

Relevance Feedback

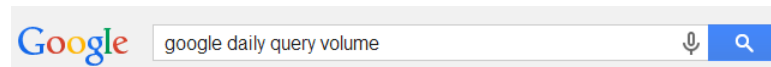
Slides borrowed from Stanford and Hongning Wang with
modifications

User feedback

should be

- An IR system ~~is~~ an interactive system

Query



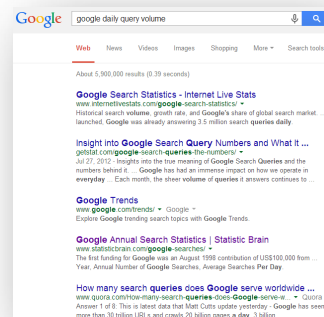
Information need



Feedback

GAP!

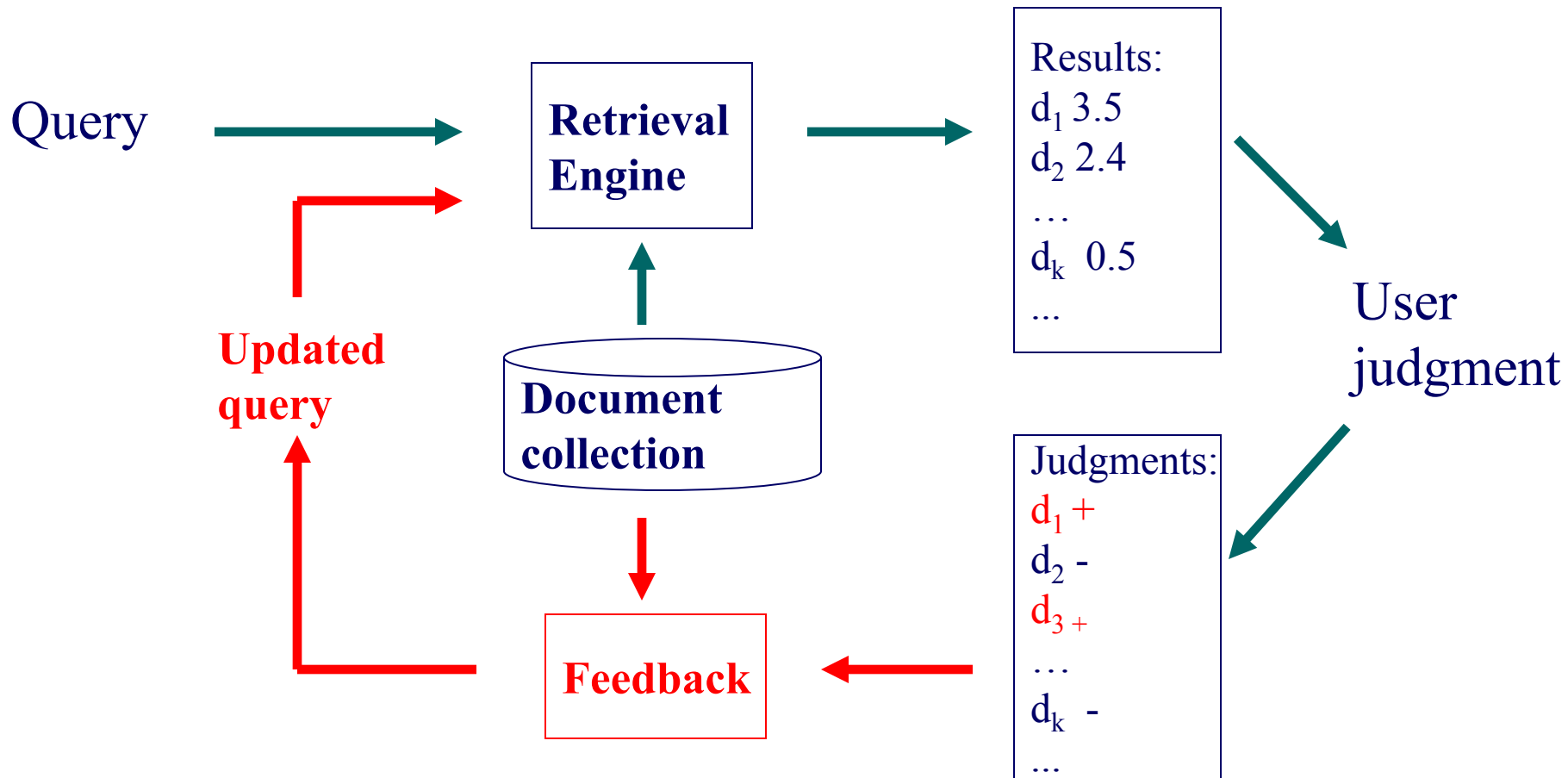
Ranked documents



Inferred information need



Relevance feedback



Basic idea in feedback

- Query expansion
 - Feedback documents can help discover related query terms
 - E.g., query=“information retrieval”
 - Relevant docs may likely share very related words, such as “search”, “search engine”, “ranking”, “query”
 - Expand the original query with such words will increase recall and sometimes also precision

Basic idea in feedback

- Learning-based retrieval
 - Feedback documents can be treated as supervision for ranking model update
 - In “learning-to-rank”

Relevance feedback in real systems

- Google used to provide such functions

