Cluster-Based Visualization of Web Search Results

Matthias Tilsner

March 11, 2009

Project Domain

Web Documents

- URL
- header data
  - title
  - meta-tags
- body data
  - textual content
  - links

Search Parameters

- query string
  - search terms

Project Domain

Web Documents

- URL
- header data
  - title
  - meta-tags
- body data
  - textual content
  - links

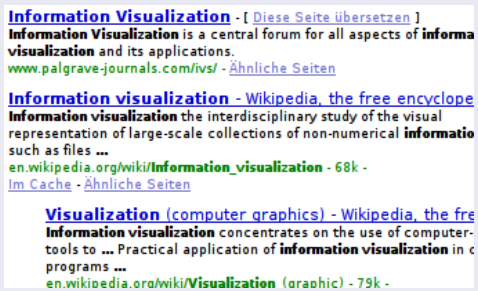
Search Parameters

- query string
  - search terms

Visualization Techniques

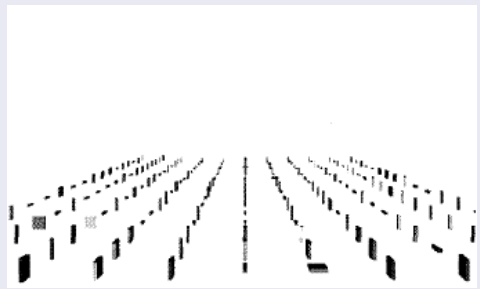
Relevance to Search Terms/Query

- **position** [2, 3, 5, 8]
- color [4, 6, 8]
- size [7, 9]



(a) position [3]

(b) color [4]

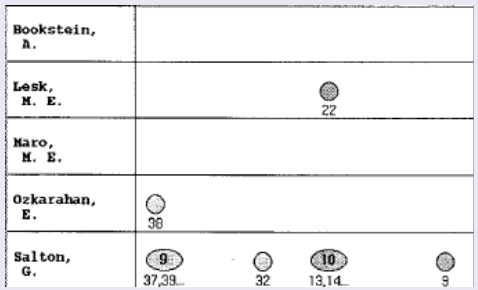


(c) size [7]

Visualization Techniques

Relationship of Search Results

- position [8]
- connection [2, 6, 9, 16]



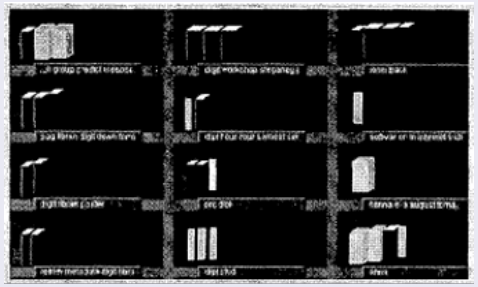
(d) position [8]

(e) connection [16]

Visualization Techniques

Similarity of Search Results

- position [1, 2, 7, 6, 9, 10, 11, 12, 13, 14]



(f) position [10]

Interaction Techniques

Details on Demand

- highlighting [15]
- popup [2]
- zoom [5, 7, 9, 10]

Data Refinement

- redefine search terms [11]
- search result list [2, 6]

Interaction Techniques

Details on Demand

- highlighting [15]
- popup [2]
- zoom [5, 7, 9, 10]

Data Refinement

- redefine search terms [11]
- search result list [2, 6]

Current Status

Summary of Existing Research

- either extending or abandoning conventional result lists
- display of all result items or a subset
  - zoom in for structural details
  - popup metadata

Assumptions

- users: untrained, unwilling, impatient, used to conventional result lists
- search must be intuitive
- no existing solution has been widely accepted

Current Status

Summary of Existing Research

- either extending or abandoning conventional result lists
- display of all result items or a subset
  - zoom in for structural details
  - popup metadata

Assumptions

- users: untrained, unwilling, impatient, used to conventional result lists
- search must be intuitive
- no existing solution has been widely accepted

Open Issues

Interface Requirements

- intuitive to use
- enables fast search success

Beneficial Principles

- similarity to conventional result lists
- usable without training
  $\Rightarrow$ training provides additional functionality
- overview-zoom-detail interaction

