Temporal Information Retrieval

Wintersemester 2016/17

http://www.l3s.de/~anand/tir

Introduction and Course Overview

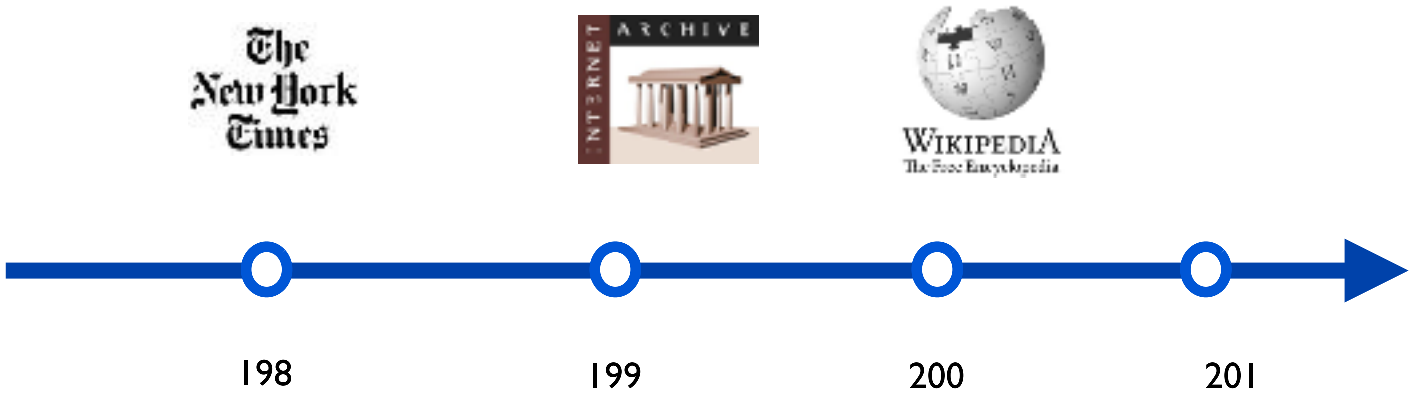
Who are we ?

- **Instructor:** Dr. Avishek Anand
- **TA :** Jaspreet Singh
- **L3S Research Center**

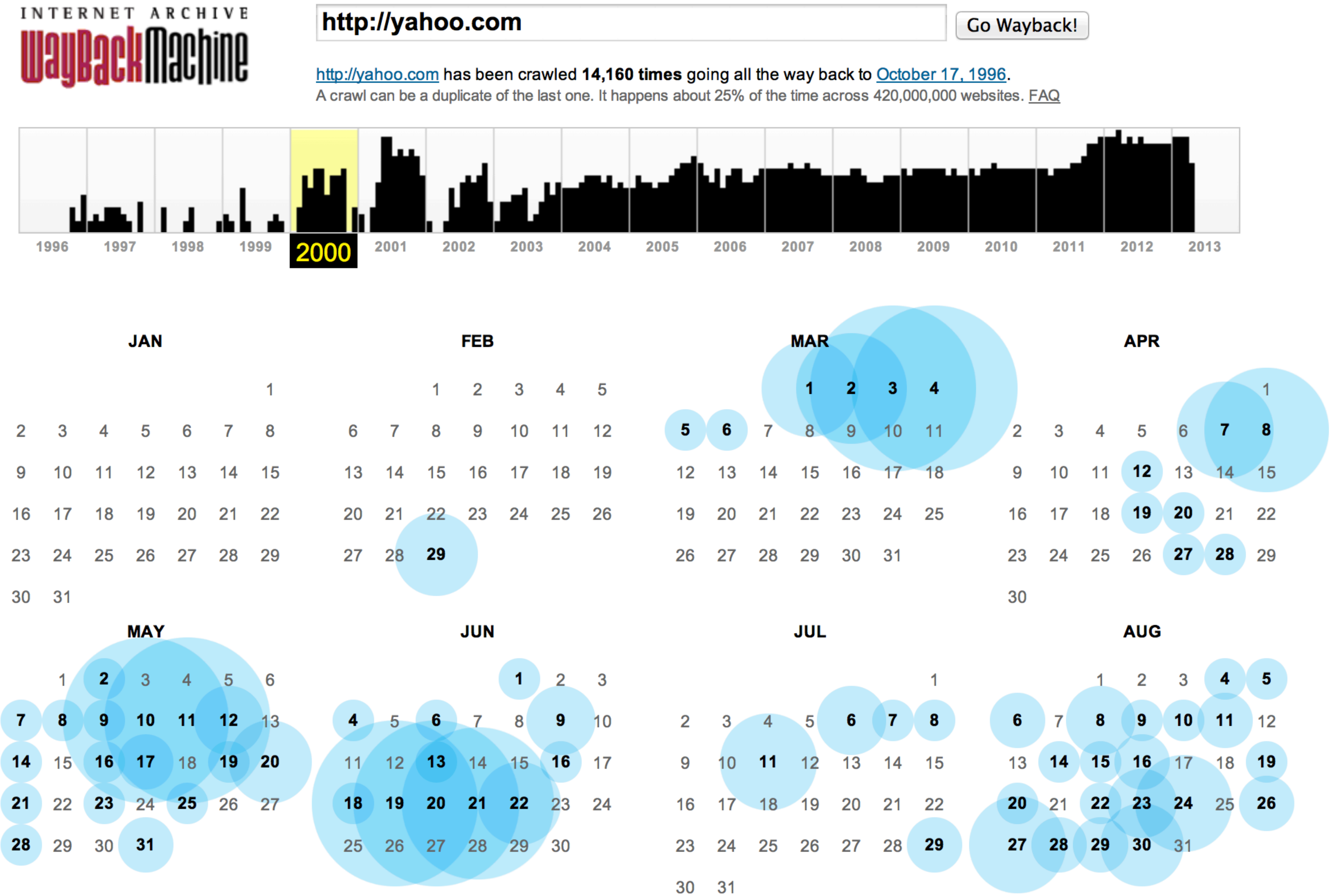
  - Fun with Web stuff - News, Social Media, Wikipedia, Blogs, Archives, Flickr, Amazon reviews …….
  - Analysis, Retrieval, Mining, Learning, Crawling,…
  - Cutting edge research
  - Building information systems for Web based data

Temporal Collections

Digital content is growing continuously...



Temporal Collections



http://yahoo.com

Go Wayback!

http://yahoo.com has been crawled **14,160 times** going all the way back to October 17, 1996.