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

Personalization involves using technology to accommodate the differences between individuals. Once confined mainly to the Web, it is increasingly becoming a ...

[en.wikipedia.org/wiki/Personalized](#) - 42k - [Cached](#) - [Similar pages](#) - 

Relevant

[Personalized Gifts from Personalization Mall](#)  

It shows you went out of your way to find the perfect gift and to **personalize** it to make it theirs alone! At PersonalizationMall.com, we design most of our ...

[www.personalizationmall.com/Default.aspx?&did=111028](#) - 47k -

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Nonrelevant

[What is personalization?](#) - a definition from Whatis.com  

Mar 6, 2007 ... On a Web site, **personalization** is the process of tailoring pages to individual users' characteristics or preferences.

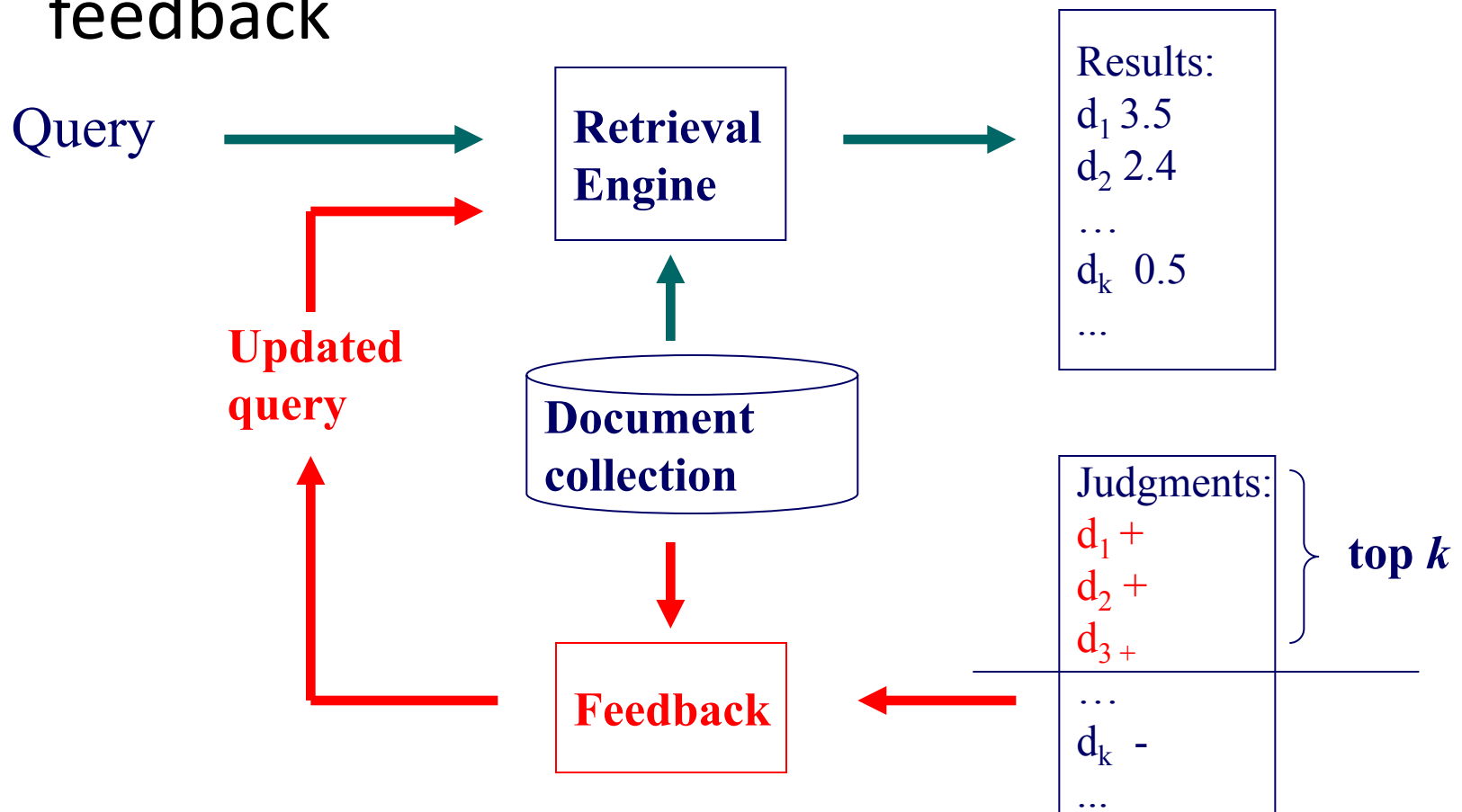
[searchcrm.techtarget.com/sDefinition/0,,sid11_gci532341,00.html](#) - 72k -

