Introduction to Information Retrieval

http://informationretrieval.org

IIR 1: Boolean Retrieval

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2011-08-29

Models and Methods

1. Boolean model and its limitations (30)
2. Vector space model (30)
3. Probabilistic models (30)
4. Language model-based retrieval (30)
5. Latent semantic indexing (30)
6. Learning to rank (30)

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- Boolean model and Inverted index: The Boolean model and the basic data structure of most IR systems
- Processing Boolean queries
- Why is Boolean retrieval not enough? or Why do we need ranked retrieval?

Outline

Definition of *information retrieval*

Information retrieval (IR) is finding material (usually documents) of an unstructured nature (usually text) that satisfies an information need from within large collections (usually stored on computers).

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The adhoc retrieval problem: Given a user information need and a collection of documents, the IR system determines how well the documents satisfy the query and returns a subset of relevant documents to the user. □

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- The seach engine returns all documents that satisfy the Boolean expression.

Model collection: The works of Shakespeare

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Each of Shakespeare's tragedies, comedies etc is a document in this collection.

Term-document incidence matrix

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	Anthony and Cleopatra	Julius Caesar	The Tempest	Hamlet	Othello	Macbeth	...
ANTHONY	1	1	0	0	0	1	
BRUTUS	1	1	0	1	0	0	
CAESAR	1	1	0	1	1	1	
CALPURNIA	0	1	0	0	0	0	
CLEOPATRA	1	0	0	0	0	0	
MERCY	1	0	1	1	1	1	
WORSER	1	0	1	1	1	0	

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Entry is 1 if term occurs. Example: CALPURNIA occurs in *Julius Caesar*.
Entry is 0 if term doesn't occur. Example: CALPURNIA doesn't occur in *The tempest*.

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We will return to this matrix many times in this class. □

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- Inverted index: We only record the 1s. □

Inverted Index

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For each term t, we store a list of all documents that contain t.

= For each term t, we store the 1s in its row in the incidence matrix

BRUTUS	$\longrightarrow$	1	2	4	11	31	45	173	174
CAESAR	$\longrightarrow$	1	2	4	5	6	16	57	132	...
CALPURNIA	$\longrightarrow$	2	31	54	101				

$\vdots$

dictionary **postings**

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  5. Intersect the two postings lists
  6. Return intersection to user

Intersecting two postings lists

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- This is linear in the length of the postings lists. □

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- So are we done? □

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- Most users don't want to wade through 1000s of results.
- This is particularly true of web search.

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- In Boolean retrieval, it takes a lot of skill to come up with a query that produces a manageable number of hits. □

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Feast or famine: No problem in ranked retrieval

- With ranking, large result sets are not an issue.
- Just show the top 10 results and the user won't be overwhelmed
- Premise: the ranking algorithm works: More relevant results are ranked higher than less relevant results. □

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- Dan Russell was at the "Über Tech Lead for Search Quality & User Happiness" at Google. □

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?

