbuch Datenbanksysteme** gekauft haben.

Mehr zu entdecken

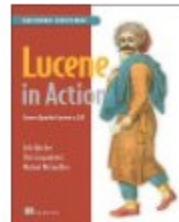
Sie haben sich angesehen:



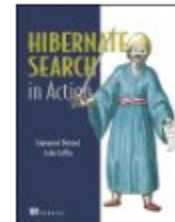
[Building Search Applications: Lucene...](#) Taschenbuch von
Manu Konchady
EUR 31,89

> [Verwandte Artikel entdecken](#)

Ihnen könnten diese Artikel gefallen:



[Lucene in Action](#) Taschenbuch von Erik Hatcher, Otis...
EUR 30,95



[Hibernate Search in Action](#) Tasche
Bernard...
EUR 33,95

⇒ static and item-centric approach

Example 2: Product Recommendation

amazon.com

More to Explore

As someone who's browsed lenses, you may be interested in checking out bestselling digital SLR lenses from Amazon.com.



[Canon EF-S 55-250mm f/4.0-5.6 IS Telephoto Zoom Lens for Canon Digital SLR Cameras](#)



[Canon EF 50mm f/1.8 II Camera Lens](#)



[Nikon 50mm f/1.8D AF Nikkor Lens for Nikon Digital SLR](#)



[Nikon 55-200mm f/4-5.6G ED IF AF-S DX VR \[Vibration](#)

Canon EF 75-300mm f/4-5.6 III Telephoto Zoom Lens for Canon SLR Cameras

Other products by [Canon](#) | [See collection](#)

4.1 out of 5 stars [See all reviews](#) ([140 customer reviews](#)) | [More about this product](#)

List Price: ~~\$199.99~~

Price: **\$155.00** & this item ships for **FREE** with **Super Saver Shipping**. [Details](#)

You Save: **\$44.99** (22%)

[Special Offers Available](#)

In Stock.

We are not able to ship this item to your default shipping address.

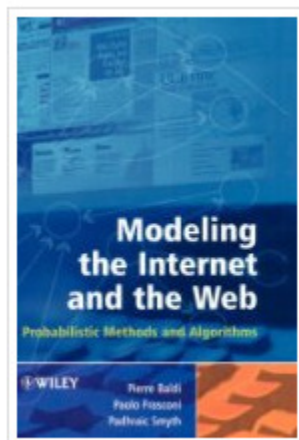
Ships from and sold by **Amazon.com**. Gift-wrap available.

[18 new](#)

[19 used](#) from **\$125.00**

[8 refurbished](#) from **\$129.90**

Example 3: Book Recommendations



Modeling the Internet and the Web: Probabilistic Methods and Algorithms by [Pierre Baldi](#)

Members	Reviews	Popularity	Average
10	None	439,588	

▼ Book information

Modeling the Internet and the Web: Probabilistic Methods and Algorithms

by [Pierre Baldi](#)

Wiley (2003), Hardcover, 285 pages

LibraryThing recommendations

1. [Web Metrics: Proven Methods for Measuring Web Site Success](#) by Jim Sterne
2. [Differentiated services for the Internet](#) by Kalevi Kilkki
3. [Internet Measurement: Infrastructure, Traffic and Applications](#) by Mark Crovella
4. [Designing Campus Networks](#) by Terri Quinn-Andry
5. [True Names: And the Opening of the Cyberspace Frontier](#) by Vernor Vinge
6. [Me++: The Cyborg Self and the Networked City](#) by Will
7. [What Just Happened: A Chronicle from the Information](#) by Gleick
8. [The Digital Sublime: Myth, Power, and Cyberspace](#) by
9. [24 Hours in Cyberspace: Painting on the Walls of the I](#) by 150 of the World's Lead
10. [Crypto Anarchy, Cyberstates, and Pirate Utopias](#) by Pe

LibraryThing Recommendations

304 recommendations — page [1] | 2 | 3 | 4

1. [Machine Learning](#) by [Thomas Mitchell](#)

169 copies, 1 reviews, Average rating 4.08.

[No thanks!](#) | [Why?](#) (close why) Recommendation based on:

[Artificial Intelligence: A Modern Approach](#) by [Stuart J. Russell](#)

[Data Mining: Practical Machine Learning Tools and Techniques, Second Edition](#) (Morgan Kaufmann Series in Data Management) by [Ian H. Witten](#)

[An Introduction to Support Vector Machines and Other Kernel-based Learning Methods](#) by [Nello Cristianini](#)

[All of Statistics: A Concise Course in Statistical Inference](#) (Springer Texts in Statistics) by [Larry Wasserman](#)

Towards user-centric recommendations

Assume n users U , m items I .

Model *user-item relation* as $n \times m$ – matrix V :

- $V = \{0,1\}^{n \times m}$: binary *purchase matrix*
- $V = [\min, \max]^{n \times m}$: quantified *preference matrix*

Both are very sparse!

(Librarything: 1,000,000 users, 52 mio books,
less than 200 books for most users
 $\Rightarrow 0,0004\%$ non-zero entries)

„semantics“: v_{ij} seen as „vote“ of user i for item j

Recommendation Problem

Inputs:

- Set of votes of user u with items I_u
- Set of votes of other users

Goal: predict votes of u for items in $I \setminus I_u$
(to identify the items with highest votes)

\Rightarrow yields scalability problem ($|I|$ is large!)

