Beyond 10 Blue Links: User-Oriented Design of Search Interfaces

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Introduction
Most Web search tasks are rather simple
Finding a single page is often sufficient

What is L3S?

What is the weather forecast for Hannover?
There are also (less frequent) complex Web search tasks. Tasks in other domains with other data are usually more complex, e.g.

- medical search
- patent search
- enterprise search

Find information about the treatments of diabetes mellitus

Conducting a prior-art patent search for avoiding patent infringement
Different task types need different kinds of search system functions:

- "one size fits all" approach neither effective nor efficient for advanced search tasks.
Search System Functions
Search System Functions

Search System Function

- Operation or parameter of a search system
- Can be invoked by the user or (automatically) by the system
Search System Functions

Select - Organize - Project

- **Select**: Selecting possibly relevant items
- **Organize**: How the set of result items is structured and organized logically
- **Project**: Construction of the surrogates to be presented in the results page
Search System Functions

Select
Example: Taxonomies of Web Search

Broder 2002

Navigational: to reach a particular site
Informational: to acquire information assumed to be present on one or more web pages
Transactional: to perform some web-mediated activity

Develop task-specific selection methods

Navigational: find home page
Informational: find page containing requested info
Transactional: find page w/ transaction form
Select
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Search System Functions

Select (S) functions

**Ranking method:** e.g. precision- or recall-oriented

**Ranking principle:** e.g. relevance or diversity ranking

**Querying:** simple (set of words) to complex (field, data types) queries, a-priori or by given items (query by example)

<table>
<thead>
<tr>
<th>Text</th>
<th>retrieval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>e.g. &quot;information retrieval&quot; AND search</td>
</tr>
<tr>
<td>Author</td>
<td>smith</td>
</tr>
<tr>
<td>Year</td>
<td>e.g. $\geq 1970$ AND $\leq 1972$</td>
</tr>
</tbody>
</table>

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Search System Functions

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Search System Functions

Select (S) functions

Formal filter conditions: Filtering by formal criteria

Hannover

Web  Maps  Images  News  Videos  More  Search tools

Past 24 hours  Sorted by relevance  All results  Clear

Any time
Past hour

✓ Past 24 hours
Past week
Past month

Allprofi verbreitet Hannover-96-Angebot

All-News › Primera División - Translate this page

Kick ins internationale Transfergeschäft: Der Fußballprofi
Search System Functions

Organize (O) functions
Search System Functions

Organize (O) functions

**Sorting**: Sorting of items by one (1D) or more attributes (2D, ...)

---

nuclear power plant germany

**Gundremingen Nuclear Power Plant**
Dr. August-Werneck-St. 1, 88956 Gundremingen, Deutschland
+49 6224/76 ext. 1
1. Informationbericht
   *Abschalten, und zwar sofort!*

**Brokdorf Nuclear Power Plant**
Osterende, 25576 Brokdorf, Deutschland
+49 4523/760
1. Informationbericht

**Oberrhein Nuclear Power Plant**
Kernkraftwerk; 1, 74647 Oberrhein, Deutschland
+49 7021/860 ext. 0

**Atol Energie AG**
Franz-Franzfeld-Weg 2, 40473 Düsseldorf, Deutschland
+49 211/77368 ext. 0
Kategorie: Nuclear Power Plants

**Vattenfall Europe Nuclear Energy GmbH**
1. mehr Infos
### Organize (O) functions

**Grouping:** Grouping by simple (e.g. grouping by document type) or complex criteria

<table>
<thead>
<tr>
<th>Years 1960 - 1969 (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fact Retrieval and Deductive Question-Answering Information Retrieval Systems</td>
</tr>
<tr>
<td>William S. Cooper</td>
</tr>
<tr>
<td>1964 (DBLP)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Years 1970 - 1979 (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A Heuristic Approach to Inductive Inference in Fact Retrieval Systems</td>
</tr>
<tr>
<td>C. William Skinner</td>
</tr>
<tr>
<td>1974 (DBLP)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years 1980 - 1989 (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Indexing and Retrieval Strategies for Natural Language Fact Retrieval</td>
</tr>
<tr>
<td>Janet L. Kolodner</td>
</tr>
<tr>
<td>1983 (DBLP)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years 1990 - 1999 (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Integration of Probabilistic Fact and Text Retrieval</td>
</tr>
<tr>
<td>Norbert Fuhr</td>
</tr>
<tr>
<td>1992 (DBLP)</td>
</tr>
</tbody>
</table>
Organize (O) functions

Clustering: Content-focused grouping by similarity

Linking: Showing e.g. Web links, co-author relationships, citations, ...
Organize (O) functions

**Clustering:** Content-focused grouping by similarity

**Linking:** Showing e.g. Web links, co-author relationships, citations, ...
Project (P) functions
**Selecting:** Select attributes of result items

