Cross-lingual Ontology Alignment using EuroWordNet and Wikipedia

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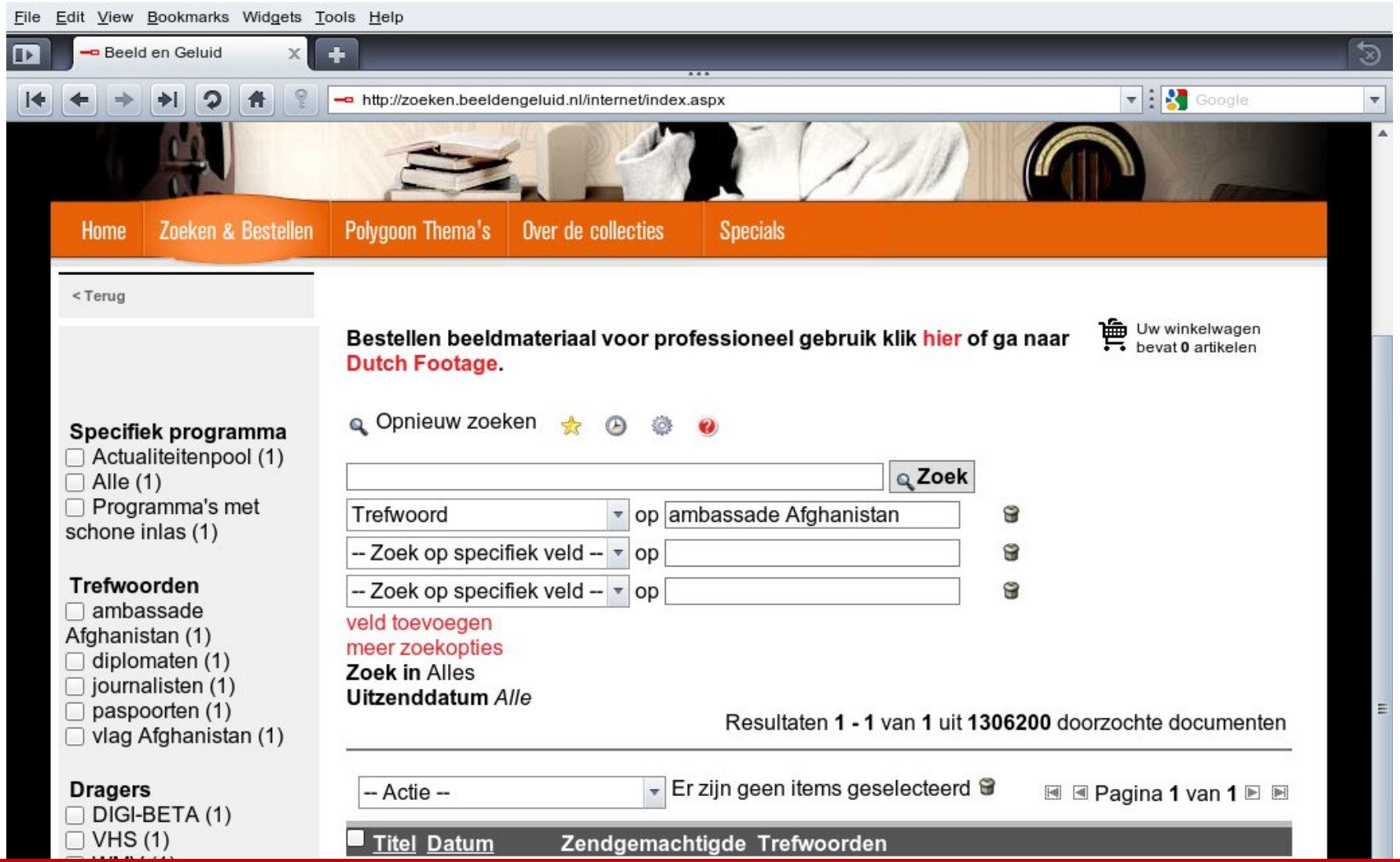
LREC 2010

Searching multimedia archive



Multilingual Access

GTAA Thesaurus

- Dutch Institute for Sound and Vision
- archives tv and radio fragments
- Indexed by thesaurus keywords
- subject (3,887), location (13,992), person (97,617), organizations and misc (27,104)

Multilingual Access: How to support users not fluent in Dutch?

- Provide English keywords
  - Using terms from English WordNet
  - Using terms from English Wikipedia

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Cross-lingual Resources

From Dutch keywords to English Wordnet?

- EuroWordNet: links Dutch synsets to English synsets

From Dutch keywords to English Wikipedia?

- Dutch (& English) Wikipedia cross-language links and more...

