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Database
Research
Group

Search-As-You-Type in Forms:

Leveraging the Usability and the Functionality of Search Paradigm in Relational Databases

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Motivation

Problem Statement

Challenges

Initial Achievements

Conclusions

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Motivation

- Relational databases are widely used.
- There are many search paradigms:
  - Structured Query Language (SQL)
  - Keyword Search (KS)
  - Query-By-Example (QBE)
- Different search paradigms are needed by different users.

Motivation

#1: SQL is complex.

```
SELECT *
FROM   Author A, Autor_Paper AP, Paper P
WHERE  title   LIKE 'keyword' AND
       title   LIKE 'search'  AND
       authors LIKE 'g%'      AND
       A.id    =    AP.aid    AND
       P.id    =    AP.pid
```

Motivation

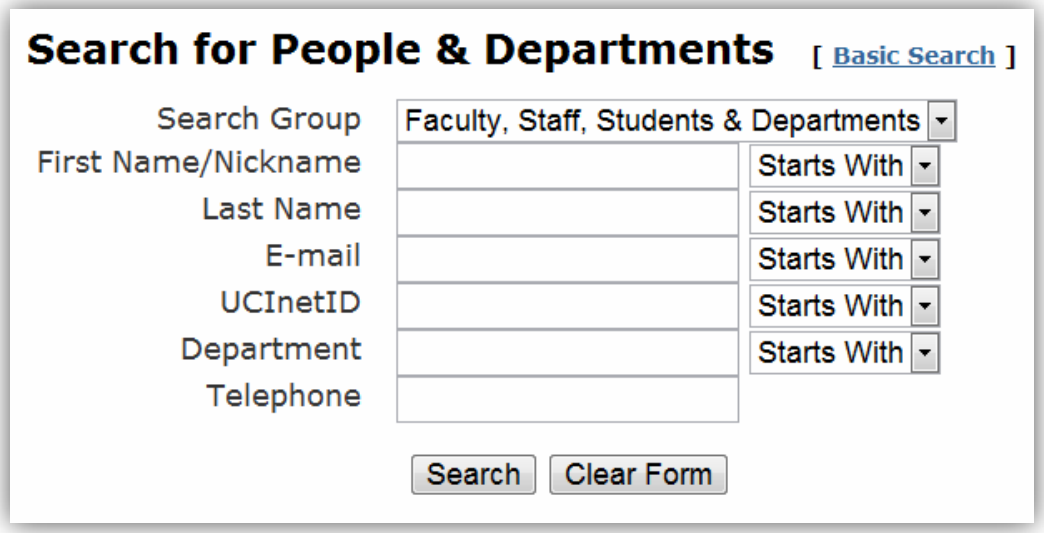
#2: Traditional keyword search is imprecise.

keyword search g 

Title? Conf. name? Author name?

Motivation

#3: Form is awkward.



UCI Directory: http://directory.uci.edu/index.php?form_type=advanced_search

Motivation

#4: The "Search" button is not convenient.

Motivation

Keyword Search

\+ Form-Style Interface

\+ Search-as-you-type

= Seaform

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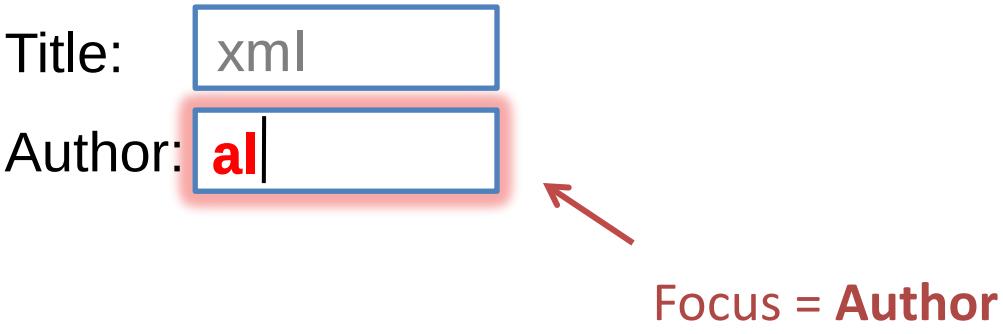
Problem Statement

- Data:
  - Single relational table.
  - Several searchable attributes.