1. **Introduction to Information Retrieval** by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze (Jul 7, 2008)

<table>
<thead>
<tr>
<th>Formats</th>
<th>Rent</th>
<th>Buy</th>
<th>New</th>
<th>Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardcover</td>
<td>$17.97</td>
<td>-</td>
<td>-</td>
<td>$47.97</td>
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<tr>
<td>Kindle Edition</td>
<td>$39.83</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Order in the next 7 hours to get it by Thursday, Jun 26. FREE Shipping.
Search System Functions

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</thead>
<tbody>
<tr>
<td>Hardcover</td>
<td>$17.97 - $18.00</td>
<td>$55.69</td>
<td>$47.97</td>
<td>$30.00</td>
</tr>
<tr>
<td>Kindle Edition</td>
<td>$39.83</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Summarizing: Summaries of single answer documents

Advantages of query biased summaries in information retrieval...
dl.acm.org/citation.cfm?id=290947  Diese Seite übersetzen
Hideo Joho, David Hannah, Joemon M. Jose, Emulating query-biased summaries using document titles, Proceedings of the 31st annual international ACM ...
**Aggregating:** Generate single entry representing several items

🌟🌟🌟🌟🌟 EXCELLENT CAMERA
This is an EXCELLENT CAMERA, This is the

🌟🌟🌟🌟🌟 Love this camera!
The best feature: Great quality photos! I just

🌟🌟🌟🌟🌟 Easy to use great pics
I have owned earlier models of this camera, so
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Extracting: Extracting and generating new data (e.g. common terms or frequent authors)
Supporting Search Modes
Supporting Search Modes

Search Activities and Search Modes [Marcchionini 1995]

- Top-level categories of search activities by Marchionini
- Notion of **Search Mode** by Russel-Rose et al.
- Search mode = subtype of a search activity category
- Based on analyzing real-world scenarios (site and enterprise search)
- $\leadsto$ entity search
Supporting Search Modes

Search Activities and Search Modes

- **Lookup**: (i) Locate, (ii) Verify, (iii) Monitor
  - Specified queries
  - No complicated examination of results required
- **Learn**: (i) Compare, (ii) Comprehend, (iii) Explore
  - Gaining knowledge, comprehension, comparisons, ...
  - Processing and interpretation necessary
- **Investigate**: (i) Analyze, (ii) Evaluate, (iii) Synthesize
  - Analysing, synthesizing information
  - Searchers needs high knowledge level
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Mapping Search Modes to Search Functions

- **Examples** of search modes and how they can be supported by search functions
- Each search mode needs Select, Organize and Project functions
- Focus on most important and distinctive functions
Lookup: Verify/Monitor

wolfgang nejdl phone number

About 272,000 results (0.52 seconds)

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Homepage of Wolfgang Nejdl - KBS
www.kbs.uni-hannover.de/~nejdl/
George Bernard Shaw. Prof. Dr. techn. Dipl.-Ing. Wolfgang Nejdl. Institut für Verteilte Systeme Wissensbasierte Systeme (KBS) Appelstrasse 4 30167 Hannover

L3S Forschungszentrum | Prof. Dr. techn. Wolfgang Nejdl
https://www.l3s.de/visitenkarte/id/wolfgang-nejdl/
Prof. Dr. techn. Wolfgang Nejdl. Prof. Dr. Wolfgang Nejdl (born 1960) has been full professor of computer science at the University of Hannover since 1995.

dblp: Wolfgang Nejdl
www.informatik.uni-trier.de/~ley/pers/hv/Nejdl-Wolfgang.html
Wolfgang Nejdl, Johann Gamper: Model-Based Diagnosis with Qualitative Temporal ...
Wolfgang Nejdl, Peter Brusilovsky: EIC Editorial and Introduction of New ...
Supporting Search Modes

### Lookup: Verify/Monitor

Verifying that a CPU has a certain clock rate

- **Selecting** relevant parts or attributes for projection (P)

<table>
<thead>
<tr>
<th>Produkt</th>
<th>Taktfrequenz</th>
<th>Level2 Cache</th>
<th>Level3 Cache</th>
<th>Bewertung</th>
<th>Preis</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMD FX-4100 Boxed, &quot;Zambizi&quot;</td>
<td>3600 MHz</td>
<td>4096 kB</td>
<td>8192 kB</td>
<td>46 Bewertungen</td>
<td>€ 107,90*</td>
</tr>
<tr>
<td>Auf Lager</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AMD FX-4170 Boxed, &quot;Zambizi&quot;</td>
<td>4200 MHz</td>
<td>4006 kB</td>
<td>8192 kB</td>
<td>25 Bewertungen</td>
<td>€ 129,90*</td>
</tr>
<tr>
<td>Auf Lager</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>AMD FX-4170 &quot;Zambizi&quot; Auf Lager</td>
<td>4200 MHz</td>
<td>4096 kB</td>
<td>8192 kB</td>
<td>3 Bewertungen</td>
<td>€ 122,90*</td>
</tr>
</tbody>
</table>
Supporting Search Modes

