Sentence Level Text Analysis

Vojtěch Kovář

Natural Language Processing Centre, Faculty of Informatics
Masaryk University, Brno, Czech Republic

kovar@fi.muni.cz

Common Workshop of NLP Centre and Seznam.cz
May 16, 2014

Simon speaks about sex with Britney Spears

Zkolaboval katastr nemovitostí , lidé musejí přespávat v parcích

Zkolaboval katastr nemovitostí

kdo/co	katastr nemovitostí
přísudek	Zkolaboval

lidé musejí přespávat v parcích

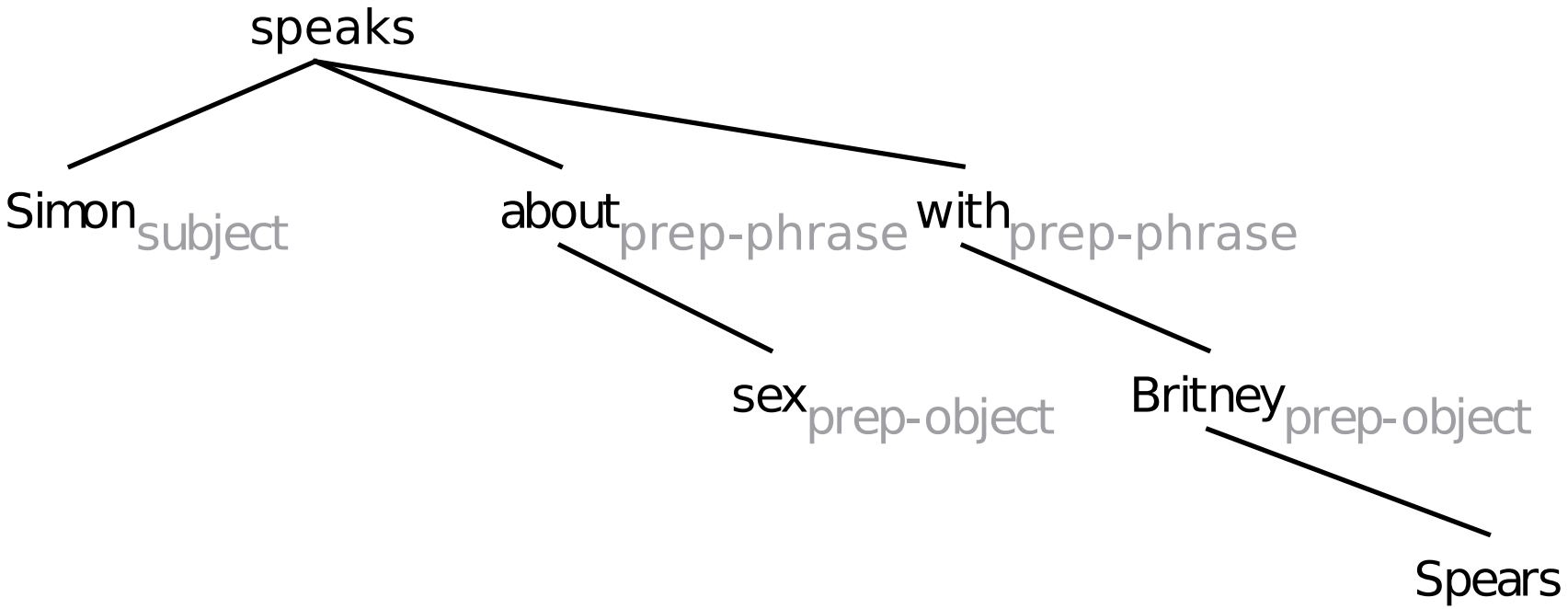
kde	v parcích
kdo/co	lidé
přísudek	musejí přespávat

