

## 09 – Automatic relation extraction

### IA161 Advanced Techniques of Natural Language Processing

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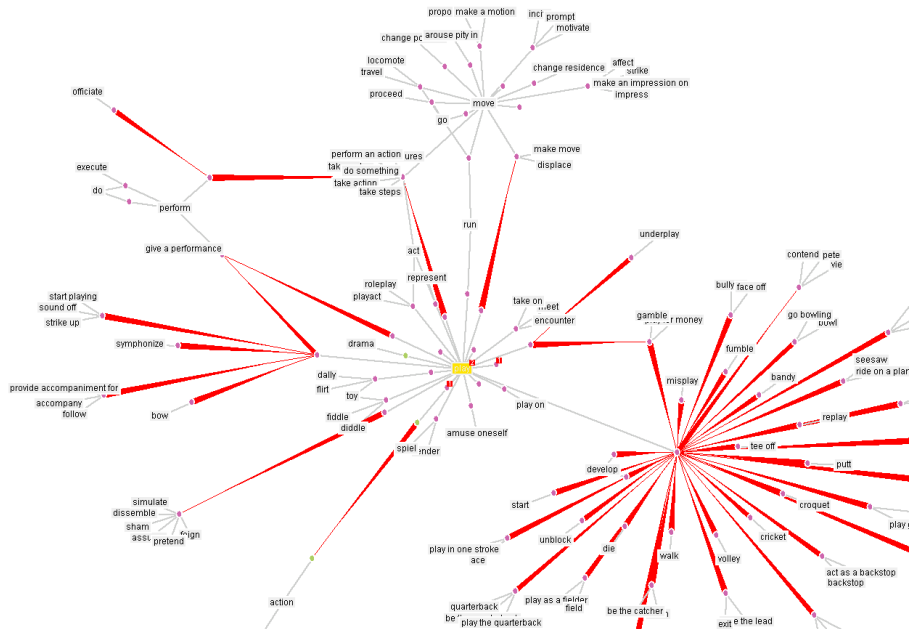
## 1 Introduction

## 2 Extraction

- Pattern-based approach
- Distributional approach

## 3 Evaluation

# Automatic relation extraction



# Why would you do that?

- semantic analysis
- query expansion
- lexical substitution
- machine translation
- question answering
- domain classification
- summarization
- paraphrase

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## Example

Human illuminates Document

AG[bird:1] VERB sezobnout SUBS[feed:1]

# What do we need?

- morphological tags
- syntactic analysis (phrases)
- dataset (dictionary, corpus, Wikipedia...)

# Pattern recognition

regular expression to match Part-of-Speech and text

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...most *European countries*, especially *France*, *England*, and *Spain*.

European country >France

European country >England

European country >Spain

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e.g. {NP,}\* {and |or} NP.

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European country >England

European country >Spain

## Example

e.g. {NP,}\* {and |or} NP.

...e.g. apples, bananas, or pears.

synonyms

## Example

NP such as  $\{NP, \}^* \{and \mid or\} NP$

## Example

NP such as {NP, }\* {and |or} NP

common *domestic animals* such as the *ferret* and the *fancy rat*

domestic animal >ferret

domestic animal >(fancy) rat

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in areas with a long history of *mining* such as *South-west England*

mining >South-west England

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in areas with a long history of *mining* such as *South-west England*

mining >South-west England

in *areas* (with a long history of mining) such as *South-west England*

area >South-west England

- remove stopwords
- detect optional adjunct phrases
- detect named entities

No.	Pattern	Number of occurrences	Number of relevant occurrences	Intermediary precision (%)
1.	other than	168	164	97.6
2.	especially	120	90	75
3.	principally	11	6	54.5
4.	usually	18	14	77.8
5.	such as	2470	1950	78.9
6.	in particular	78	48	61.5
7.	e(.)g(.)	280	216	77.1
8.	become	780	510	66.7
9.	another	92	72	78.3
10.	notably	76	42	55.3
11.	particularly	130	80	61.5
12.	except	13	4	30.8
13.	called	270	220	81.5
14.	like	1600	1300	81.3
15.	including	670	430	64.2



## Corpus query

- special case of pattern recognition, CQL query
- bigger data at hand, less options

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### Example

je/jsou

```
2: [k="k1"&c="c1"] ([lc=","] [k="k1"])*  
([lc="a"|lc="i"|lc="nebo"|lc="či"] [k="k1"])?  
[lemma_lc="být"&tag="k5eAaImIp3.*"&lc!="ne.*"]  
([k="k1"&c="c[1246]" [k="k2"]{0,2})?  
1: [k="k1"&c="c[1246]"
```

experiment on domain dictionary: precision 40%, when limited to dictionary terms 52%

# Multilingual translation

using translation equivalents from multilingual dictionary to provide synonyms

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## Example

stůl = table

table = stůl, stolek

stůl = stolek

# Synonym transitivity

- expanding relations based on existing relations (transitive closure)

## Example

city = town, town = municipality

⇒ city = municipality

# Distributional approach

- vector space model
- word-context frequency matrix
- clustering
- similar context  $\neq$  synonym
- e.g. Sketch Engine thesaurus

# TOEFL test evaluation

- evaluation by solving TOEFL synonym test
- Choose synonym for *fabricate*.
  - ▶ construct, alter, select, demonstrate
- build synonym set for each word
- detect overlap
- success rate 88 %

# References I



Barbu, V. (2008).

Hyponymy patterns: Semi-automatic extraction, evaluation and inter-lingual comparison.

In *Text, Speech and Dialogue*, pages 37–44.



Grefenstette, G. (2015).

Inriasac: Simple hypernym extraction methods.

*arXiv preprint arXiv:1502.01271*.



Hearst, M. A. (1998).

Automated discovery of wordnet relations.

*WordNet: an electronic lexical database*, pages 131–153.



## References II



Lefever, E., Van de Kauter, M., and Hoste, V. (2014).

Evaluation of automatic hypernym extraction from technical corpora in english and dutch.

*In Proceedings of the 9th International Conference on Language Resources and Evaluation (LREC 2014)*, pages 490–497.



Sang, E. T. K. and Hofmann, K. (2009).

Lexical patterns or dependency patterns: which is better for hypernym extraction?

*In Proceedings of the Thirteenth Conference on Computational Natural Language Learning*, pages 174–182. Association for Computational Linguistics.



Schropp, G., Lefever, E., and Hoste, V. (2013).

A combined pattern-based and distributional approach for automatic hypernym detection in dutch.

*In RANLP*, pages 593–600.

## References III



Wang, T. and Hirst, G. (2012).

Exploring patterns in dictionary definitions for synonym extraction.

*Natural Language Engineering*, 18(03):313–342.