FACULDADE DE CIÊNCIAS UNIVERSIDADE DE LISBOA

Experiments with Semantic-f avored Query Reformulation of Geo-Temporal Queries

Nuno Cardoso[1] and Mário J. Silva[2]

[1] Universidade de Lisboa, Faculdade de Ciências, Laboratório LaSIGE, Lisbon. Portugal and SINTEF Natural Language Technologies Group, SINTEF ICT, Oslo, Norway

[2] Universidade de Lisboa, Faculdade de Ciências, Laboratório LaSIGE, Lisbon, Portugal

ncardoso@xldb.di.fc.ul.pt, mjs@di.fc.ul.pt

XLDB GReaSE SINTEF Natural Language Technologies Group POS_Conhecimento Programa Operacional Sociedade do Conhecimento União Europeia FEDER UMIC Agência para a Sociedade do Conhecimento FCCN Fundação para a Computação Científica Nacional

NTCIR-8 GeoTemporal task – 15-18th June, 2010 - Tokyo, Japan

Overview

1. PhD motivation
2. Objectives
3. System overview
4. Experiments and results
5. Lessons learned and conclusions

PhD motivation

- Simple queries work well with simple IR systems (term-match based document retrieval)
- What about complex queries?
- Current query expansion (QE) methods help...

  More terms → matching odds increased → better retrieval results

- … but sometimes not.

  Bad selection of terms → drift from initial topic → noisy results

PhD motivation (cont.)

- Most queries have *entities*, and entities have semantic information.
- Statistics-based QE works at term level. Reasoning-based QE requires working at entity level, where its semantic role is grounded.

PhD motivation (cont.)

- Why don't we try to understand what the user want, instead of retrieving what the user said?
- Why don't we reason to get answers instead of guessing terms?
- Is there a better approach for elaborated queries, such as queries with concrete geographic and temporal scopes?

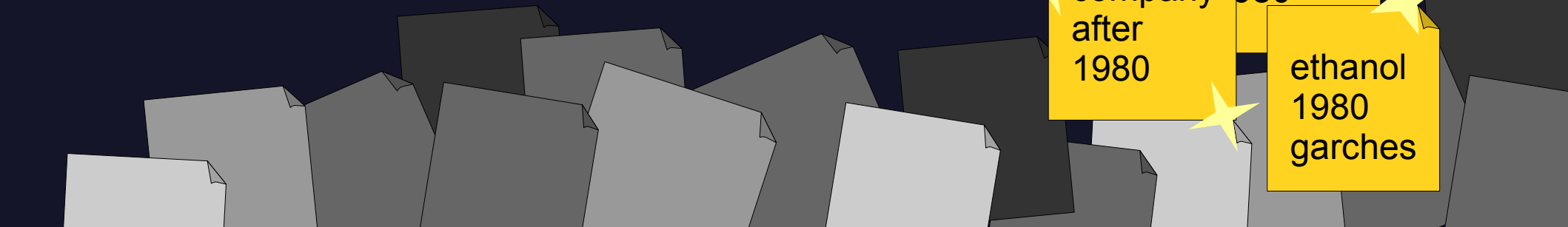
Statistics-based Query Expansion

"Companies founded in California after 1980"

Query Expansion using blind relevance feedback (BRF)

terms in cloud obtained with LucQE using the NYT collection

1980 founded california companies ethanol landau gallery angeles garches los carter pacific felix moores austria carters center artists rhalter nebinger his0homu

