Discussion on Web Search and Querying at SUM 2010

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Searching and Querying the Web

Before going to Toulouse, I would like to get some information about...

- A book on Claude Nougaro
- A biography of Claude Nougaro
- An autobiography of Claude Nougaro
- A book written by Claude Nougaro
- A book on the poetry of Claude Nougaro
- A songbook of Claude Nougaro
- ...

and I search the Web for finding some answers...

Searching and Querying the Web with Search Engines

The Web would not have been so successful without the existence of search engines, but many problems remains:

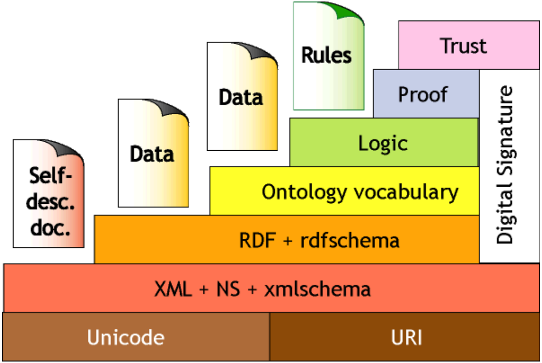
- High recall and low precision.
- Low or no recall.
- Results are highly sensitive to vocabulary.
- Results are (usually) single Web pages rather than classified Web pages, i.e. not really "information retrieval" but rather "location finding".
- The user must browse the result of a search for selecting the "correct" documents where to extract the requested information.
- Search engines are isolated applications.

Guiding Document Manipulation with Domain Knowledge

How to improve things?

- With explicit metadata and annotations: for being accessible and processable by software agents, the content of a document has to be explicitly represented as a structured description with an associated semantics.
- An intelligent manipulation of documents is based on the understanding of the content of the documents w.r.t. domain knowledge.
- In the context of Semantic Web, ontologies are set to play a key role in establishing a common terminology between software and human agents, thus ensuring that different agents have a shared understanding of terms.

The semantic Web "cake"



A Few Words about Ontologies

- In computer science, the term ontology refers to an engineering artifact which:
- constitutes a model of some part of the world,
- introduces a specific vocabulary and specifies relative meaning,
- is formalized within a knowledge representation language (e.g. description logics),
- is usually intended to provide a coherent view of a domain and to assist query answering, reasoning, and problem-solving.

Guiding Document Manipulation with Domain Knowledge

- Reasoning operations: subsumption and satisfiability within classification-based reasoning and case-based reasoning.
- Information extraction and information retrieval.
- Data mining and text mining for analyzing and classifying documents with respect to their content, and for ontology engineering.
- Methods for ontology engineering:
  (i) constructing an ontology manually,
  (ii) reusing existing ontologies (alignment),
  (iii) using semi-automatic methods based on KDD processes.

Elements for Discussion: Web search needs KDD, Knowledge Representation, and Reasoning

The KDD process is iterative, interactive, and guided by an analyst.

Data

↓ selection and preparation of data

↓ cleaning and formatting the data

Prepared data

↓ data mining operations

↓ numerical and symbolic methods

Discovered patterns

↓ interpretation / evaluation

↓ representation of discovered patterns

Knowledge units

↓

Knowledge systems (problem-solving, ontologies)

More Elements for Discussion

- How can we define Web Search and Querying?
  What do we expect from Web Search and Querying?
- Web Search applies on a very large collection of documents, actually an open universe, needing to pay attention to:
  - needs for a guided search
  - taking into account scalability: algorithms, data organization,
  - taking into account the open world

More Elements for Discussion

- Guided Search: ontologies and annotations for guiding and improving the search, representation of the document content,
- Scalability: efficient search algorithms (based on annotation or indexing), data classification through e.g. Formal Concept Analysis (FCA) for organizing data and the result of a search and then navigating this result (Web Clustering Engines).
- Open World: which kinds of problems are appearing and will have to be solved?
- Correctness, completeness, and precision of the answers.

Some elements for discussion w.r.t. four papers

- Semantic Web Search (d'Amato et al.): using standard Web Search engines with ontological background knowledge plus inductive reasoning for offline ontology compilation (guided search concerns)
- Dealing with Plethoric Answers (Bosc et al.): query-oriented cooperative systems for providing minimal sets of correct and useful answers by introducing predicates and fuzzy cardinalities (query answering and scalability concerns).
- Aggregate queries and aggregate constraints (Flesca et al.): computing range-consistent answers of aggregate queries with aggregate constraints (query answering and guided search concerns).
- Ontology matching (Wang et al.): structure-based similarity for improving ontology matching (ontology engineering concerns for guiding search).

Some other directions...

- Web clustering engines (Carpineto et al., ACM Computing Surveys, 2009)
- Semantic search using graph-structured semantic models for supporting search process (Tran - Haase - Studer, ICCS 2009)
- Semantic Wiki search (Haase et al. ESWC 2009)
- Ontology searching and querying with Swoogle, a “Metadata engine for the Semantic Web” (SHOE, SIRIO etc.).
- ...