Vote Prediction

Initial vote calibration (to remove bias):

$$v_i = \frac{1}{|I_i|} \sum_{j \in I_i} v_{ij} \qquad v_{ij}^* = v_{ij} - v_i$$

Predict vote of user u for item j as weighted average over the votes of all other users:

$$\hat{v}_{uj} = v_u + \frac{1}{C} \sum_{i=1}^n w_{ui} \cdot v_{ij}^*$$

\uparrow
similarity of users u and i

$$C = \sum_{i=1}^n |w_{ui}|$$

Estimating User-User Similarity

- Correlation-Based similarity:

$$w_{ai} = \frac{1}{C_2} \sum_{j \in I_a \cap I_i} (v_{aj} - v_a)(v_{ij} - v_i)$$

$$C_2 = \left(\sum_{j \in I_a \cap I_i} (v_{aj} - v_a)^2 \sum_{j \in I_a \cap I_i} (v_{ij} - v_i)^2 \right)^{1/2}$$

Unreliable results if overlap between users is small

- Vector similarity (cosine):

$$w_{ai} = \sum_{j \in I} \frac{v_{aj}}{\sqrt{\sum_{k \in I_a} v_{ak}^2}} \frac{v_{ij}}{\sqrt{\sum_{k \in I_i} v_{ik}^2}}$$

Remaining problem: high dimensionality (number of users and items)

Reducing Dimensionality: SVD

Replace V by *rank- k approximation* of V using SVD:

$$V = A \times S \times B^T$$

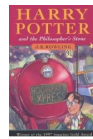
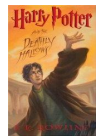
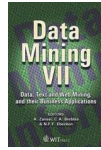
A : **user-concept** similarity matrix ($n \times r$)

S : diagonal matrix of **singular values** (with r nonzero entries, where $r = \text{rank}(V)$), corresponding to **topics**

B^T : **concept-item** similarity ($r \times m$)

Additionally *restrict to k largest singular values* to further reduce dimensionality

SVD Example



$$V = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$



$$= \begin{pmatrix} 0.707 & 0 & -0.544 & 0 & 0.707 \\ 0.5 & 0 & -0.707 & 0 & -0.5 \\ 0.5 & 0 & 0.707 & 0 & -0.5 \\ 0 & 0.788 & 0 & -0.615 & 0 \\ 0 & 0.615 & 0 & 0.788 & 0 \end{pmatrix} \times \begin{pmatrix} 2.414 & 0 & 0 & 0 & 0 \\ 0 & 2.136 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0.662 & 0 \\ 0 & 0 & 0 & 0 & 0.414 \end{pmatrix} \times \begin{pmatrix} 0.5 & 0.5 & 0.707 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.369 & 0.657 & 0.657 \\ -0.707 & 0.707 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -0.929 & 0.261 & 0.261 \\ 0.5 & 0.5 & -0.707 & 0 & 0 & 0 \end{pmatrix}$$

A

S

B^T

SVD Example

$$V = \begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \end{pmatrix}$$














$$\approx \begin{pmatrix} 0.707 & 0 \\ 0.5 & 0 \\ 0.5 & 0 \\ 0 & 0.788 \\ 0 & 0.615 \end{pmatrix} \times \begin{pmatrix} 2.414 & 0 \\ 0 & 2.136 \end{pmatrix} \times \begin{pmatrix} 0.5 & 0.5 & 0.707 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.369 & 0.657 & 0.657 \end{pmatrix} = \begin{pmatrix} 0.854 & 0.854 & 1.207 & 0 & 0 & 0 \\ 0.604 & 0.604 & 0.854 & 0 & 0 & 0 \\ 0.604 & 0.604 & 0.854 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.621 & 1.106 & 1.106 \\ 0 & 0 & 0 & 0.485 & 0.864 & 0.864 \end{pmatrix}$$

A
S
B^T

Recommendations with SVD

- Predict votes on A, not on V
⇒ compute estimate v'_{uj} for each topic j
- Extend the vote estimate from topics to items

$$v_{ui} = \sum_{j=1}^k (v'_{uj} \cdot S_{jj} \cdot B_{ji})$$

New issue: Maintaining the SVD when data changes

SVD generates implicit clustering of items

Reducing Dimensionality: Clustering

- Reduce number of users by precomputing ***K clusters of similar users***
- Represent each cluster P by its ***centroid*** $c(P)$:

$$c(P)_i = \frac{1}{|P|} \sum_{u \in P} v_{ui}$$

- For prediction:
 - Assign user to one of the clusters
 - Compute „nearest neighbor“-prediction for clusters instead of users
- **Potential problem:**
users may belong to multiple clusters

User-Centric is Expensive

- User actions are highly dynamic
 - difficult to precompute and maintain similarities
 - best recommendations based on items just bought
- One recommendation takes time $O(n+m)$:
 - needs to scan all users and their items
 - most users have $\leq C1$ items
 - few users ($\leq C2$) have $>C1$ items
 - cost bounded by $(n-C2) \cdot C1 + C2 \cdot m = O(n+m)$
 - n, m large
- Recommendations need to be computed in real time ($\leq 200\text{ms}$)

Item-centric Recommendations

Observation:

Relationships of items (i.e., correlation in purchases) a lot less dynamic than relationships of users

- information from yesterday still reasonably accurate today
- not recommending new items tolerable

Predict vote of user u for item j as weighted average over the votes of user u for other items:

$$\hat{v}_{uj} = v_u + \frac{1}{C} \sum_{i=1}^m w_{ji} \cdot v_{ui}^*$$

\uparrow
similarity of items j and i

$$C = \sum_{i=1}^m |w_{ui}|$$

Requires only limited knowledge about the user

Estimating Item-Item Similarity

using correlation-based or cosine similarity
(similar to user-user similarity)

Example: cosine similarity

$$w_{ji} = \sum_{u \in U} \frac{v_{uj}}{\sqrt{\sum_{k \in U} v_{kj}^2}} \frac{v_{ui}}{\sqrt{\sum_{k \in U} v_{ki}^2}}$$

Computing similarities expensive ($O(m^2n)$), but offline
Computing predictions is cheap ($O(m)$ if only constant
number of items considered)

Using Search to Recommend

Assume we can identify *features* of items (genre, actors, director, keywords, ...)

