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Exploring the knowledge in Semi Structured Data Sets with Rich Queries

Jürgen Umbrich
Sebastian Blohm

Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft

Universität Karlsruhe (TH)
Forschungsuniversität • gegründet 1825

Overview

- How to use a annotation engine to extract implicit knowledge encoded in semi structured data sets.
- How to discover, in a automatical way, relation patterns between concepts/categories.
- A framework with support for free text search combined with annotation search
- A user-interface, that hides the complexity of a structured query syntax from the end-user

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Motivation: (Semi-) Structured KBs

- Effort to manage unstructured information in (semi-) structured knowledge bases
  - Encyclopedias, like Wikipedia
  - ODP
- Information management is often maintained either manually and/or in a supervised manner.
- KB's reflect the “wisdom of the crowd” and cover a lot of different domains

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Challenges

- Current approaches to **access** information in semi structured KB
  - Keyword search interface
  - Exploring the data set by article and category links or facets

  -> Works well only for small and/or specific data sets
- Inability to incooporate **background knowledge** of users
  - Background knowledge about the domain
  - Knowledge about relations in the result pages

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Solution Approach:

- Accessing the KB via freetext search combinded with annotation search
  - By extracting implicit knowledge encoded in the KB like **categories and links** between articles,
  - By semantical grounding of extracted information with an ontology
- Support the background knowledge of end-users
  - By automatically extracted relation patterns from the knowledge base

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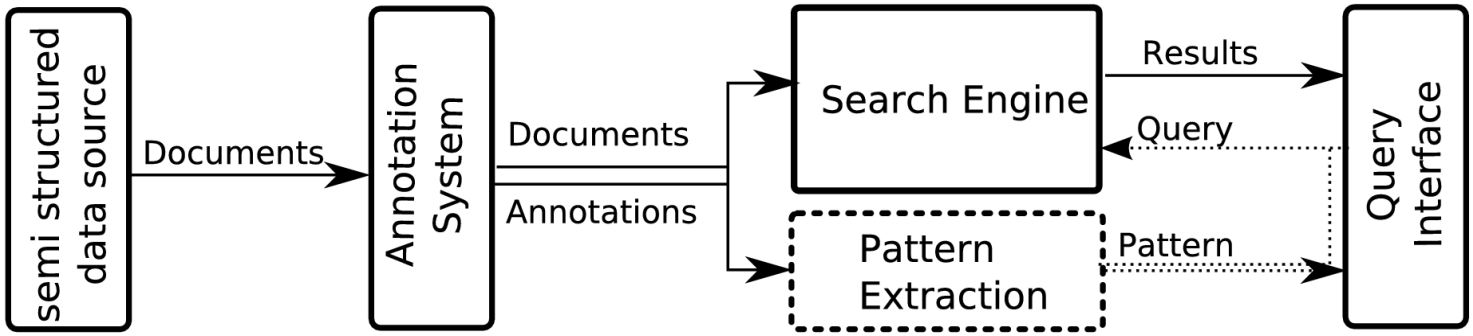
Solution Architecture: Overview