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– Vulnerable to spammers though

Pseudo relevance feedback

- What if the users are reluctant to provide any feedback



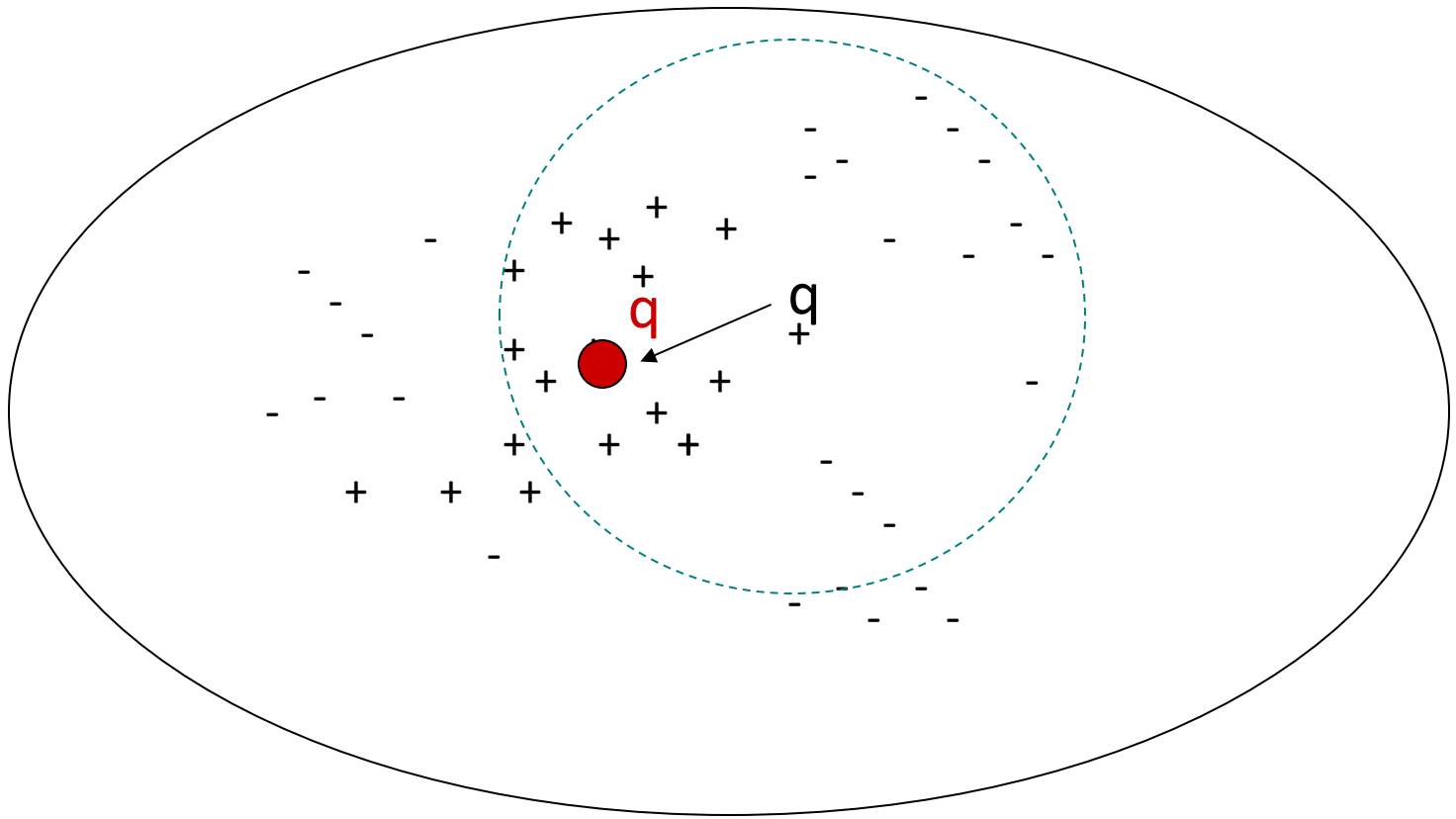
Feedback techniques

- Feedback as query expansion
 - Step 1: Term selection
 - Step 2: Query expansion
 - Step 3: Query term re-weighting
- Feedback as training signal
 - in learning to rank

Relevance feedback in vector space models

- General idea: query modification
 - Adding new (weighted) terms
 - Adjusting weights of old terms
- The most well-known and effective approach is Rocchio [Rocchio 1971]

Illustration of Rocchio feedback



Formula for Rocchio feedback

- Standard operation in vector space

Modified query

Parameters

$$\vec{q}_m = \alpha \vec{q} + \frac{\beta}{|D_r|} \sum_{\forall \vec{d}_i \in D_r} \vec{d}_i - \frac{\gamma}{|D_n|} \sum_{\forall \vec{d}_j \in D_n} \vec{d}_j$$

Original query

Rel docs

Non-rel docs

The diagram illustrates the Rocchio feedback formula. The formula is presented as $\vec{q}_m = \alpha \vec{q} + \frac{\beta}{|D_r|} \sum_{\forall \vec{d}_i \in D_r} \vec{d}_i - \frac{\gamma}{|D_n|} \sum_{\forall \vec{d}_j \in D_n} \vec{d}_j$. Annotations include: 'Modified query' pointing to \vec{q}_m ; 'Original query' pointing to \vec{q} ; 'Parameters' with arrows pointing to α , β , and γ ; 'Rel docs' pointing to the set D_r in the second term's denominator; and 'Non-rel docs' pointing to the set D_n in the third term's denominator.

Rocchio in practice

- Negative (non-relevant) examples are not very important (why?)
- Efficiency concern
 - Restrict the vector onto a lower dimension (i.e., only consider highly weighted words in the centroid vector)
- Avoid “training bias”
 - Keep relatively high weight on the original query
- Can be used for relevance feedback and pseudo feedback
- Usually robust and effective

What you should know

- Purpose of relevance feedback
- pseudo relevance feedback
- Rocchio relevance feedback for vector space models

