The NAIST Machine Translation System for IWSLT 2012

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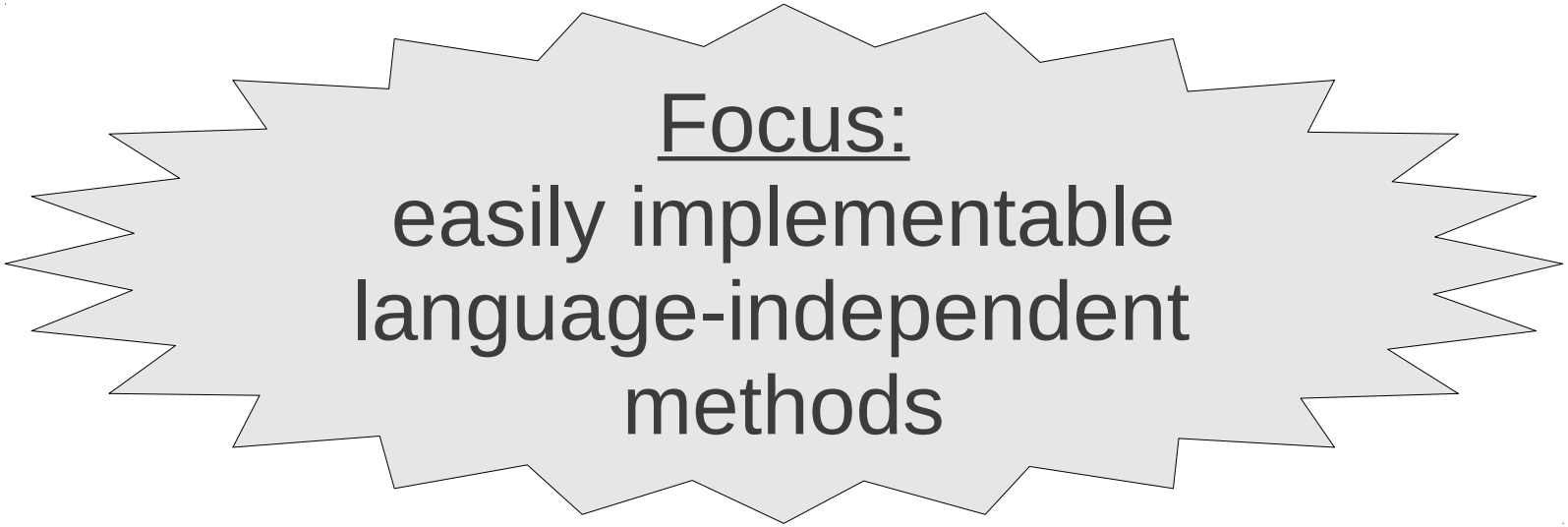
Overview

- Phrase-based machine translation
- Built on Moses (experiment management system)
- Evaluated on TED Translation:
  - English → French official track
  - XXX → English other tracks