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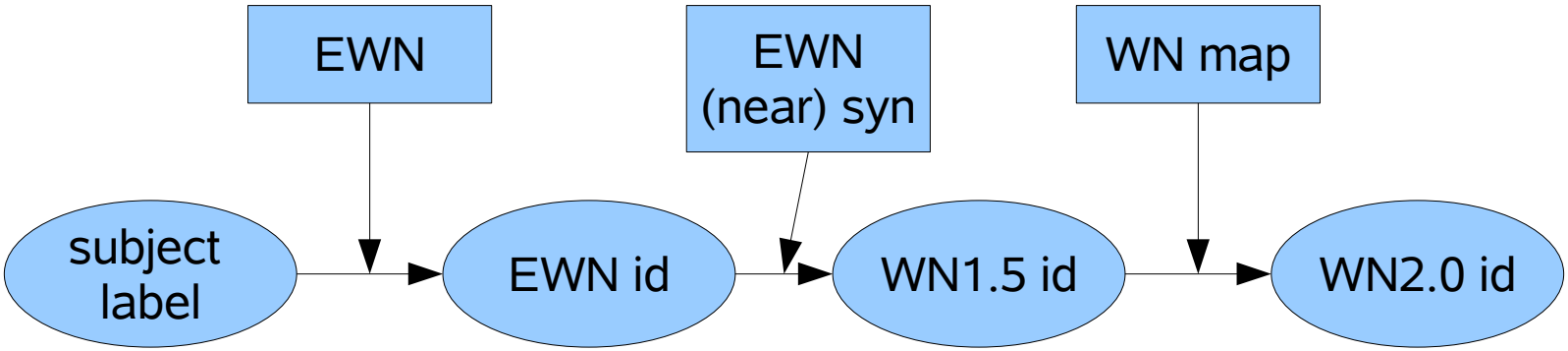
OAEI Workshops

Ontology Alignment Evaluation Initiative

- Organizes ontology alignment tasks and evaluation
- Very Large Cross-lingual Resources
  - One of the 2009 tasks
  - Aligning GTAA thesaurus with WN 2.0 and dbpedia
  - 2 participants in this task

GTAA → EWN → WN



- (Dutch) WordNet contains mostly subject terms, very few named entities
- Mapping from WN 1.5 to WN 2.0 : Daude, Prado, Rigau, *Mapping wordnet using structural information*, ACL 2000.

Linguistic Preprocessing

Stemming and Compound analysis

GTAA term	root	English
armoede	armoede	*poverty*
presidenten	president	*president*
biotechnologie	bio_technologie	*biotechnology*

Linking GTAA stems to EWN

- Both GTAA and EWN stemmed using Alpino (van Noord, 2009)
  - Ensures consistent analysis of compounds
- Compounds could be linked to more general concepts
  - *bio_technologie* hyponym of *technologie*
  - Providing hypernym relations was not part of the VLCR task

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Aligning GTAA subject terms to EWN and WN

Coverage

subject labels	3,887	
linked to Dutch EWN	2,617	(67%)
unique ILIs	3,703	
avg. ambiguity	1.4	
linked to WN2.0	2,392	(62%)
unique synsets	3,676	
avg. ambiguity	1.5	

Ambiguity

- How to select the correct Dutch EWN synset?
- How to select the correct English WN 2.0 translation?

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Word Sense Disambiguation

(Ambiguous) Mappings

Label	EWN	WN 2.0	WN Label
Ambassades	32482	103163291	embassy-noun-1
Ateliers	15723	104177492	studio_apartment-noun-1
Ateliers	15723	102651812	artist_s_workroom-noun-1
Schrijvers	19488	110090311	writer-noun-1
Schrijvers	25105	110090311	writer-noun-1
Anatomie	26879	104916889	human_body-noun-1
Anatomie	26879	105699031	anatomy-noun-1
Anatomie	32496	104916889	human_body-noun-1
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Word Sense Ambiguity

Wide-coverage method for Dutch?

- Find Predominant Word Senses (McCarthy et al., CL 2007)
- Used to align Dutch Wikipedia and EWN (Bouma, 2009)

concept	EWN synset	ILI	wn synset
Anatomie	26879	105699031	anatomy-noun-1
Anatomie	32496	104916889	human_body-noun-2

No WSD...