A crawl can be a duplicate of the last one. It happens about 25% of the time across 420,000,000 websites. FAQ

JAN

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

FEB

		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	**29**				

MAR

			1	**2**	**3**	**4**
5	**6**	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

APR

						1
2	3	4	5	6	**7**	**8**
9	10	11	**12**	13	14	15
16	17	18	**19**	**20**	21	22
23	24	25	26	**27**	**28**	29
30						

MAY

	1	**2**	3	4	5	6
7	**8**	**9**	**10**	**11**	**12**	13
14	15	**16**	**17**	18	**19**	**20**
21	22	**23**	24	**25**	26	27
28	29	30	**31**			

JUN

				1	2	3
4	5	**6**	7	8	**9**	10
11	12	**13**	14	15	**16**	17
18	**19**	**20**	**21**	**22**	23	24
25	26	27	28	29	30	

JUL

						1
2	3	4	5	**6**	**7**	**8**
9	10	**11**	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	**29**
30	31					

AUG

		1	2	3	**4**	**5**
6	7	**8**	**9**	**10**	**11**	12
13	**14**	**15**	**16**	17	18	**19**
20	21	**22**	**23**	**24**	25	**26**
27	**28**	**29**	**30**	31		

Temporal Collections

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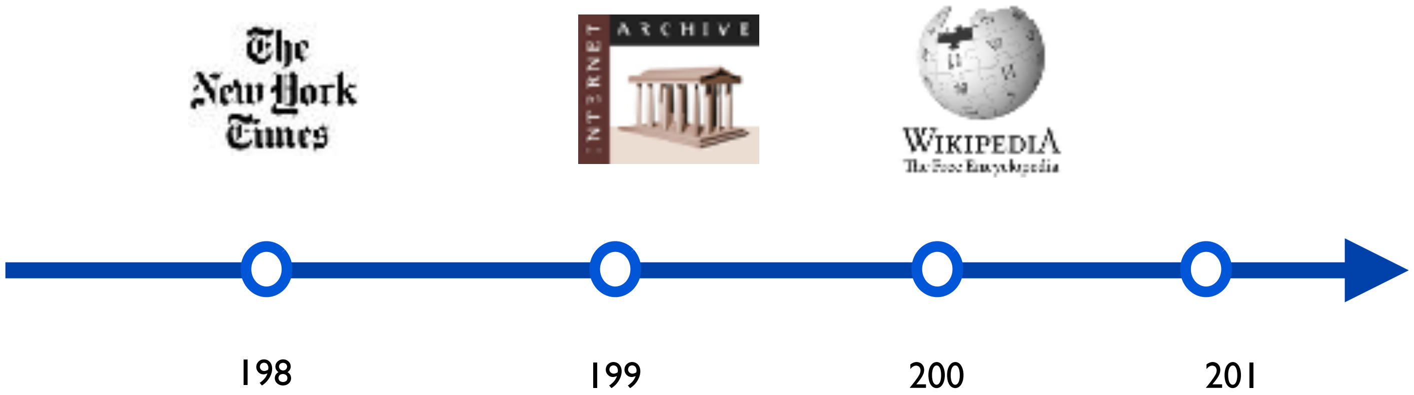
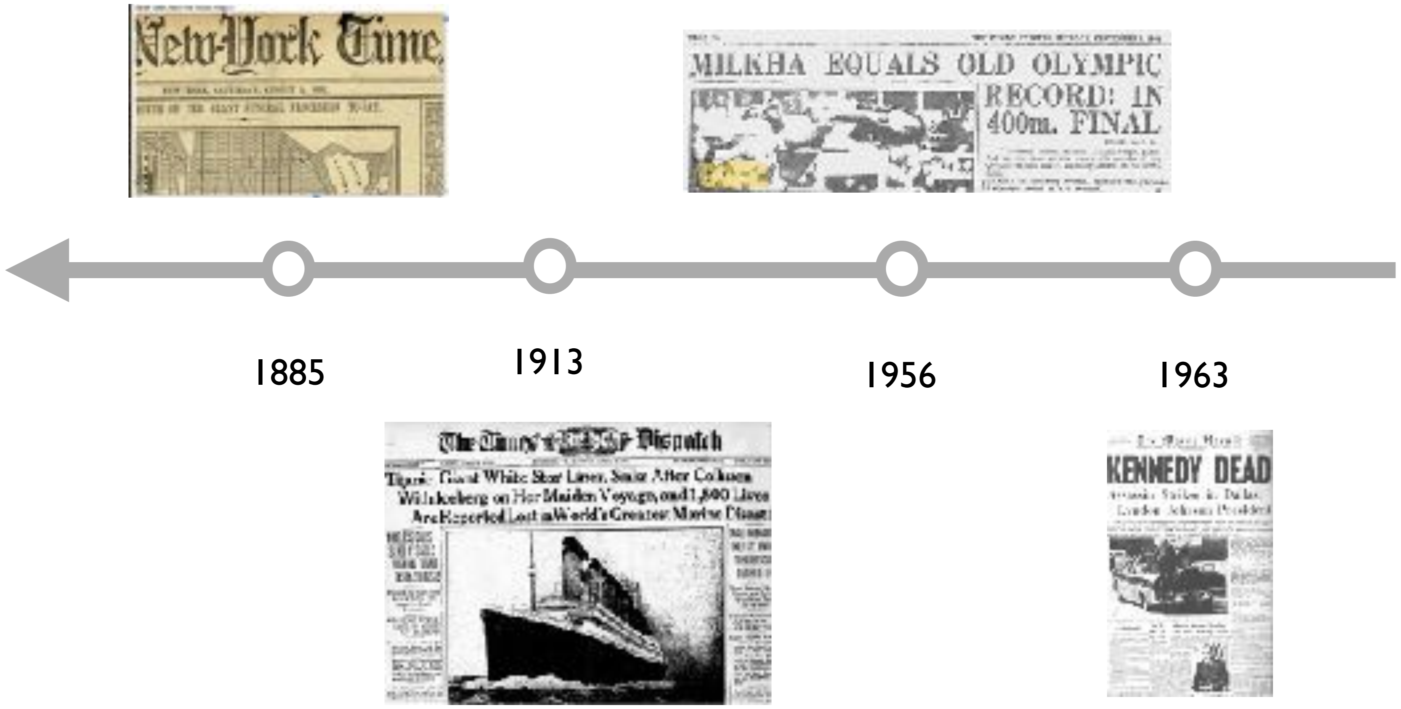