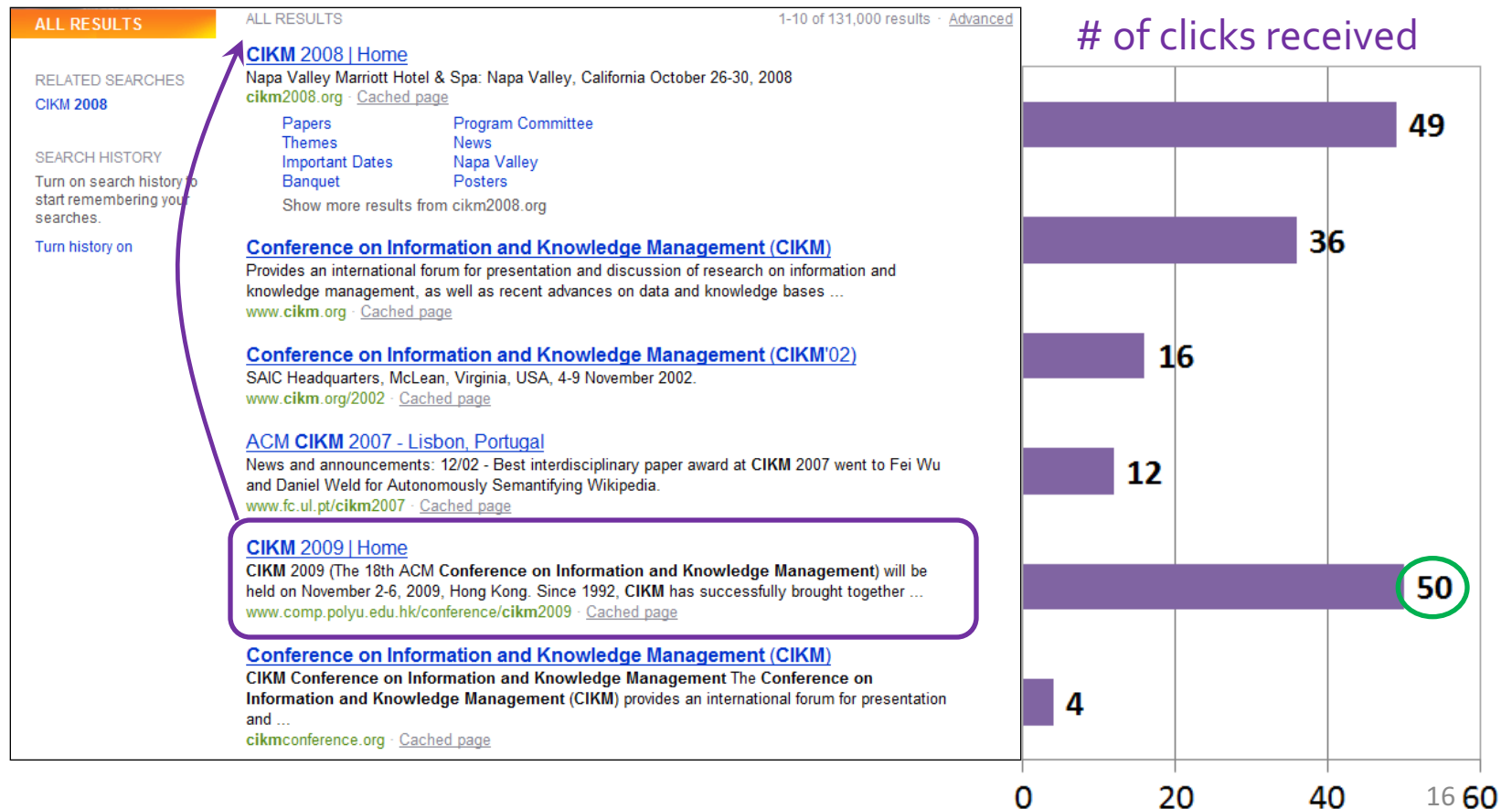
Today's reading

- Chapter 9. Relevance feedback and query expansion
 - 9.1 Relevance feedback and pseudo relevance feedback

Implicit User Feedback
-user clicks

User Behavior

- Adapt ranking to user clicks?




Web search click log

An
example

user-ct-test-collection-06.txt						
1998497	anthony burger	2006-03-05 13:01:36	2	http://www.anthonyburger.com		
1998497	gaither	2006-03-05 13:02:22	4	http://www.bill.gaither.com-music.homepages.org		
1998497	allegiant air	2006-03-05 15:27:59	1	http://www.allegiantair.com		
1998497	gaithe	2006-03-05 17:07:32				
1998497	gaither	2006-03-05 17:07:44	7	http://www.gaither.com		
1998497	gaithe	2006-03-05 17:09:53				
1998497	gaither	2006-03-05 17:10:03	7	http://www.gaither.com		
1998497	allegiant air	2006-03-05 18:22:26	1	http://www.allegiantair.com		
1998497	disney coronado springs resort orlando fl	2006-03-07 14:09:00	5	http://hotels.about.com		
1998497	www.hli.com	2006-03-10 09:05:39				
1998497	heritage lottery international	2006-03-10 09:06:56	1	http://blog.supersurge.com		
1998497	googlemaps.com	2006-03-11 00:12:28	1	http://www.googlemaps.com		
1998497	amy grant	2006-03-11 19:29:34	7	http://www.mindspring.com		
1998497	amy grant	2006-03-11 19:29:34	2	http://www.amygrant.com		