- Identify *frequent/characteristic features* for the user's items
- Submit *search* for those features and recommend the results

Problems:

- Does not scale well for many owned items
- Does not provide good recommendations

Probabilistic Models for Recommendation

Consider *joint probability distribution* for m-dimensional set of items (binary preferences):

$P[v_1 \dots v_m]$: probability that random user has vote vector (v_1, \dots, v_m)

Predict unknown value v_{ui} as $P[v_i=1 | v_j=1 \text{ for } j \in I_u]$

Impossible to maintain explicitly (2^m parameters!)

\Rightarrow approximate through *finite mixture*:

$$P[v_1 \dots v_m] \approx \sum_{k=1}^K P[v_1 \dots v_m | c = k] \cdot P[c = k]$$

assume independence within each component:

$$P[v_1 \dots v_m | c = k] = \prod_{j=1}^m P[v_j | c = k]$$

Evaluating Recommender Systems

Goal:

Out of several recommendation algorithms, determine which gives best recommendations.

Required components of such a *benchmark*:

- set of (user,item,rating) tuples for *training* (known to the algorithm in advance)
- set of (user,item,rating) tuples for *testing* (where the algorithm needs to predict *rating*)
 - Can be offline (part of the data) or live user experiment
- metrics for *quantifying result quality*

Properties of Data Sets for Evaluation

- can be *synthetic* vs. *real-life*
- features of the application domain
 - *novelty* vs. *quality* focus of recommendations
 - *cost/benefit ratio* of true/false positive/negatives
 - *granularity* of true user preferences (vs. ratings)
- inherent features of the data set (and ratings)
 - *Implicit* or *explicit* ratings
 - *scale* & *dimensions* of ratings
 - *history* of ratings (timestamps) and recommendations
- sample features
 - *density* of rating set (overall & for test users)
 - *size* of data set

Offline Evaluation vs. User Experiments

- **Offline evaluation:** *compare* predicted votes to actual votes made by the user
 - low effort, can be done automatically
 - can be used to evaluate series of ratings (timestamps)
 - But: limited choice of predictions to evaluate
- **Live user experiments:** *ask* user for opinion or *observe* user behavior
 - understand if and why people like (or dislike) recommendations, interfaces, systems

Evaluation metrics

Widely used: measure *accuracy* of predictions by measuring the *error* of prediction and actual rating

- mean absolute error (MAE)

$$|\bar{E}_{MAE}| = \frac{\sum_{i=1}^N |p_i - r_i|}{N}$$

p_i : prediction

r_i : recommendation

N : # recommendations

- Root mean square error (RMSE; emphasises large errors)

$$|\bar{E}_{RMSE}| = \sqrt{\frac{\sum_{i=1}^N (p_i - r_i)^2}{N}}$$

- precision/recall, rank accuracy metrics, ...