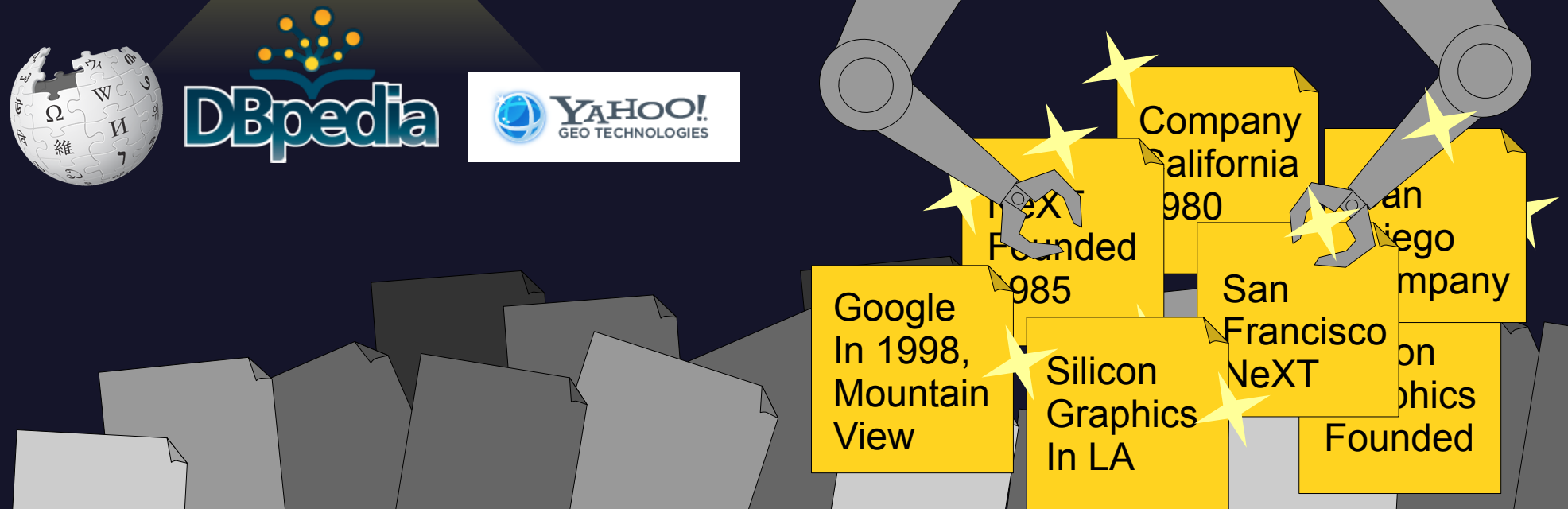


Semantic-based Query Reformulation

"Companies founded in California after 1980"

Semantic-based Query reformulation

Entities: California , 1980
Gescope: in California
Geographic places: California (state)
Time scope: after 1980
Timeline: [1980 ,...[
Subject: http://dbpedia.org/ontology/Company
Condition: formationYear, foundationPlace
Answers: NeXT, Silicon Graphics,...



PhD objectives

- Build a semantically-flavored query reformulation (SQR) approach, using external knowledge resources and reasoning approaches to reformulate queries at entity level.
- Evaluate how suitable is a SQR approach on retrieving documents for geographically-challenging queries.

That's where NTCIR GeoTemporal task comes in...

System overview

1. Detect and ground entities in user queries and in the *whole* document collection

   - requires a named entity recognition (NER) software.

2. Use external knowledge bases (Wikipedia, DBpedia, geographic ontologies) to access more information about entities.

System overview

3. Index terms and semantic information (NEs, entities, places and time expressions)

4. Extend a retrieval engine to cope with term / semantic indexes, reformulate queries to use against those indexes

contents:companies contents:founded
contents:California ne-LOCAL:'California'
entity:California woeid:2347563 contents:after
contents:1980 time:198* ne-ORGANIZATION:'NeXT'
entity:NeXT ne-ORGANIZATION:'Silicon Graphics'
entity:Silicon_Graphics ne-ORGANIZATION:
'Salesforce.com' entity:Salesforce.com

Query Parsing example

“ Where and when did Astrid Lindgren die ? ”

