Features for Syntax-based Moses: Project Report

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MT Marathon

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Features for Syntax-based Moses

Syntax-based translation with Moses

- Phrases as SCFG rules: GHKM minimal and composed rules
- Chart-based decoding
- Core implementation is stable
- Has been applied successfully for multiple language pairs in recent evaluation campaigns

Additional features?

- Some useful features are available for phrase-based Moses, but not for the syntax-based system yet
- Some useful features are implemented in other SMT toolkits, but not in Moses
- Syntax-based translation is attractive for development of novel features: come up with ideas!

Current Project Status

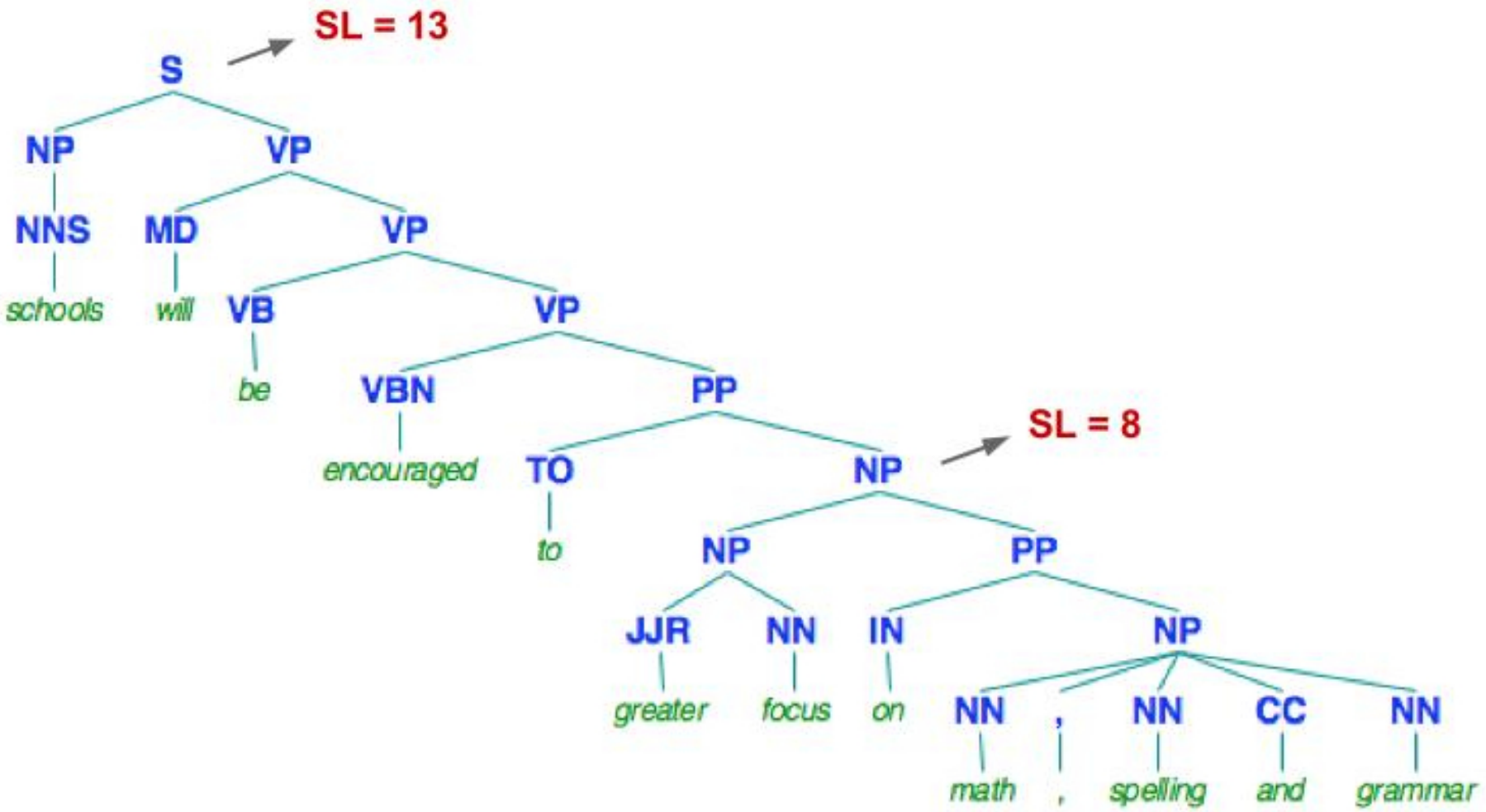
Feature implementation

- Based on Moses' feature function framework
- Possibly using the new phrase properties framework
- . . . Or novel functionality that is not a "feature" in a strict sense

Extending Moses' GHKM extractor and chart-based decoder with features that are not currently supported

- Sparse feature that combines the NT label with the span length
- Phrase orientation model
- *n*-best tree output, MIRA/MERT with head-word chain metric
- Employ parse trees with semantic information, bilingual tree alignment
- Gender agreement for long distance predicative
- (Morphological smoothing feature)

Span Length (1)



Span Length (2)

Model span length (SL) of non-terminals:

- For source and target parse tree
- Sparse features
- Computed during decoding

Features:

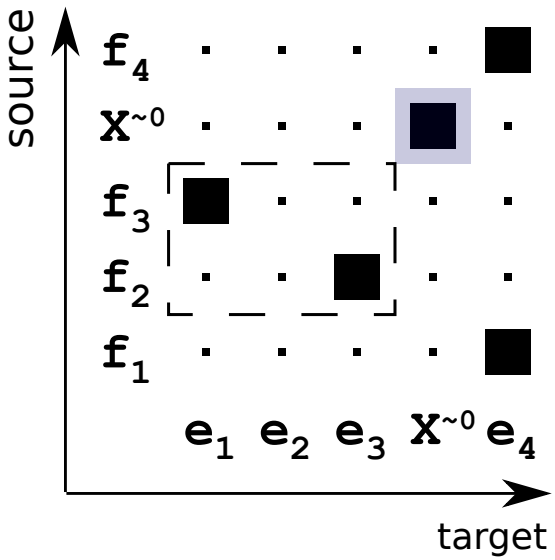
- LHS label & source SL
- LHS label & target SL
- LHS label & source SL & target SL
- LHS label & (source SL − target SL)
- first 3 features with SL binned (SL/3)

Initial results (cased BLEU):

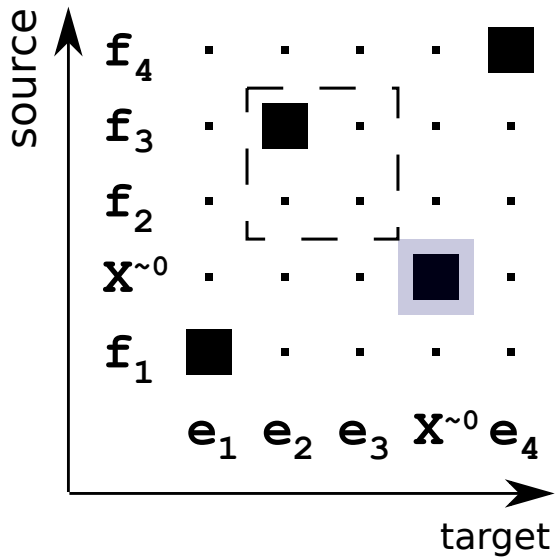
- Baseline: 22.3
- With span length sparse features: 22.2

Phrase Orientation (1)