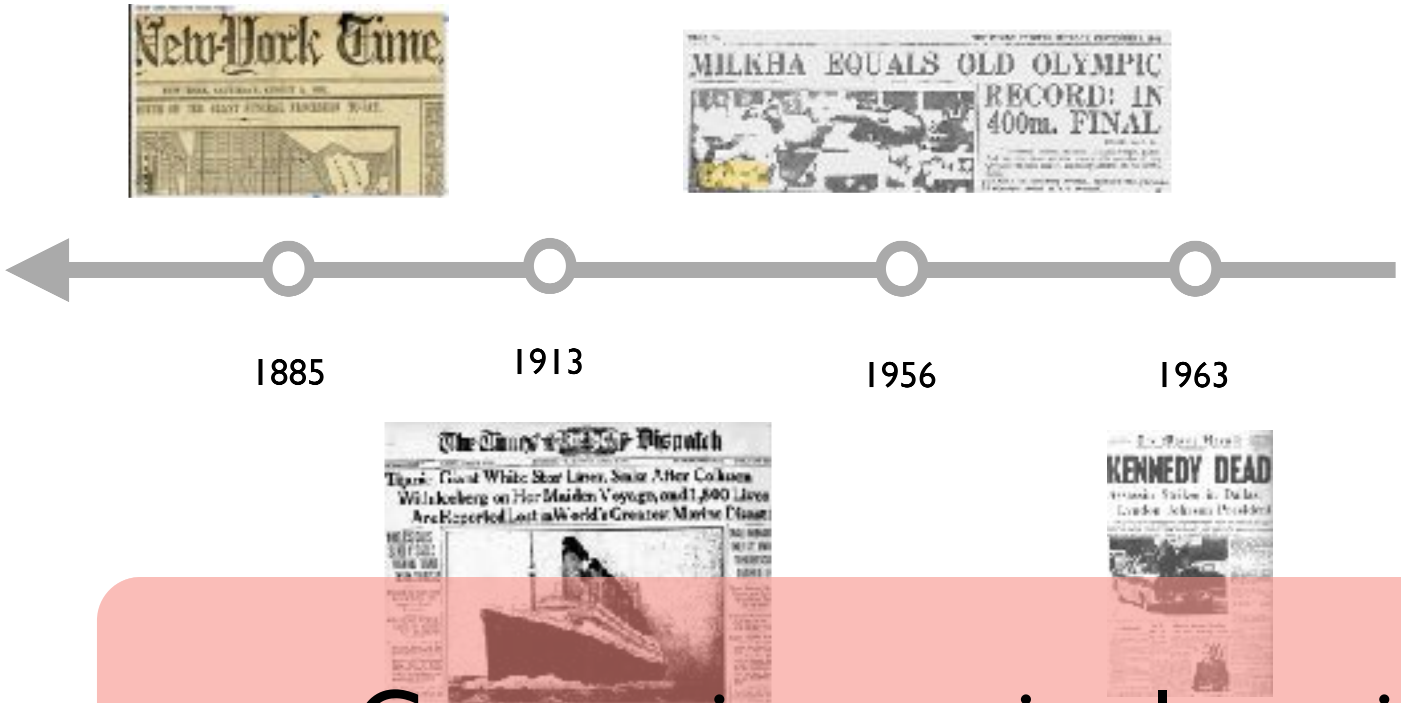


Content increasingly getting digitized...

Temporal Collections

Digital content is growing continuously...

The New York Times
INTERNET ARCHIVE
WIKIPEDIA
The Free Encyclopedia
198
199
200
201



Content increasingly getting digitized...

Content is spanning long time periods and growing

Queries

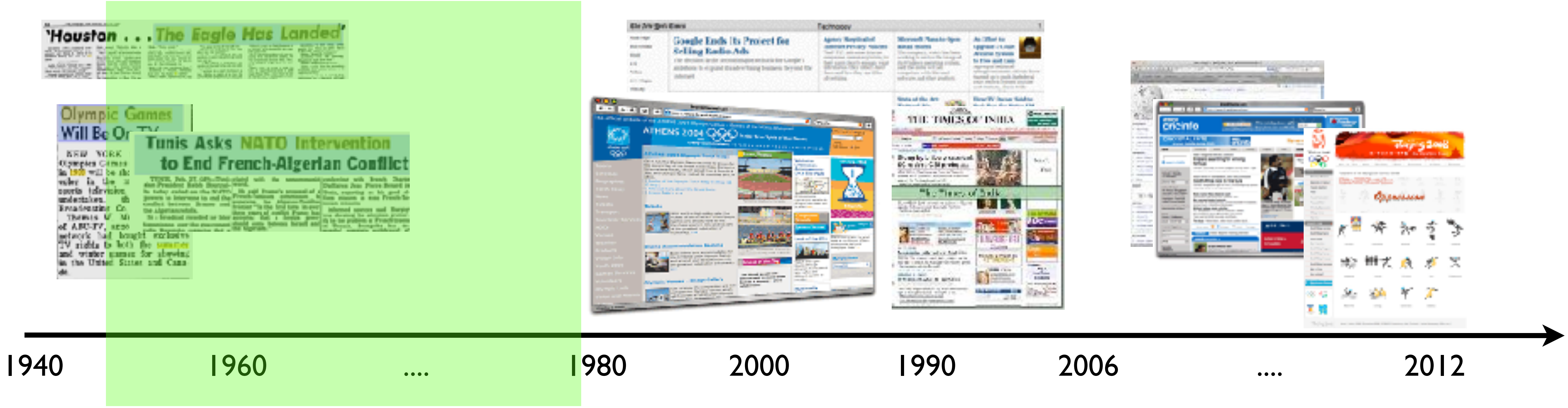
'Houston . . . The Eagle Has Landed'

Olympic Games Will Be On TV

Tunis Asks NATO Intervention to End French-Algerian Conflict

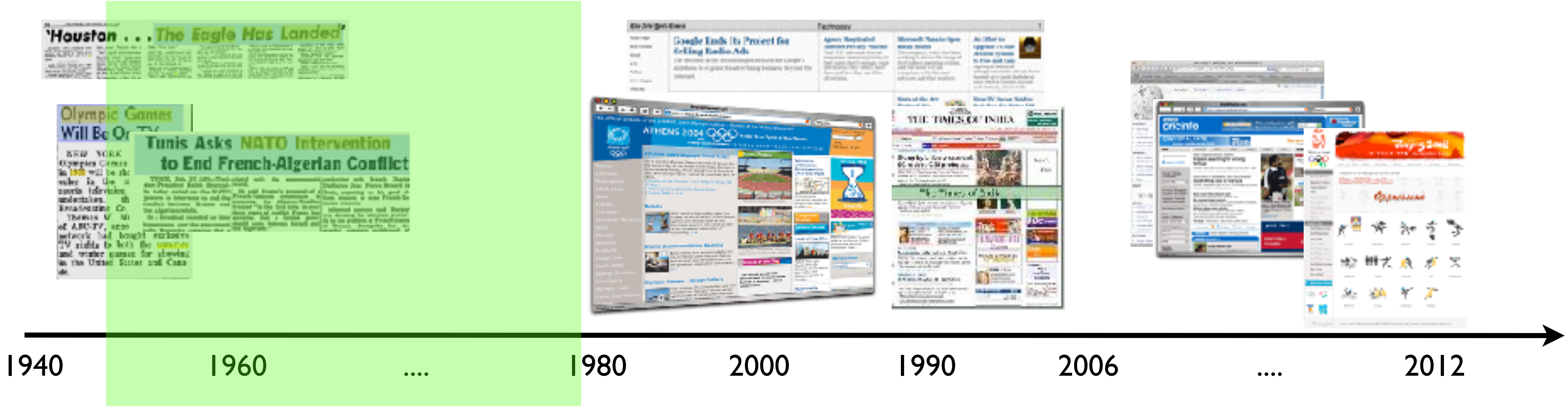
1940 1960 .... 1980 2000 1990 2006 2012

Queries


'Houston . . . The Eagle Has Landed'
Olympic Games Will Be On TV
Tunis Asks NATO Intervention to End French-Algerian Conflict
Google Ends Its Project for Selling Radio Ads
ATHENS 2004
THE TIMES OF INDIA
1940
1960
....
1980
2000
1990
2006
....
2012

***nato intervention* @ 1950-1980**

Queries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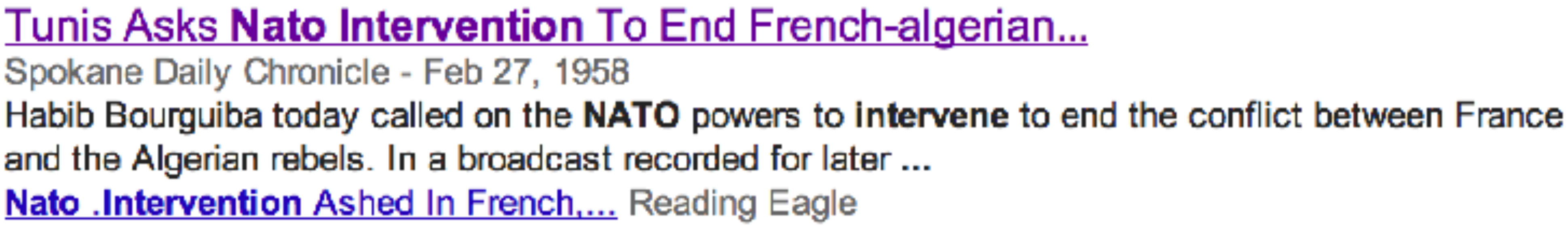
nato intervention **@** **1950-1980**