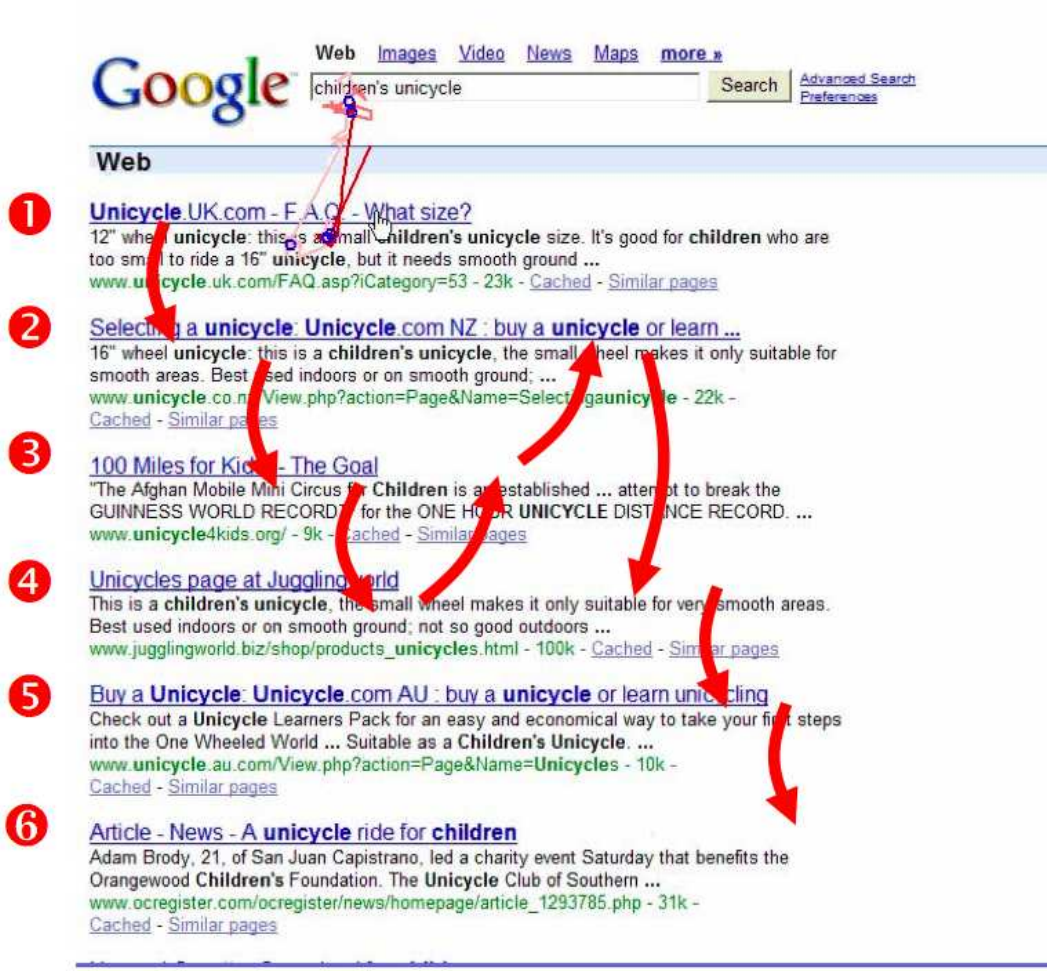
No I didn't, actually… that's really funny.