English-French

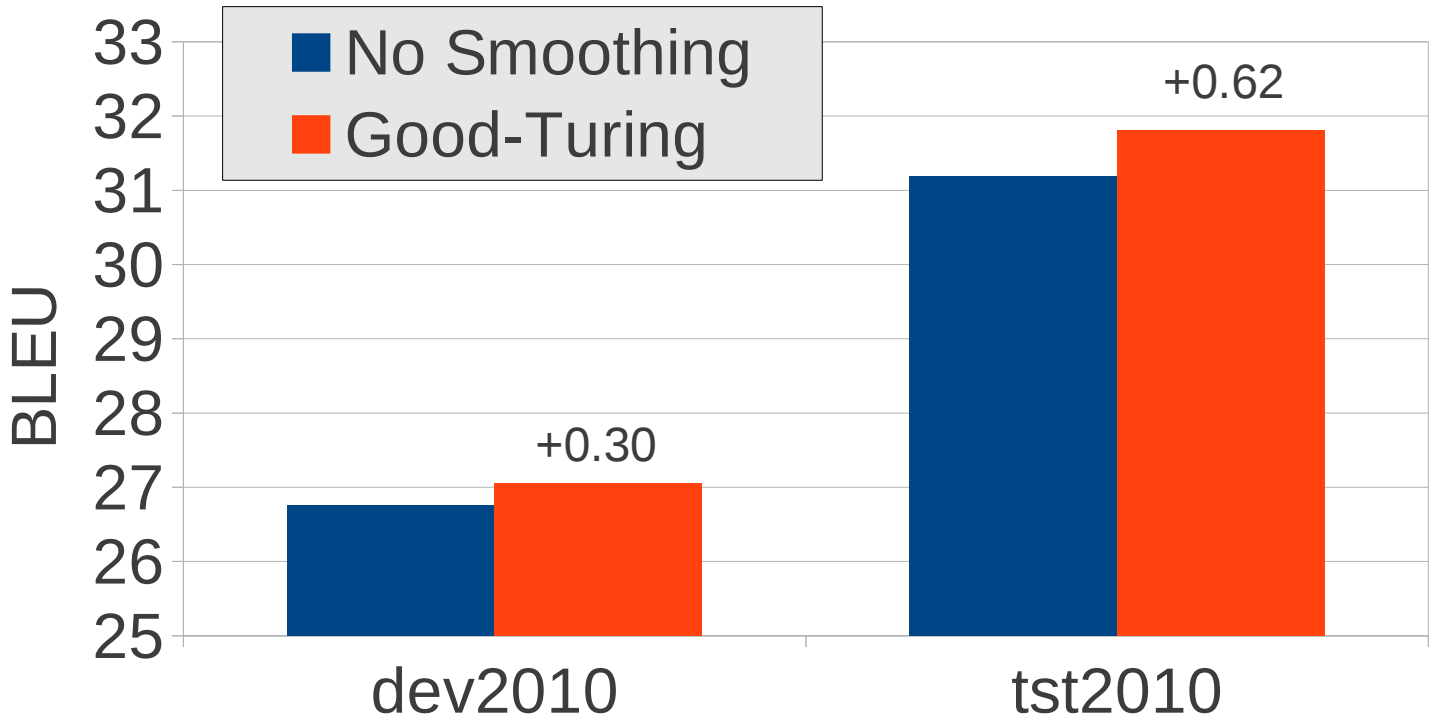
Summary of English-French

- Four successful statistical methods:
  - Phrase-table smoothing
  - Language model interpolation
  - Calibrated minimum Bayes risk decoding
  - Large-scale data with filtering
- Combination raises BLEU 29.75 → 31.81
- Ablation tests to examine the factors

Phrase Table Smoothing

- Phrase probabilities for rare phrases over-fit the training data
- Smoothing discounts observed counts when calculating probabilities
- Here we test Good-Turing smoothing [Foster 06]