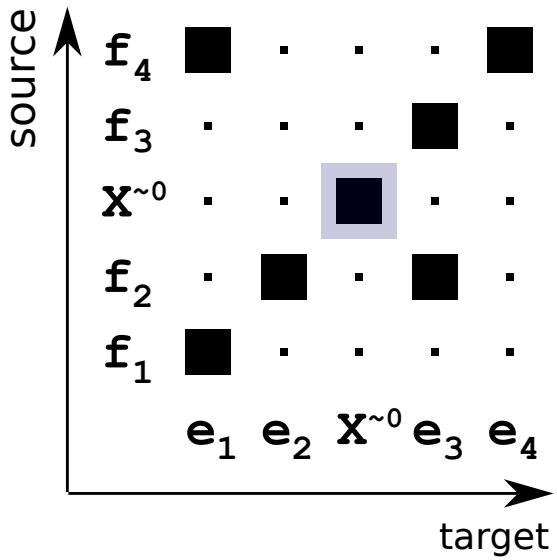
Lexicalized reordering for syntax-based translation



Monotone non-terminal orientation



Swap non-terminal orientation



Discontinuous non-terminal orientation

Huck, Wuebker, Rietig, Ney: A Phrase Orientation Model for Hierarchical Machine Translation (WMT 2013)

Phrase Orientation (2)

Moses implementation:

- Four orientation classes, left-to-right + right-to-left direction
- Extract smoothed relative frequencies of orientations given the rule
- Store as additional phrase property

```
very [X] ||| sehr [ADV] ||| ... ||| {{Orientation 0.72 0.03 0.2 0.05 ...}}
```

- During decoding, determine orientations and score them with the respective values from the additional property

Prototype available, but not ready for productive use. TODO:

- Handle degenerate cases correctly
- Efficiency
- EMS integration
- Testing

n-best Tree Output, MIRA/MERT with Head-word Chain Metric (1)

- Support for *n*-best tree output
- Tree similary score (HWCM: head-word chain metric) for MERT
- Pipeline integration — HWCM requires reference tree instead of reference string

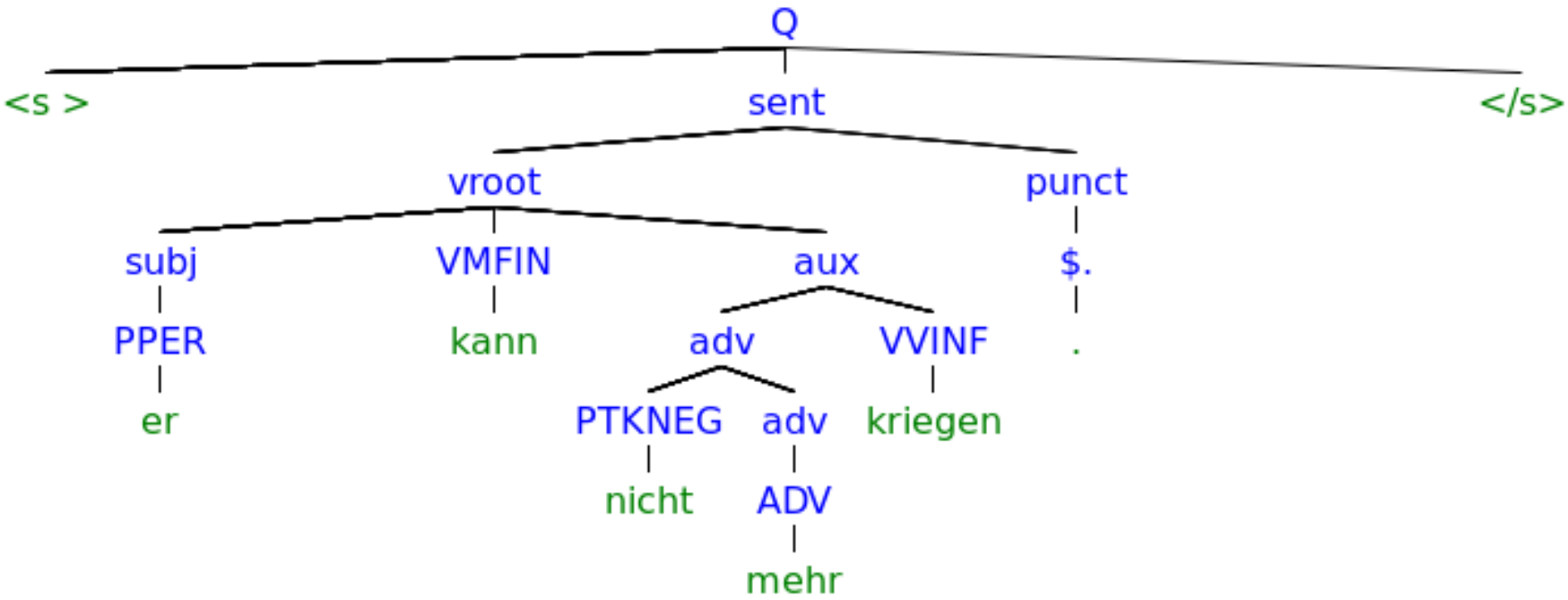
Example:

SRC: he can not get any more .
REF: zu mehr kann er nicht verurteilt werden .

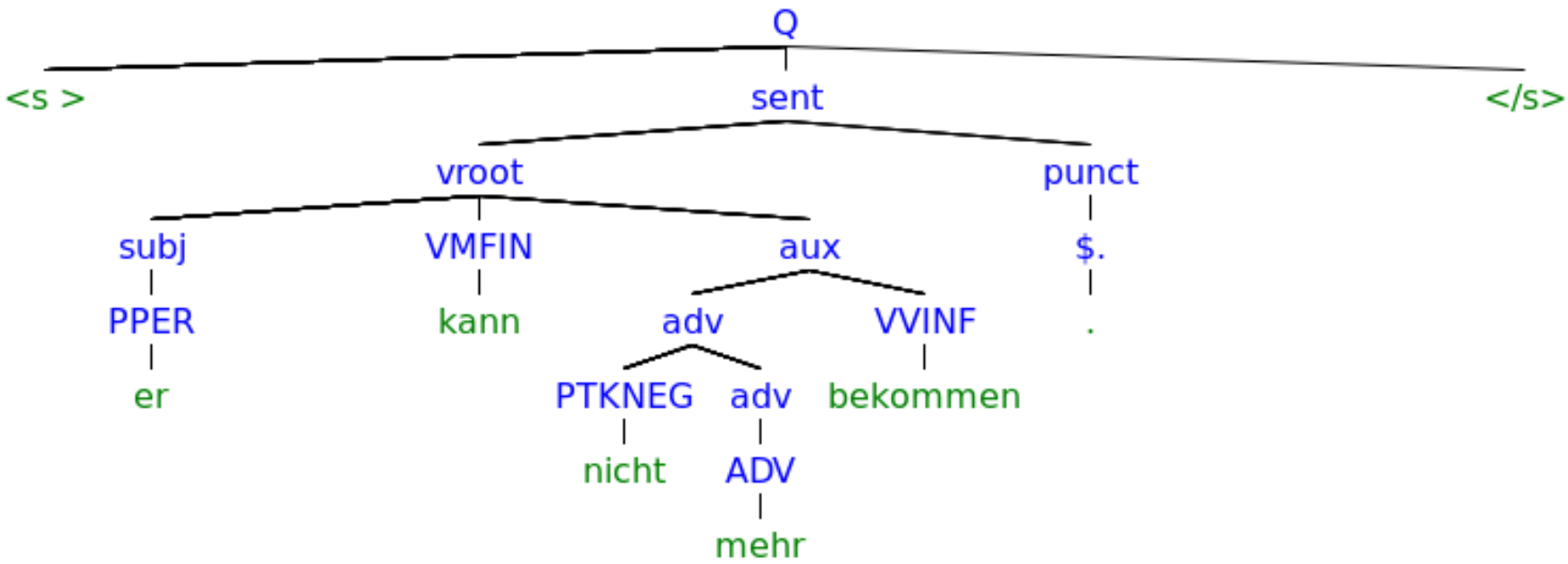
Tree output in *n*-best list:

```
er kann nicht mehr kriegen . ||| [Q <s> [sent [vroot [subj [PPER er]] [VMFIN kann] [aux [adv [PTKNEG nicht] [adv
er kann nicht mehr bekommen . ||| [Q <s> [sent [vroot [subj [PPER er]] [VMFIN kann] [aux [adv [PTKNEG nicht] [adv
er kann nicht mehr aussteigen . ||| [Q <s> [sent [vroot [subj [PPER er]] [VMFIN kann] [aux [adv [PTKNEG nicht] [a
er kann nicht mehr gewöhnen . ||| [Q <s> [sent [vroot [subj [PPER er]] [VMFIN kann] [aux [adv [PTKNEG nicht] [adv
er kann nicht mehr erhalten . ||| [Q <s> [sent [vroot [subj [PPER er]] [VMFIN kann] [aux [adv [PTKNEG nicht] [adv
```