Interview video

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>

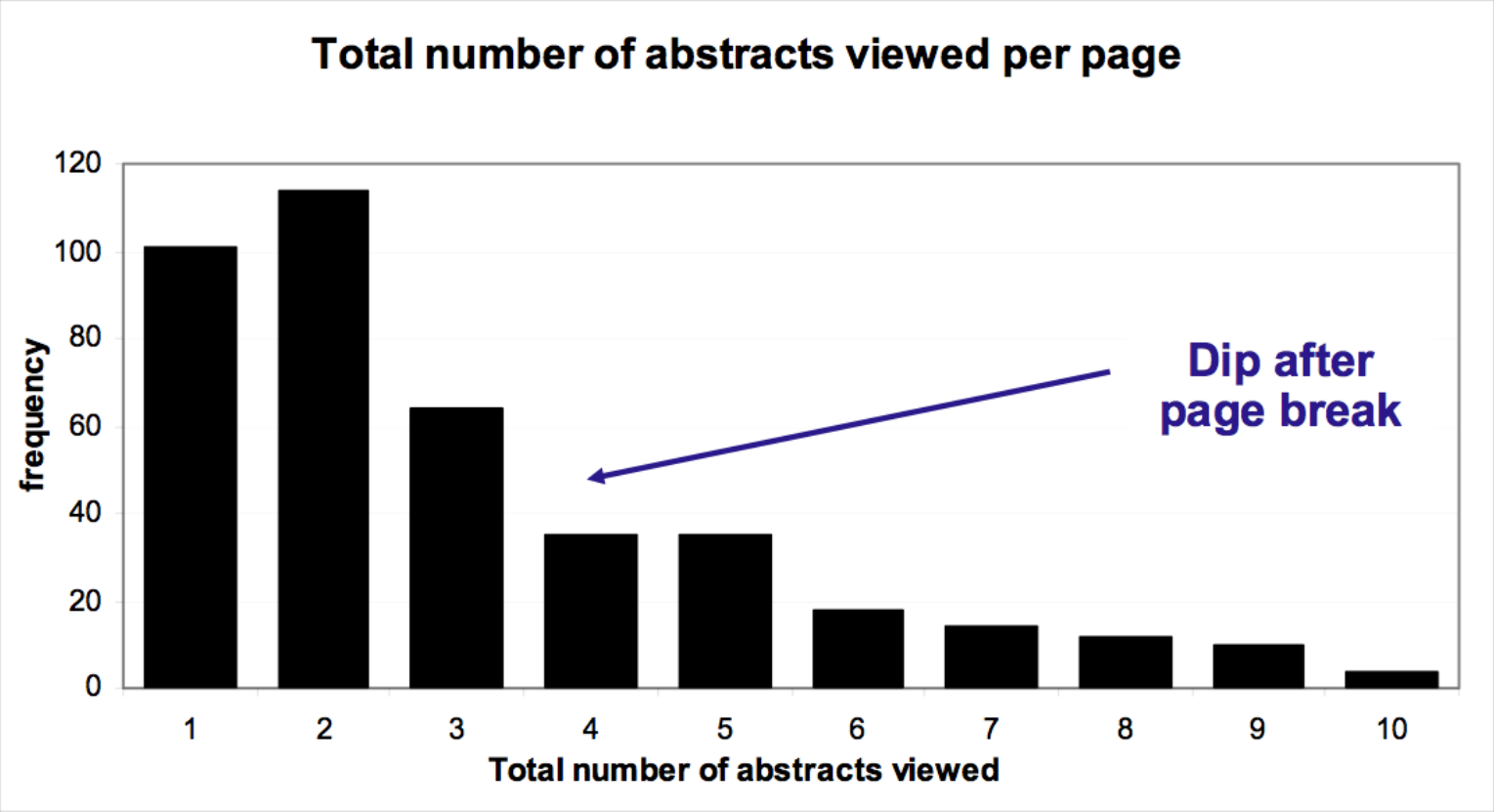


Q: Why do this?

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

Google

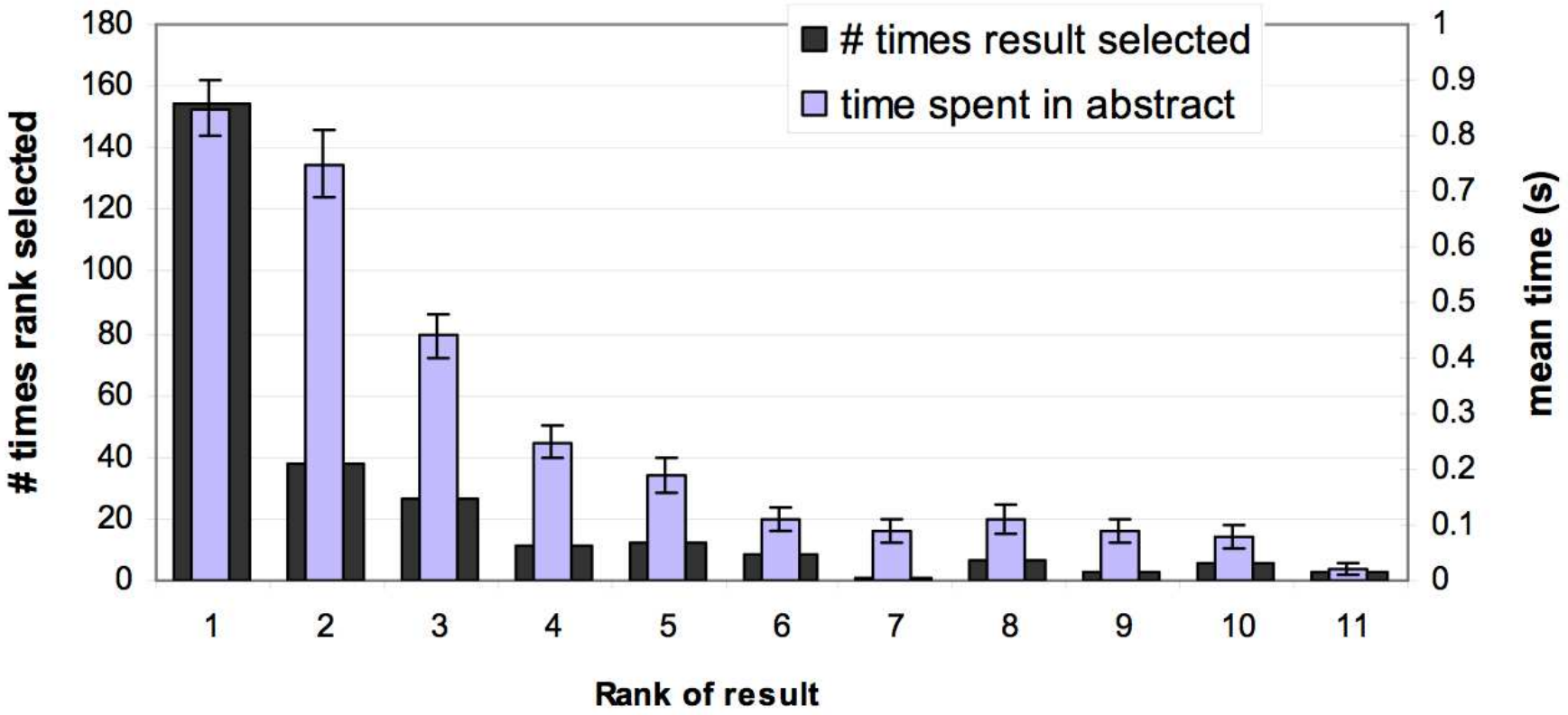
How many links do users view?