Question type:
Where ,When
Expected answer types: PLACE, TIME

NE: Person
Entity: http://dbpedia.org/resource/Astrid_Lindgren
rdf:label – “Astrid Lindgren”@pt
"アストリッド・リンドグレーン” @jp

Property:
http://dbpedia.org/ontology/deathPlace
http://dbpedia.org/ontology/deathDate

About: Astrid Lindgren
An Entity of Type : person, from Named Graph : http://dbpedia.org, within Data Space : dbpedia.org

DBpedia

アストリッド・リンドグレーン（Astrid Lindgren,1907年11月14日 - 2002年1月28日）は、スウェーデンの児童書の編集者で、同時に児童文学作家でもある。彼女の著書は、世界の70ヶ国語以上に翻訳され、100以上の国で出版されている。

SPARQL query to DBpedia:

```
SELECT ?place, ?date where {
  dbpedia:Astrid_Lindgren
     dbpedia-owl:deathPlace?place .
  dbpedia:Astrid_Lindgren
     dbpedia-owl:deathDate?date .
}
```

Place: http://dbpedia.org/resource/Stockholm

Date: 2002-01-28

Query Parsing example

“ japanese animators | born in | Tokyo ”

DBpedia resource:
http://dbpedia.org/resource/Category:Japanese_animators

NE: Place
Entity: http://dbpedia.org/resource/Tokyo

Question type:
none (→ Which)

Expected answer type:
“japanese animators”

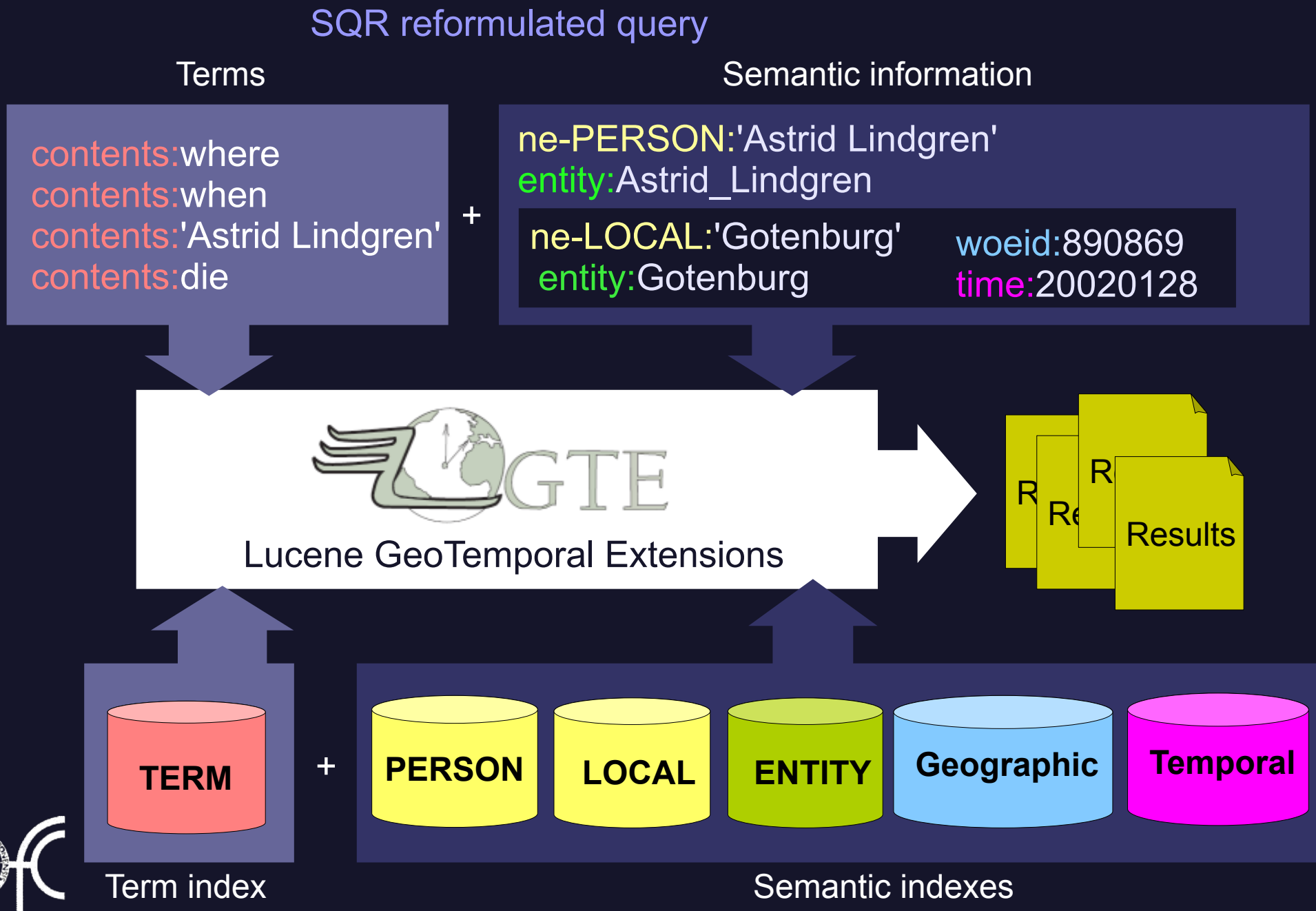
Property:
http://dbpedia.org/ontology/birthPlace