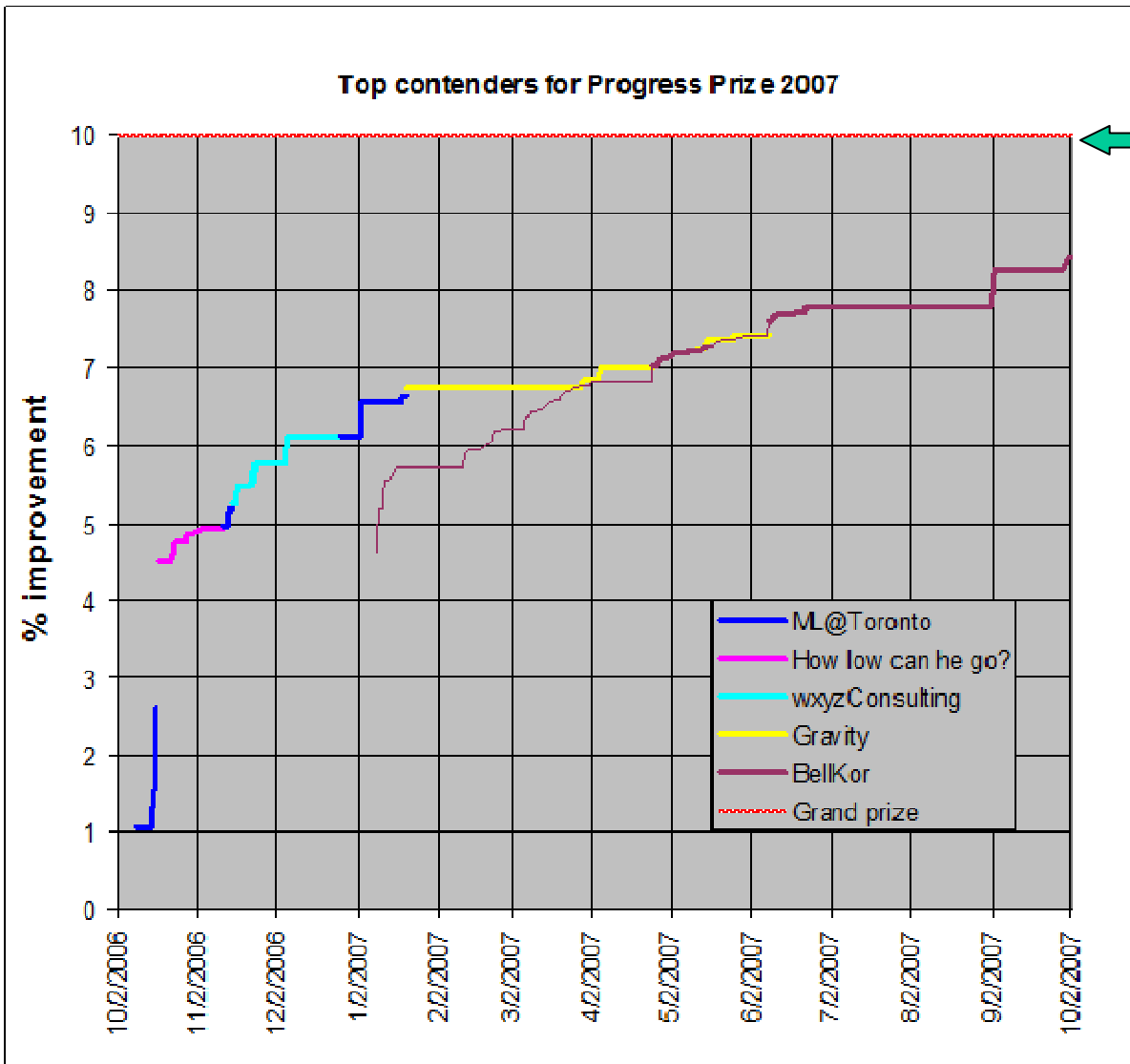
Additional Evaluation Dimensions

- **Coverage:**
 - Recommendations for how many items
 - How many items are actually recommended
- **Learning rate:**
 - How fast recommendation quality increases with increased amount of training data
- **Novelty:**
 - Focus on items unknown to the user, but within its scope (e.g., new movie of favourite director)
- **Serendepity:**
 - Surprising recommendations (e.g., new movie of new director that fits the user's taste)
- **Confidence**

Benchmarks: Netflix Prize

- <http://www.netflixprize.com>
- set up by online movie portal
- provides (anonymized) training data (480,000 users, 18,000 movies, 10^6 ratings on a 1..5 scale)
- Goal: improve over portal's own recommender (RMSE: 0.9514)
- High reward to make the benchmark attractive: 1,000,000\$ for the first 10% improvement in RMSE on test data (1.4 million user-movie pairs), 50,000\$ intermediate progress award per year

Netflix: Result Improvements over Time



10% improvement
reached on July 26, 2009

Web Dynamics

Part 7 – Human Behaviour on the Web

7.1 Recommendation

7.2 Personalized Search

Goal: Resolve inherent disambiguity of search

Example 1: Search for „IR“ may return

- Ingersoll-Rand Company
- Web pages in Arabic from Iran (*.ir)
- Infrared Light
- Information Retrieval

Example 2: Search for „Java“ should return

- Programming tools for a programmer
- Tutorials for a teacher
- FAQ lists for a novice user

global context
of the user

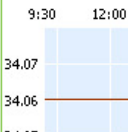
Goal: Resolve inherent disambiguity of search

ir

Web Finance

ALL RESULTS

[ir camera](#)
Thermal Imaging

[Ingersoll-Rand](#)


[News](#)
[More](#)

[Any time](#)
[Latest](#)
[Past 2 weeks](#)
[More search tools](#)

[Infrared - Wikipedia](#)
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 Infrared radiation micrometres, w
[en.wikipedia.org](#)

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[www.irf.com](#) - C

ir

Search

YAHOO!

ir

Search

Search In: ☒ the Web ☐ pages in German

Search Pad

SearchScan - On

1,460,034,150 results for ir:

Show All


Wikipedia

Also try: [ir spectroscopy](#), [ir blaster](#), [ir repeater](#), [ir extender](#), [more...](#)

[Infrared - Wikipedia, the free encyclopedia](#)

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Infrared radiation (IR radiation) is electromagnetic radiation with a wavelength between 0.7 and 300 micrometres, which equates to a frequency range between approximately 1 and 430 THz.
[en.wikipedia.org/wiki/Infrared](#) - 141k - [Cached](#)



[Infrared Waves](#)

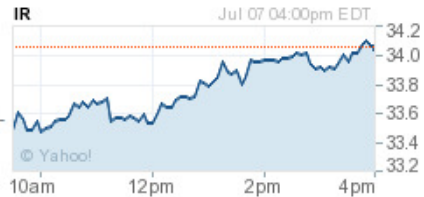
Near "infrared" light is closest in wavelength to visible light and "far infrared" is ... of SE-IR Corporation, Goleta, CA) shows a cat in the infrared. ...
[science.hq.nasa.gov/kids/imagers/ems/infrared.html](#) - [Cached](#)

[InfraRED: Opensource J2EE Performance Monitoring Tool - Overview](#)

A low overhead, non-intrusive performance monitoring tool for J2EE applications. [Open source, Apache License]
[infrared.sourceforge.net/versions/latest](#) - [Cached](#)

[IR - Ingersoll-rand Plc \(ireland\)](#)

34.06 0 (0%) at 13:01 PDT Jul 7
 Quote delay: 15 min - Nasdaq, 20 min - NYSE and Amex
[News](#) | [Charts](#) | [Quotes](#) | [Message Boards](#)
[Altucher Sees S&P 500 Back to All-Time Highs](#) -
 at Barron's Online
[finance.yahoo.com](#)



[Infrared Radiation - Warmth From The Cold of Space](#)

What is **Infrared** Radiation? The light we see with our eyes is really Although **infrared**

Summer Term 2010

Goal: Resolve inherent disambiguity of search

Example 3: Search for „restaurant“ should return

- places in Geneva while planning for SIGIR 10
- places in Singapore while planning for VLDB 10
- places in Saarbrücken otherwise

Example 4: Search for „Saarbrücken“ should return

- Restaurants (when I've been searching for them)
- Computer shops, dentists, hospitals, ...

**Search results may depend on current context
(that is not constant and may change over time)**

Dimensions of Personalized Search

- Different *kinds of user contexts*:
 - global: background of the user, long-term profile
 - session: set of queries following similar needs
 - query: use last query & actions

each only for searches, for all browser actions, or for (more/all) actions

- Different *places* to collect & use context info:
 - Service provider vs. Web server vs. local client
- Different *actions* to use context info:
 - modify query vs. rerank results

Simple Personalization: Relevance Feedback

- collect *feedback from user* for query results
 - explicit feedback (buttons in the interface)
 - implicit feedback (clicks of the user)
- generate *improved query*
 - add new terms
 - drop some old terms
 - change weights of terms

Example: Simple Feedback on iGoogle

Web Bilder Videos Maps News Shopping E-Mail Mehr ▼



ir

Suche

[Erweiterte Suche](#)
[Einstellungen](#)




Suche: ☒ Das Web ☐ Seiten auf Deutsch ☐ Seiten aus Deutschland

Web

[International Rectifier - The Power Management Leader](#) - [[Diese Seite übersetzen](#)]

Manufacturer of power semiconductors (MOSFET, IGBT, Diodes and Thyristors).