ID	Title	Conf.	Author
1	xml database	VLDB	albert
2	xml database	SIGMOD	bob
3	xml search	VLDB	albert
4	xml security	VLDB	alice
5	rdbms	SIGMOD	charlie

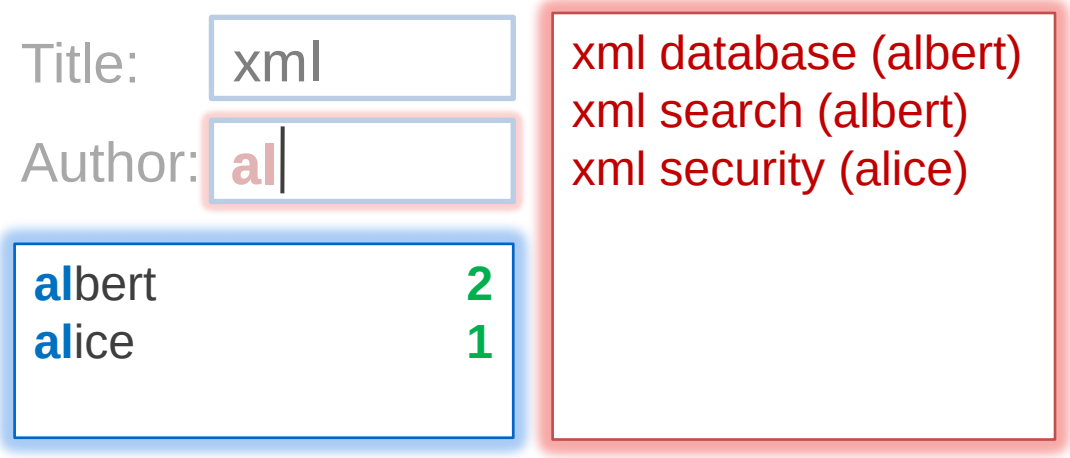
Problem Statement

- Query:
  - A set of keywords (prefixes) split by fields.
  - A focus indicator.



Problem Statement

- Results:
  - Global results: corresponding tuples.
  - Local results: corresponding attribute values.
  - Aggregations.



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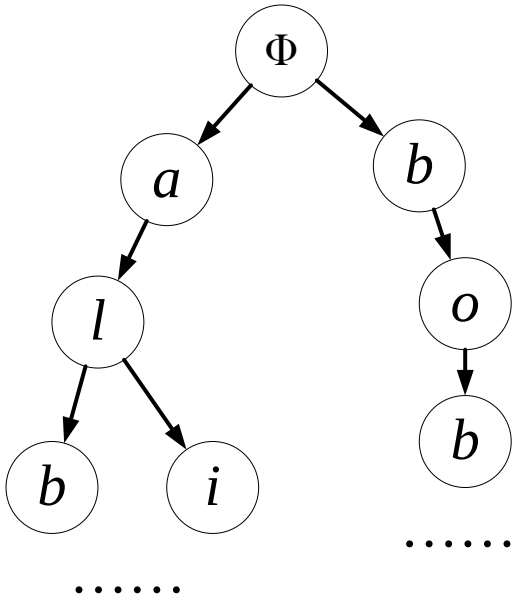
Challenges: Search-As-You-Type

- Prefix matching:
  - E.g. al → albert, alice, …
    Trie structure w/ cache.
- Fast response:
  - Synchronization of local results and global results yields heavy computational cost.
    On-demand synchronization and dual-list trie.