zdroj textu: www.infobaden.cz

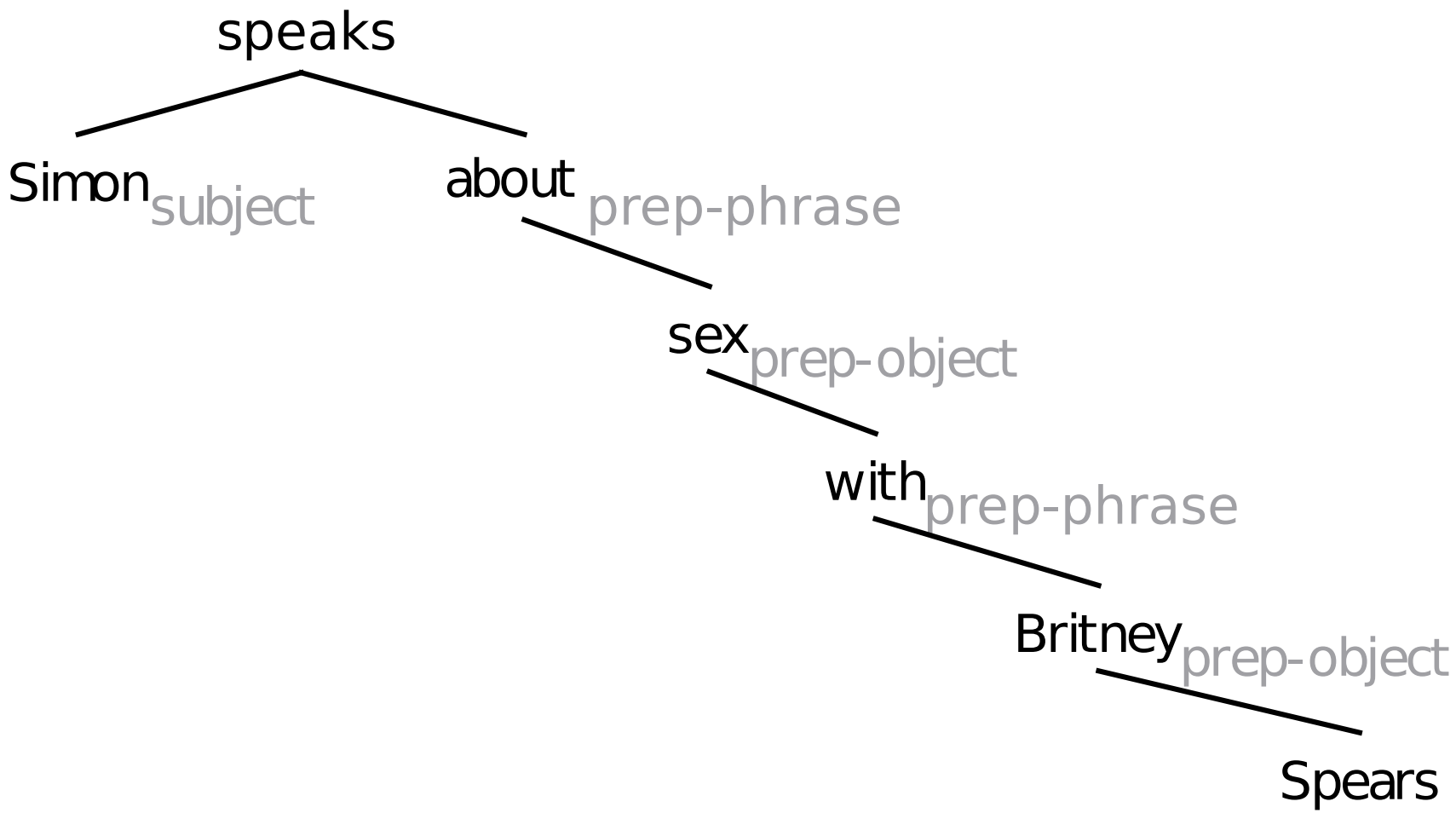
Sentence level analysis

- Natural language syntax
  - describes relationships among words
- Automatic syntactic analysis
  - revealing inter-word relationships on various levels
  - detection of noun (prepositional, verb, ...) phrases, clauses
- | Simon | spoke | about sex | with Britney Spears |
- | Simon | spoke | about sex with Britney Spears |

Syntactic trees



Syntactic trees



Why are we doing this?

- Syntactic units are carriers of meaning
  - "in the city"
  - meaning of "in", "the" is unclear, complicated
  - meaning of "in the city" is simply where
- Words are not enough
  - red brick house vs. brick house red vs. red house brick
  - Honey, give me love vs. Love, give me honey
- Starting point for intelligent natural language applications
  - extraction of facts & question answering
  - logical analysis
  - punctuation detection & grammar checking
  - natural text generation
  - authorship detection
  - machine translation

