Robust Parsing with a Large HPSG Grammar

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Parsing with Rule-based Precision Grammars

- Lexical acquisition model (together with the handling of MWEs) fills in the missing lexical knowledge with certain confidence level
- Studies have shown strong correlation between the lexicon quality and parser performance (especially parsing coverage/robustness)
- Unpredictable irregularities in real world texts adds to the difficulties in parsing with hand-written grammars

Question

- How to define and extract partial analysis when not all constraints in the grammar are satisfied?

A Two-Stage Robust Parser [Zhang and Kordoni, 2008]

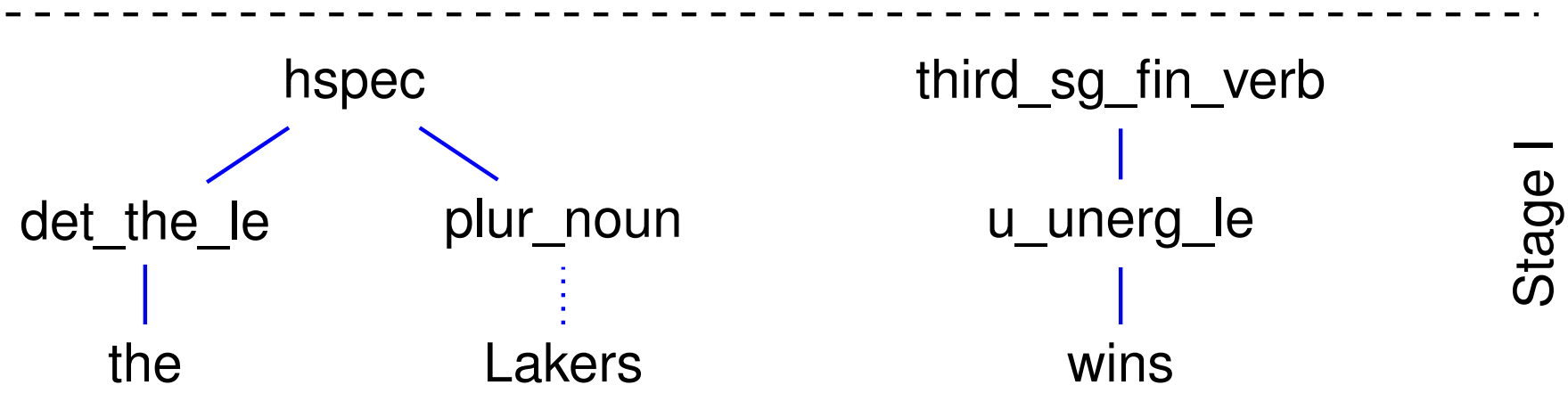
1. HPSG grammar is used to build bottom-up local analyses
2. A CFG backbone grammar extracted from HPSG treebank (LOGON) is used to continue parsing with the passive edges built by HPSG

- Results are complete (pseudo-) derivation trees
- The CFG backbone grammar is generally more relaxed and allows robust construction