Open Issues

Interface Requirements

- intuitive to use
- enables fast search success

Beneficial Principles

- similarity to conventional result lists
- usable without training
  $\Rightarrow$ training provides additional functionality
- overview-zoom-detail interaction

Idea

Visualization

- fuzzy clustering
- “Concept Highlighter”-like visualization

Interaction

- result filtering
- interactive creation of customized result set

Idea

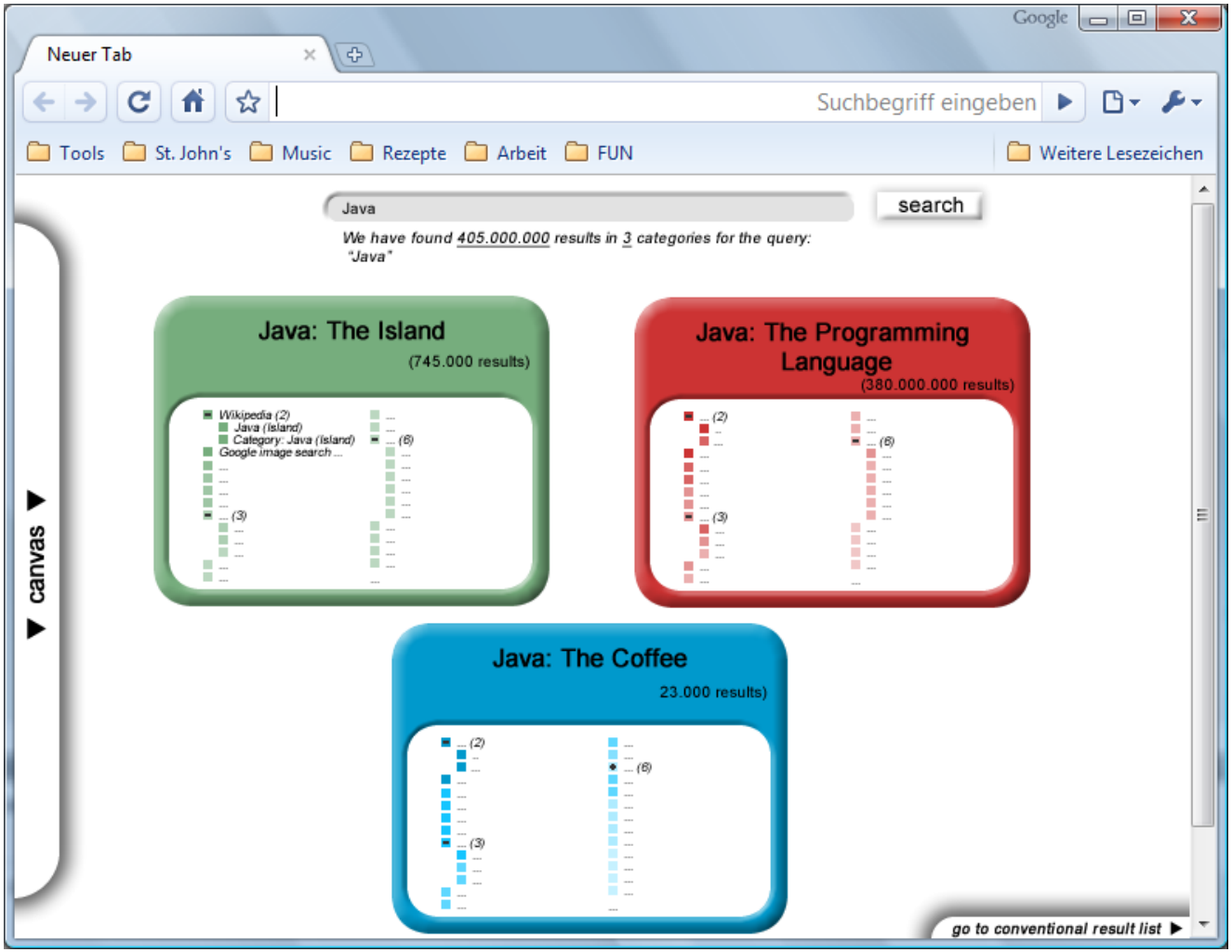
Visualization

- fuzzy clustering
- “Concept Highlighter”-like visualization

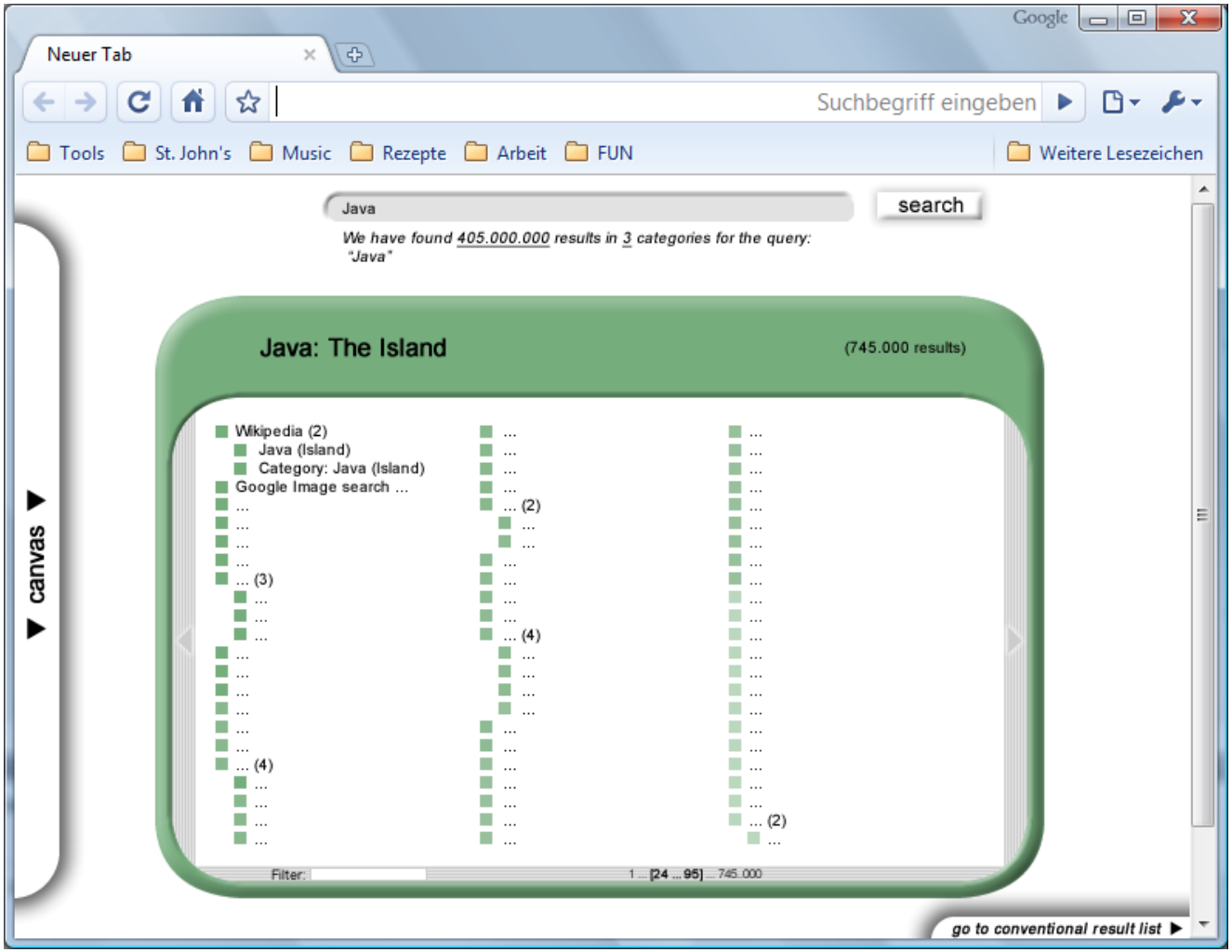
Interaction

- result filtering
- interactive creation of customized result set

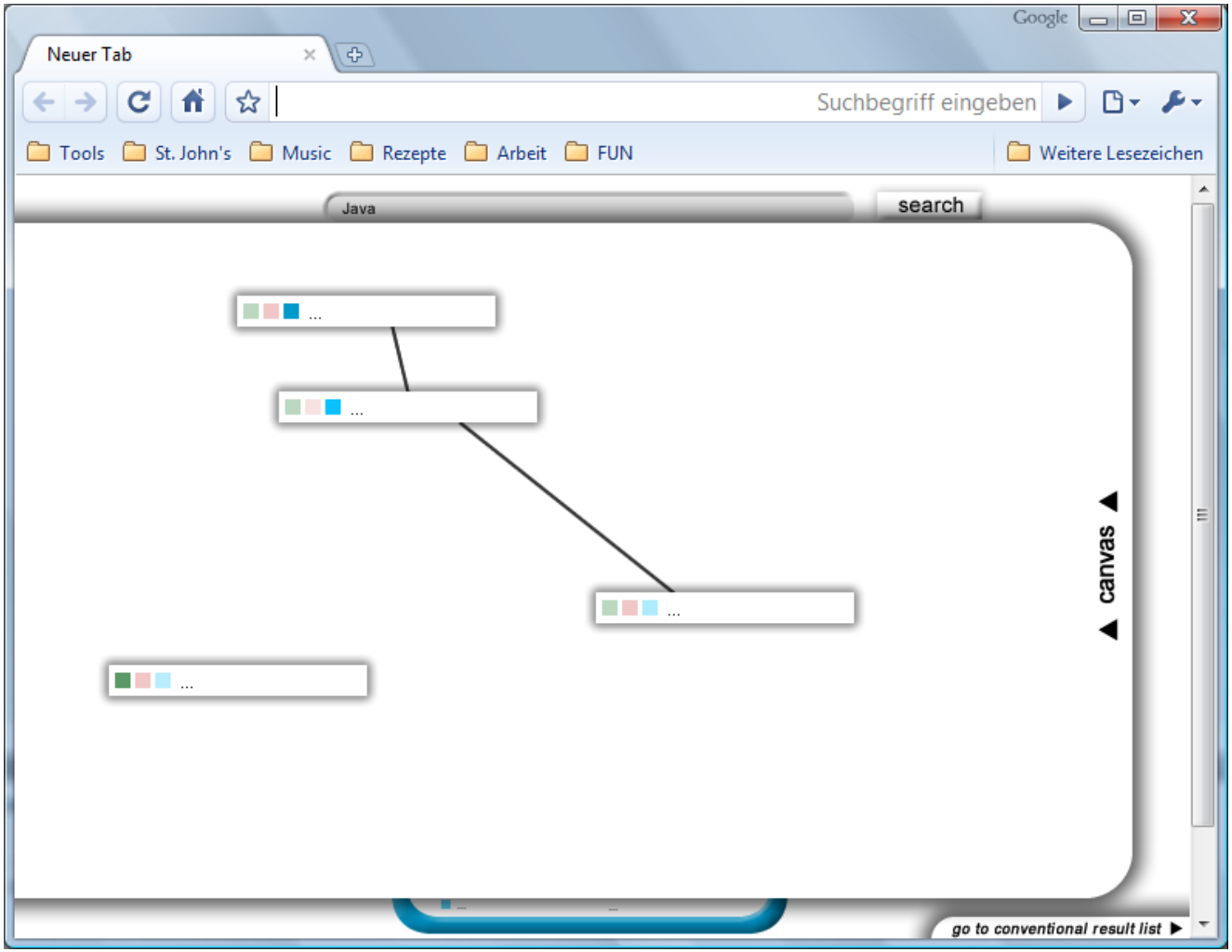
Fuzzy Clustering



“Concept Highlighter”-Like Visualization



Interactive Creation of Customized Result Sets



Risks and Potentials

Risks

- performance
- intuitivity / usability
- quality (clustering & topic identification)

Potentials

- fast reduction of search space
- easy identification of relevant results
- topic distinction