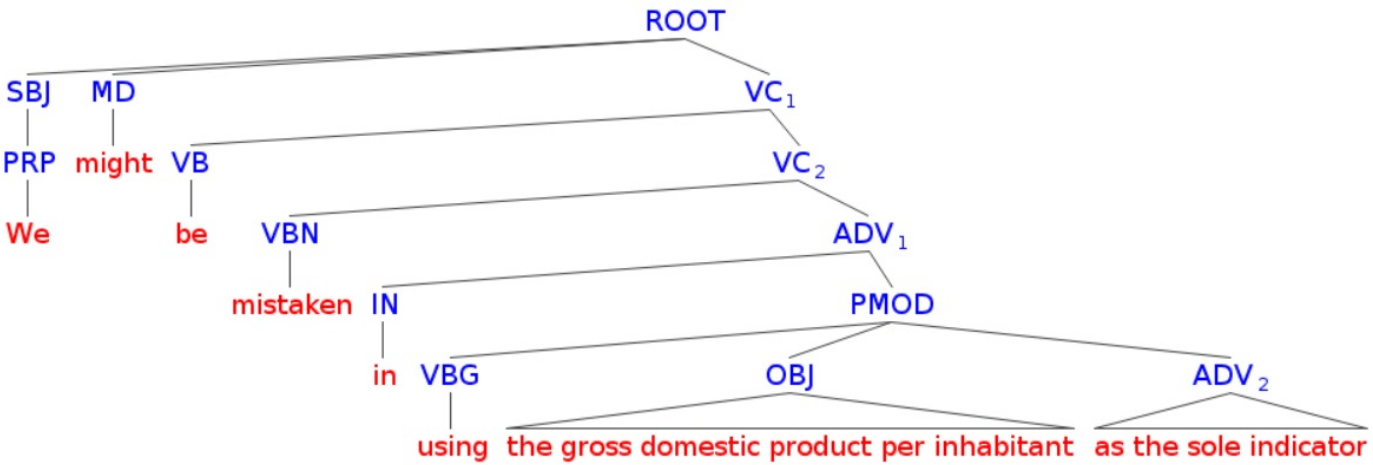
n-best Tree Output, MIRA/MERT with Head-word Chain Metric (2)