Challenges: Error Tolerance

- Misplacing of keywords:
  - E.g. input "albert" into the **Title** input box.
    Automatic query refinement (given a query, how can we modify it to obtain more results?)
    Large search space; rely on precise estimation and probabilistic model.
- Fuzzy matching:
  - E.g. input "albrt" instead of "albert".
    Edit-distance computation on trie structure.
    Ranking issue of local results: should local results be sorted by edit-distance, or by aggregation values?

Challenges: Scalability

- Handle large-scale databases:
  - There are large number of tuples.
    1) Top-k algorithm
    Precise aggregation is impossible in this case.
    2) Using RDBMS itself
    Index structure should be redesigned for DBMS; performance issues.
- Handle multiple tables:
  - Data are regularized to several tables.
    Generalize the single-table local-global computation and reduce on-the-fly joins using pre-joined tables.
    It is hard to determine which tables are the most necessary to pre-join; extra storage cost.

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Initial Achievements

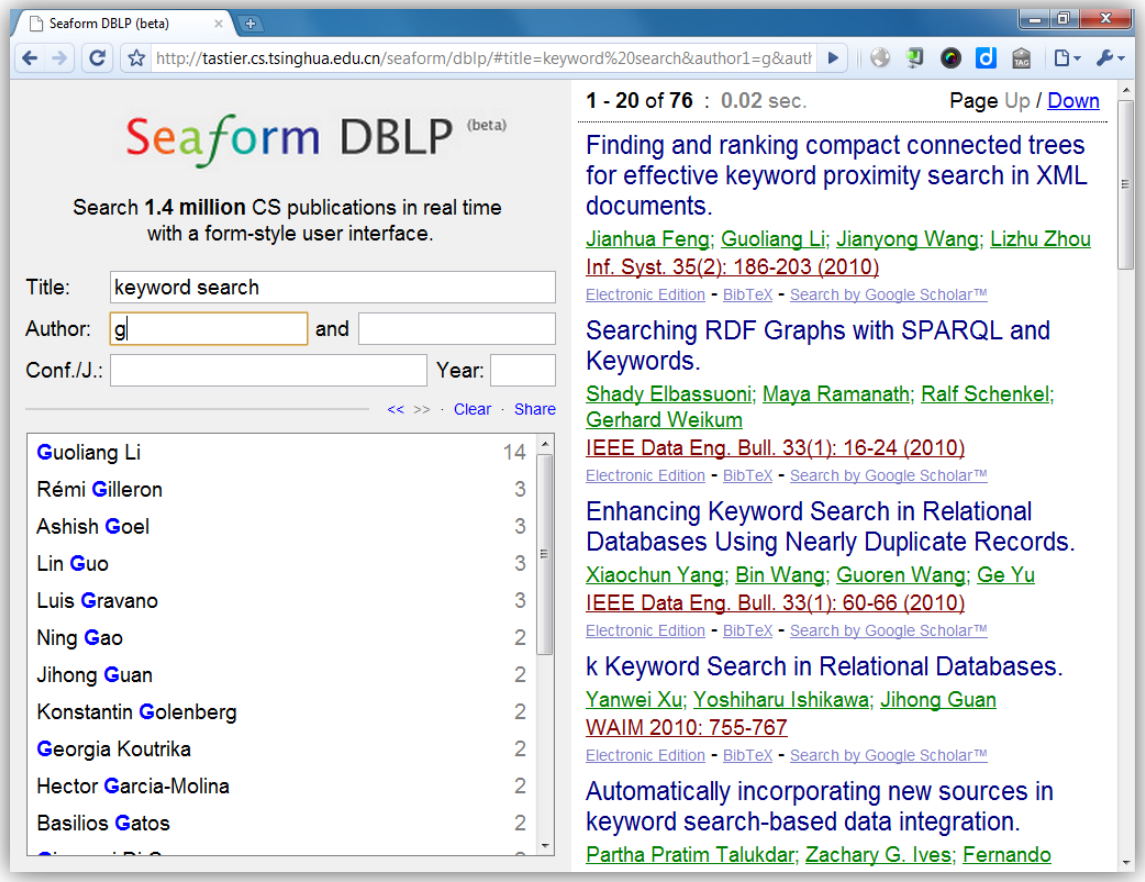
Seaform-DBLP

Features:

- Single table.
- Prefix matching.
- Average response time is less than 30 ms.

