Information Storage and Retrieval

CSCE 670
Texas A&M University
Department of Computer Science & Engineering
Instructor: Prof. James Caverlee

Link Analysis: Getting Started
2 February 2017

Empirical investigation of the effect of ranking

- How can we measure how important ranking is?
- Observe what searchers do when they are searching in a controlled setting
  - Videotape them
  - Ask them to "think aloud"
  - Interview them
  - Eye-track them
  - Time them
  - Record and count their clicks
- The following slides are from Dan Russell's JCDL talk
- Dan Russell is the "Über Tech Lead for Search Quality & User Happiness" at Google.

Interview video

So.. Did you notice the FTD official site?

To be honest, I didn't even look at that.

At first I saw "from $20" and $20 is what I was looking for.

To be honest, 1800-flowers is what I'm familiar with and why I went there next even though I kind of assumed they wouldn't have $20 flowers

And you knew they were expensive?

I knew they were expensive but I thought "hey, maybe they've got some flowers for under $20 here…"

But you didn't notice the FTD?

No I didn't, actually… that's really funny.

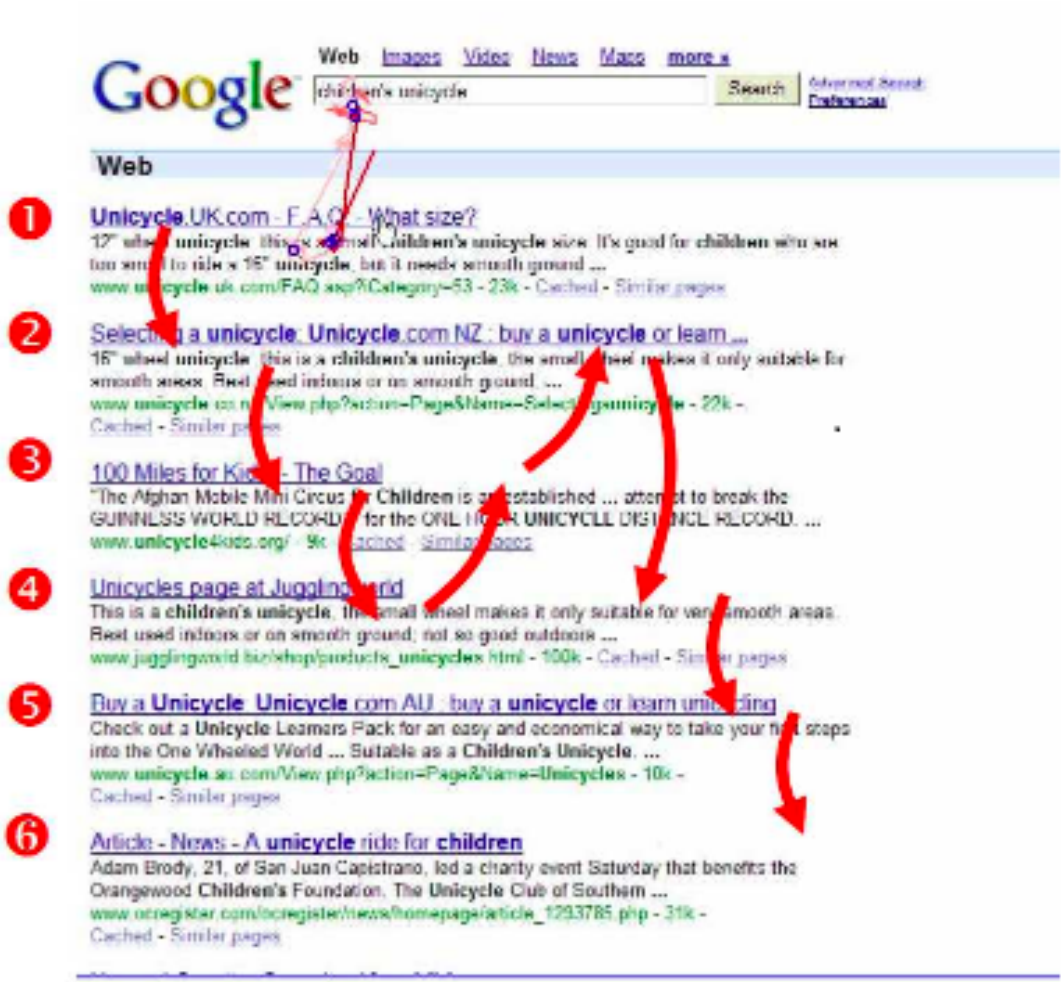
Rapidly scanning the results

Note scan pattern:

Page 3:
Result 1
Result 2
Result 3
Result 4
Result 3
Result 2
Result 4
Result 5
Result 6 <click>

Q: Why do this?