Mean: 3.07 Median/Mode: 2.00

Google

Looking vs. Clicking

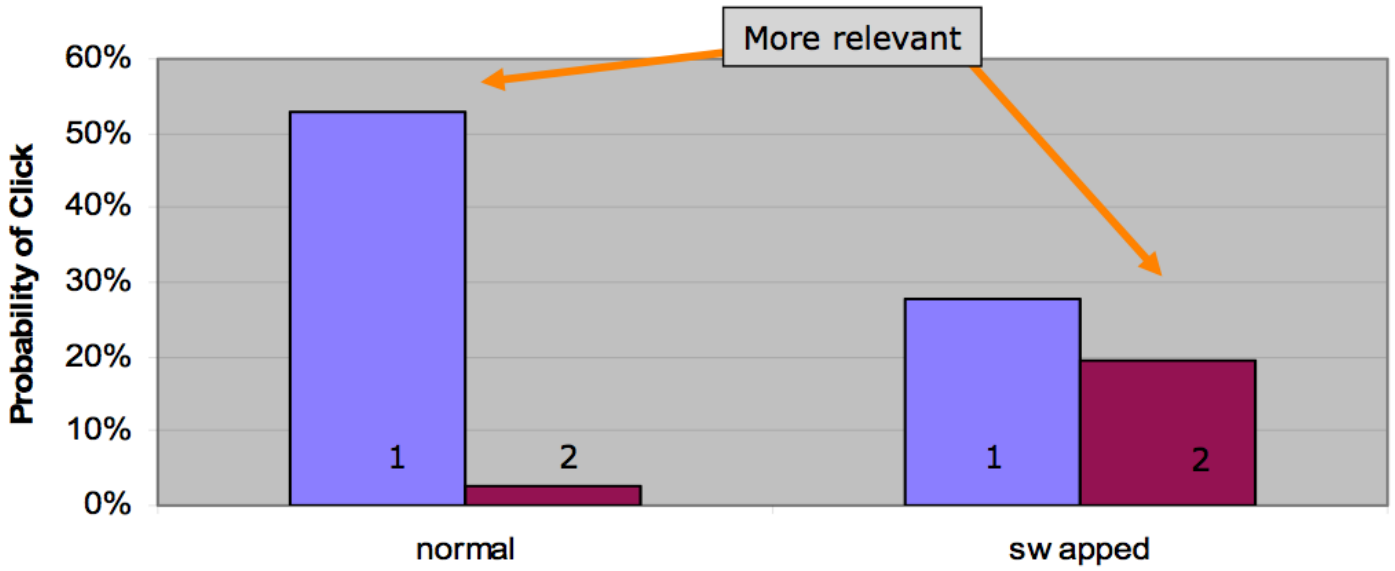


- Users view results one and two more often / thoroughly
- Users click most frequently on result one

Google

Presentation bias – reversed results

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



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- $\rightarrow$ Getting the ranking right is very important.

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- $\rightarrow$ Getting the ranking right is very important.
- $\rightarrow$ Getting the top-ranked page right is most important. □

Importance of ranking: Summary

- Viewing abstracts: Users are a lot more likely to read the abstracts of the top-ranked pages (1, 2, 3, 4) than the abstracts of the lower ranked pages (7, 8, 9, 10).
- Clicking: Distribution is even more skewed for clicking
- There is a very strong bias to click on the top-ranked page.
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Take-away

- Boolean model and Inverted index: The Boolean model and the basic data structure of most IR systems
- Processing Boolean queries
- Why is Boolean retrieval not enough? or Why do we need ranked retrieval?

Resources

- Chapter 1 of Introduction to Information Retrieval
- Resources at http://informationretrieval.org/essir2011
  - List of useful information retrieval resources
  - Shakespeare search engine
  - Daniel Russell's home page

Exercise

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Does Bing/Google use the Boolean model?

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Does Spotlight use the Boolean model?

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  - Simple Boolean retrieval returns matching documents in no particular order.
  - Google (and most well designed Boolean engines) rank the result set – they rank good hits (according to some estimator of relevance) higher than bad hits.