

Non-projective Dependency-based Pre-Reordering with Recurrent

Neural Network for Machine Translation

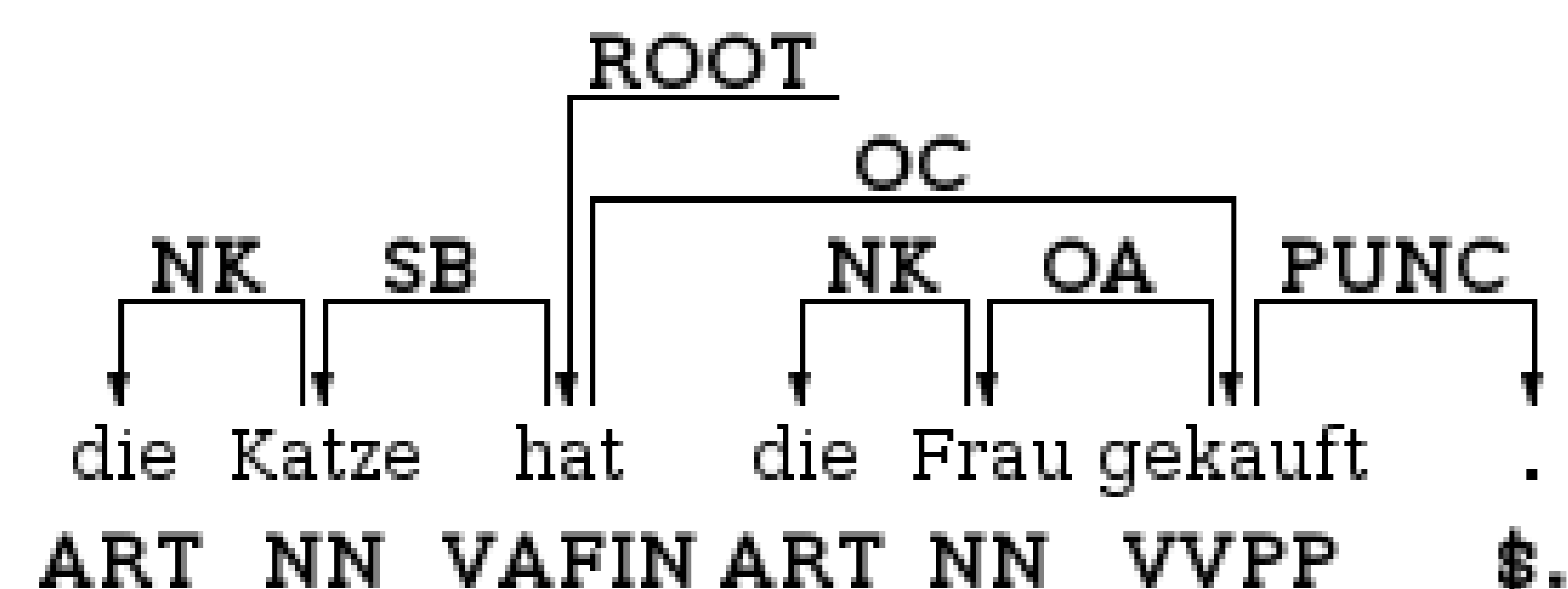
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Reorder sentences in a target-like word order

die Katze hat die Frau gekauft .
die Frau hat gekauft die Katze .
the woman has bought the cat .

Based (but not constrained) on
the source dependency parse



Using recurrent neural network models:

Base RNN-RM

Base GRU-RM

Fragment RNN-RM

Results

- Experiments on *de-en* Europarl, news2009, news2013
- All models improve over baseline (Moses)
- Base GRU-RM and Fragment GRU-RM equal or improve over Collins et al. (2005) rules
- Translation BLEU (Europarl):

| | | | | | |
|------------------|--------------|--------------|---------------------|--------------|--------------|
| Moses: | 33.00 | | Base RNN-RM: | 33.41 | +0.41 |
| Collins: | 33.52 | +0.52 | Base GRU-RM: | 34.15 | +1.15 |
| "Oracle": | 41.80 | +8.80 | Fragment RNN-RM: | 33.54 | +0.54 |

Reordering transition system

State:

$(curNode, emittedNodes, lastAction)$

Actions:

$EMIT, UP, DOWN_{childNode}, RIGHT$

Fragment:

Sequence of actions between word emissions

System

- Align parallel training corpus with giza++
Symmetrize alignment with *grow-diag-final-and* heuristic
- Generate heuristic reference reordering of source training corpus
Al-Onaizan and Papineni (2006) heuristic
- Parse source side with DeSR (Attardi and Ciaramita 2007)
Parse tree may be non-projective
- Train one of these neural network models:
Base RNN-RM or *Base GRU-RM*
Compute permutation as sequence of words
Fragment RNN-RM (two-level hierarchical RNN)
Compute permutation as sequence of words and sequence transition actions between each word.
all these model support *non-tree-local* reordering
- Reorder source training corpus with the neural network model
Beam search
- Train *Moses* on the reordered parallel corpus