A: What's learned later influences judgment of earlier content.



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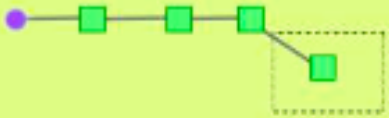
Kinds of behaviors we see in the data

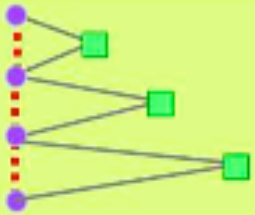
Short / Nav

Topic exploration

Topic switch

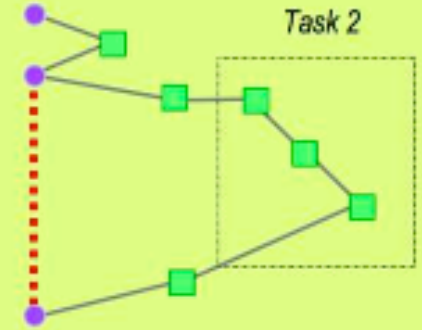


Methodical results exploration

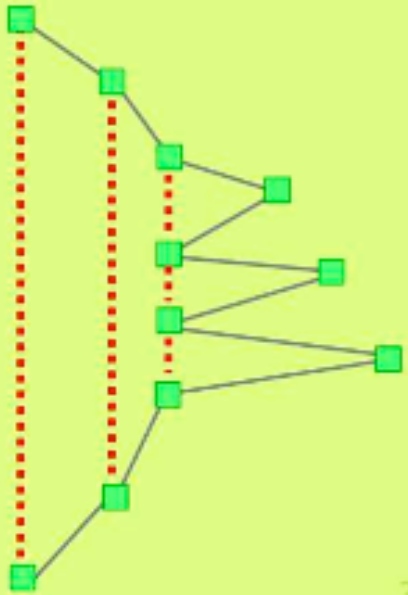


Query reform

Multitasking



Stacking behavior



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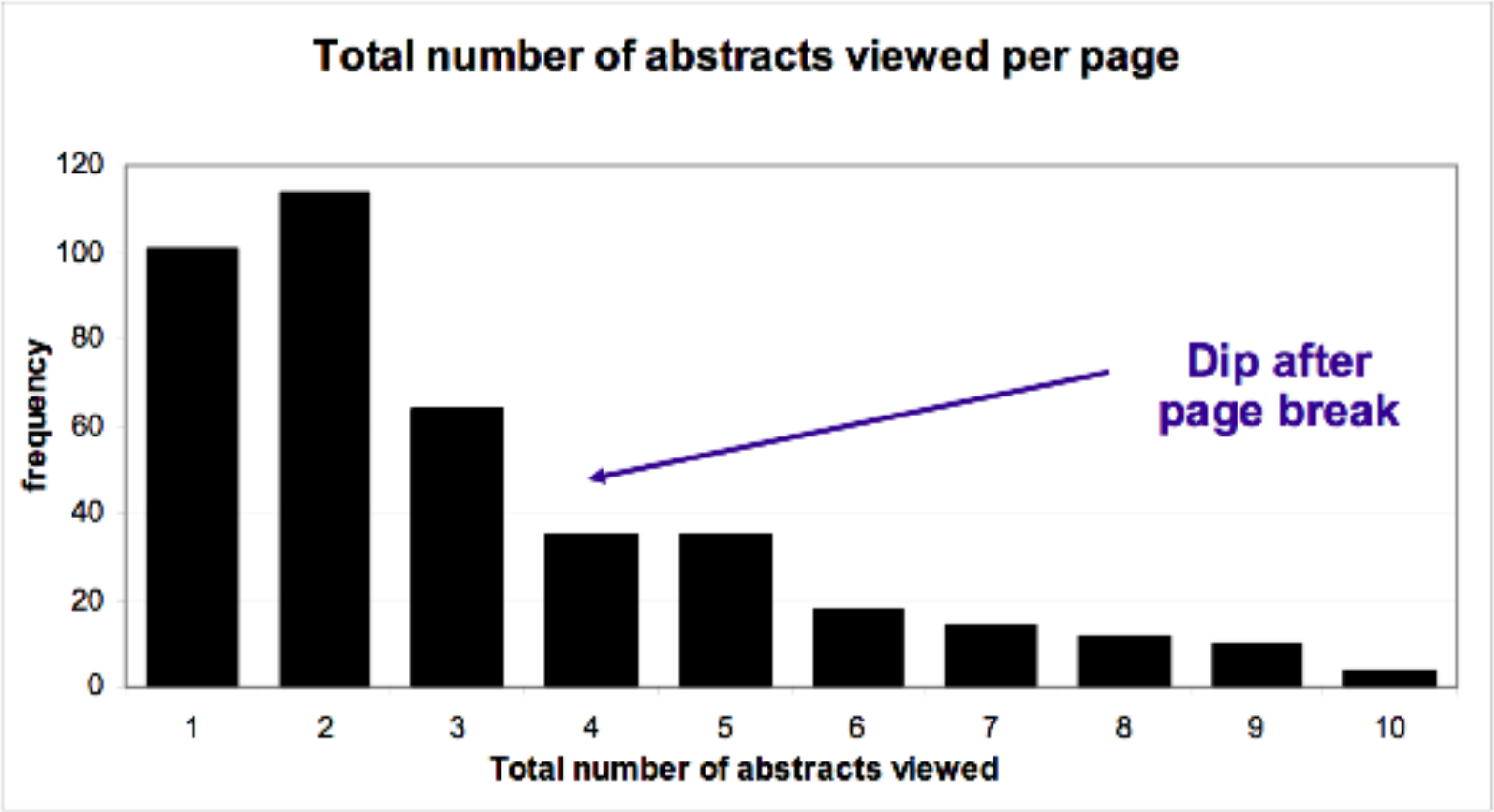
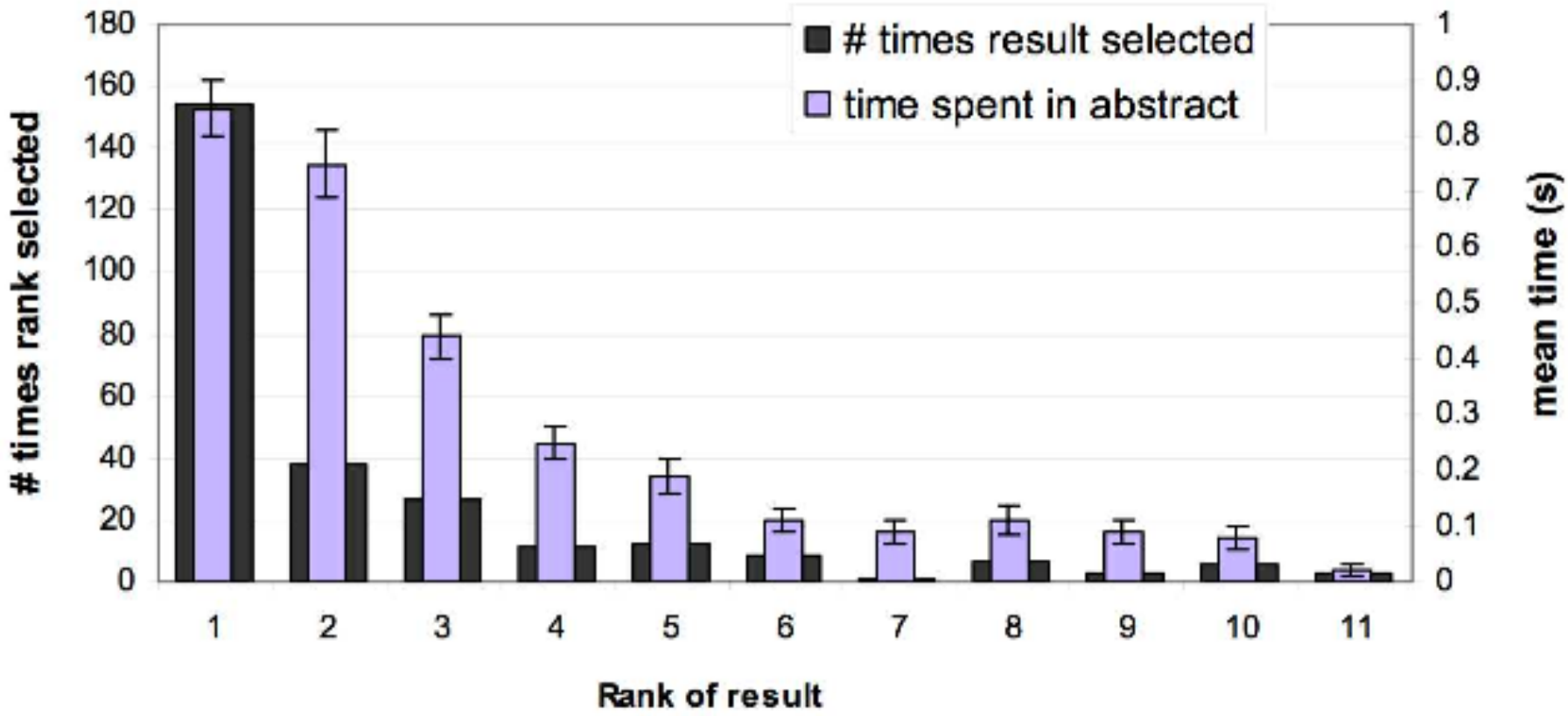
How many links do users view?