[Hexfet](#) - [Careers](#) - [Contact Us](#) - [Application Notes](#)

www.irf.com/indexnsw.html - [Im Cache](#) - [Ähnlich](#) -   


[Infrarotspektroskopie – Wikipedia](#)

Die IR-Spektroskopie wird zur quantitativen Bestimmung von bekannten Substanzen, ...
Spektroskopie im mittleren Infrarot – häufig nur als ...

de.wikipedia.org/wiki/Infrarotspektroskopie - [Im Cache](#) - [Ähnlich](#) -   

[Infrarotstrahlung – Wikipedia](#)



Als Infrarot wird der Bereich zwischen 780 nm und 1 mm (das sind 1.000.000 nm) ...
Umgangssprachlich wird IR-Licht oft mit Wärmestrahlung gleichgesetzt, ...

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[Weitere Ergebnisse von de.wikipedia.org »](#)




[IR-Spektroskopie](#)

Auf dieser privaten Seite werden die Grundlagen der IR-Spektroskopie und die Technik der FTIR-Spektrometer erklärt.

www.ir-spektroskopie.de/ - [Im Cache](#) - [Ähnlich](#) -   

[Initiativkreis Ruhr - Home](#)

Die Repräsentanten der führenden Wirtschaftsunternehmen sowie des öffentlichen Lebens zwischen Rhein und Ruhr arbeiten seit 1989 zusammen, ...

www.i-r.de/ - [Im Cache](#) - [Ähnlich](#) -   

[Infrared - Wikipedia, the free encyclopedia](#) - [[Diese Seite übersetzen](#)]

Infrared (IR) radiation is electromagnetic radiation whose wavelength is longer than that of

Give positive or negative feedback for results

Example: Simple Feedback on iGoogle



Web

Ergebnisse beinhalten Ihre SearchWiki-Hinweise für **ir**. [+ Diese Hinweise weitergeben](#)

Infrarot-Strahlung **IR**


Infrarotstrahlung (**IR**-Strahlung) - auch als Wärmestrahlung bezeichnet - ist Teil der optischen Strahlung und damit Teil des elektromagnetischen Spektrums. ...

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 1  0 - Sie sind der Erste, der dieses Ergebnis auswählt.




Infrarotspektroskopie – Wikipedia

Die **IR**-Spektroskopie wird zur quantitativen Bestimmung von bekannten Substanzen, ... Die Spektroskopie im mittleren **Infrarot** – häufig nur als ...

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Infrarotstrahlung – Wikipedia




Als **Infrarot** wird der Bereich zwischen 780 nm und 1 mm (das sind 1.000.000 nm) ... Umgangssprachlich wird **IR**-Licht oft mit Wärmestrahlung gleichgesetzt, ...

de.wikipedia.org/wiki/Infrarotstrahlung - [Im Cache](#) - [Ähnlich](#) -   

[Weitere Ergebnisse von de.wikipedia.org »](#)



IR-Spektroskopie

Auf dieser privaten Seite werden die Grundlagen der **IR**-Spektroskopie und die Technik der FTIR-Spektrometer erklärt.

www.ir-spektroskopie.de/ - [Im Cache](#) - [Ähnlich](#) -   




Infrared - Wikipedia, the free encyclopedia - [[Diese Seite übersetzen](#)]

Infrared (**IR**) radiation is electromagnetic radiation whose wavelength is longer than that of visible light (400-700 nm), but shorter than that of terahertz ...

en.wikipedia.org/wiki/Infrared - [Im Cache](#) - [Ähnlich](#) -   

AIM INFRAROT-MODULE GmbH

Die AIM **INFRAROT**-MODULE GmbH entwickelt und fertigt **Infrarot**-Detektoren und –Module für Thermografiesysteme. Das Hightech-Unternehmen ist weltweit als ein ...

www.aim-ir.de/ - [Im Cache](#) - [Ähnlich](#) -   

Sie haben Ergebnisse für diese Suche entfernt. [Ausblenden](#)

Feedback in the current Google interface

ir Suche

Ungefähr 457.000.000 Ergebnisse (0,23 Sekunden) Erweiterte Suche

Markierte Ergebnisse für ir

★ [Infrarot-Strahlung \(IR\) - www.bfs.de/de/uv/ir](http://www.bfs.de/de/uv/ir)

[Workshop IR - LWA2010 - Lernen, Wissen, Adaptivität. 4.-6. Oktober..](#) ☆ 3 Besuche - 17. Juni
Webseite des Fachgebiets Wissensverarbeitung, Fachbereich 17, Universität Kassel
www.kde.cs.uni-kassel.de/conf/lwa10/ir - Im Cache

[Infrarotspektroskopie – Wikipedia](#) ☆
Zu [Lage der IR-Absorptionsbanden](#) springen: IR-Spektren werden dahingehend interpretiert, dass man aus der Kurve des gemessenen IR-Spektrums die ...
[Varianten](#) - [Messprinzip](#) - [IR-Spektroskopie-Techniken](#) - [Siehe auch](#)
de.wikipedia.org/wiki/Infrarotspektroskopie - Im Cache - Ähnliche

[Infrarotstrahlung – Wikipedia](#) ☆
Als Infrarotstrahlung (kurz **IR**-Strahlung, auch Ultrarotstrahlung) bezeichnet man in der Physik elektromagnetische Wellen im Spektralbereich zwischen ...
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www.ir-spektroskopie.de/ - Im Cache - Ähnliche