1998497	amy grant	2006-03-11 19:29:34	5	http://en.wikipedia.org		
1998497	david phelps	2006-03-11 19:33:55	1	http://www.davidphelps.com		
1998497	imercer.com socil security	2006-03-12 13:58:18				
1998497	imercer.com social security	2006-03-12 13:58:30				
1998497	www.uhc.com	2006-03-12 15:07:01	1	http://www.uhc.com		
1998497	www.metlife.com	2006-03-12 15:31:06	2	http://www.metlife.com		
1998497	www.vsp.com	2006-03-12 15:36:37	1	http://www.vsp.com		
1998497	www.birdsandblooms.com	2006-03-15 20:06:15				
1998497	www.birdsandblooms.com	2006-03-15 20:06:27	2	http://www.birdsandblooms.com		
1998497	yahoo.com	2006-03-18 13:32:15	1	http://www.yahoo.com		
1998497	google.com	2006-03-18 13:51:35	1	http://www.google.com		
1998497	google.com	2006-03-18 14:13:57				
1998497	google.com	2006-03-18 14:14:25				
1998497	google.com	2006-03-18 14:14:52				
1998497	google.com	2006-03-18 14:15:17				
1998497	google.com	2006-03-18 14:15:54				
1998497	google.com people	2006-03-18 14:16:17				
1998497	www.bostonmarket.com	2006-03-20 19:48:30	1	http://www.bostonmarket.com		
1998497	american heart association	2006-03-24 16:58:34	1	http://www.americanheart.org		
1998497	american cancer society	2006-03-24 19:45:55	5	http://www.acs-tx.org		