Example: Extraction of facts

Zkolaboval katastr nemovitostí , lidé musejí přespávat v parcích

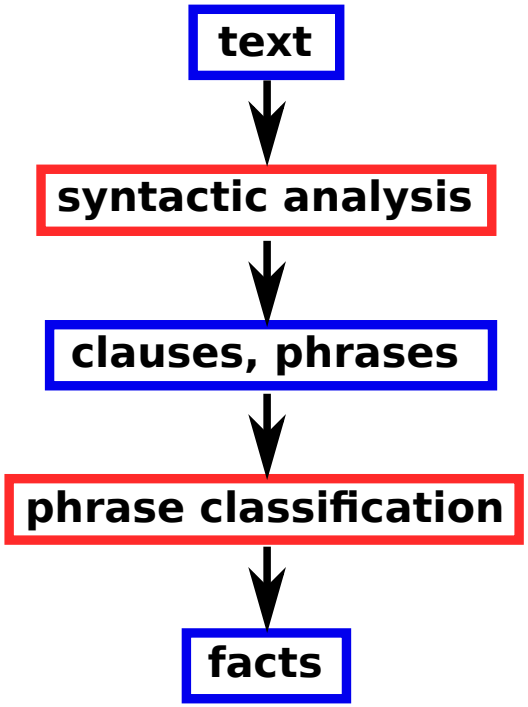
Zkolaboval katastr nemovitostí

kdo/co	katastr nemovitostí
přísudek	Zkolaboval

lidé musejí přespávat v parcích

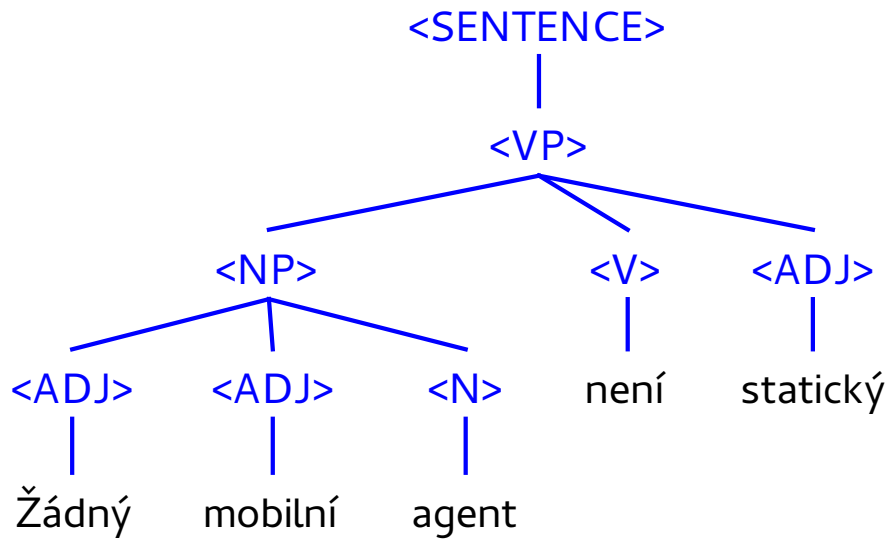
kde	v parcích
kdo/co	lidé
přísudek	musejí přespávat

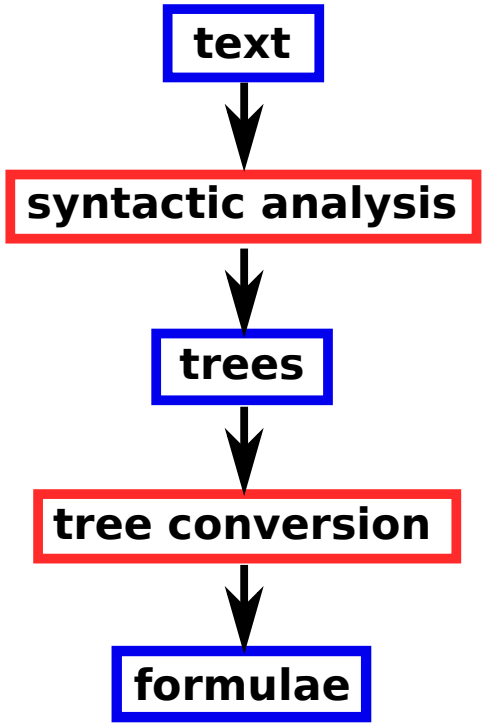
zdroj textu: www.infobaden.cz



Example: Logical analysis

Žádný mobilní agent není statický .





$$\neg\exists x(\mathit{mobilni}(x) \wedge \mathit{agent}(x) \wedge \mathit{staticky}(x))$$

$$\lambda w_1 \lambda t_2 \big[\mathbf{Not}, \big[\mathbf{True}_{w_1 t_2}, \lambda w_3 \lambda t_4 (\exists i_5)\big(\big[\mathbf{statický}_{w_3 t_4}\ i_5\big] \wedge \big[\big[\mathbf{mobilní}, \mathbf{agent}\big]_{w_3 t_4}, i_5\big]\big)\big]\big]_{\ldots\Pi}$$

Example: Grammar checking

- Let's eat grandma!
  - syntactic analysis
  - detection of non-probable constructions
  - → grandma is not a usual object of eating
  - → correction suggestion
- Let's eat, grandma!
  - life saved :)
- Similarly with other grammar phenomena
  - "This is worth try" → "This is worth trying"

How to analyse natural language syntax?

- Prerequisites
  - word level analysis (part of speech, gender, number)
  - named entity recognition
  - common sense information (e.g. "pregnant" goes with women only)
- Named entity recognition
  - determine that e.g. "prof. Václav Šplíchal" is a person
  - can be viewed as a sub-task of syntactic analysis

How to analyse natural language syntax?

- Statistical methods
  - people annotate corpus
  - statistic methods learn rules from the corpus
  - universal across languages (to some extent)
  - annotation is expensive
  - hard to customize for different applications
  - data are usually not big enough
- Rule-based methods
  - specialists develop a set of rules ("grammar")
  - not universal, depends on specialists
  - grammar can become uneasy to maintain
  - easy to customize for different applications
- Hybrids

Syntactic analysers in the NLP Centre

- Synt
  - C++, fast (0.07 s/sentence)
  - based on an expressive meta-grammar
- SET
  - Python, slower but easily adaptable
  - based on a set of phrase patterns
- Synt+SET
  - rule-based backbone with statistical extensions
  - grammars for Czech, English and Slovak
  - accuracy 85 – 90 % on newspaper texts
- Word Sketches
  - very fast shallow syntax for large corpora
  - 31 languages

Conclusions

- Sentence level analysis
  - detection of phrases and inter-word relationships
  - their further processing
- Applications
  - grammar checking
  - information analysis of text
  - text generation