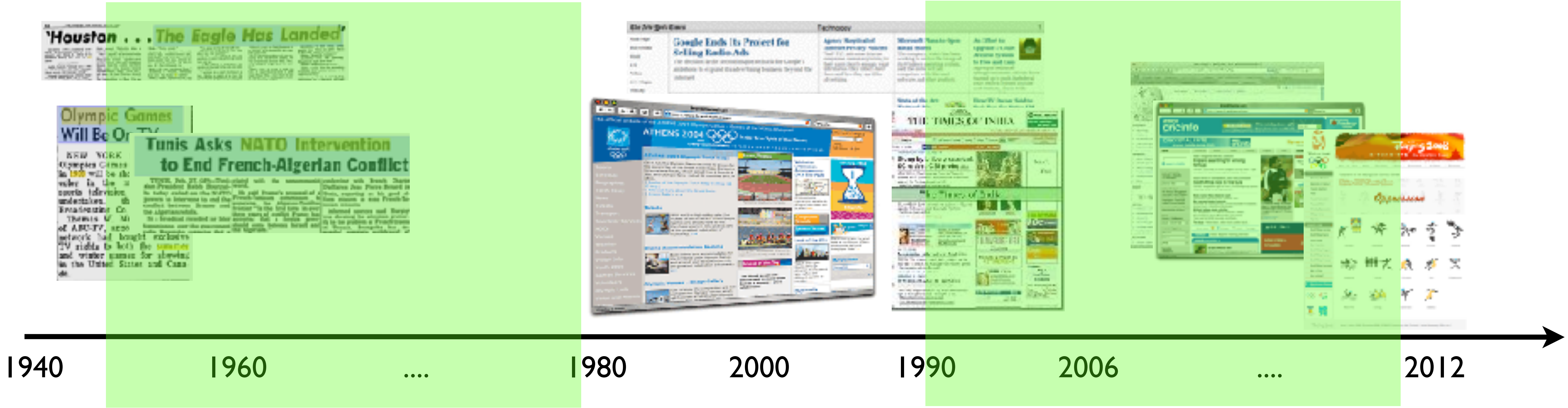
Tunis Asks **Nato Intervention** To End French-algerian...

Spokane Daily Chronicle - Feb 27, 1958

Habib Bourguiba today called on the **NATO** powers to **intervene** to end the conflict between France and the Algerian rebels. In a broadcast recorded for later ...

Nato .Intervention Ashed In French,... Reading Eagle

Queries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***nato intervention* @ 1950-1980**

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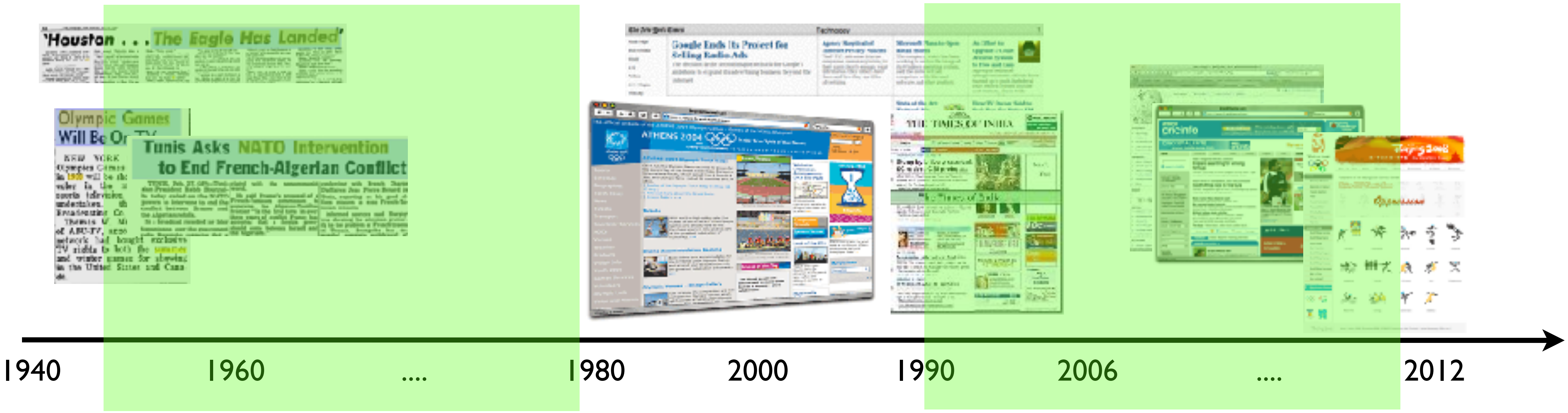
Queries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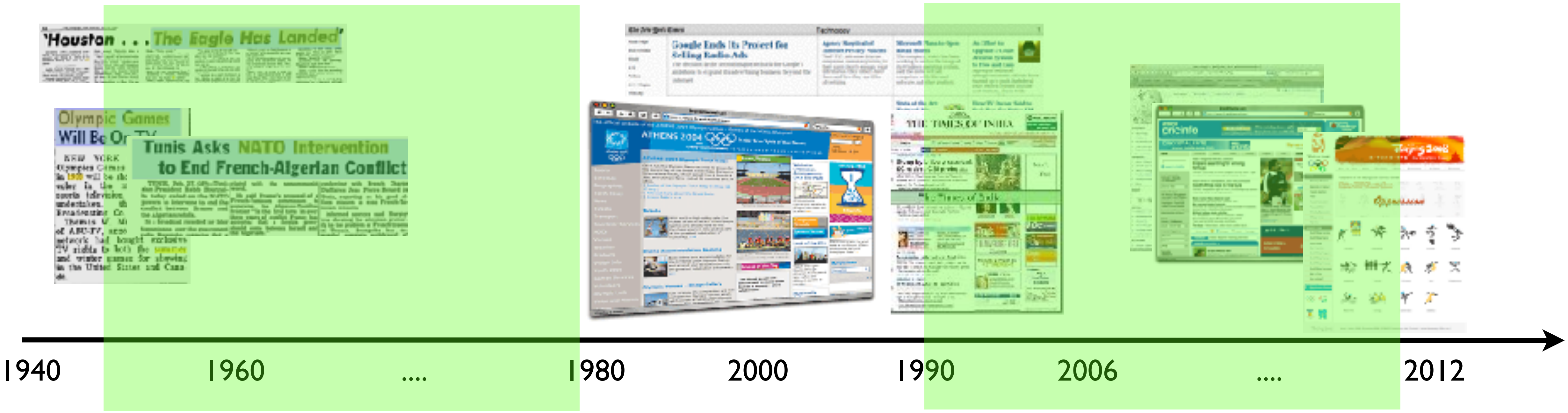
nato intervention **@** ***1950-1980***   ***nato intervention*** **@** ***1990-2012***

- Time-travel queries : Keyword queries with time of interest

nato intervention **@** ***25/12/2001***   ***nato intervention*** **@** ***1950-1980***

time points vs time ranges

Queries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***nato intervention* @ 1950-1980**

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- Time-travel queries : Keyword queries with time of interest