Web Search Click Log

- How large is the click log?
 -  search logs: 10+ TB/day
 - In existing publications:
 - [Silverstein+99]: 285M sessions
 - [Craswell+08]: 108k sessions
 - [Dupret+08] : 4.5M sessions (21 subsets * 216k sessions)
 - [Guo +09a] : 8.8M sessions from 110k unique queries
 - [Guo+09b]: 8.8M sessions from 110k unique queries
 - [Chapelle+09]: 58M sessions from 682k unique queries
 - [Liu+09a]: 0.26PB data from 103M unique queries



Interpret Clicks: an Example

[CIKM 2008 | Home](#)
Napa Valley Marriott Hotel Napa: Napa Valley, California October 26-30, 2008
[cikm2008.org](#) - [Cached page](#)

Papers	Program Committee
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[Conference on Information and Knowledge Management \(CIKM'02\)](#)
SAIC Headquarters, McLean, Virginia, USA, 4-9 November 2002.
[www.cikm.org/2002](#) - [Cached page](#)



[ACM CIKM 2007 - Lisbon, Portugal](#)
News and announcements: 12/02 - Best interdisciplinary paper award at CIKM 2007 went to Fei Wu and Daniel Weld for Autonomously Semantifying Wikipedia.
[www.fc.ul.pt/cikm2007](#) - [Cached page](#)

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CIKM 2009 (The 18th ACM Conference on Information and Knowledge Management) will be held on November 2-6, 2009, Hong Kong. Since 1992, CIKM has successfully brought together ...
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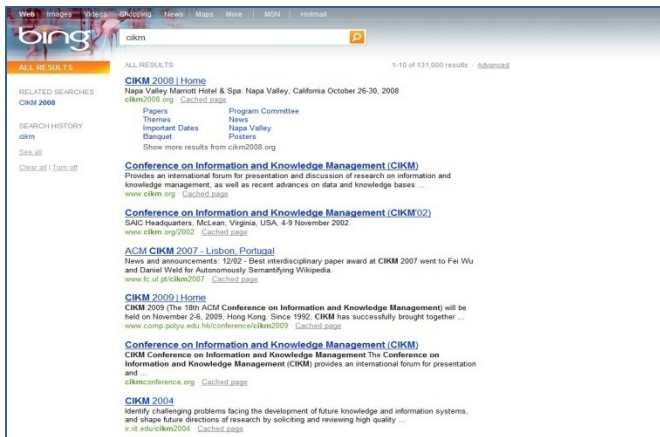
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CIKM Conference on Information and Knowledge Management The Conference on Information and Knowledge Management (CIKM) provides an international forum for presentation and ...
[cikmconference.org](#) - [Cached page](#)

[CIKM 2004](#)
Identify challenging problems facing the development of future knowledge and information systems, and shape future directions of research by soliciting and reviewing high quality ...
[ir.iit.edu/cikm2004](#) - [Cached page](#)