SPARQL query to DBpedia:

```
select ?s where {
 { ?s skos:subject
   dbpedia:Category:Japanese_animators
 } UNION { ?s skos:subject ?category .
   ?category skos:broader
   dbpedia:Category:Japanese_animators
 }
 ?s dbpedia-owl:birthPlace dbpedia:Tokyo .
}
```

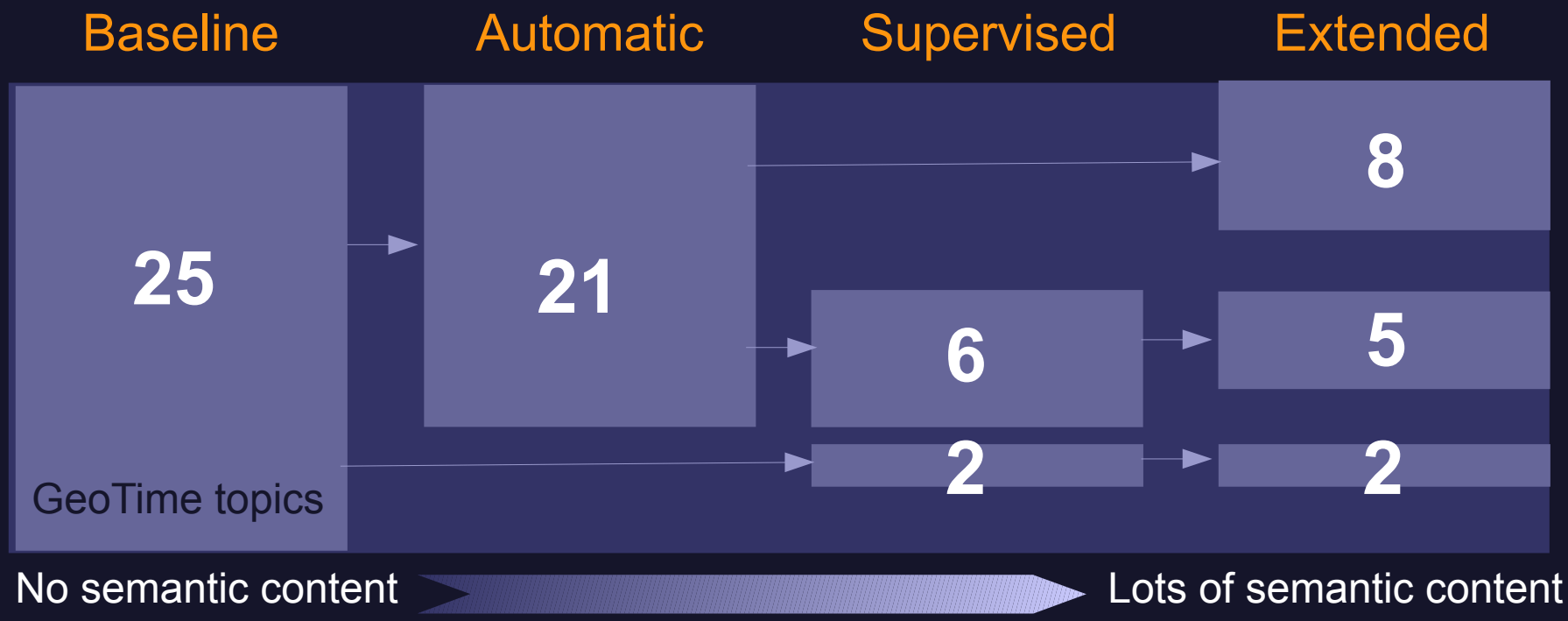
http://dbpedia.org/resource/Hayao_Miyazaki
http://dbpedia.org/resource/Shinji_Higuchi
http://dbpedia.org/resource/Kihachir%C5%8D_Kawamoto