***nato intervention* @ 25/12/2001**

***nato intervention* @ 1950-1980**

time points vs time ranges

- Retrieve documents from the past

- Relevance based on time of interest

Issues in Temporal IR

- Temporal Collections

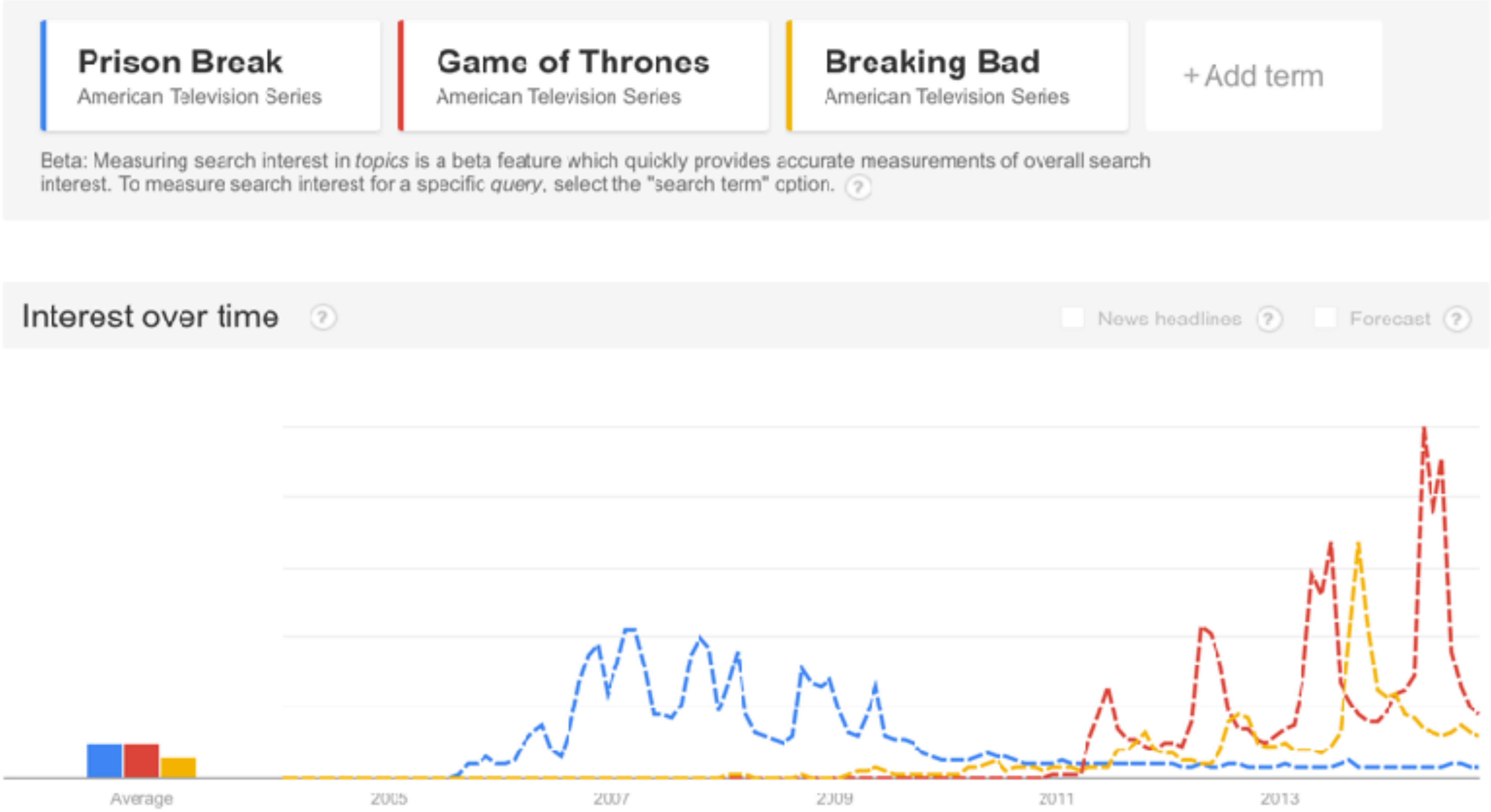
The New York Times
INTERNET ARCHIVE
WIKIPEDIA The Free Encyclopedia
19
19
20
20

  - Web Archives, News Archives, Wikipedia Versions….
- Temporal information needs

nato intervention **@** **25/12/2001**

  - Historical vs Recency
- Document relevance with temporal relevance
  - Is the doc relevant vs Is the doc relevant at the time of interest ?

Issues in Temporal IR



Prison Break
American Television Series

Game of Thrones
American Television Series

Breaking Bad
American Television Series

+ Add term

Beta: Measuring search interest in *topics* is a beta feature which quickly provides accurate measurements of overall search interest. To measure search interest for a specific *query*, select the "search term" option.