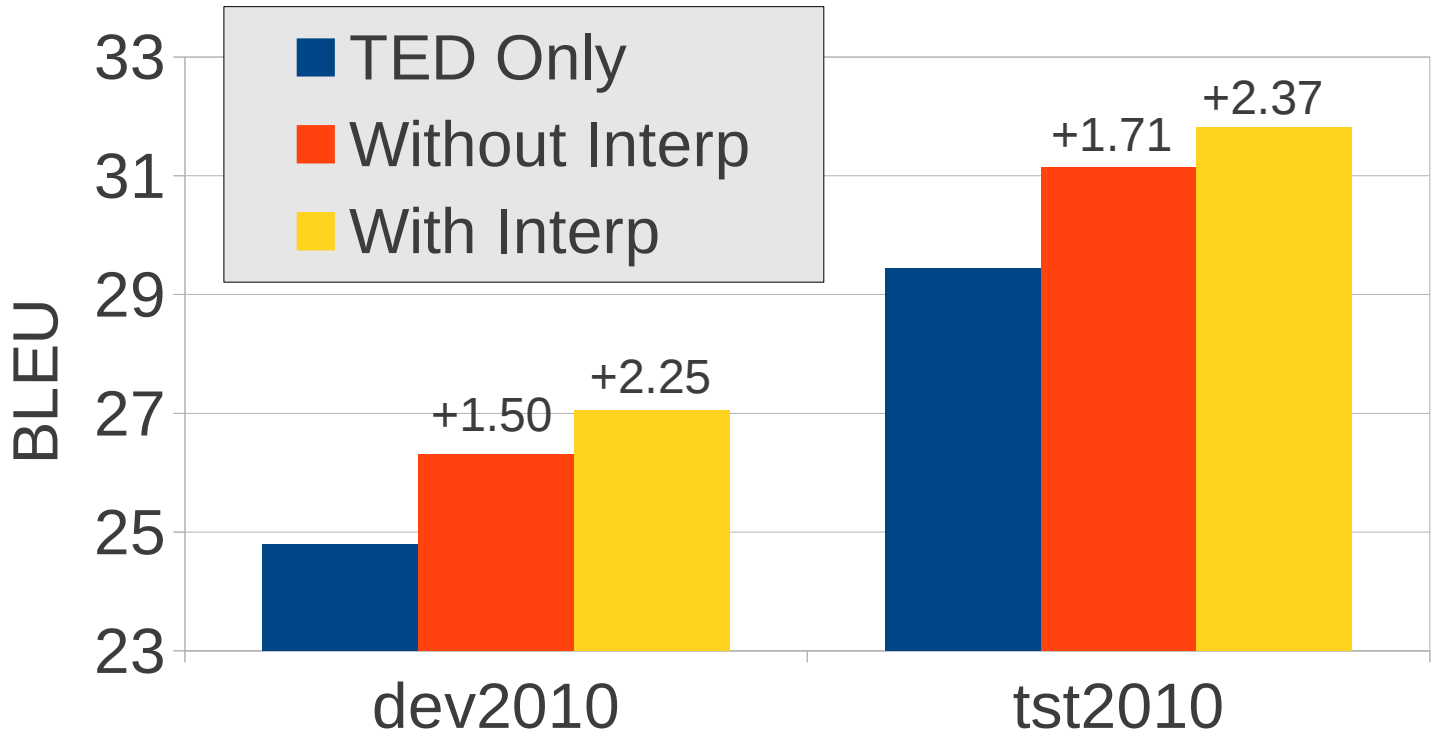
Smoothing Results



Language Model Interpolation

- LM data from heterogeneous sources
  - TED, News Commentary, Europarl, Giga
- Combine using simple linear interpolation
- Maximize likelihood of development set [Jelinek 80]

