Information Retrieval
Visualization

CPSC 533c Class Presentation
Qixing Zheng
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Purpose of Information Retrieval (IR)

“The purpose of information retrieval is to help users effectively access large collections of objects with the goal of satisfying users’ stated information needs.”

-- W. Bruce Croft
Too Few or Too Many

- **Your Search:** \{collaborative\};\{visualization\};\{tool\}
  **Search Results:** Records found: 2 / Total characters: 5667

- **Your Search:** \{collaborative, visualization, tool\}
  **Search Results:** Records found: 3213 / Total characters: 4000286
The Search Results...

**image network**

This is a searchable index. Enter search keywords:

Index conf.announce contains the following 164 items relevant to 'image network'. The first figure for each entry is its relevance score, the second the number of lines in the item.

* 1000 1190 /ftp/pub/conf.announce/jenc5
* 886 125 /ftp/pub/conf.announce/image.processing.conf
* 800 334 /ftp/pub/conf.announce/image.analysis.symposium
* 743 303 /ftp/pub/conf.announce/sans-III
* 543 376 /ftp/pub/conf.announce/atinac.94
* 486 133 /ftp/pub/conf.announce/sid
* 486 125 /ftp/pub/conf.announce/ges2
* 457 138 /ftp/pub/conf.announce/europen.forum.94
* 429 378 /ftp/pub/conf.announce/mva.94
* 429 785 /ftp/pub/conf.announce/openview.conf
* 429 104 /ftp/pub/conf.announce/high.performance.networking
* 400 217 /ftp/pub/conf.announce/nonlinear.signal.workshop
* 429 378 /ftp/pub/conf.announce/vision.interface.94
* 429 785 /ftp/pub/conf.announce/inet.94
* 429 104 /ftp/pub/conf.announce/icmcs.94
* 400 217 /ftp/pub/conf.announce/internetworking.94
* 371 220 /ftp/pub/conf.announce/iss.95
* 371 168 /ftp/pub/conf.announce/ges1
* 343 152 /ftp/pub/conf.announce/conti.94
* 343 247 /ftp/pub/conf.announce/elvira
Outline

• Background on IR

• InfoCrystal (Spoerri, 1993)

• TileBars (Hearst, 1995)

• Evaluation of a Tool for Visualization of Information Retrieval Results (Veerasamy & Belkin, 1996)
Background on IR

• Common approaches of text retrieval
  
  – Boolean term specification

    e.g. information retrieval AND (query language OR human factors)

  – Similarity search: vector space model, probabilistic models, and etc.

    Rank documents according to how close they are to the terms in the query
Functionalities of IR Visualization Systems

- Relationships between queries and retrieved documents
- Generating Boolean Queries
- Query terms distribution in the document
- Search support
- Keyword-based / Full text
- Frequency of query terms
- Transparency of Ranking
- Providing overview of query words in the document space
- Document length
Outline

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InfoCrystal Formation

- Shape coding
- Proximity coding
- Rank coding
- Color or texture coding
- Orientation coding
- Size or Brightness &saturation coding
InfoCrystal

Numbers indicate the amount of documents retrieved

Ranking vs. proximity principle

Users can select relationships by clicking icons

The threshold slider
Features of InfoCrystal

• A visualization tool and a visual query language

• Visualize all the possible discrete and continuous relationships among N concepts

• User can selectively emphasize the qualitative or the quantitative information

• Users can specify Boolean and vector-space queries graphically
Functionality Check

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- Generating Boolean Queries
- Query terms distribution in the document
- Search support
- Keyword-based / Full text
- Frequency of query terms
- Transparency of Ranking
- Providing overview of query words in the document space
- Document length
Critique

• Pros
  – Very smart idea
  – Nice comparison with relevant previous work

• Cons
  – No user studies to test the effectiveness of the visualization
  – Concentrate on the shortcomings all other systems
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TileBars

Three Term sets

Large rectangle indicates a document

Click on a tile to see the contents of the document.

Term frequency and distribution information is important for determining relevance.
Functionality Check

- Relationships between queries and retrieved documents
- Generating Boolean Queries
- Query terms distribution in the document
- Search support
- Keyword-based / Full text
- Frequency of query terms
- Transparency of Ranking
- Providing overview of query words in the document space
- Document length
Critique

• Pros
  – One of the first paper focused on long texts information access
  – Provides information on how different query facets overlap in different sections of a long document

• Cons
  – No user studies to test the effectiveness of the visualization
  – Good for long text retrieval, constrained by length
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Another IR Visualization
Metrics for Evaluation

• Test effectiveness, usability, and acceptability of the visualization tool

• Prediction: the visualization tool will make better decisions about which documents to look at than those without visualization

• Parameters:
  – # of documents saved per search (s-p-s)
  – Interactive trec precision (i-t-p)
  – Interactive user precision (i-u-p)
  – Precision of the search
Experiment 1

• 36 subjects, 3 groups
  – Group “with-out: with”
    • initial tutorial, 1\textsuperscript{st} search without visualization, intermediate tutorial, 2\textsuperscript{nd} search with visualization tool
  – Group with: with
  – Group without: without

• Results
  – No significant differences between any two groups in any of the four measures
Experiment 2

• 36 subjects, 2 groups
  – Group “viz”
  – Group “noviz”

• Results
  – Favor “viz” group, but not significant
  – One explanation: visualization of this sort is helpful for naïve searchers, but loses its effect when users become more experienced with the IR system
Critique

• Pros
  – Initial attempt to evaluate visualization tool for IR
  – Generate possible metrics for evaluation

• Cons
  – Many confounds in the experiment
  – No user feedback was reported
  – Did not state why the authors decided to choose the particular vis tool to evaluate
Conclusion

• How can we use visualization to help us to filter the huge information collection?

• What are the key features that make a IR visualization useful?

• How can we design better user studies to test these systems?

• Would the combination of IR visualization tools and IR intelligent agents be more powerful, and can assists users better?