Document retrieval example



GeoTime experiments (EN only)

1. Baseline run, plain terms with no expansion
2. Automatic run, with DBpedia ontology lookup
3. Supervised run, with DBpedia ontology lookup
4. Extended run, with DBpedia abstract entities



Queries accumulate more semantic information from 1 to 4

Query reformulation example

hurricane katrina make landfall united states ne-LOCAL-HUMANO-PAIS-index:"United States" woeid-index:23424977 ne-EVENT-index:"Hurricane Katrina" ne-LOCAL-FISICO-AGUAMASSA-index:"Atlantic Ocean" ne-LOCAL-HUMANO-PAIS-index:"Bahamas" ne-LOCAL-FISICO-ILHA-index:"Bahamas" ne-LOCAL-HUMANO-DIVISAO-index:Florida ne-LOCAL-HUMANO-DIVISAO-index:Louisiana ne-LOCAL-FISICO-REGIAO-index:Gulf ne-LOCAL-HUMANO-DIVISAO-index:Texas ne-LOCAL-HUMANO-DIVISAO-index:"New Orleans" woeid-index:55959709 woeid-index:23424758 woeid-index:55959686 woeid-index:2347577 woeid.index:2347602 woeid-index:615134 tg-index:20050830 tg-index:20050823

Added in Baseline run

Added in Automatic run

Added in Supervised run

Added in Extended run

NYT 2002-2005 collectionn (EN)

Nr of **documents**	315,371
Nr of **NEs**	17,952,142
Nr of **classifications** assigned for **NEs**	18,364,572
Nr of classifications grounded to **entities**	3,344,235
Nr of classifications grounded do a **place**	588,621
Nr of docs with **geographic places**	202,624 (64%)
Nr of docs with **temporal expressions**	70,403 (22%)

Official results

Run	mean AP
1. Baseline	0.3301
2. Automatic	**0.3354**
3. Supervised	0.3255
4. Extended	0.2978

GeoTime best: 0.4158

- Only topic title
- No entity index at the time
- No stemming, 1:1 term:semantic index weight

Post-hoc experiments

- Prefer entity index to NE index
- Stemming, different term:semantic index weights
- Compare/combine BRF and SQR

1. Baseline run, term index, no expansion
2. BRF run, term index, BRF expansion
3. SQR runs, term + semantic, SQR expansion
4. BRF+SQR runs, term + semantic, BRF expanded terms + SQR expanded semantic content