Mean: 3.07 Median/Mode: 2.00

Google

Looking vs. Clicking

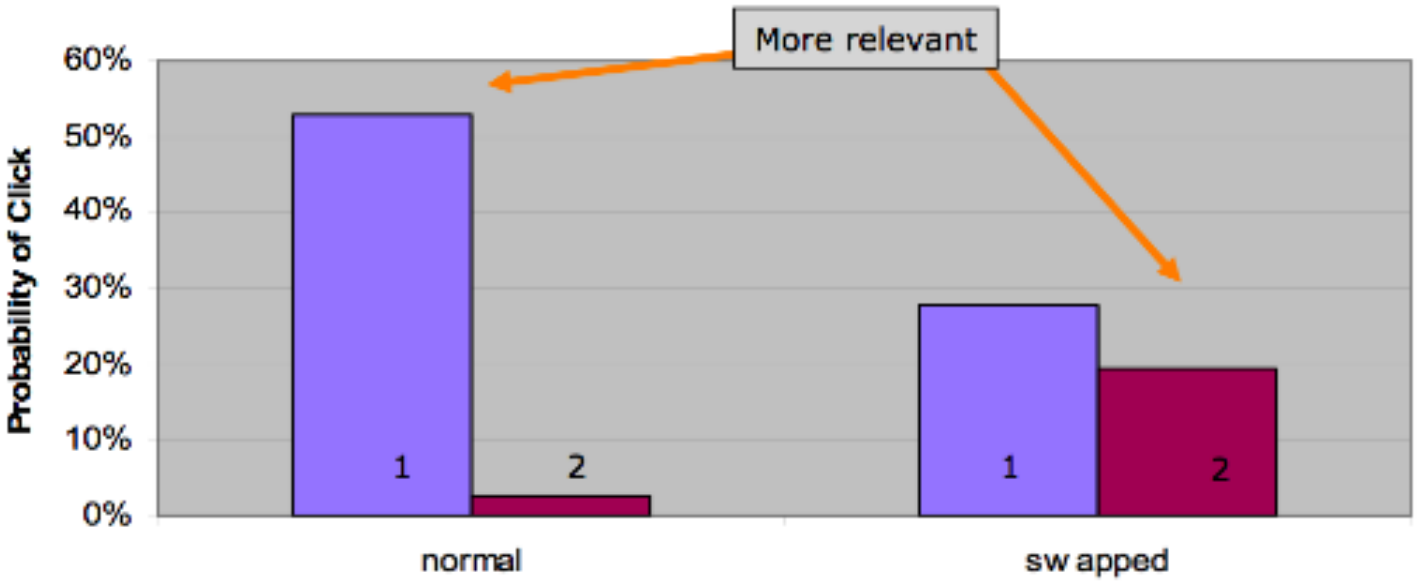


- Users view results one and two more often / thoroughly
- Users click most frequently on result one

Google

Presentation bias – reversed results

- Order of presentation influences where users look **AND** where they click



Google

IR History (Again)

Hans Peter Luhn

TF (1957)

The weight of a term that occurs in a document is simply proportional to the term frequency.