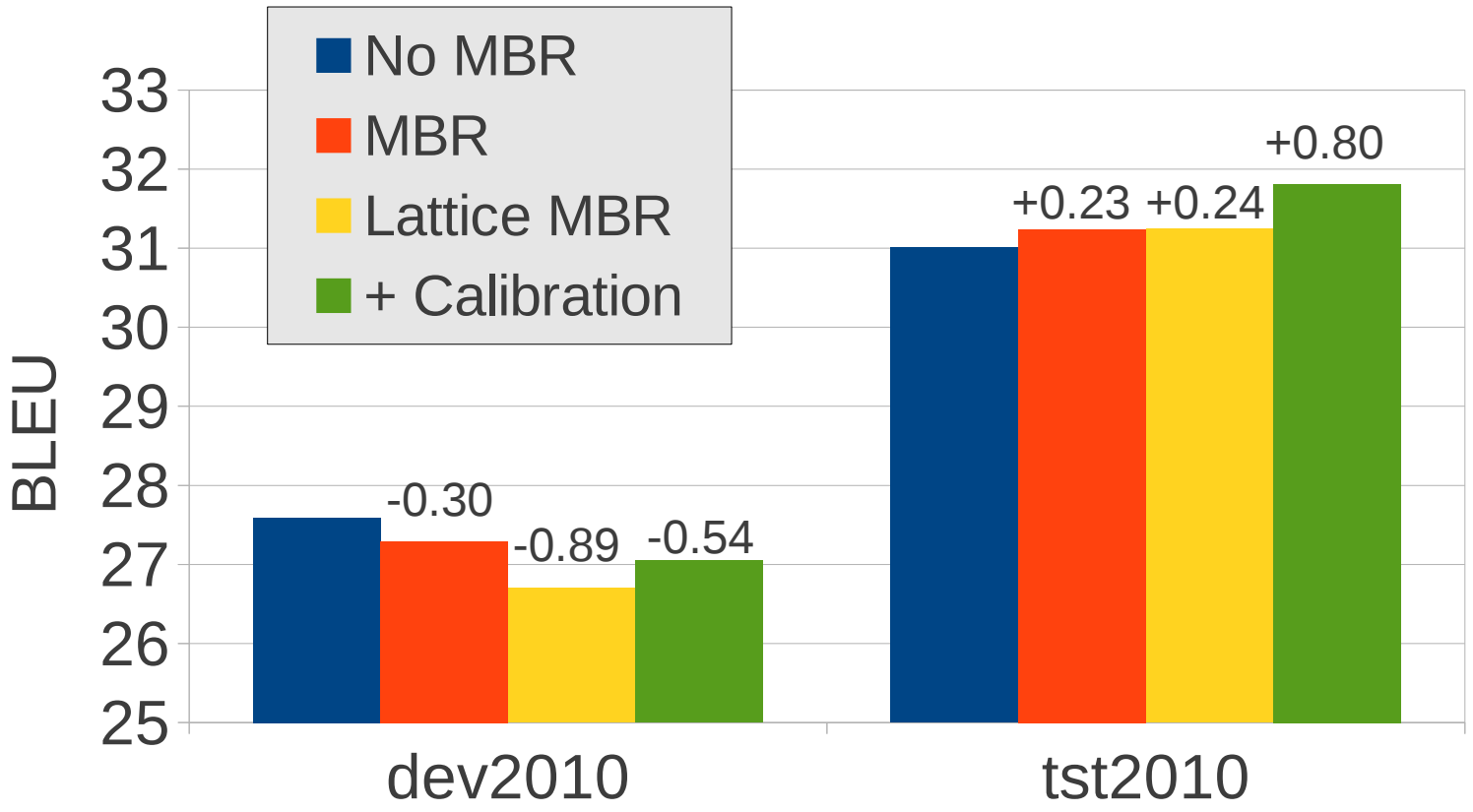
Language Model Interpolation Results



Minimum Bayes Risk Decoding

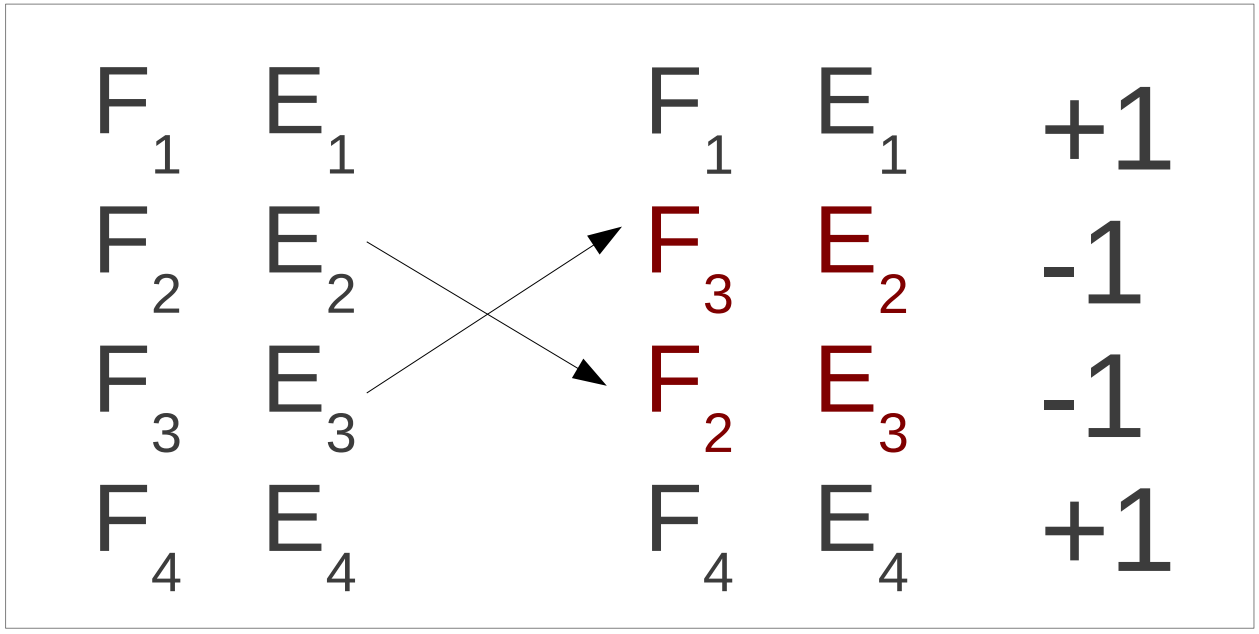
- Normal Decoding: Choose the translation with highest probability
- MBR Decoding: From an n-best list, choose the translation with the lowest expected loss [Kumar 04]
- Lattice MBR Decoding: MBR over lattices [Tromble 08]
- Also tested calibrating the probability distribution