Risks and Potentials

Risks

- performance
- intuitivity / usability
- quality (clustering & topic identification)

Potentials

- fast reduction of search space
- easy identification of relevant results
- topic distinction

Outlook

Future Issues

- customized / optimized ranking
- result retaining & sharing
- Web Service API
- visualization customizing
- search term weighting

Thank you for your attention

"If you type 'Google' into Google, you can break the Internet"
- *Jen (The IT Crowd)*

References I

[1] C. Benjamin, W. Woon, and K. Wong.
A graphical and convenient tool for document comparison and visualization.
In *Proceedings of the International Conference on Computer and Communication Engineering*, pages 362–367, May 2008.

[2] K. Einsfeld, S. Agne, M. Deller, A. Ebert, B. Klein, and C. Reuschling.
Dynamic visualization and navigation of semantic virtual environments.
In *Proceedings of the Tenth International Conference on Information Visualization*, pages 569–574, July 2006.

[3] Google Inc.
Google search, 2009.
http://www.google.com.

[4] O. Hoeber and X. D. Yang.
Visually exploring concept-based fuzzy clusters in web search results.
In *Proceedings of the 4th International Atlantic Web Intelligence Conference*, pages 81–90, 2006.

[5] M. Konchady, R. D'Amore, and G. Valley.
A web based visualization for documents.
In *Proceedings of the 1998 Workshop on New Paradigms in Information Visualization and Manipulation*, pages 13–19, New York, NY, USA, 1998. ACM.

[6] S. Mukherjea and Y. Hara.
Visualizing world-wide web search engine results.
In *Proceedings of the 1999 IEEE International Conference on Information Visualization*, pages 400–405, 1999.

References II

[7] S. Mukherjea, K. Hirata, and Y. Hara.
Visualizing the results of multimedia web search engines.
In *Proceedings of the 1996 IEEE Symposium on Information Visualization*, pages 64–65, 122, Oct 1996.

[8] L. T. Nowell, R. K. France, D. Hix, L. S. Heath, and E. A. Fox.
Visualizing search results: Some alternatives to query-document similarity.
In *Proceedings of the 19th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, pages 67–75, New York, NY, USA, 1996. ACM.

[9] F. Paulovich, R. Pinho, C. Botha, A. Heijs, and R. Minghim.
Pex-web: Content-based visualization of web search results.
pages 208–214, July 2008.

[10] A. Rauber and H. Bina.
"'andreas, rauber'? conference pages are over there, german documents on the lower left...": An "old-fashioned" approach to web search results visualization.
In *Proceedings of the 11th International Workshop on Database and Expert Systems Applications*, pages 615–619, 2000.

[11] D. Roussinov.
Internet search using adaptive visualization.
In *Extended Abstracts of the 1999 Conference on Human Factors in Computing Systems*, pages 69–70, New York, NY, USA, 1999. ACM.

[12] M. M. Sebrechts, J. V. Cugini, S. J. Laskowski, J. Vasilakis, and M. S. Miller.
Visualization of search results: A comparative evaluation of text, 2d, and 3d interfaces.
In *Proceedings of the 22nd Annual International ACM SIGIR Conference on Research and Development in Information Retrieval*, pages 3–10, New York, NY, USA, 1999. ACM.

References III

[13] M. Tvarozek and M. Bielikova.
Personalized view-based search and visualization as a means for deep/semantic web data access.
In *Proceeding of the 17th International Conference on World Wide Web*, pages 1023–1024, New York, NY, USA, 2008. ACM.

[14] E. Weippl.
Visualizing content-based relations in texts.
In *Proceedings of the Second Australasian User Interface Conference*, pages 34–41, 2001.

[15] M. Weiss-Lijn, J. McDonnell, and L. James.
Visualising document content with metadata to facilitate goal-directed search.
In *Proceedings of the Fifth International Conference on Information Visualisation*, pages 71–76, 2001.

[16] C. M. Zaina and M. C. C. Baranauskas.
Revealing relationships in search engine results.
In *Proceedings of the 2005 Latin American Conference on Human-computer Interaction*, pages 120–127, New York, NY, USA, 2005. ACM.