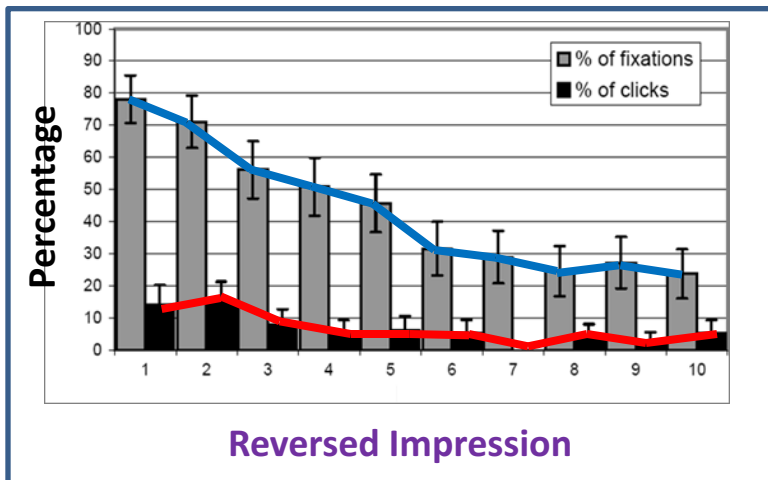
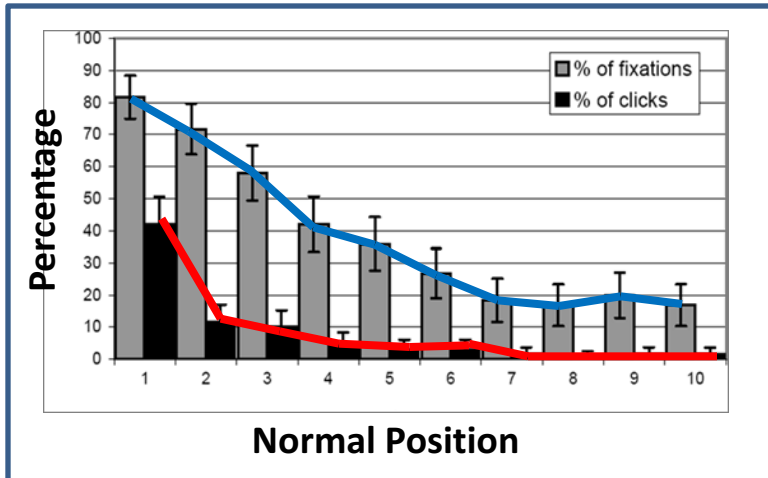
[CIKM](#)
International Conference on Information and Knowledge Management (CIKM) CIKM Home Page
ACM DL: CIKM 17. CIKM 2008: Napa Valley, California, USA. James G. Shanahan, Sihem Amer-Yahia ...
[www.informatik.uni-trier.de/~ley/db/conf/cikm/index.html](#) - [Cached page](#)

- Clicks are good...
 - Are these two clicks equally “good”?
- Non-clicks may have excuses:
 - Not relevant 
 - Not examined 

Eye-tracking User Study



Click Position-bias



- Higher positions receive more **user attention** (**eye fixation**) and **clicks** than lower positions.
- This is true even in the extreme setting where the order of positions is **reversed**.
- “Clicks are informative but biased”.

[Joachims+07]

User behavior

- User behavior is an intriguing source of relevance data
 - Users make (somewhat) informed choices when they interact with search engines
 - Potentially a lot of data available in search logs
- But there are significant caveats
 - User behavior data can be very noisy
 - Interpreting user behavior can be tricky
 - Spam can be a significant problem
 - Not all queries will have user behavior

Features based on user behavior

From [Agichtein, Brill, Dumais 2006; Joachims 2002]

- Click-through features
 - Click frequency, click probability, click deviation
 - Click on next result? previous result? above? below>?
- Browsing features
 - Cumulative and average time on page, on domain, on URL prefix; deviation from average times
 - Browse path features
- Query-text features
 - Query overlap with title, snippet, URL, domain, next query
 - Query length

Incorporating user behavior into ranking algorithm

- Incorporate user behavior features into a ranking function like BM25F
 - But requires an understanding of user behavior features so that appropriate V_j functions are used
- Incorporate user behavior features into *learned* ranking function
- Either of these ways of incorporating user behavior signals improve ranking

What you should know

- Clicks as implicit relevance feedback
- Positional bias
- modeling approaches for click models