Word Reordering in Statistical Machine Translation with a POS-Based Distortion Model

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- Long range reorderings

Example: auxiliary verb and infinite verb
Ich *werde* morgen nachmittag ... *ankommen*
I *will arrive* tomorrow afternoon ...

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- $\Rightarrow$ our work based on this approach

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- Correct reorderings in different contexts
- Better translations of long range reorderings

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- Create a lattice with possible reorderings
- Decoder finds best monotone translation path through the lattice

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- Example: ADJ NN $\rightarrow$ 1 0 : 0.72

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- Idea: Use more complex left hand side that indicates the context $\Rightarrow$
  - Usage of POS-Tags to the left and / or right of sequence
  - Usage of words to the left and / or right of sequence
  - Usage of words as the sequence

Example Rules with Context Information

source sequence	rule	freq.
PDAT NN VVINF	3 1 2	0.60
VVFIN :: PDAT NN VVINF	3 1 2	0.71
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Table: Example rules for German to English translation with no context, with one tag of context to the left and one word of context to the left

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- "Ich moechte *diese Gelegenheit nutzen* , . . ."
- becomes "Ich moechte *nutzen diese Gelegenheit* , . . ."

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- Throw away rules seen less than a given threshold

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- BUT: This works only for one rule type!

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- $\Rightarrow$ For same reorderings use max score of all rule types
- For monotone Path:
  - use minimum score over all individual scores for the monotone path

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- Question: How should the training be corpus reordered?
- Usage of alignment information to monotonize alignment
  - new alignment should be nearly monotone
- Usage of the rules to reorder corpus
  - better fits the decoding situation

Setup

- English $\rightarrow$ Spanish (TC-Star 07)
  - Training Corpus: Europarl Corpus $33M$ Words
  - Developement Set: 1.2K Sentences / 79 OOV
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- Brill Tagger for English (36 Tags)
- Stuttgart Tree-Tagger for German (57 Tags)

Combination of all Ruletypes

- Addition of different context types to the rules

System	en → es	en → de	de → en
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no Context	49.52	17.78	24.79
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  - AND: Phrases did not match lexical reorderings anymore

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  - Phrases do not match decoding situation
- Reordering: Most probable word order according to Reordering Rules

System	en → es	en → de	de → en
Rule Reordering	49.75	18.42	25.06

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- $\approx$ 0.7 improvement on English to German
- $\approx$ 1.4 improvement on German to English

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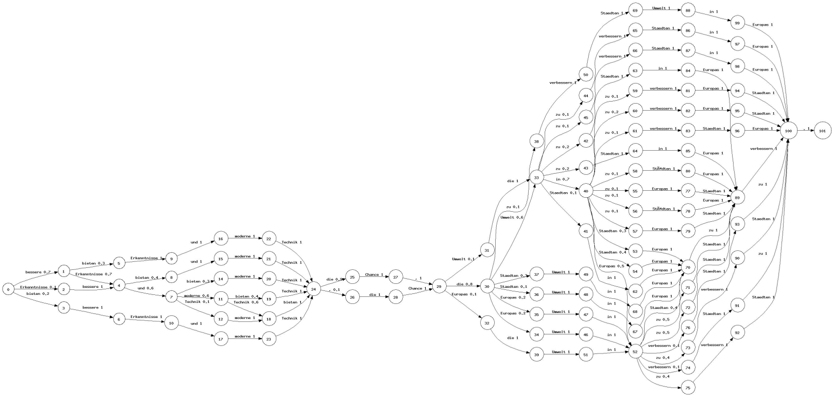
  - Baseline: better knowledge and modern technology offer the chance of the environment in Europe 's cities to improve .
  - Combination: better knowledge and modern technology offers the opportunity to improve the urban environment in Europe .

The Lattice



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- Dealing with languages without reliable POS-Tagger (using word clustering techniques)

The End

Thank you for your attention


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