Post-hoc results

MAP values (trec_eval)		no BRF	With BRF
no SQR		0.3418	0.3246
SQR	1:1	0.2869	0.2631
	2:1	0.3289	0.2958
	5:1	**0.3441**	0.3157
	10:1	0.3439	0.3269
	100:1	0.3415	0.3204
	1000:1	0.3379	0.3183

XLDB official best: 0.3354

GeoTime best: 0.4158

Lessons learned

- Baselines performed well, subjects were much more important than geoscopes or timescopes
  - references to Astrid Lindgren only about her death...
- No control over term:semantic index weights → recipe for disaster
  - more semantic information means more indexes used on retrieval
  - summing partial scores from multiple indexes with BM25 unbalances retrieval focus
  - Best term:semantic ratios around 5:1

Conclusions

- Semantic query reformulation can achieve good retrieval performances for geographic and temporal-flavoured queries
- Reasoning answers to add entities is hard, but grounding entities and detecting their roles is easier and very important for document ranking
- Mixing term and semantic indexes must be done carefully: untuned index weights may bias retrieval

The end

Questions?

Experiments with Semantic-f avored Query Reformulation of Geo-Temporal Queries

Nuno Cardoso[1] and Mário J. Silva[2]

[1] Universidade de Lisboa, Faculdade de Ciências, Laboratório LaSIGE, Lisbon. Portugal and SINTEF Natural Language Technologies Group, SINTEF ICT, Oslo, Norway

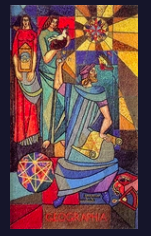
[2] Universidade de Lisboa, Faculdade de Ciências, Laboratório LaSIGE, Lisbon, Portugal