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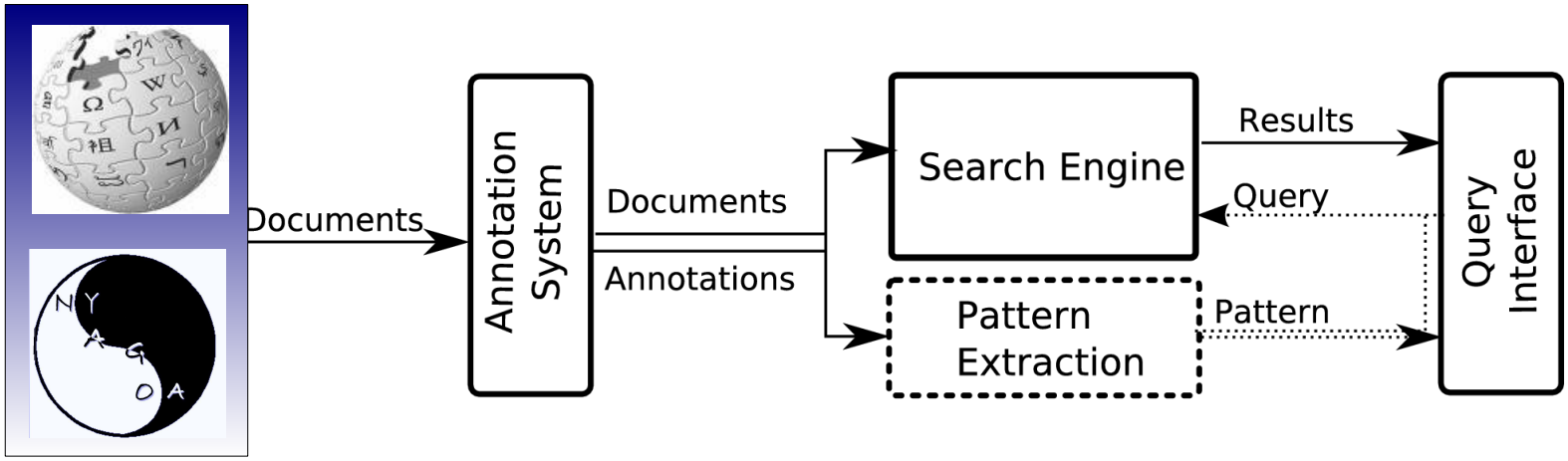
(Semi-)Structured Data Source



- A local **Wikipedia** dump (current from December 2006)
- Wikipedia categories semantically grounded with the **Yago ontology**
  - Mapping between Wikipedia categories and the Yago hierachy

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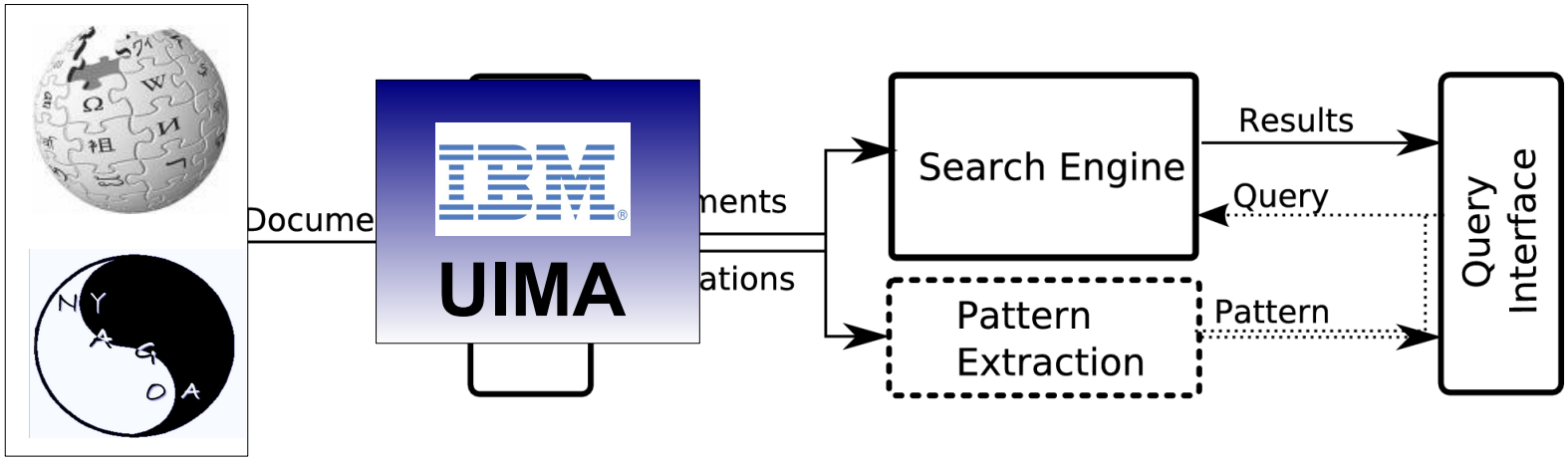
Annotation System (AS)