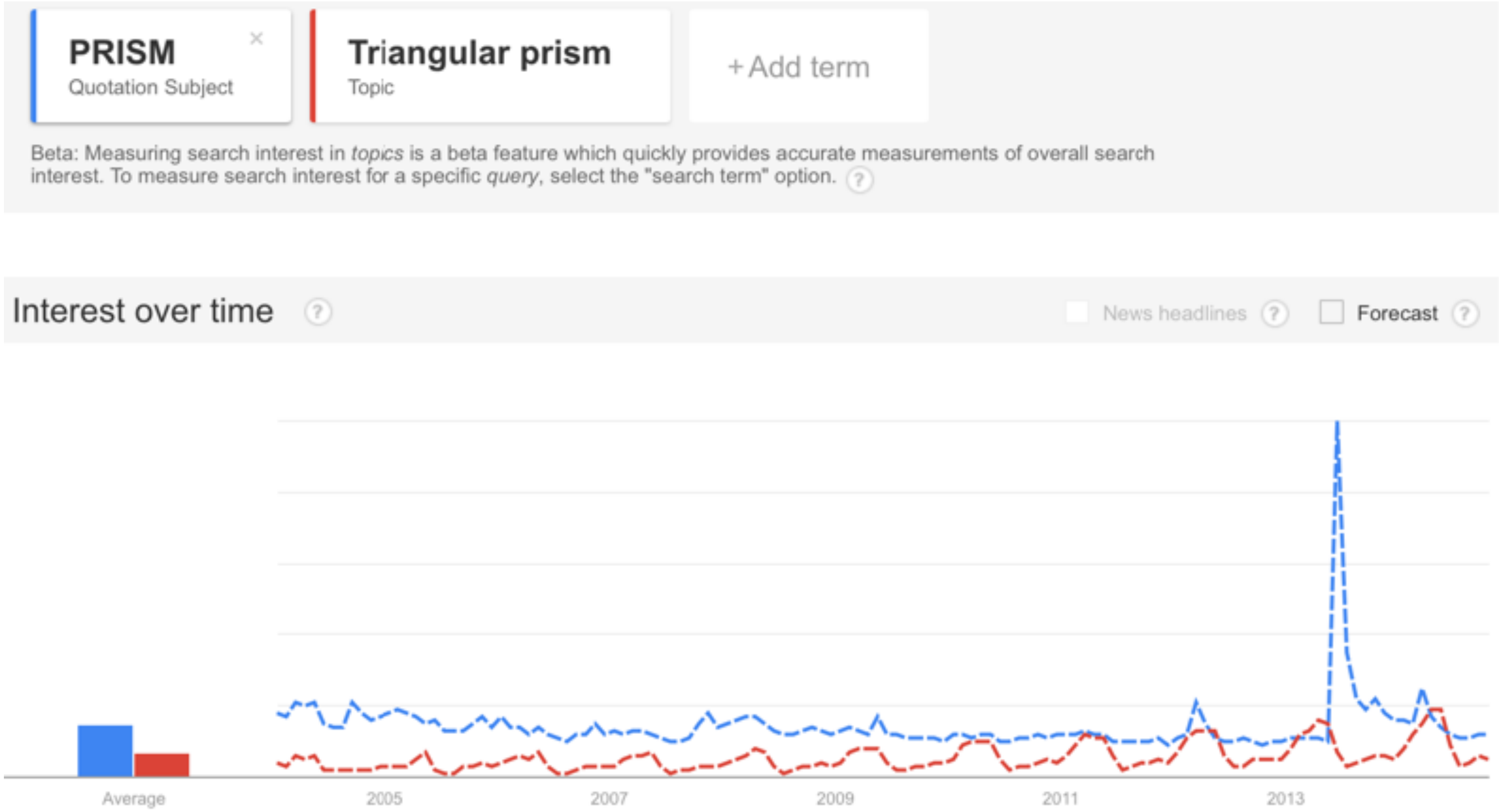
Interest over time

□ News headlines

□ Forecast

- Infer popular terms to improve ranking & suggestions

Issues in Temporal IR



PRISM ×
Quotation Subject

Triangular prism
Topic

+ Add term

Beta: Measuring search interest in *topics* is a beta feature which quickly provides accurate measurements of overall search interest. To measure search interest for a specific *query*, select the "search term" option. ?

Interest over time ?

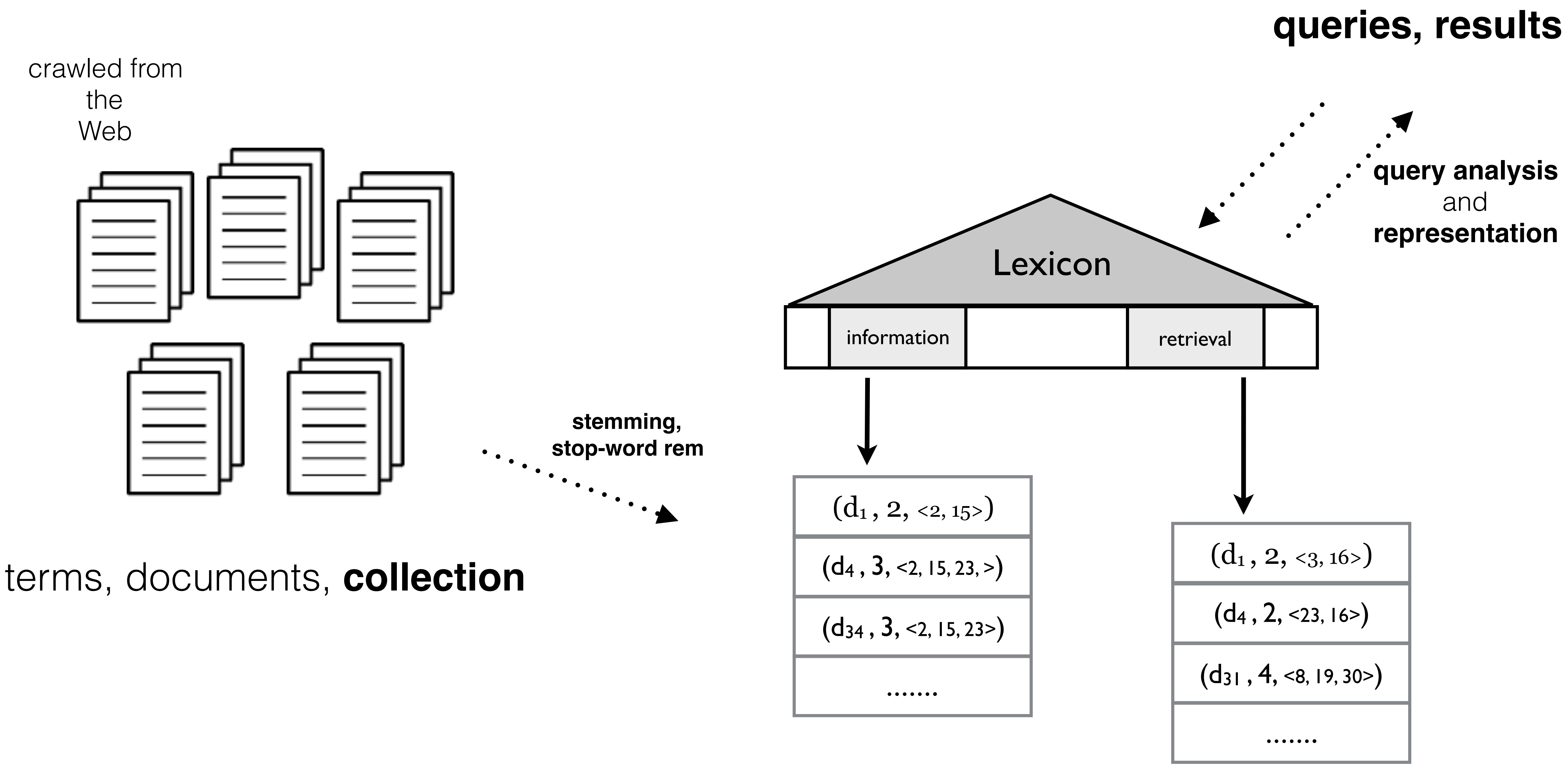
□ News headlines ? □ Forecast ?

- Infer popular terms to improve ranking & suggestions

Course Outline

- Foundations of Temporal Analysis
- Indexing for Temporal Retrieval
- Retrieval Models
- Query Analysis
- Word Representations

Simplistic Overview - Web IR System



queries, results

crawled from
the
Web

query analysis
and
representation

Lexicon

information

retrieval

stemming,
stop-word rem

terms, documents, **collection**

(d_1 , 2, <2, 15>)

(d_4 , 3, <2, 15, 23, >)

(d_{34} , 3, <2, 15, 23>)

....

(d_1 , 2, <3, 16>)

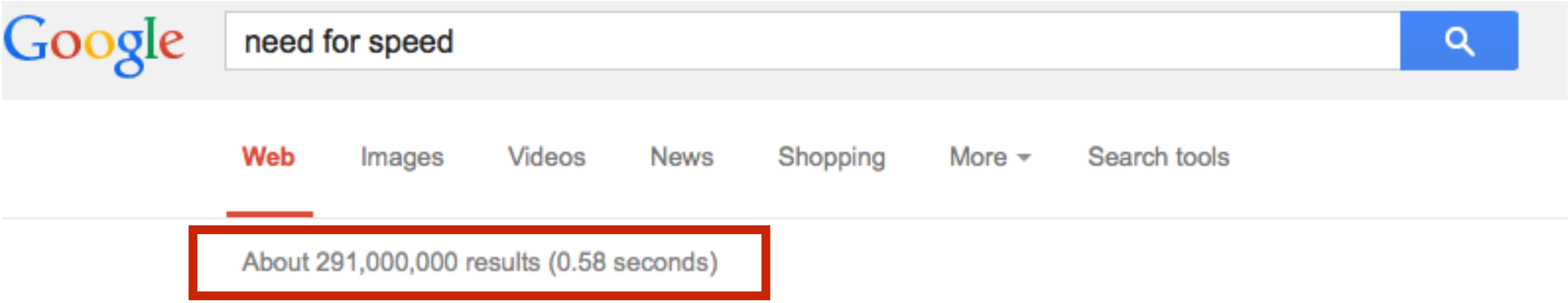
(d_4 , 2, <23, 16>)

(d_{31} , 4, <8, 19, 30>)

....