[Infrarot-Strahlung \(IR\)](#) ☆
Infrarotstrahlung (**IR**-Strahlung) - auch als Wärmestrahlung bezeichnet - ist Teil der optischen Strahlung und damit Teil des elektromagnetischen Spektrums. ...
www.bfs.de/de/uv/ir - Im Cache - Ähnliche

[Infrared](#) [Wikipedia, the free encyclopedia](#) ☆ [\[Diese Seite übersetzen\]](#)

iGoogle: Collaborative Feedback



Alle Such-Wiki-Einträge



19 Einträge gespeichert für: **ir**

[IR Japan | 株式会社アイ・アールジャパン](#) - [[Diese Seite übersetzen](#)]

IR活動支援のパイオニア、アイ・アールジャパンは委任状争奪戦などの有事においてはプロキシーアドバイザー (PA) として、また、平時においては買収防衛策導入支援、...

www.irjapan.net/ - vor 6 Stunden gefunden - [Im Cache](#) - [Ähnlich](#) -

2 0

[Infrarot-Strahlung \(IR\)](#) - [Wiederherstellen](#)

Infrarotstrahlung (IR-Strahlung) - auch als Wärmestrahlung bezeichnet - ist Teil der optischen Strahlung und damit Teil des elektromagnetischen Spektrums. ...

www.bfs.de/de/uv/ir - [Im Cache](#) - [Ähnlich](#) -

1 0

[Welcome to WAR LIBRARY](#) - [[Diese Seite übersetzen](#)]

welcome to war library, you can find many books about wars in this library in persian , english and arabic ,....

www.warlib.ir/ - [Im Cache](#) - [Ähnlich](#) -

1 0

[Time Warner: Time Warner Inc.: Investor Relations](#) - [[Diese Seite übersetzen](#)]

Reports & SEC Filings. Financial publications, earnings information and SEC filings, including Annual Reports; 10-K, 10-Q and 8-K reports; proxy statements; ...

ir.timewarner.com/ - vor 8 Stunden gefunden - [Im Cache](#) - [Ähnlich](#) -

1 0

[إذاعة الجمهورية الإسلامية في إيران | الصفحة الرئيسية](#)

زوروا موقع إذاعة طهران العربية على الانترنت للاطلاع على آخر الاخبار والانباء والتقارير وأهم عناوين الصحف العربية والإيرانية وأحداث العالم عبر الصور.

arabic.trib.ir/ - vor 3 Stunden gefunden - [Im Cache](#) - [Ähnlich](#) -

1 0 [Kommentar](#)

[Internal Revenue Service](#) - [[Diese Seite übersetzen](#)]

US government agency responsible for tax collection and tax law enforcement. Provides downloadable income tax forms, instructions, agency publications

Implicit Feedback from Clicks

General rules to collect implicit feedback:

- **Clicked results** are relevant for the query
 - unless the user left that page immediately
- **Non-clicked** results don't really help
 - User may immediately rate them as nonrelevant (from the snippet)
 - User may already know the result (which may be relevant or nonrelevant)
 - User may not have looked at the result (was satisfied by other results)

Advanced Implicit Feedback

Modify browser to collect *behavior data*:

- dwelling time on a page
- scrolling
- mouse movements
- mouse clicks
- followed links

⇒ Yields better estimate of “relevance”

iGoogle: Logging Searches and Clicks

Webprotokoll für ralf.schenkel@gmail.com

Gesamtes Protokoll	Heute
Web	11:12 Gesucht nach google search personalization - 3 Ergebnisse angezeigt
Bilder	★ Google Ramps Up Personalized Search - searchengineland.com
News	★ The Future of Google's Search Personalization - Search... - searchenginewatch.com
Produkte	★ Google Web History and Search Personalization - googletutor.com
Anzeigen	

Context-based Search on Google



Personalisierte Suche: **ir**

Wenn möglich, passt Google Ihre Suchergebnisse anhand des Standortes und/oder Ihrer aktuellen Suchvorgänge an. Wenn Sie in Ihrem Google-Konto angemeldet sind, erhalten Sie außerdem basierend auf Ihrem Suchverlauf meist noch relevantere und nützlichere Ergebnisse.

Die folgenden Informationen wurden verwendet, um Ihre Suchergebnisse für **ir** zu verbessern:

Webprotokoll	Ein oder mehrere Elemente in Ihrem Webprotokoll wurden zur Verbesserung der Suchergebnisse verwendet. Webprotokoll verwalten Webprotokoll aus meinem Google-Konto entfernen
---------------------	---

Wenn Sie neugierig sind, können Sie sich anschauen, wie eine Suche nach **ir** [ohne Anpassungen](#) aussieht.

Der Link 'Weitere Details' auf der Suchergebnisseite kann verwendet werden, um diese Seite für etwa 30 Minuten anzuzeigen. Danach wird diese Seite nicht länger angezeigt.

Markierte Ergebnisse für **ir**

★ [Infrarot-Strahlung \(IR\)](#) - www.bfs.de/de/uv/ir

Infrarotspektroskopie – Wikipedia ☆

Zu [Lage der IR-Absorptionsbanden](#) springen: IR-Spektren werden dahingehend interpretiert, dass man aus der Kurve des gemessenen IR-Spektrums die ...