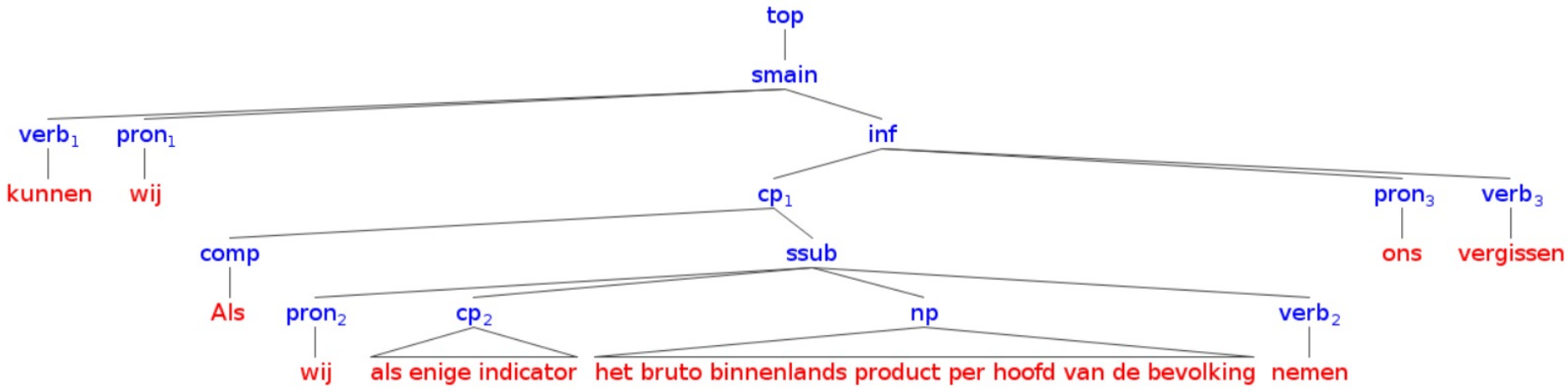


n-best Tree Output, MIRA/MERT with Head-word Chain Metric (3)



Parse Trees with Semantic Information, Bilingual Tree Alignment (1)