Inverted Index

Need for Speed



About 291,000,000 results (0.58 seconds)

- Sub-second retrieval

Indexing

- Interactive search
- Search as a primitive for further mining and post processing

Indexing Temporal Collections

- How do you search these collections efficiently ?
- How do you build and maintain indexes over evolving text collections ?
- What will you learn:
  - **Indexing large text collections,**
  - **Compression and how to handle updates, QP**
  - **Software: Lucene**

Temporal Ranking

- Ranking a large set of results
- Rank results based on relevance to
  - Text in the document
  - Temporal intent
- Temporal Diversity
- Test Collections and Evaluation

Temporal Ranking

- What will you learn ?
    - Statistical Language Models
    - Support Vector Machines
    - Learning to Rank
    - **Software: RankLib, SVMRank**

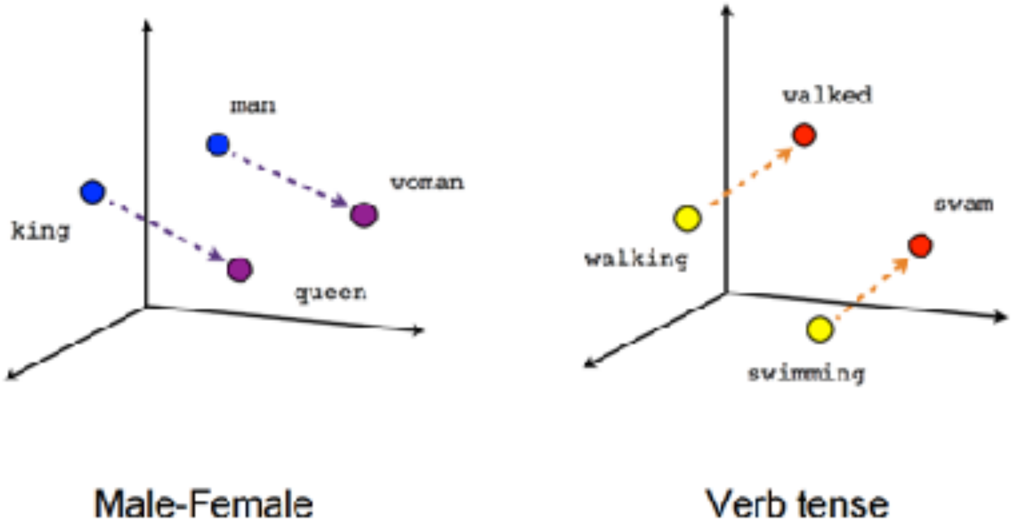
Query Understanding

- What does the user mean by the query ?
  - Query : jaguar price

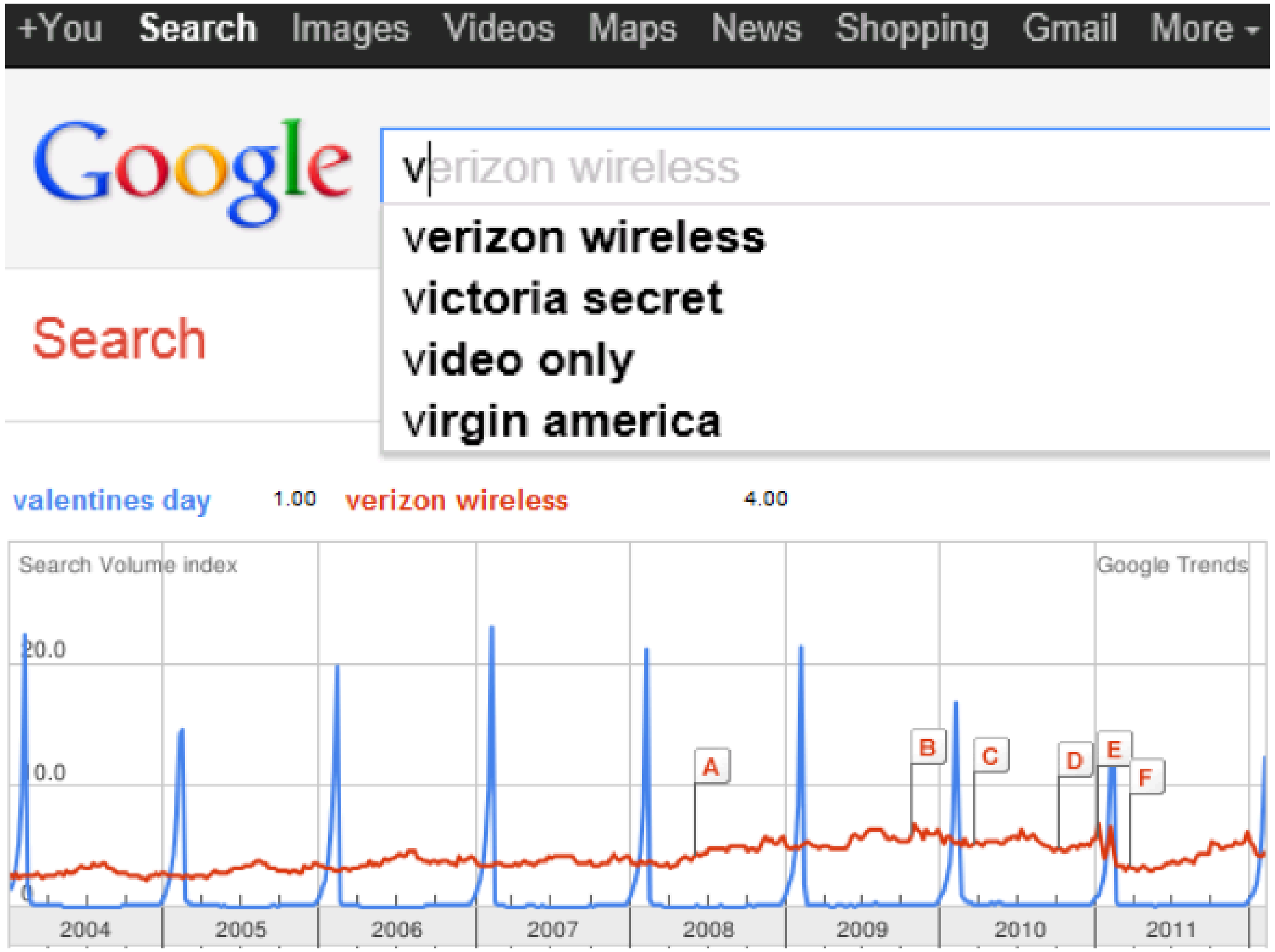
RAY PRICE
GREATEST HITS
Inducted Into The Country Hall Of Fame 1996

Query Understanding

- Word embeddings
  - Similar words share similar contexts
  - Compositionality
- What will you learn ?
  - Neural Networks (basics)
  - **Software: Word2Vec**

