TAXI at SemEval-2016 Task 13: a Taxonomy Induction Method based on Lexical-Syntactic Patterns, Substrings and Focused Crawling

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Introduction

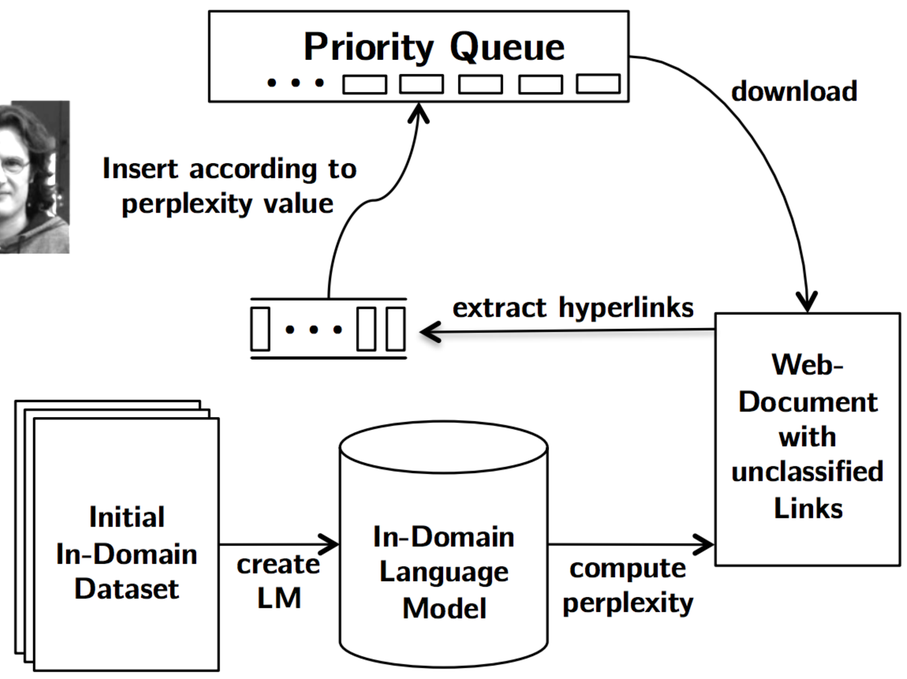
Task:

- Given a domain vocabulary construct a taxonomy
- 24 domain-specific vocabularies
- **Languages:** English, French, Dutch, Italian
- **Domains**: Science, Food, Environment
- **Golden Standard**: WordNet, EuroVoc
- 150 – 1500 terms per language-domain pair

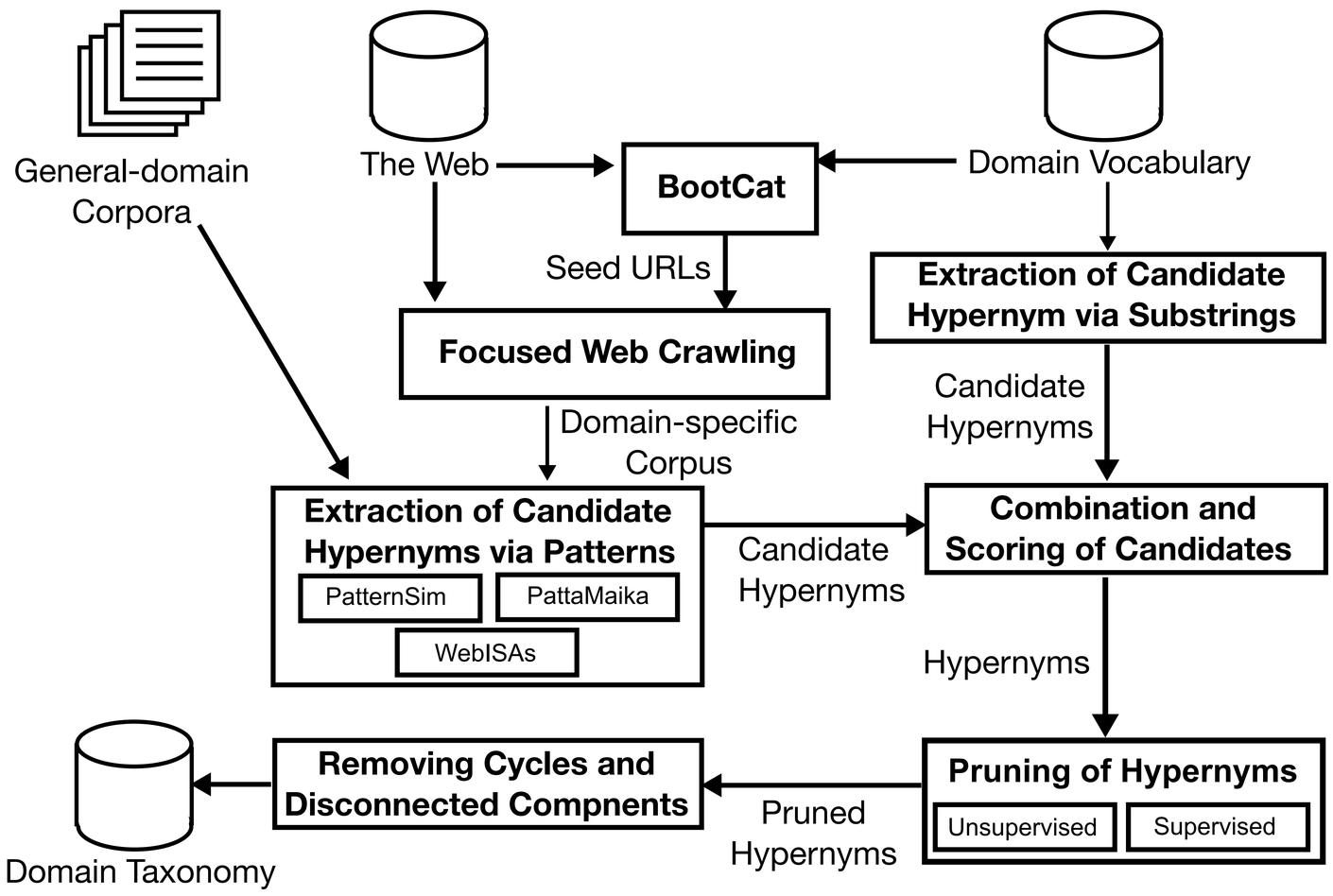
Result:

- Our system, called TAXI, obtained the **first place** in this task.