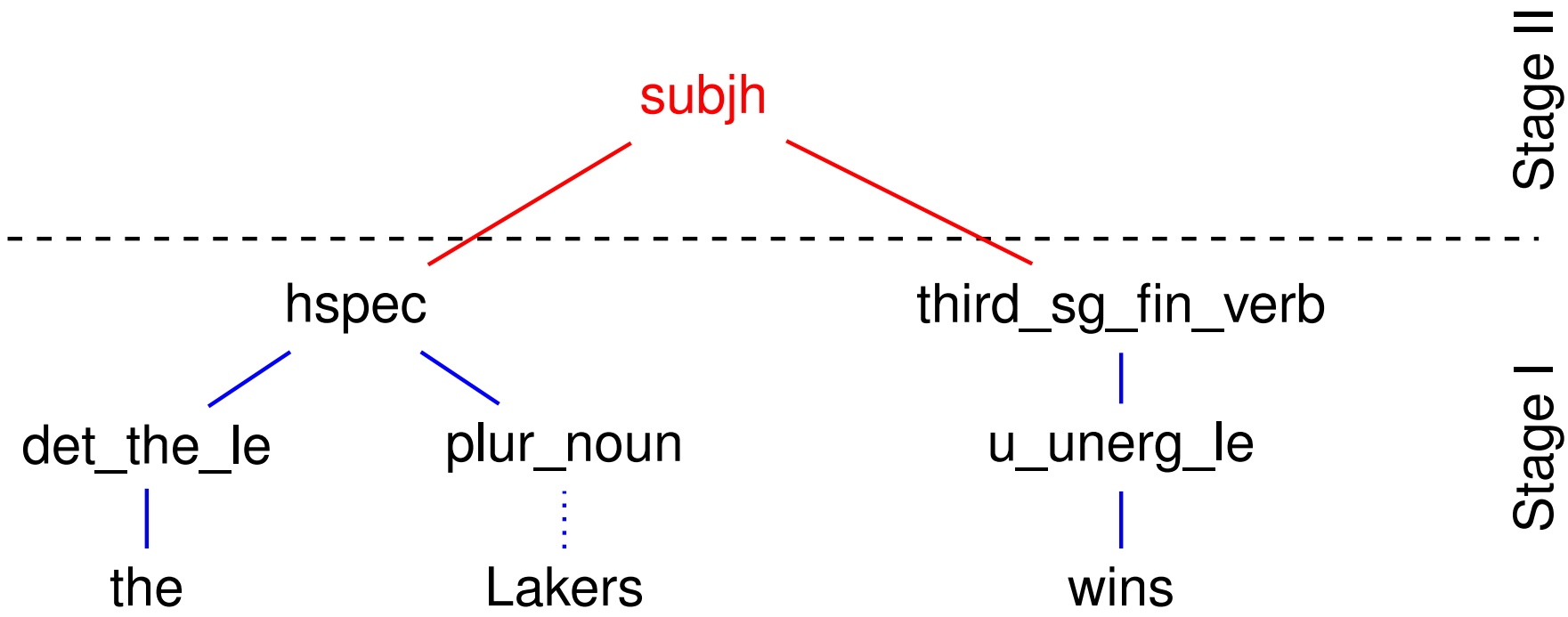
An Example

the Lakers wins

An Example


hspec
third_sg_fin_verb
det_the_le
plur_noun
u_unerg_le
the
Lakers
wins
Stage I

An Example


subjh
hspec
third_sg_fin_verb
det_the_le
plur_noun
u_unerg_le
the
Lakers
wins
Stage II
Stage I

Implementation Issues

The two-stage parsing model is implemented as extension to the PET parser, and experimented with ERG

- Disambiguation model
- Efficiency Concerns
- Semantic Composition

Disambiguation model

- Most of the features used in [Toutanova et al., 2002]'s discriminative model can be obtained from derivation tree (feature structures are not necessary), although the model is approximate, for the differences in tree language (T) of CFG and HPSG.
- A separately estimated generative PCFG model can be applied in the second parsing phase.

Efficiency Concerns

- Packing is used to reduce local structural ambiguity
  - Subsumption-based packing for Stage I (HPSG parsing)
  - Equivalence-based packing for Stage II (CFG parsing)
- Selective unpacking [Zhang et al., 2007] is invoked to extract best partial readings from pseudo-parse forest
- Must handle cyclic unary productions in the PCFG backbone grammar
  - X $\rightarrow$ X (e.g. noptcomp $\rightarrow$ noptcomp)
  - X $\rightarrow$ Y, Y $\rightarrow$ X

Robust Semantic Composition

- CFG rules can be paired with semantic composition rules from the original grammar to compose the MRS analyses
- Robust unification will be applied to guarantee the unifiability between any pair feature structures, by dynamic extension to the existing signature (type hierarchy)

For Further Reading I

Toutanova, K., Manning, C. D., Shieber, S. M., Flickinger, D., and Oepen, S. (2002).

Parse ranking for a rich HPSG grammar.

In *Proceedings of the 1st Workshop on Treebanks and Linguistic Theories (TLT 2002)*, pages 253–263, Sozopol, Bulgaria.

Zhang, Y. and Kordoni, V. (2008).

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In *Proceedings of the Sixth International Language Resources and Evaluation (LREC'08)*, Marrakech, Morocco.

Zhang, Y., Oepen, S., and Carroll, J. (2007).

Efficiency in unification-based N-best parsing.

In *Proceedings of the 10th International Conference on Parsing Technologies (IWPT 2007)*, pages 48–59, Prague, Czech.