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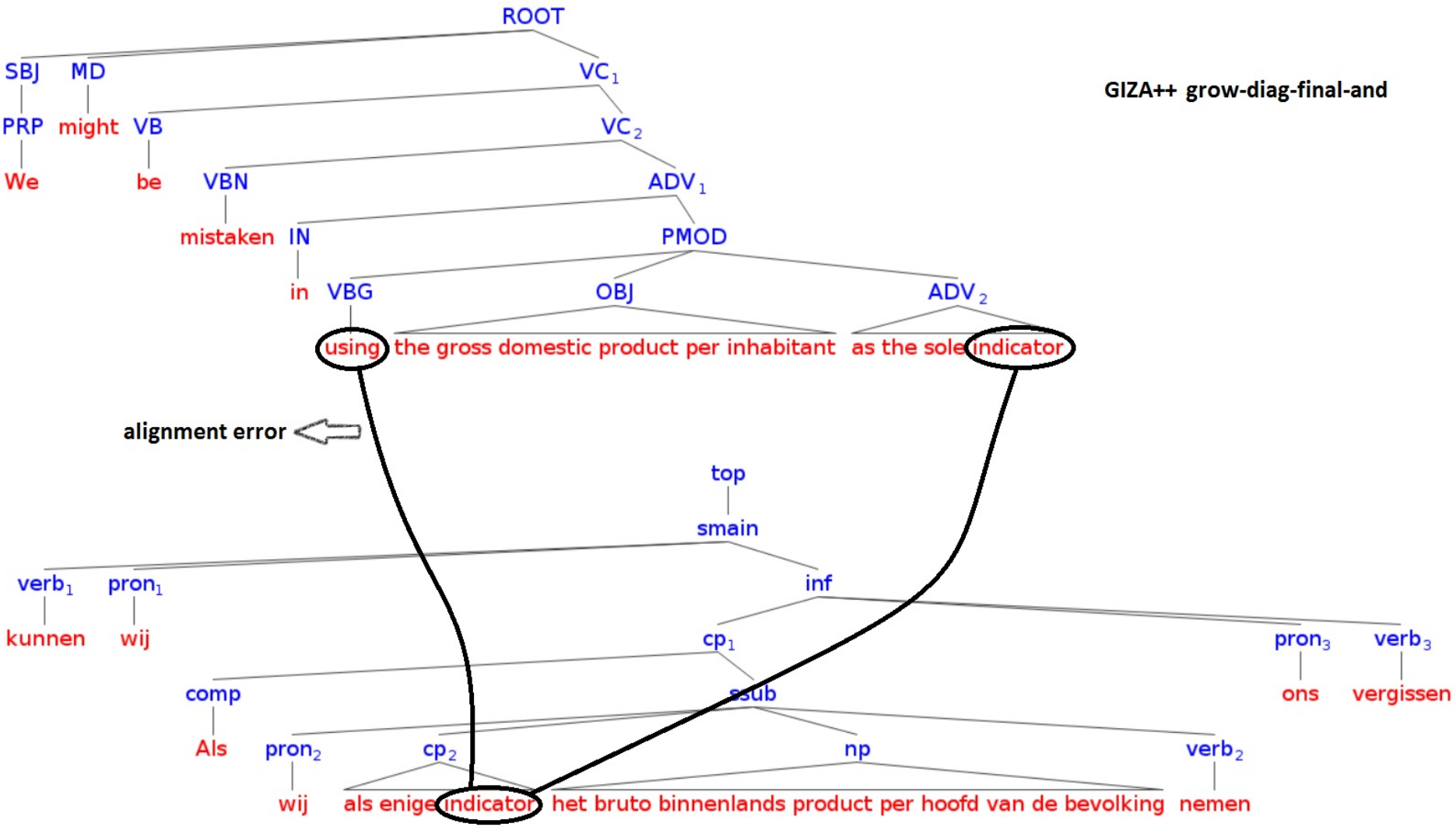
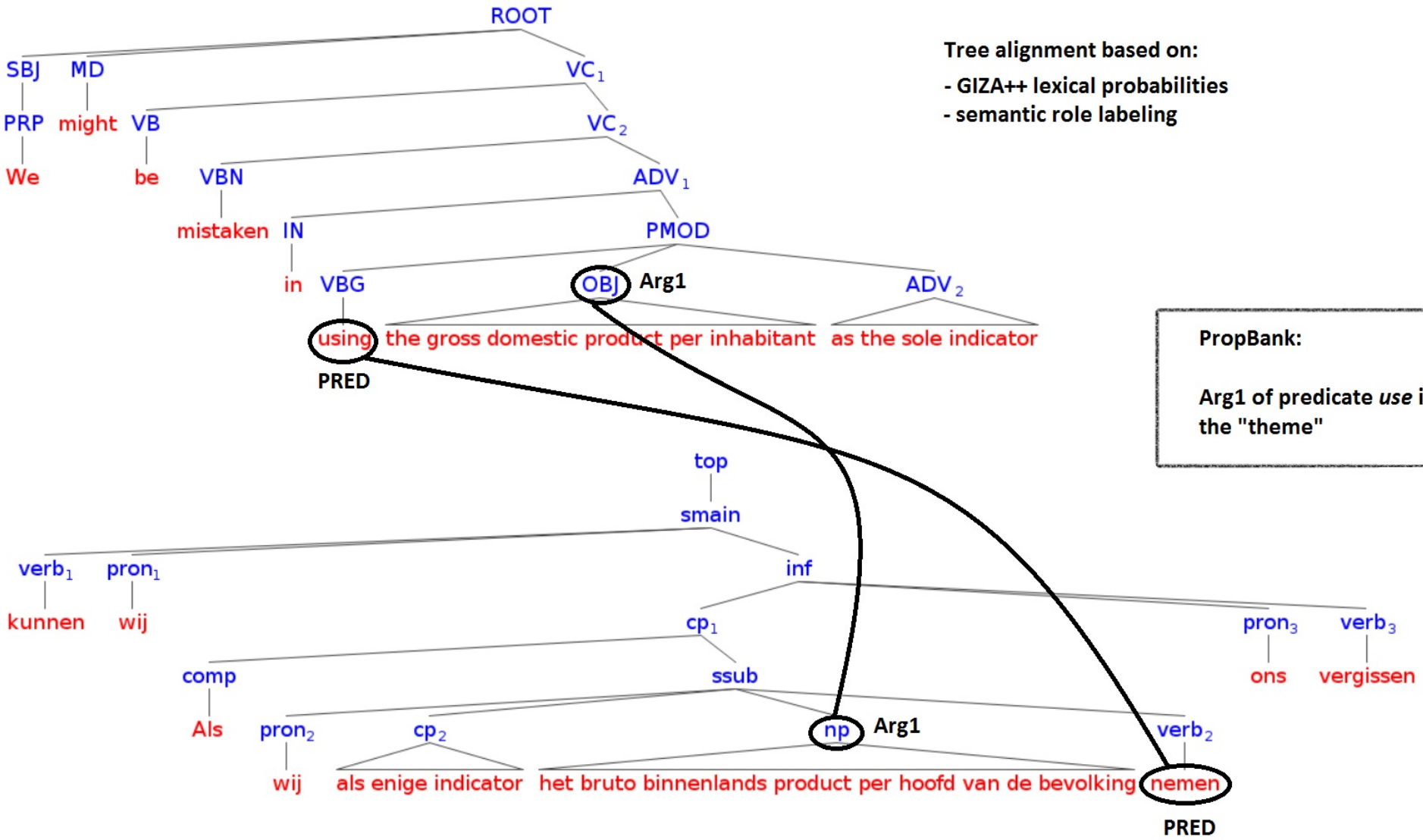