Limitations:

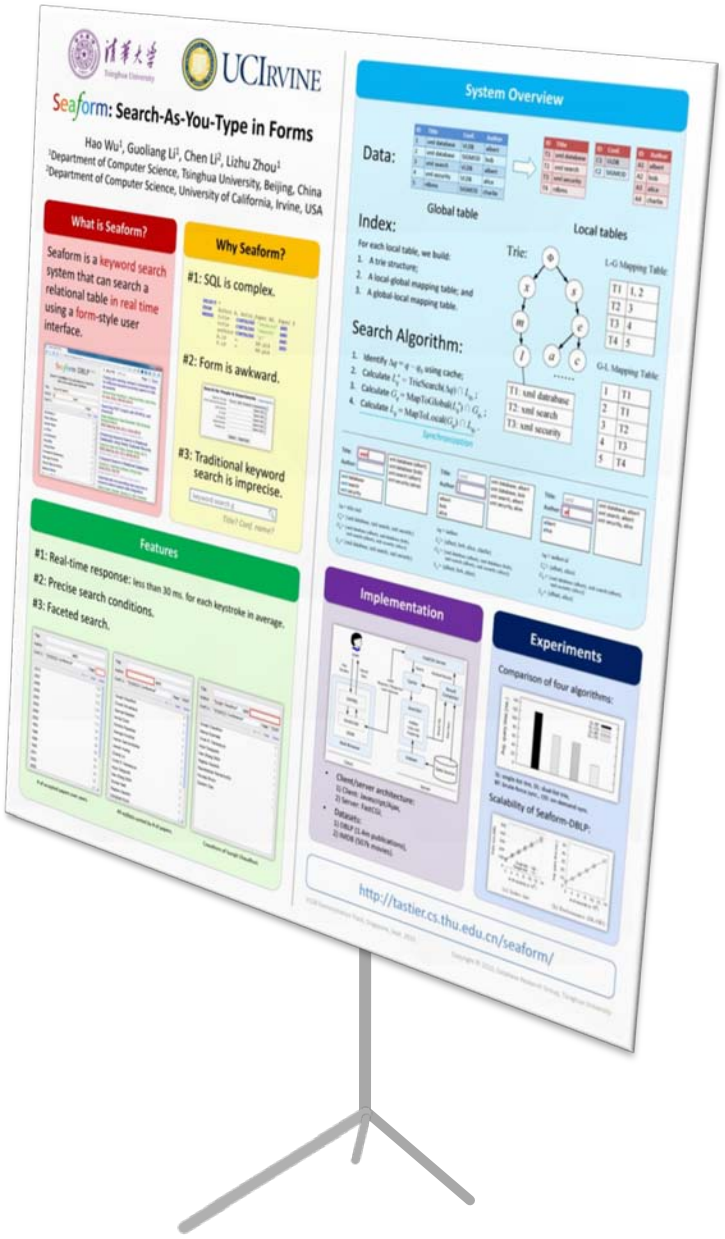
- Does not tolerate errors.
- Non-top-k, i.e. it returns all matching results.
- Memory-resident.



Demonstrations:

2 Sept. 14, Tuesday
14:00 to 15:30

5 Sept. 15, Wednesday
14:00 to 15:30



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Conclusions

- Search-as-you-type with form is a good choice to balance the usability and functionality.
- There are still many problems to solve:
  - More effective index other than *trie + inverted lists*.
  - Support error tolerance.
  - Native DBMS support.
  - Top-k algorithms.
  - Pre-join (materialize) tables.
  - …

Thanks

http://tastier.cs.thu.edu.cn/seaform/

My homepage: http://dbgroup.cs.thu.edu.cn/wuhao/