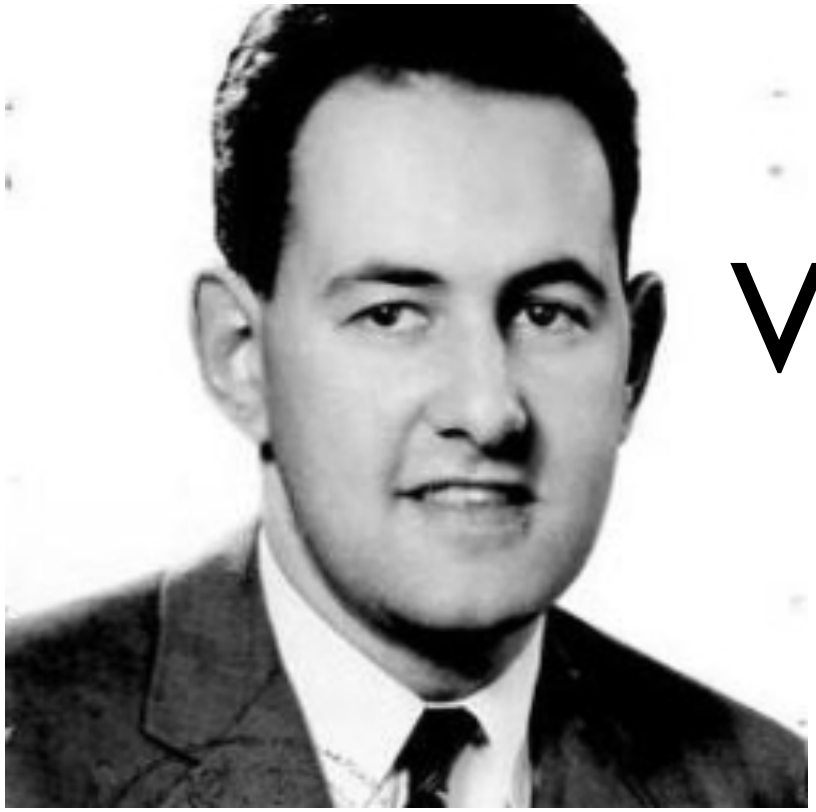
IBM Researcher
Foundational work in the 1950s
(invented an algorithm to checksum your credit card numbers!)

Karen Spärck Jones

IDF (1972)

Gerard Salton

Father of Information Retrieval



TF-IDF (1975)
Vector Space Model

SMART system (at Cornell)

Amit Singhal (PhD 1996 with Salton)

Joins Google 2000 : Later, Head of Search

Maron and Kuhns

Probabilistic IR (1960)

Stephen Robertson

with Karen Spark Jones
Binary Independence Model (1976)

Larry Page and Sergey Brin

PageRank (1997-8)

Jon Kleinberg

HITS (1998)

Professor at Cornell

Web Search: Pre-History

Brief (non-technical) history of Web search

- Early keyword-based engines ca. 1995-1997
  - Altavista, Excite, Infoseek, Inktomi, Lycos
- Paid search ranking: Goto (morphed into Overture.com → Yahoo!)
  - Your search ranking depended on how much you paid
  - Auction for keywords: ***casino*** was expensive!

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Brief (non-technical) history

- 1998+: Link-based ranking pioneered by Google
  - Blew away all early engines save Inktomi
  - Great user experience in search of a business model
  - Meanwhile Goto/Overture's annual revenues were nearing $1 billion
- Result: Google added paid search "ads" to the side, independent of search results
  - Yahoo followed suit, acquiring Overture (for paid placement) and Inktomi (for search)
- 2005+: Google gains search share, dominating in Europe and very strong in North America
  - 2009: Yahoo! and Microsoft propose combined paid search offering

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iPhone 6's RAM still up in the air
CNET - by Lance Whitney - 2 hours ago
A blog site's report that the next iPhone will stick with 1GB of RAM turns out to be based on a misreading of a technical diagram, but the ...