[Varianten](#) - [Messprinzip](#) - [IR-Spektroskopie-Techniken](#) - [Siehe auch](#)
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Infrarotstrahlung – Wikipedia ☆

Als Infrarotstrahlung (kurz **IR**-Strahlung, auch Ultrarotstrahlung) bezeichnet man in der Physik elektromagnetische Wellen im Spektralbereich zwischen ...

de.wikipedia.org/wiki/Infrarotstrahlung - [Im Cache](#) - [Ähnliche](#)

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Personal Google Web history

Web History for ralf.schenkel@gmail.com

Web History

[Web](#)

[Images](#)

[News](#)

[Products](#)

[Sponsored Links](#)

[Video](#)

[Maps](#)

[Blogs](#)

[Books](#)

Pause

Remove items

Trends

Bookmarks

Show trends for: [Last 7 days](#) | [Last 30 days](#) | [Last year](#) | [All time](#)

Top queries

1. [vldb 2010](#)
2. [sigir 2010](#)
3. [icde 2010](#)
4. [dblp ralf schenkel](#)
5. [cikm 2010](#)
6. [ecir 2010](#)
7. [ralf schenkel](#)
8. [wise 2010](#)
9. [trec](#)
10. [sigmod 2010](#)

Top sites

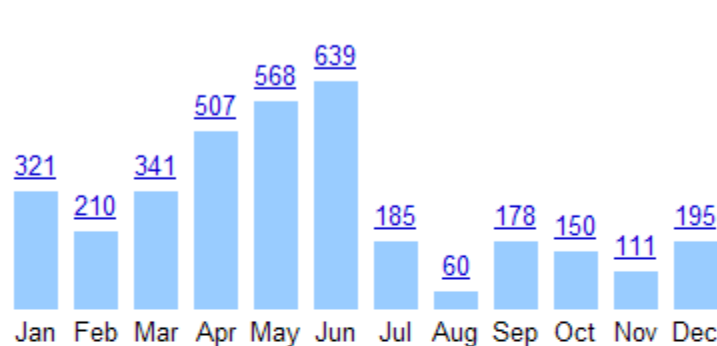
1. [www.informatik.uni-trier.de](#)
2. [de.wikipedia.org](#)
3. [en.wikipedia.org](#)
4. [www.amazon.de](#)
5. [portal.acm.org](#)
6. [www.vldb2010.org](#)
7. [citeseerx.ist.psu.edu](#)
8. [www.mpi-inf.mpg.de](#)
9. [hadoop.apache.org](#)
10. [www.mail-archive.com](#)

Top clicks

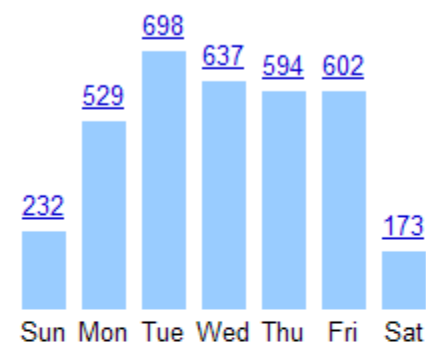
1. [DBLP: Ralf Schenkel](#)
2. [VLDB2010 Spore : Conferen](#)
3. [home \[ACM SIGIR 2010\]](#)
4. [ICDE 2010](#)
5. [ECIR 2010 | The Annual Eur](#)
6. [The 19th ACM International \(](#)
7. [The 11th Internation Confere](#)
8. [Text REtrieval Conference \(T](#)
9. [The 2010 ACM SIGMOD/PO](#)
10. [INEX 2010](#)

Personal Google Web history

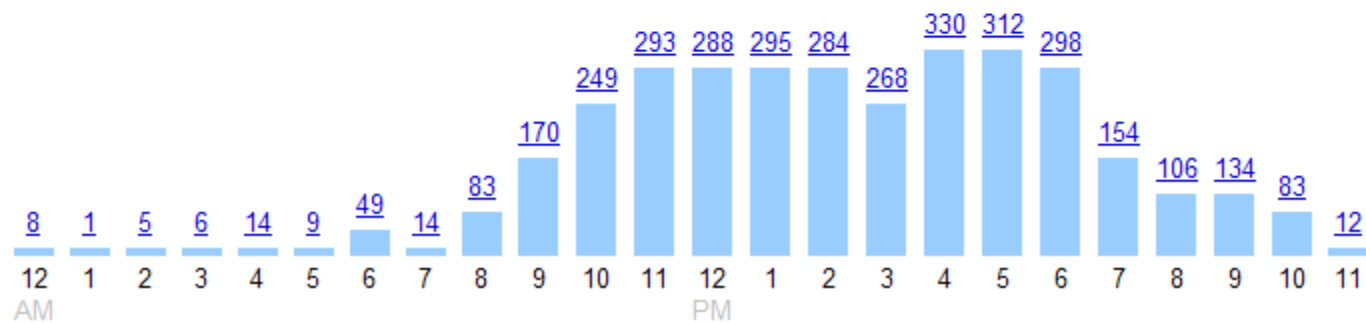
Monthly search activity




Daily search activity



Hourly search activity



Searching personal histories



Search History

Search the Web

Your web history is

Web History for ralf.schenkel@gmail.com

All History

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[Bookmarks](#)

Search results 1 - 25 of 119 for vldb - [Browse all history](#)

☆ [VLDB2010 Spore : Conference Overview](#) - [vldb2010.org](#) - Dec 23 - Viewed 25 times
VLDB is a premier annual international forum for data management and database researchers, vendors, practitioners, application deve
Searched for [vldb 2010](#) - [Viewed 2 results](#)

☆ [VLDB2010 Spore : Conference Overview](#) - [www.vldb2010.org/](#) - Jun 30 - Viewed 25 times
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VLDB 2010 , 36th International Conference on Very Large Data Bases Singapore : 13 to 17 Sept 2010, Grand Copthorne Waterfr
Searched for [vldb 2010](#) - [Viewed 1 result](#)

☆ [VLDB2010 Spore : Conference Overview](#) - [www.vldb2010.org/](#) - Jun 17 - Viewed 25 times
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VLDB is a premier annual international forum for data management and database researchers, vendors, practitioners, application

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Summer Term 2010

Web Dynamics

7-47

Standard RF: Rocchio's Method (1971)

- Goal: Find query that is close to relevant documents
- Compute *Rocchio weights [1971]* for each term (also used as weight in query):

$$w(t) = \alpha \cdot q(t) + \beta \frac{r_t}{R} - \gamma \frac{n_t}{N}$$

where

$q(t)$	weight of term t in the query
r_t	number of relevant results with term t
R	number of relevant results
n_t	number of nonrelevant results with term t
N	number of nonrelevant results