- Unstructured Information Managemen Architecture (UIMA)
- Open source Java framework (Sun Java version)
- Various text analysis engines (TAE) build from scratch
  - Sentence and paragraph splitters, tokenizer ,etc ...
- Easy developement of own TAE (in Java)
  - e.g. a simple data annotator or Wikipedia to Yago category mapping

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(AS) Article Annotations

Wikipedia article of "Karl Steinbuch"

- Semantically enriched annotations
  - Utilising the Yago ontology
  - Each wikipedia category is modelled as a hierachy of yago categories e.g. German_computer_scientist ->... -> scientist ->... -> person

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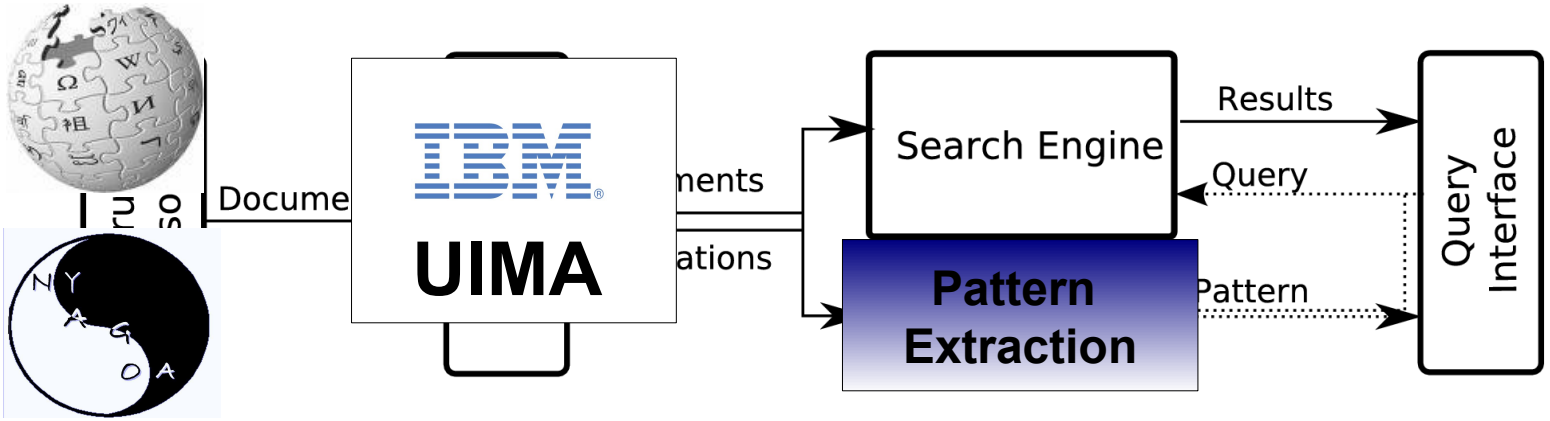
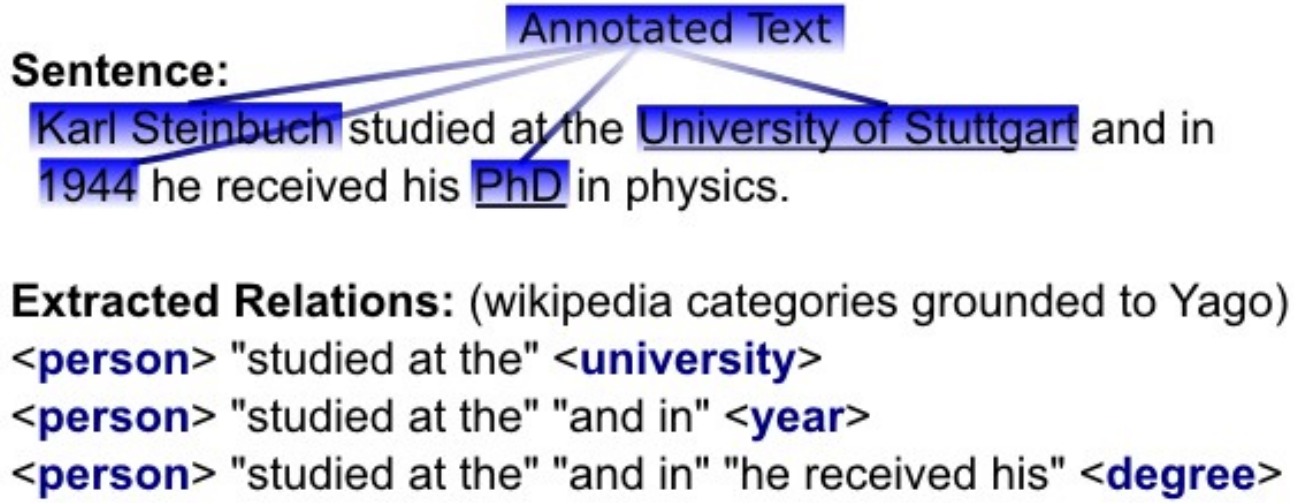