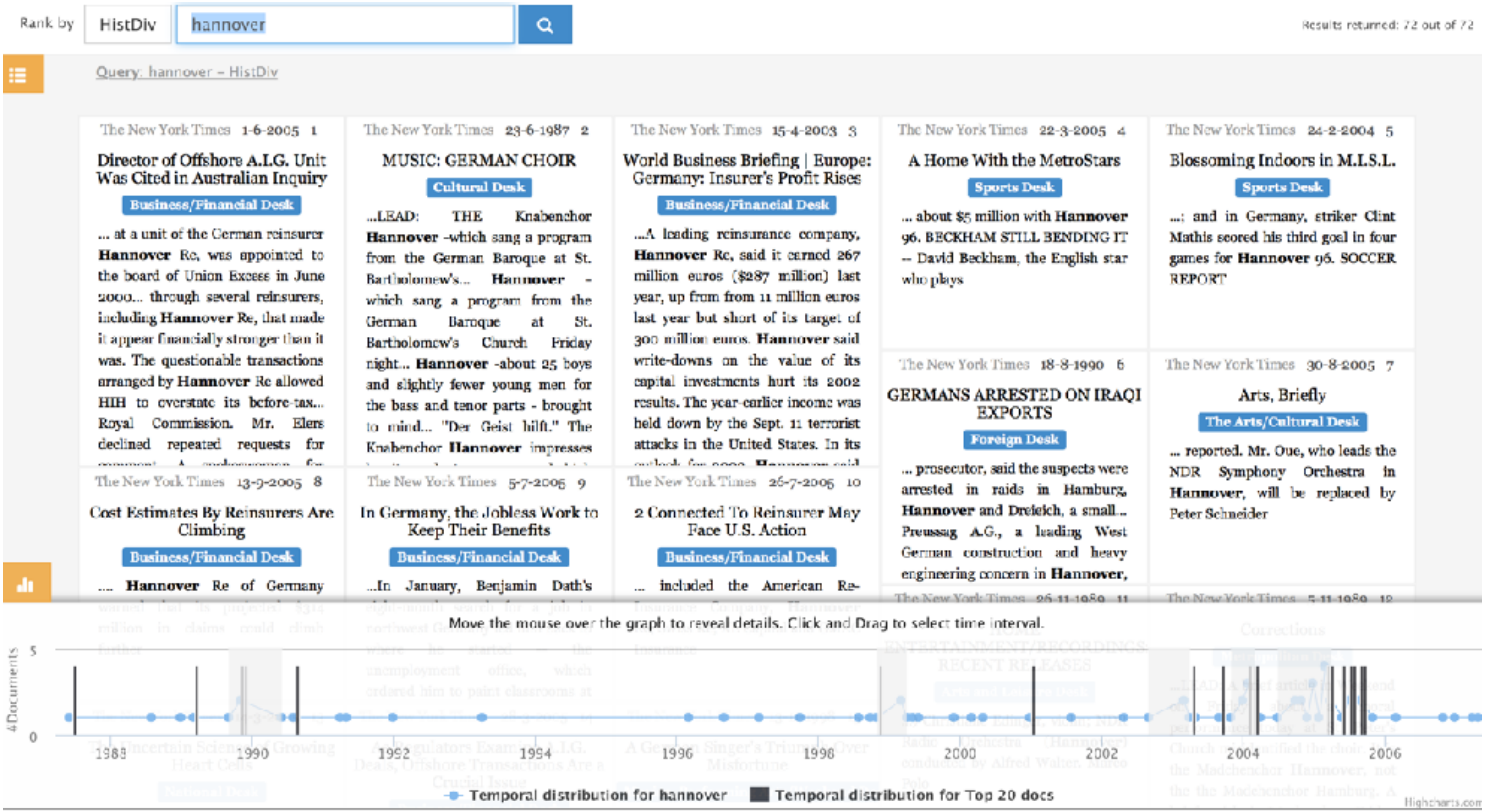


Query Analysis



- Query auto-completion
- Query Suggestion
- Query Expansions

Building a Temporal Search Engine



Rank by HistDiv hannover

Results returned: 72 out of 72

Query: hannover – HistDiv

The New York Times 1-6-2005 1

Director of Offshore A.I.G. Unit Was Cited in Australian Inquiry

Business/Financial Desk

... at a unit of the German reinsurer **Hannover** Re, was appointed to the board of Union Excess in June 2000... through several reinsurers, including **Hannover** Re, that made it appear financially stronger than it was. The questionable transactions arranged by **Hannover** Re allowed HIH to overstate its before-tax... Royal Commission. Mr. Elers declined repeated requests for

The New York Times 23-6-1987 2

MUSIC: GERMAN CHOIR

Cultural Desk

...LEAD: THE Knabenchor **Hannover** -which sang a program from the German Baroque at St. Bartholomew's... **Hannover** - which sang a program from the German Baroque at St. Bartholomew's Church Friday night... **Hannover** -about 25 boys and slightly fewer young men for the bass and tenor parts - brought to mind... "Der Geist hilft." The Knabenchor **Hannover** impresses

The New York Times 15-4-2003 3

World Business Briefing | Europe: Germany: Insurer's Profit Rises

Business/Financial Desk

...A leading reinsurance company, **Hannover** Re, said it earned 267 million euros ($287 million) last year, up from from 11 million euros last year but short of its target of 300 million euros. **Hannover** said write-downs on the value of its capital investments hurt its 2002 results. The year-earlier income was held down by the Sept. 11 terrorist attacks in the United States. In its

The New York Times 22-3-2005 4

A Home With the MetroStars

Sports Desk

... about $5 million with **Hannover** 96. BECKHAM STILL BENDING IT -- David Beckham, the English star who plays

The New York Times 24-2-2004 5

Blossoming Indoors in M.I.S.L.

Sports Desk

...; and in Germany, striker Clint Mathis scored his third goal in four games for **Hannover** 96. SOCCER REPORT

The New York Times 18-8-1990 6

GERMANS ARRESTED ON IRAQI EXPORTS

Foreign Desk

... prosecutor, said the suspects were arrested in raids in Hamburg, **Hannover** and Dreieich, a small... Preussag A.G., a leading West German construction and heavy engineering concern in **Hannover**,

The New York Times 30-8-2005 7

Arts, Briefly

The Arts/Cultural Desk

... reported. Mr. Oue, who leads the NDR Symphony Orchestra in **Hannover**, will be replaced by Peter Schneider

The New York Times 13-9-2005 8

Cost Estimates By Reinsurers Are Climbing

Business/Financial Desk

.... **Hannover** Re of Germany

The New York Times 5-7-2005 9

In Germany, the Jobless Work to Keep Their Benefits

Business/Financial Desk

...In January, Benjamin Dath's

The New York Times 26-7-2005 10

2 Connected To Reinsurer May Face U.S. Action

Business/Financial Desk

... included the American Re-

Move the mouse over the graph to reveal details. Click and Drag to select time interval.

# Documents
5
0
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Temporal distribution for hannover
Temporal distribution for Top 20 docs
Highcharts.com

Assignments

- **Tutorials**:
  - Programming assignments
    - Languages: Python, Java
    - 2 weeks to solve
  - Theoretical questions

★ **Assignment - 1 [Indexing]**

★ **Assignment - 2 [Retrieval Models - LM]**

★ **Assignment - 3 [Learning to Rank]**

★ **Assignment - 4 [Word Embeddings]**

Final Exam

- **Qualifying for the exam:** 50% in assignments
- **Last lecture:** 24th January
    - Conclusions and Exam revisions
- 30th January : Q&A
- **Final Exam:** Oral Exam
    - **1st Week of February**

SAVE THE DATE

SAVE THE DATE

SAVE THE DATE

Administrivia and Dates

- **Webpage:** **http://www.l3s.de/~anand/tir**
- Assignments, slides and references will be put up every week after the lecture
- **Office hours:** 30 mins after the lecture
- **Recitations:** To improve your foundations, or delve into more details

Demos

- Systems in action
  - Wayback Machine - link
  - Portugese Web Archive - link
  - British library - link
  - L3S HistDiv System - link