ncardoso@xldb.di.fc.ul.pt, mjs@di.fc.ul.pt

FACULDADE·DE·CIÊNCIAS UNIVERSIDADE·DE·LISBOA

SINTEF Natural Language Technologies Group

XLDB



GReaSE

Prototype snapshots

REMBRANDT

Português | English

Search

Home > REMBRANDT Web Service > RENOIR QA service

RENOIR beta

forest fires in Portugal

Suggestions

Search

User: Nuno Cardoso

Collection: New York Times 2002-2005

Advanced search >>

Portugal ⊗

Results 1 - 10 of 8935 for **forest fires in Portugal**. More info >>

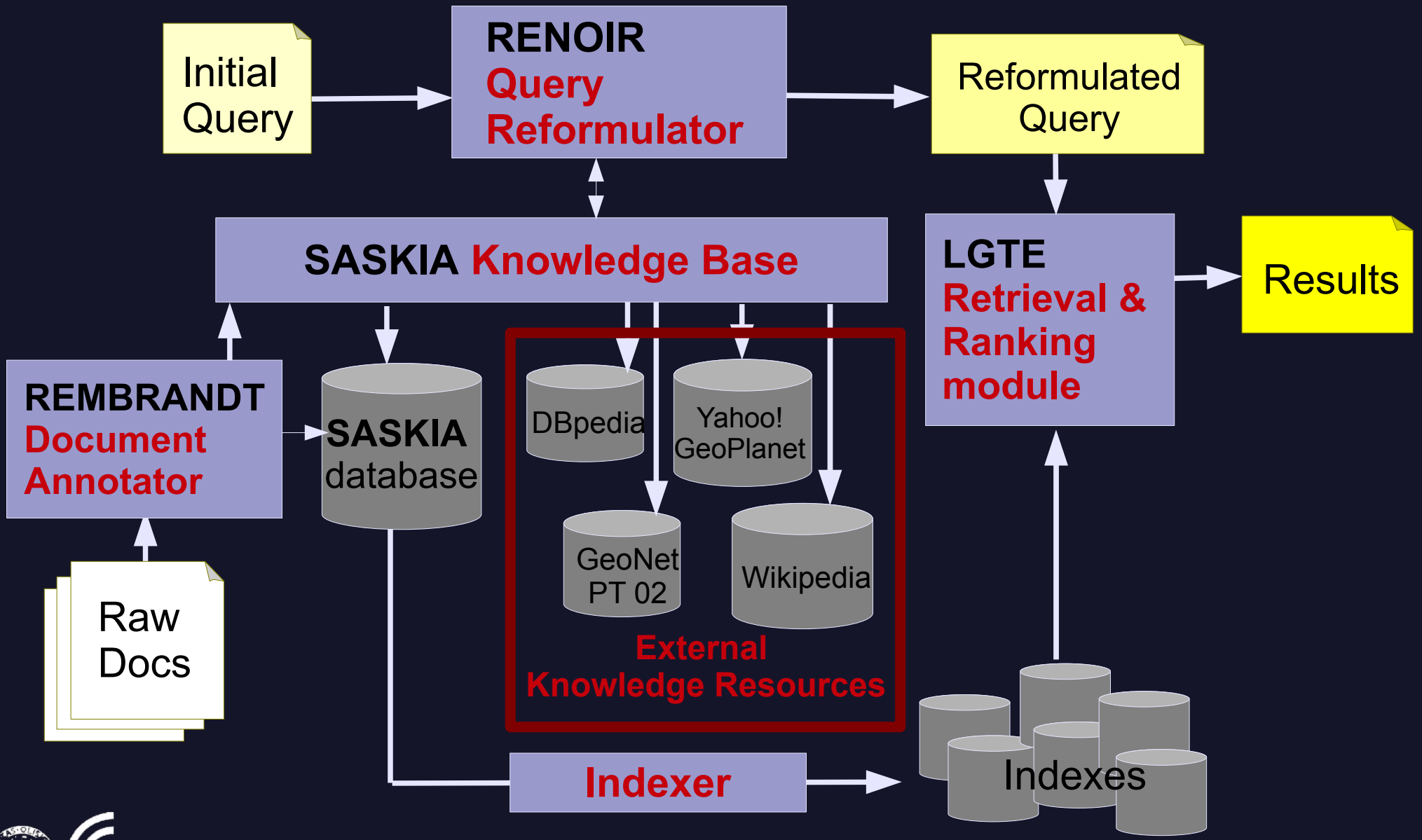
Results

1 NEW FOREST MANAGEMENT RULES DRAW PRAISE AND CRITICISM
the nation 's 155 national forests and making it easier for regional **forest** managers to decide whether(...) **forest** and grasslands . They also cut back on requirements for public participation in **forest** planning decisions . **Forest** Service officials said the rules are designed to give local foresters more(...) foresters see as a legal and regulatory gridlock that has delayed **forest** plans for years because(...) want the **forest** to look and be in the future , " said Rick D. Cables , the **Forest** Service
3KB - 2004-12-22 | Show | Details | More info