Relation Pattern Extraction
Semi - semantic relation patterns



- Extracting relation between wikipedia categories and their respective Yago categories
  - In sentences and paragraphs
- Relation patterns support query creation in the UI

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Crawling - Indexing - Searching

- Integrates UIMA (Version 1.4 , current published Version is 2.x)
- Query functionality to combine text with annotation search
- XML-Fragment or Xpath Syntax

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End-User Interface

- Hides the compexity of the underlying query syntax
- Two query creation modes (Simple and Advanced)
- Uses know query concepts (e.g. Textfield and DropDown menu)
- Implementation in Java Swing

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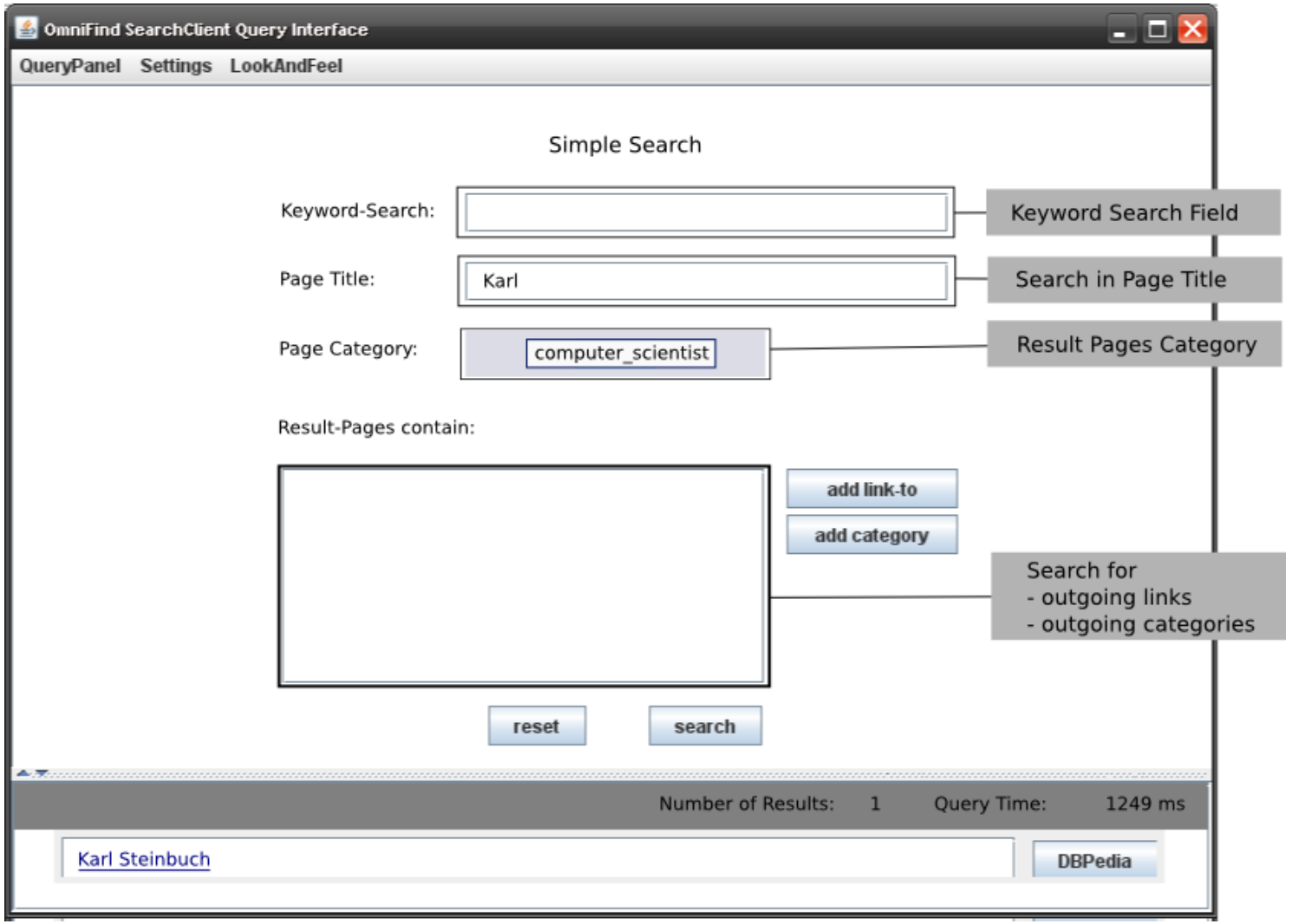
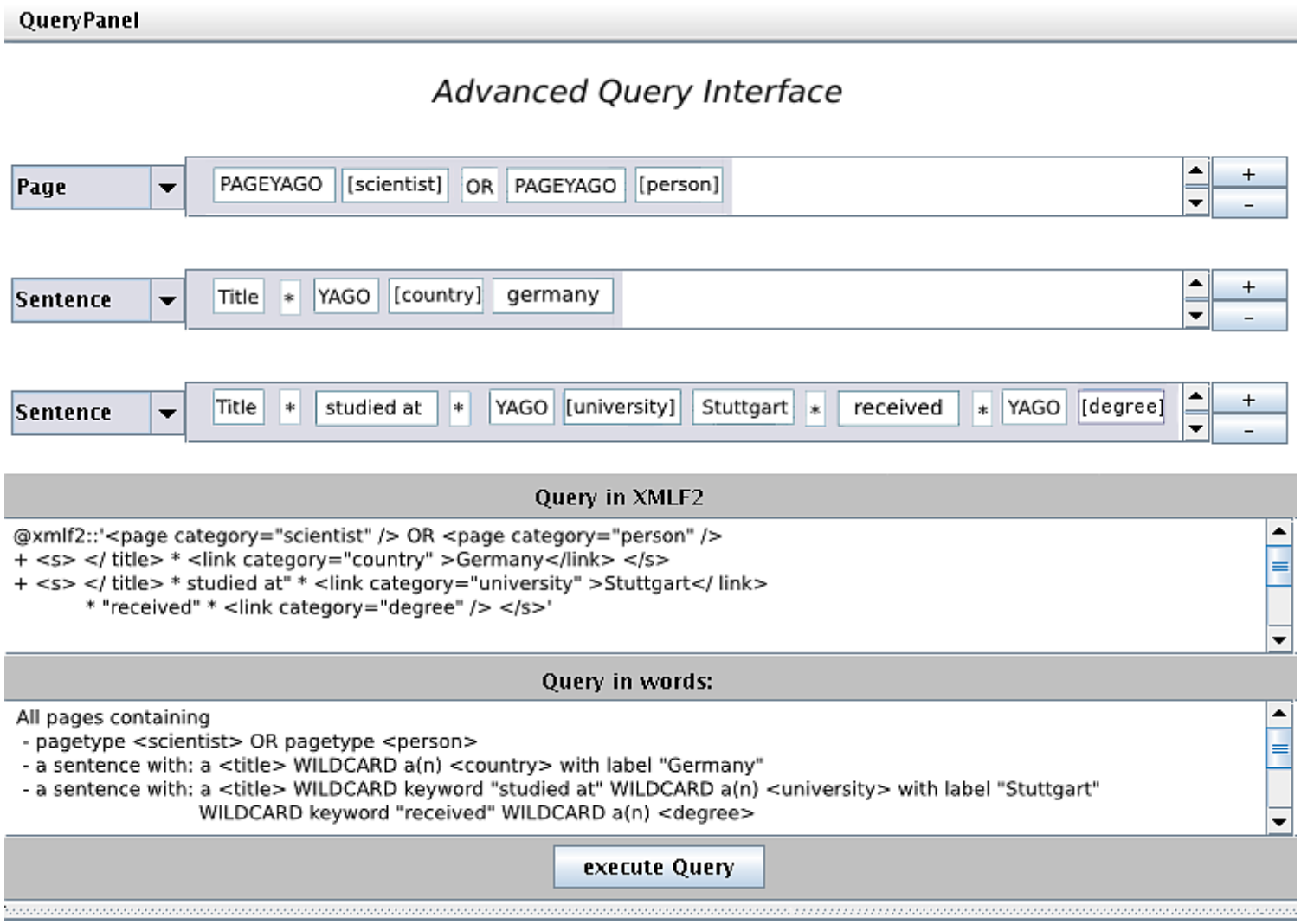
User Interface: Simpe Mode