- All WN senses are given as targets
- But in case of ambiguity with a lower confidence score

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OAEI Results

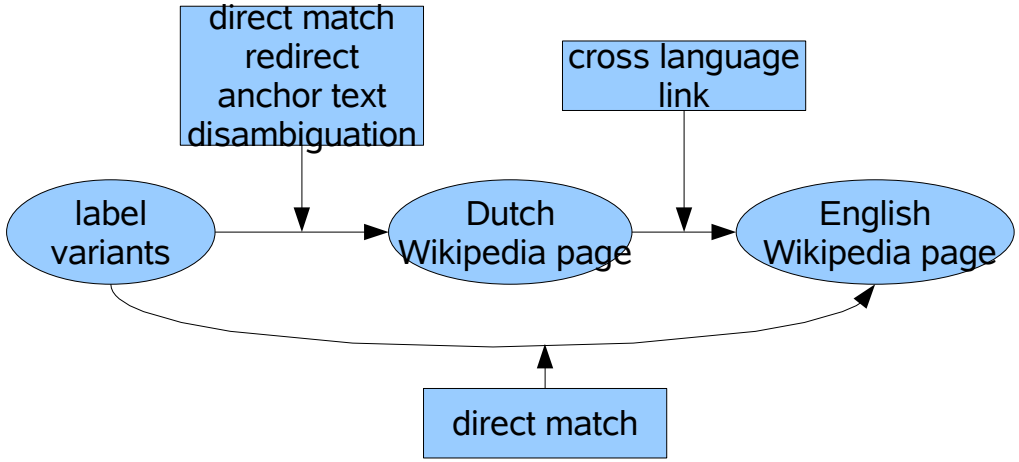
Official Evaluation Scores

	this paper			DSSim		
	# links	Prec	Rec	# links	Prec	Rec
Subject	3,663	0.59	0.59	655	0.77	0.19
Names	–	–	–	1,750	≈0.50	–

DSSim

- General purpose alignment tool
- Nagy, Vargas-Vera, Stolarski, 2009, *DSSim results for OAEI*

Aligning GTAA to Wikipedia (EN)



Dutch Wikipedia (2008) Statistics

page titles	656K
redirects	198K
unique anchors	1.1M
disambiguation pages	29K
cross-language links (NL→EN)	313K

Preprocessing

Generate Label Variants

- adelaars (*eagles*) → Adelaar
- adelaars → arenden (alternative GTAA label)
- Abbado, Claudio → Claudio Abbado

Examples

GTAA	match	Dutch Wikipedia	English Wikipedia
Aamodt, Kjetil Andre	redirect	Kjetil André Aamodt	Kjetil André Aamodt
Abbos, Samira	redirect	Samira Bouchibti	–
Abbado, Claudio	NL page	Claudio Abbado	Claudio Abbado
Abalkin, Leonid	EN page	–	Leonid Abalkin
Aleksej	anchor	Aleksej Nikolajevitsj van Rusland	Alexei Nikolaevich, Tsarevich of Russia
bedreigde diersoorten	redirect	Bedreigde soort	Endangered species
schrijvers (auteurs) (*writers* (*authors*))	NL match	Auteur	Author
abortusklinieken (*abortion clinics*)	anchor	Abortus	Abortion
computerspelletjes	anchor	Videospel	Video game

Coverage

	subject		misc name		location		person	
link type	links	%	links	%	links	%	links	%
nl page	2,027	**52.3**	3,128	11.5	5,135	**36.7**	7,311	7.5
redirect	423	10.9	984	3.6	400	2.9	762	0.8
anchor	621	16.0	616	2.3	357	2.6	176	0.2
en page	260	6.7	4,085	**15.1**	3705	26.5	9,246	**9.5**
linked	3,127	**80.6**	8,830	**32.6**	9,602	**68.6**	17,521	**17.9**
no-english	357	9.2	2,197	8.1	878	6.3	5,721	5.9
no-link	394	10.2	16,077	59.3	3,512	25.1	74,375	76.2
total	3,878	100.0	27,104	100.0	13,992	100.0	97,617	100.0

Results

	this paper			DSSim		
	# links	Prec	Rec	# links	Prec	Rec
subject-dbp	3,381	0.86	0.62	1,363	0.70	0.30
person-dbp	17,516	0.91	–	2,238	0.79	–
misc-name-dbp	9,023	0.63	–	3,989	0.64	–
location-dbp	9,527	0.94	–	5,566	0.80	–

Discussion

Cross-lingual Resources

- Using cross-lingual information improves recall dramatically
  - 6x more recall than (generic) DSSim approach on linking concepts to WN
  - 3x more recall for linking terms to Wikipedia

Disambiguation Strategies

- *A4* → A4 (highway in the Netherlands), A4 (highway in Austria), A4 (paper format)
- Use categorical information in GTAA (*A4* is a location keyword)
- *Carole Lombard* → actress, ship
- Use scope note (*ship*) from GTAA
- Terms with same scope note map to pages in same category?

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Cross-language Links

- From EN→NL or NL→EN ?
- Cross-language links are not always reversible!
- EN→NL: *Bowling, Ten pin bowling → Bowling (NL)*
- NL→EN: *A4 highway → highways in the Netherlands*