Parse Trees with Semantic Information, Bilingual Tree Alignment (3)



Long Distance Agreement (1)

Problem: Gender agreement for long distance predicative

Example: (for translation to Greek)

The citizens of our countries were victims of natural [disasters:female], which were indeed [terrible:female]

Feasibility test: Identify whether there are enough resources

- Get access to the Greek parser
- See whether Greek parser output annotation is sufficient and easily convertible

Pre-processing of the Greek side

- Parsed 12,300 sentences. . . until parser crashed
- Unfortunately parses miss alignment to parallel corpus
- Identified pattern out of dependency tree

Long Distance Agreement (2)

TODO:

- Train a syntax-based baseline
- Add the desired constraint

Constraint:

```
if dependency_label == 'Pnom'
  and pos_tag == 'Aj'
  and pos_tag(dependency.get_parent()) == 'Vb'
  and pos_tag(dependency.get_parent().get_parent()) = 'No':
    node.constrain_gender(dependency.get_parent().get_parent().get_gender())
```

Long Distance Agreement (3)

1	Αντιθέτως	αντίθετα		Ad	Ad	Ba	8
2	,	,	PUNCT	PUNCT	_	1	AuxX	_
3	οι	ο	At	AtDf	Ma|Pl|Nm	4	Det
4	πολίτες	πολίτης	No	NoCm	Ma|Pl|Nm	8	Sb
5	ορισμένων	ορισμένος		Aj	Aj	Ba|Fe|Pl|Ge
6	χωρών	χώρα	No	NoCm	Fe|Pl|Ge	4	Atr
7	μας	μου	Pn	PnPo	Ma|01|Pl|Ge|Xx	6	Pos
8	υπήρξαν	υπάρχω	Vb	VbMn	Id|Xx|03|Pl|Xx|Xx|Av|Xx	0
9	θύματα	θύμα	No	NoCm	Ne|Pl|Nm	8	Sb
10	φυσικών	φυσικός	Aj	Aj	Ba|Fe|Pl|Ge	11	Atr
11	καταστροφών	καταστροφή		No	NoCm	Fe|Pl|Ge
12	,	,	PUNCT	PUNCT	_	15	AuxX	_
13	οι	ο	At	AtDf	Fe|Pl|Nm	14	Det
14	οποίες	οποίος	Pn	PnRe	Fe|03|Pl|Nm|Xx	15	Sb
15	ήταν	είμαι	Vb	VbMn	Id|Xx|03|Pl|Xx|Xx|Pv|Xx	11
16	όντως	όντως	Ad	Ad	Ba	17	Adv	_
17	φοβερές	φοβερός	Aj	Aj	Ba|Fe|Pl|Nm	15	Pnom
18	.	.	PTERM_P	PTERM_P	_	0	AuxK	_

Questions?

Thank you for your attention

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