User Interface: Advanced Mode



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Conclusion

- Automatical extraction of (semi) semantic relation patterns from semi structured KB
  - Using text information extraction tools
- Explore and query semi structured KB's with a combination of freetext and annotation search
  - Document or entity centric search
  - Instance and/or concept search

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Future Work

- Evaluation of the architecture
  - Annotation time (current measures: ~3sec/doc)
  - Indexing time/size
  - Query time related to query complexity
- Automatical discovery of semantic relation patterns (SRP)
  - e.g. *[concept:person] [relation:studiedAt] [concept:university]*
  - Automatically build a concept-relation ontology based on the Wikipedia corpus
- Extending UI interoperability capabilities
  - Support the UI with semantic relation patterns

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Questions?

- **Contact**
  juergen@umbrich.net
  blohm@aifb.uni-karlsruhe.de

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X-MEDIA

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Article Annotations

- Annotate Wikipedia articles by
  - Title and title occurences in the article
  - Article categories
  - Links, link title and link categories
  - Date information from various date formats
- Annotation semantically grounded with the Yago ontology
  - Each wikipedia category is modelled as a hierachy of yago categories
    e.g. american_tennis_player -> player -> person -> causal_agent

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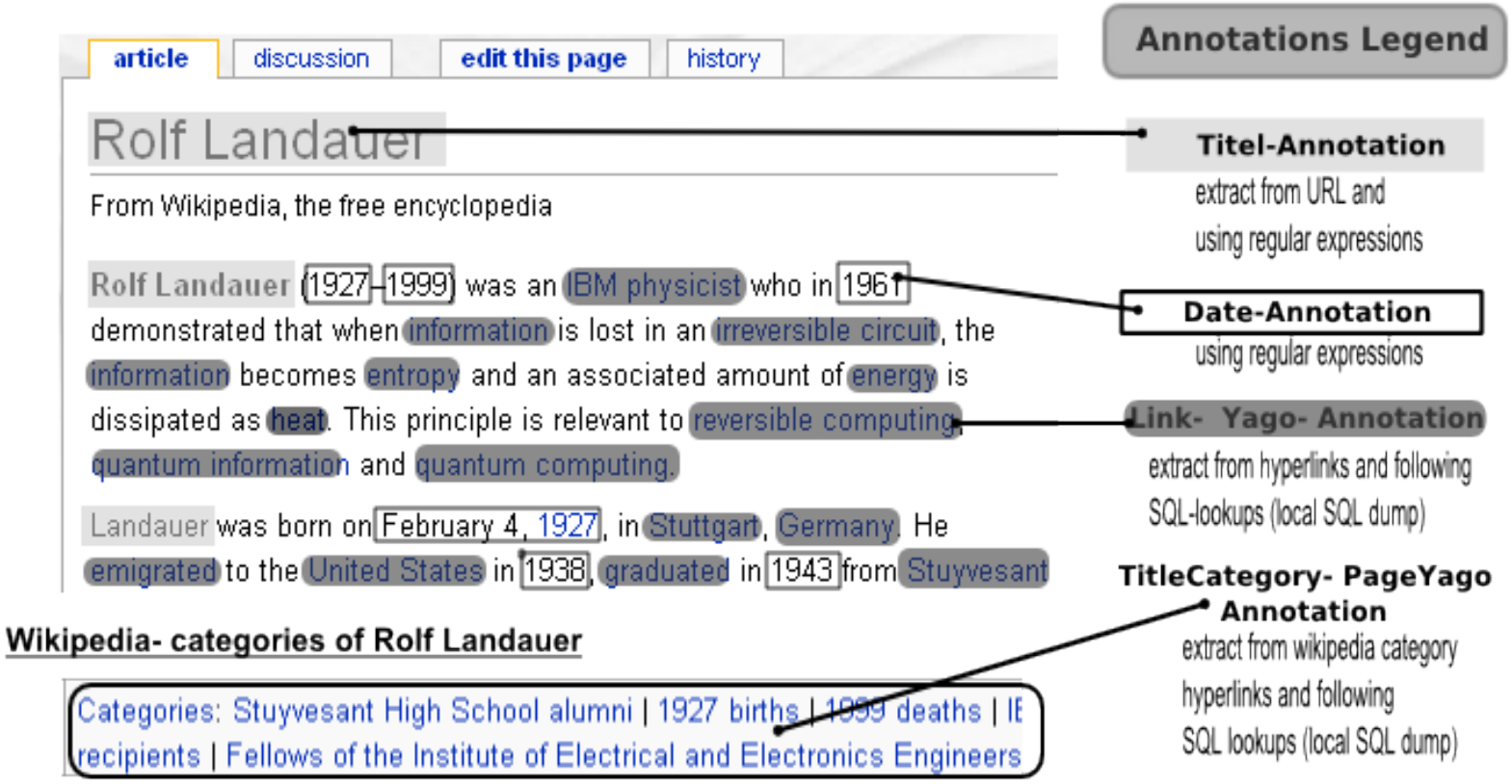
Sample: Annotated Wikipedia article



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OmniFind: Query Syntax

- XML-Fragment or Xpath Syntax
- Access to the KB: API or User-Interface
- Sample Query

```
@xmlf2::'
  <page category="scientist" /> OR <page category="person" />
  + <sentence>
        </title> * "born in" * <link category="country">Germany</link>
     </sentence>
  + <sentence>
        </title> * "studied at" * <link category="University"/>
        * <link category="city">Karlsruhe</link>
        * "received" * <link category="Degree"/>
  </sentence>
'
```


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