Learn: Compare

Comparing ovens to identify similarities and differences

- **Sorting** relevant items (O) and **selecting** relevant attributes for projection visualized in tabular form (P)

### SIEMENS

<table>
<thead>
<tr>
<th>Product Code</th>
<th>HB75GB550B</th>
<th>HB78GB590B</th>
<th>HB78GB670B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Image</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### General Properties

<table>
<thead>
<tr>
<th>Feature</th>
<th>HB75GB550B</th>
<th>HB78GB590B</th>
<th>HB78GB670B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color / Material Front</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td>Black</td>
</tr>
<tr>
<td>Built-in / Free-standing</td>
<td>Built-in</td>
<td>Built-in</td>
<td>Built-in</td>
</tr>
<tr>
<td>Installation typology</td>
<td>Half-integrated</td>
<td>Half-integrated</td>
<td>Half-integrated</td>
</tr>
<tr>
<td>Energy input</td>
<td>Electric</td>
<td>Electric</td>
<td>Electric</td>
</tr>
<tr>
<td>Electrical connection rating (W)</td>
<td>3,650 W</td>
<td>3,650 W</td>
<td>3,650 W</td>
</tr>
<tr>
<td>Current (A)</td>
<td>16 A</td>
<td>16 A</td>
<td>16 A</td>
</tr>
</tbody>
</table>
Supporting Search Modes

Learn: Comprehend

Comprehending and understanding important attributes when buying a solid-state drive

- Showing facets (P) and using them for grouping (O)
Supporting Search Modes

Learn: Explore

Explore interesting new topics for organizing a seminar

- Facet as formal filter conditions (S), grouping according to facets (O) and extracting frequent terms (P)
Supporting Search Modes

Investigate: Analyze

Analyzing which stories, actors, .. make current movies successful

- Multidimensional sorting (O), grouping (O), clustering (O) and linking of results (O)
Supporting Search Modes

Investigate: Analyze
HyperScatter (2D sorting) and Parallel Bargrams visualisation
### Investigate: Evaluate

Evaluating cheap antivirus software for use on a notebook

- Sorting ascending by price (O) and summarizing main features (P)

<table>
<thead>
<tr>
<th>Recommended As</th>
<th>Best antivirus for Mac</th>
<th>Best antivirus software</th>
<th>Antivirus software for older/slower computers</th>
<th>Security suite with antivirus software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pros and Cons</td>
<td>✓ Pros: very good detection performance, quick installation, no ads, scans for Mac and Windows malware</td>
<td>✅ Pros: excellent malware detection and removal, fast scan times, low impact on overall system performance</td>
<td>✅ Pros: excels at preventing viruses, low impact footprint on PCs, can be used with other antivirus programs, cloud protection delivers excellent up-to-date protection</td>
<td>✓ Pros: comprehensive Internet protection, very good antivirus protection, very good anti-spam and anti-phishing protection, excellent firewall, good parental controls</td>
</tr>
<tr>
<td></td>
<td>✗ Cons: no phone or email support</td>
<td>✗ Cons: increases computer boot time, had trouble removing scareware in one test</td>
<td>✗ Cons: loses effectiveness when offline, small number of users experience slowed system performance, large number of false positives in one test</td>
<td>✗ Cons: high number of false positives, detects fewer viruses than kaspersky products</td>
</tr>
</tbody>
</table>

- **Sophos Anti-Virus for Mac**: Free
- **Kaspersky Anti-Virus 2012**: *Est. $25
- **Webroot SecureAnywhere**: *Est. $40
- **Norton Internet Security**...: *Est. $70
Implications for the design of search systems

- Ideal system should be **flexible** enough to support various search modes
- Alternatively there can be **specialized systems** (e.g. smartphone apps)
- No feature-bloated system, only **appropriate functions** should be offered (richer functionality \(\Rightarrow\) requires increased user expertise)
- **Interaction and visualisation techniques for the UI** have to be chosen carefully
Conclusion and Outlook
Conclusion and Outlook

Select – Organize – Project as basic search function types

Different search modes require different search functions

Open Issues
  * Visualization
  * Easy-to-use user interface

Current Web search deals mainly with unstructured objects (little semantics)

Various entity types, richer structure, more attributes
  \( \Rightarrow \) need for advanced search functions
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- **Various entity types, richer structure, more attributes**
  \(\leadsto\) **need for advanced search functions**