Focused Crawling



Taxonomy Induction Method (TAXI)



Candidate Hypernyms via Patterns

Such **cars**$_{hyper}$ as **Mercedes**$_{hypo}$, **BMW**$_{hypo}$ and **Audi**$_{hypo}$.

	EN	FR	NL	IT
Wikipedia	11.0	3.2	1.4	3.0
59G	59.2	–	–	–
CommonCrawl	168000.0 ‡	–	–	–
FocusedCrawl Food	22.8	7.9	3.4	3.6
FocusedCrawl Environment	23.9	8.9	2.0	7.1
FocusedCrawl Science	8.8	5.4	6.6	5.1

Corpora sizes used in our system in GB.

	EN ‡, †,§	FR‡	NL†	IT†
General	27.6‡, 4.9†, 118.9§	3.2	2.22	0.13
Food	24.1‡	3.8	0.47	0.05
Environment	26.3‡	4.5	0.32	0.95
Science	9.3‡	2.7	0.97	0.05

Number of hypernyms in millions of relations.

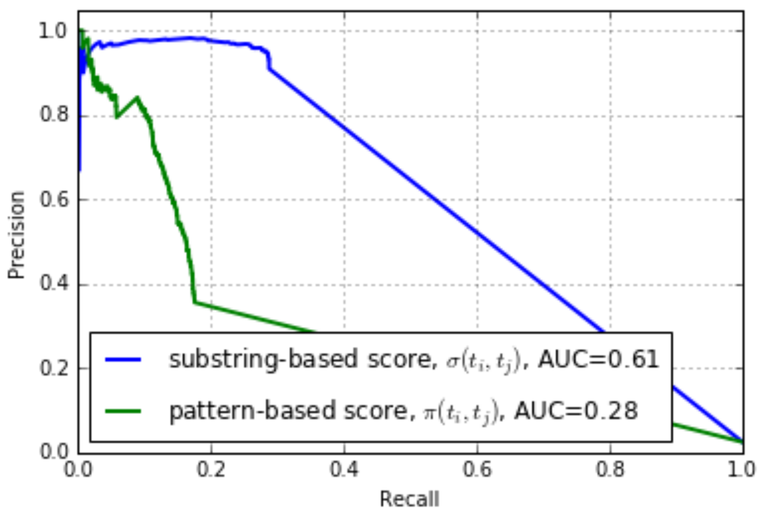
Extaction systems are denoted with ‡ for PatternSim, † for PattaMaika and § for WebISA.

Candidate Hypernyms via Substrings

Substring-based hypernymy score:

$$\sigma(t_i, t_j) = \begin{cases} \frac{length(t_j)}{length(t_i)} & \text{if } m(t_i, t_j) \wedge \neg m(t_j, t_i) \\ 0 & \text{otherwise} \end{cases}$$

- $m(t_i, t_j)$ equals true if t_i is in t_j and
  - $length(t_i) > 3$
  - if EN or NL: t_i should match in the end of t_j, e.g. "natural **science**$_{hyper}$"
  - if (IT or FR) or ((EN or NL) and a prep. in t_i): t_i should match in the beginning of t_j, e.g. "**algebre**$_{hyper}$ lineaire", "**toast**$_{hyper}$ with bacon" or "**brood**$_{hyper}$ van gekiemdgraan"



Performance of the substring-, and pattern-based features on the trial dataset.

Results: Gold Standard and Manual Evaluation

	Monolingual (EN)			Multilingual (NL, FR, IT)		
Measure	**Baseline**	**BestComp**	**TAXI**	**Baseline**	**BestComp**	**TAXI**
Cyclicity	*0*	**0**	**0**	*0*	**0**	**0**
Structure (F&M)	*0.005*	**0.406**	0.291	*0.009*	0.016	**0.189**
Categorisation (i.i.)	*77.67*	**377.00**	104.50	*64.28*	**178.22**	64.94
Connectivity (c.c.)	*36.83*	44.75	**1 .00**	*40.50*	34.89	**1.00**
Gold standard comparison (Fscore)	*0.330*	0.260	**0.320**	*0.009*	0.016	**0.189**
Manual Evaluation (Precision)	*n.a.*	**0.490**	0.200	*n.a.*	0.298	**0.625**

Overall scores obtained by averaging the results over domains (Environment, Science, Food) and languages (NL, FR, IT). The "BestComp" lists the respective best scores across all competitors.

References

- Seitner J., Bizer C., Eckert K., Faralli S., Meusel R., Paulheim H., Ponzetto S.P. (2016): **A Large DataBase of Hypernymy Relations Extracted from the Web**. LREC 2016
- Remus, S. and Biemann, C. (2016): **Domain-Specific Corpus Expansion with Focused Webcrawling.** LREC 2016

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Code & Data: http://tudarmstadt-lt.github.io/taxi