- Select n terms with highest weight to expand query

Simple Use of Feedback: Promoting

Idea: Push results with positive feedback up

- **Locally** for each user:
 - remember feedback for each user
 - promote results with feedback when query returns (approximately 30% of queries [Dou, WWW07])
- **Globally** for all users:
 - collect feedback for (frequent) queries
 - promote results with feedback from „most“ users
 - does not work well for ambiguous queries

⇒ pure reranking approach

User Profiles

Goal: Construct *summary* of the user's interests

- from the pages she accessed
- from her documents, her mails, ... (optional)

General approach:

- For each page p , consider term vector $t(p)$
- For set of browsed pages B , compute average term vector $t(B)$:

$$t(B) = \frac{1}{|B|} \sum_{p \in B} t(p)$$

Persistent vs. Session Profile

Long-term interests of user may differ from interest in *current search session*

⇒ maintain two profiles: persistent & session

- **Session profile:**

- consider pages accessed in the current session only
- Session boundaries by time or page coherence

- **Persistent profile:**

- consider all pages ever visited by the user
- lower weight for older pages (exponential decay)

Profile is mixture of session & persistent profiles

Personalization with User Profiles

Reranking of search result based on profile match:

- compute set of results R for query
- for each result p , measure *similarity* of p with profile vector (e.g., cosine)
- rank results in descending order of similarity

Improving Profiles by Collaborative Filtering

Problem:

User profile often sparse (based on few pages)

Approach:

Predict missing term weights analogously to user-centric recommendation

- Find similar users based on similarity of their profiles
- Compute predictions for term weights based on weighted average over neighborhood

Reranking Problem: Similar Results

Reranking cannot work when all results are similar
(and nonrelevant to the query)

Example:

- Query: windows (as built into houses)
- Results: only about the operating system

[Microsoft Corporation](#)
Microsoft Virtualization: Download a free trial of **Windows** Server 2008 Hyper-
trial, tools, and downloads that work with **Windows** Essential ...
[www.microsoft.com/](#) - [Cached](#) - [Similar](#)

[Microsoft Download Center](#) [Windows Vista](#)
[Windows XP](#) [Windows 7](#)
[Microsoft Help and Support](#) [Templates](#)
[Windows Update](#) [Internet Explorer](#)

[More results from microsoft.com »](#)

[Microsoft Windows](#): software and services as unique as you are
With **Windows** on your mobile phone, PC, or the Web, you have access to a
software, services, and devices to choose from.
[Downloads](#) - [Windows XP](#) - [Windows 7](#) - [Windows Vista](#)
[www.microsoft.com/windows/](#) - [Cached](#) - [Similar](#)

[Microsoft Windows Update](#)
Latest bug fixes for Microsoft **Windows**, including fixes for some possible Do
[windowsupdate.microsoft.com/](#) - [Similar](#)

The screenshot shows a Bing search results page for the query "windows". The search bar at the top contains the text "windows" and has tabs for "Web" and "Wikipedia". Below the search bar, there are two main columns of results. The left column, under the heading "RELATED SEARCHES", lists various Windows-related terms such as "House Windows", "Home Windows", "Replacement Windows", "Residential Windows", "Windows Update", "Windows Live", "Windows Live Messenger", and "Windows Media Player 11". The right column, under the heading "ALL RESULTS", shows a list of search results. The first result is "Official Windows Home Page" with a description and a link to "www.microsoft.com/windows". The second result is "Microsoft Corporation" with a description and a link to "www.microsoft.com". The third result is "Microsoft Windows - Wikipedia, the free encyclopedia" with a description and a link to "en.wikipedia.org/wiki/Microsoft_windows". The fourth result is "Microsoft Windows Update" with a description and a link to "windowsupdate.microsoft.com". At the bottom of the page, there is a "SEARCH HISTORY" section showing the current search "windows" and options to "See all", "Clear all", and "Turn off".

bing
Web

windows

Web Wikipedia

RELATED SEARCHES

- House Windows
- Home Windows
- Replacement Windows
- Residential Windows
- Windows Update
- Windows Live
- Windows Live Messenger
- Windows Media Player 11

ALL RESULTS 1-20 of 460,000,000 results ·

[Official Windows Home Page](#)
Microsoft **Windows** family of operating systems home page with product information, edition comparison charts, feature descriptions, downloads and more.
[www.microsoft.com/windows](#) - [Cached page](#)

[Microsoft Corporation](#)
Is your PC ready for **Windows** 7? Download the free Upgrade Advisor to find out if you can run **Windows** 7 on your PC. Learn more about **Windows** 7
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[Microsoft Windows - Wikipedia, the free encyclopedia](#)
Versions · History · Timeline of releases · Security
Microsoft **Windows** is a series of software operating systems and graphical user interfaces produced by Microsoft. Microsoft first introduced an operating environment named **Windows** in ...
[en.wikipedia.org/wiki/Microsoft_windows](#) - [Cached page](#)

[Microsoft Windows Update](#)
The Microsoft **Windows** Update Consumer site provides critical updates, security fixes, software downloads, and Microsoft **Windows** Hardware Quality Lab (WHQL) device drivers for your ...
[windowsupdate.microsoft.com](#) - [Cached page](#)

SEARCH HISTORY
windows

See all
Clear all · Turn off

Reranking diversified results

Exploit information about query sequences

Example:

windows → house windows → vinyl windows
→ windows xp → windows vista

Approach:

To get K results for reranking for query q ,
submit top- $K/(k+1)$ -queries for k most
frequent/diverse following queries of q in the log

Searches related to: **windows**

[windows azure](#)

[house windows](#)

[windows live](#)

[windows vista](#)

[windows xp](#)

[windows 7](#)

[home windows](#)

[windows media player](#)

References

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