Robust and Statistical Parsing in GF (C runtime)

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Overview

- The New C Runtime
  - statistical ranking
  - robust parsing
  - Python binding

- Applications in Translation
  - English Resource Grammar + Large Lexicon
  - Penn Treebank for GF
  - Prototype Online Translator
The C Runtime for GF

Initial Goals:

- small and efficient
- portable
- easy to embed in other languages
  (Python, Haskell, Prolog, etc)

*Note: the main GF runtime is in Haskell*
Using GF from Python

```python
import pgf

gr = pgf.readPGF("ParseEngAbs.pgf")

try:
    for (p,e) in gr.languages["ParseEng"].parse(sent, n=5):
        sys.stdout.write("["+str(p)+"] "+str(e)+"\n")
        print gr.languages["ParseBul"].linearize(e)
except pgf.ParseError as e:
    print e.message
```
The C Runtime

Grew Into:

- statistical engine for PMCFG which is beyond the state of the art
  - up to 100 times faster than state of the art alternatives
  - producing the same results

- the engine behind an experimental GF-based translator
The New vs The Old Parser

Parsing time for the English RGL + large lexicon
RParse

RParse is

- state of the art statistical parser for binary RCG (Kallmeyer and Maier, 2010).
- used primarily for parsing discontinuous German phrases
- using grammar learned from the German Tiger Treebank (Brants et al., 2002)
The GF Parser vs RParse

- Rparse, binary grammar
- GF, binary grammar
- GF, nonbinary grammar

average parsing time (seconds)

sentence length (tokens)
Speed up

The speed up comes from:

- the use of a different algorithm

- the statistical model guides the parser to explore first
  the most likely branches

- if only the best tree is needed there is no need to
  explore the whole search space

A baseline $A^*$ search algorithm plus an optional non-admissible heuristic.

Following Stolcke (1995), the parser is also made robust by allowing the construction of partial trees.

The algorithm is lazy, i.e. it can ultimately return all parse trees, but only the necessary part of the search space is explored.
For the prototype translator we needed a large-coverage grammar

- the English grammar from RGL
- Large Lexicon of about 50,000 lemmas derived from:
  - Oxford Advanced Learners Dictionary
  - Princeton WordNet
  - Verb Valency Frames from the Penn Treebank
For statistical parsing we need training data

Penn Treebank:

- is **de facto standard** for training English parsers
- has **about 50 000 annotated sentences**
- the original treebank has been converted to **GF abstract trees**
  - the current coverage is 94.86% (96.81%) of the constructions
Penn Treebank
Penn Treebank
An experimental online translation service is now available in the MOLTO translation interface

- Currently English to Bulgarian, Finnish, German and Hindi
- A monster PGF (39MB file / 5GB RAM)

Demo!!
Summary

- **statistical processing** in GF is a new research direction
  - the beginning of a new project and not the end

- the **translation service** is only a proof of concept
  - need for better disambiguation
  - need for better translation dictionaries
  - need dictionary of idiomatic constructions

- **scaling up**
  - in MOLTO we have promised a scale of hundreds of lemmas
  - we began scaling up to thousands, i.e. 50,000 lemmas