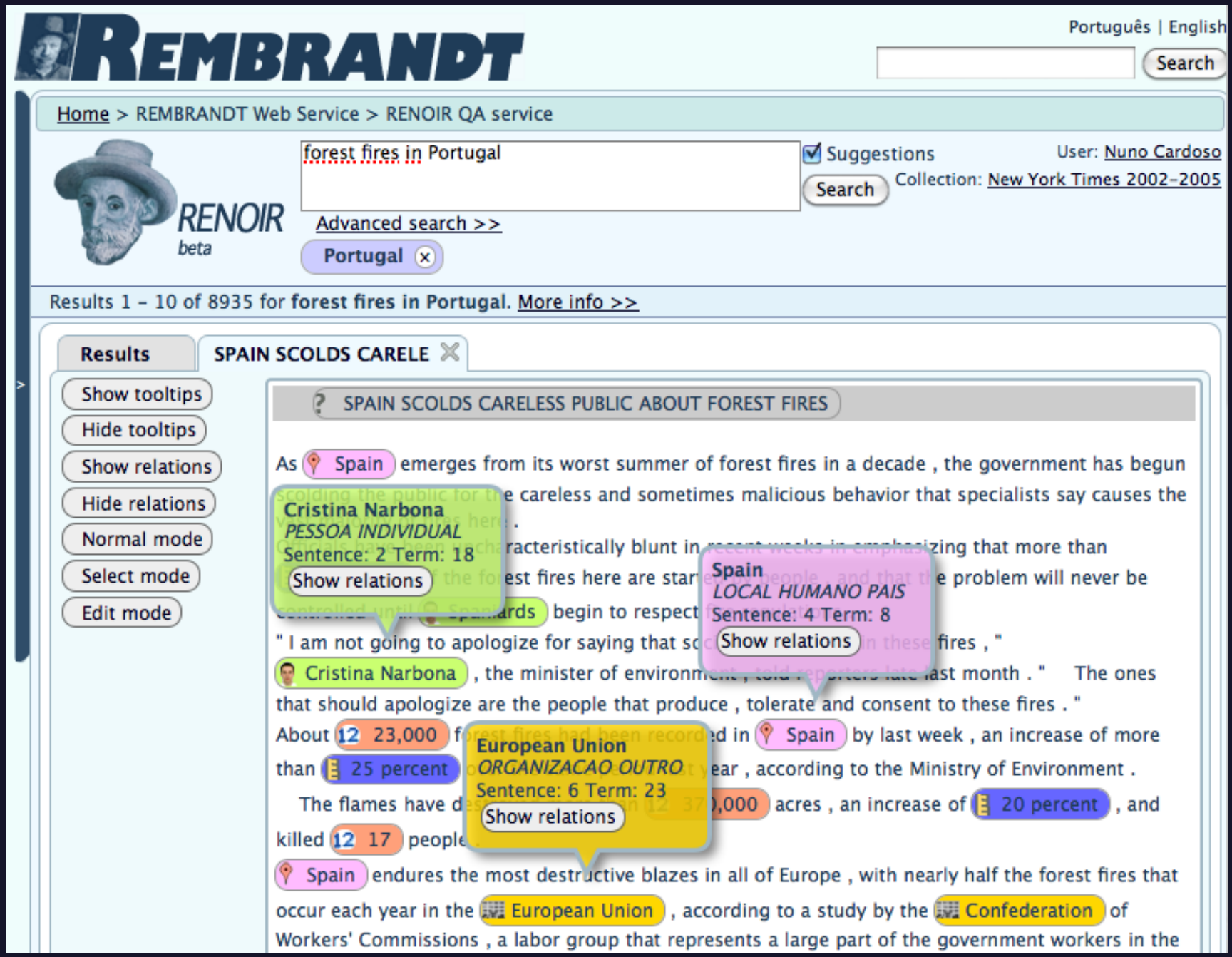
2 FOREST DISSERVICE (FOR USE
FOREST DISSERVICEUNTIL NOW , both national forests in New England have held the line against the all-terrain vehicles that chew up the **forest** floor , speed erosion , spread invasive species(...) **Forest** in New Hampshire and Maine maintains the ban on ATVs . But the recently released draft plan for the Green Mountain National **Forest** in Vermont foresees letting ATV owners cross national **forest** land on " corridors " connecting with a larger trail system outside the national **forest** . National
5KB - 2005-04-24 | Show | Details | More info

3 AFTER THE STORMS CLEARING OF FOREST READY TO RESUME
new plant growth and renewal . A lack of **fires** in the **forest** created a dense canopy that allowed relatively little sunlight to reach the **forest** floor , discouraging many plants from growing(...) habitat at Lake Wales Ridge State **Forest** . Now , those plans are back on track . A salvage logging operation to remove large trees from the floor of the 26,488-acre state **forest** in eastern Polk County(...) so **forest** visitors will know what to expect . Signs will alert visitors to what 's happening . " We

GIR Architecture



Prototype snapshots



Prototype snapshots