To get cash for an iPhone 6, lock in your old iPhone trade-in ...
CNET - by Eric Mack - 4 hours ago

Apple iPhone 6 rumor roundup: Specs, price, release date
ZDNet - by Charlie Osborne - 3 hours ago

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https://www.apple.com/iphone/ Apple Inc.
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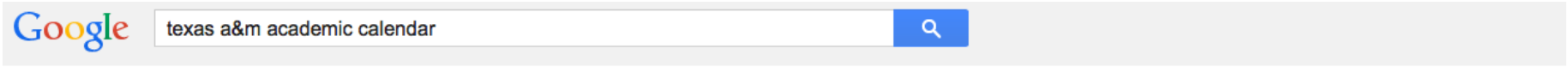

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www.tamug.edu/.../TAMUG2014-2... ▾ Texas A&M University at Galveston ▾
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[PDF] Complete 2013-2014 **Calendar** PDF Version - **Texas A&**...
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Texas A&M University at Galveston **Academic Calendar** 2013-2014. 2013 Summer Term I*. May 15. Graduation application opens for all students planning to ...

Academic Calendar - Texas A&M University at Galveston
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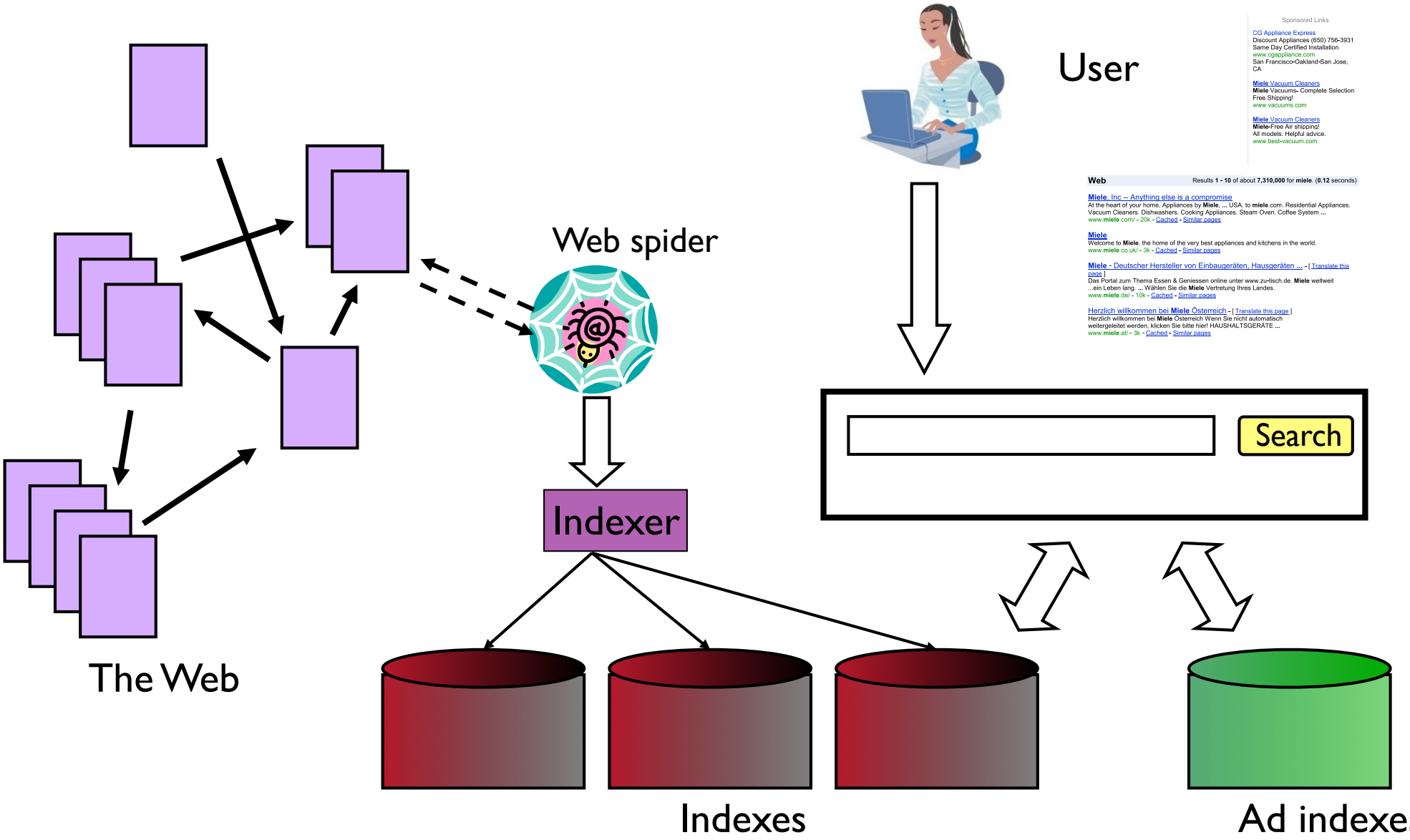
Web search basics

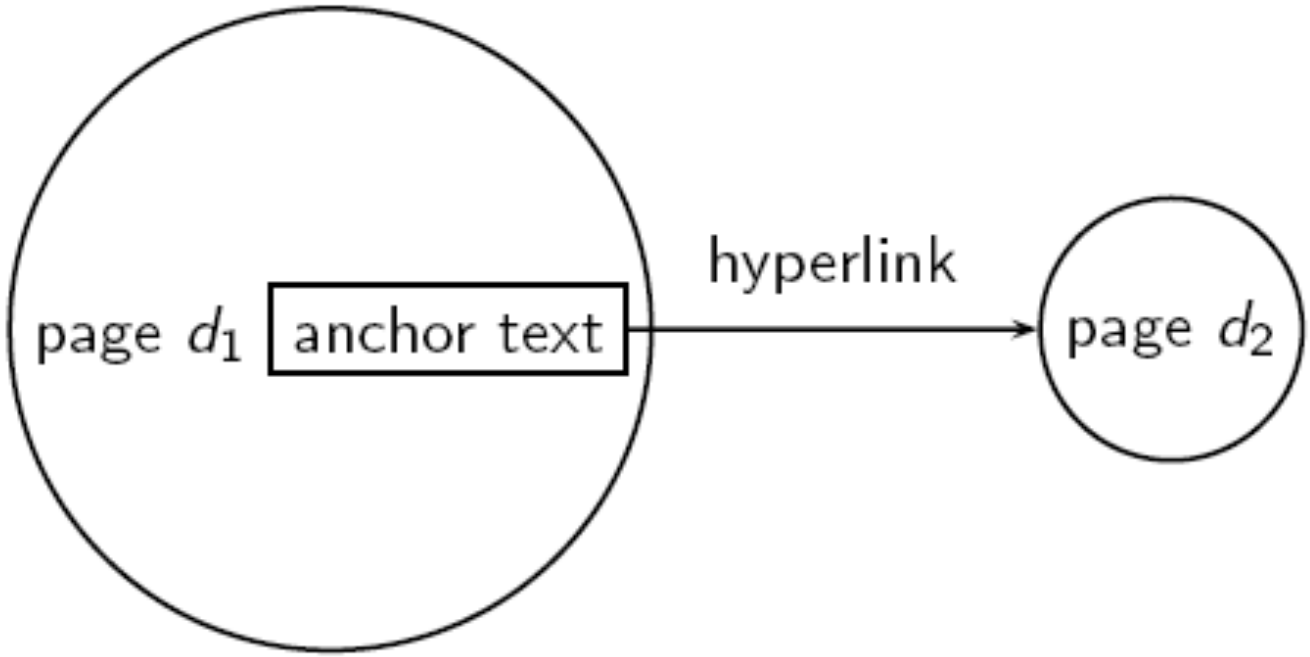


Today: Link Analysis

- Anchor text
- PageRank

Anchor text

The Web as a Directed Graph

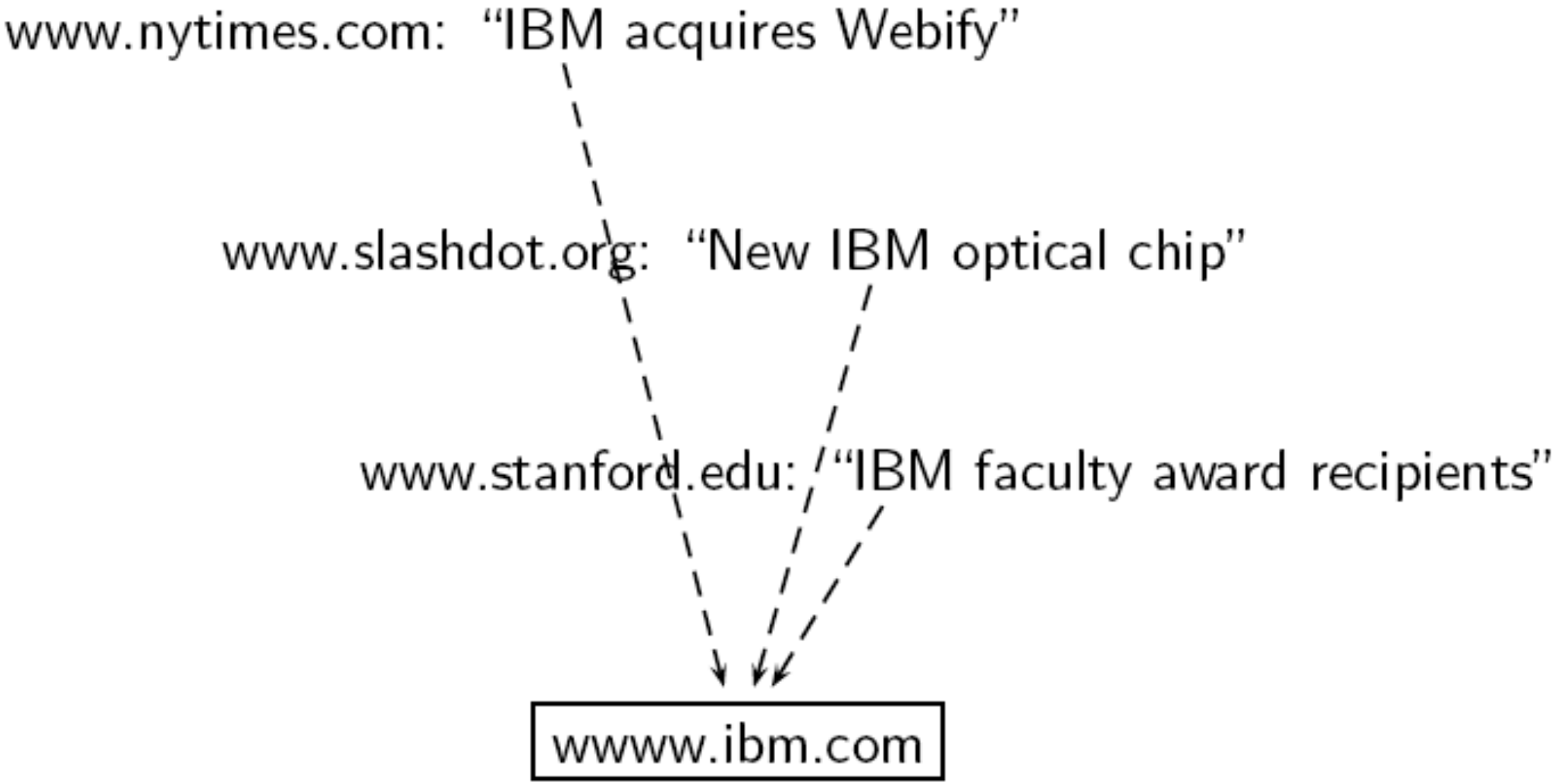


- **Assumption 1: A hyperlink is a quality signal**
  - A hyperlink between pages denotes that the author perceived relevance
- **Assumption 2: The anchor text describes the target page**
  - We use anchor text somewhat loosely here: the text surrounding the hyperlink. Example: "You can find cheap cars here."

[document text only] vs. [document text + anchor text]

- Searching on [document text + anchor text] is often more effective than searching on [document text only].
- Example: Query ***IBM***
  - Matches IBM's copyright page
  - Matches many spam pages
  - Matches IBM wikipedia article
  - May not match IBM home page! (if IBM home page is mostly graphical)
- Searching on anchor text is better for the query IBM.
- **Represent each page by all the anchor text pointing to it.**
- In this representation, the page with the most occurrences of IBM is www.ibm.com.

Anchor text containing ***IBM*** pointing to www.ibm.com



Indexing anchor text

- Thus: Anchor text is often a better description of a page's content than the page itself.
- Anchor text can be weighted more highly than document text. (based on Assumptions 1&2)
- Indexing anchor text can have unexpected side effects – Google bombs.
- A Google bomb is a search with "bad" results due to maliciously manipulated anchor text.
- Google introduced a new weighting function in January 2007 that fixed many google bombs.
- Any "live" Google bombs?

PageRank

Link-based ranking

- Query processing with link-based ranking:
  - First retrieve all pages meeting the query (say venture capital)
  - Order these by their link popularity (= citation frequency, first generation)
- . . . or by Pagerank (second generation)

- Simple link popularity (= number of inlinks of a page) is easy to spam.
- Why?