Minimum Bayes Risk Results

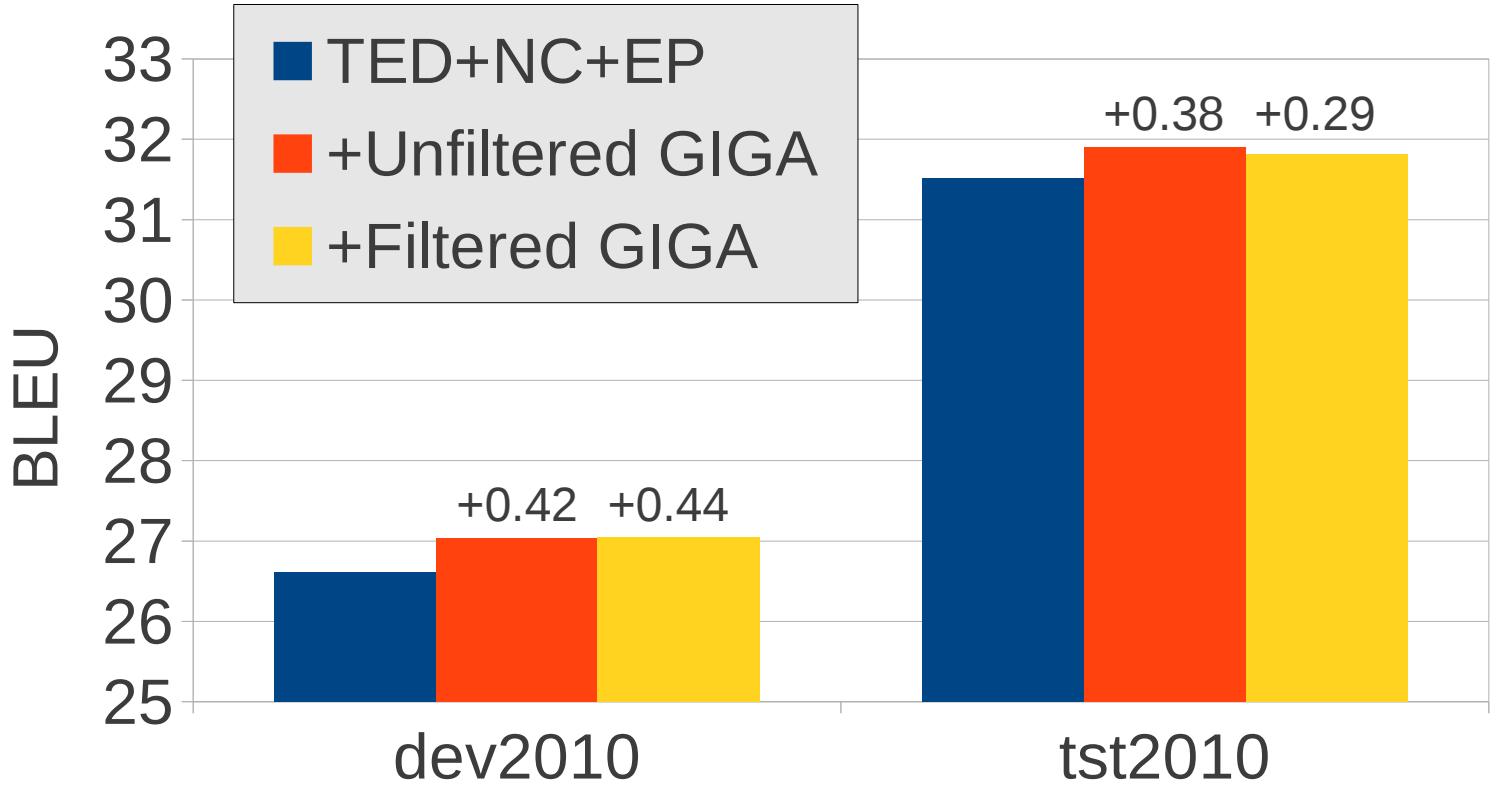


Large-Scale Data with Filtering

- Giga-word English-French corpus is large, but noisy
- Train a classifier to detect noisy sentences
  - Features: Model 1, Alignment, Length Ratio, Same Word
- Use pseudo-negative training examples by swapping 30% of sentences [Mediani 2011]



Data Filtering Results



Other Methods Investigated

- Out of domain TM data
- Word alignment methods + combination
- Lexical reordering models
- MERT vs. PRO tuning

See the paper for more details!

XXX-English Language Pairs

Linguistic Family Tree

- Indo-European Family:
  - Germantic: German (de), Dutch (nl), English (en)
  - Italic: **Portuguese (pt), Romanian (ro)**
  - Slavic: **Polish (pl), Russian (ru)**, Slovak (sk)
- Afro-Asiatic Family: Arabic (ar)
- Altaic Family: Turkish (tr)

MT Issues

- Morphology:
  - **pl**/**ru**/sk (fusional)
  - tr (agglutinative)
  - de/nl (compounding)
  - **pt**/**ro** (some inflection)
- Word order:
  - de/nl (SOV, V2)
  - ar (VSO)

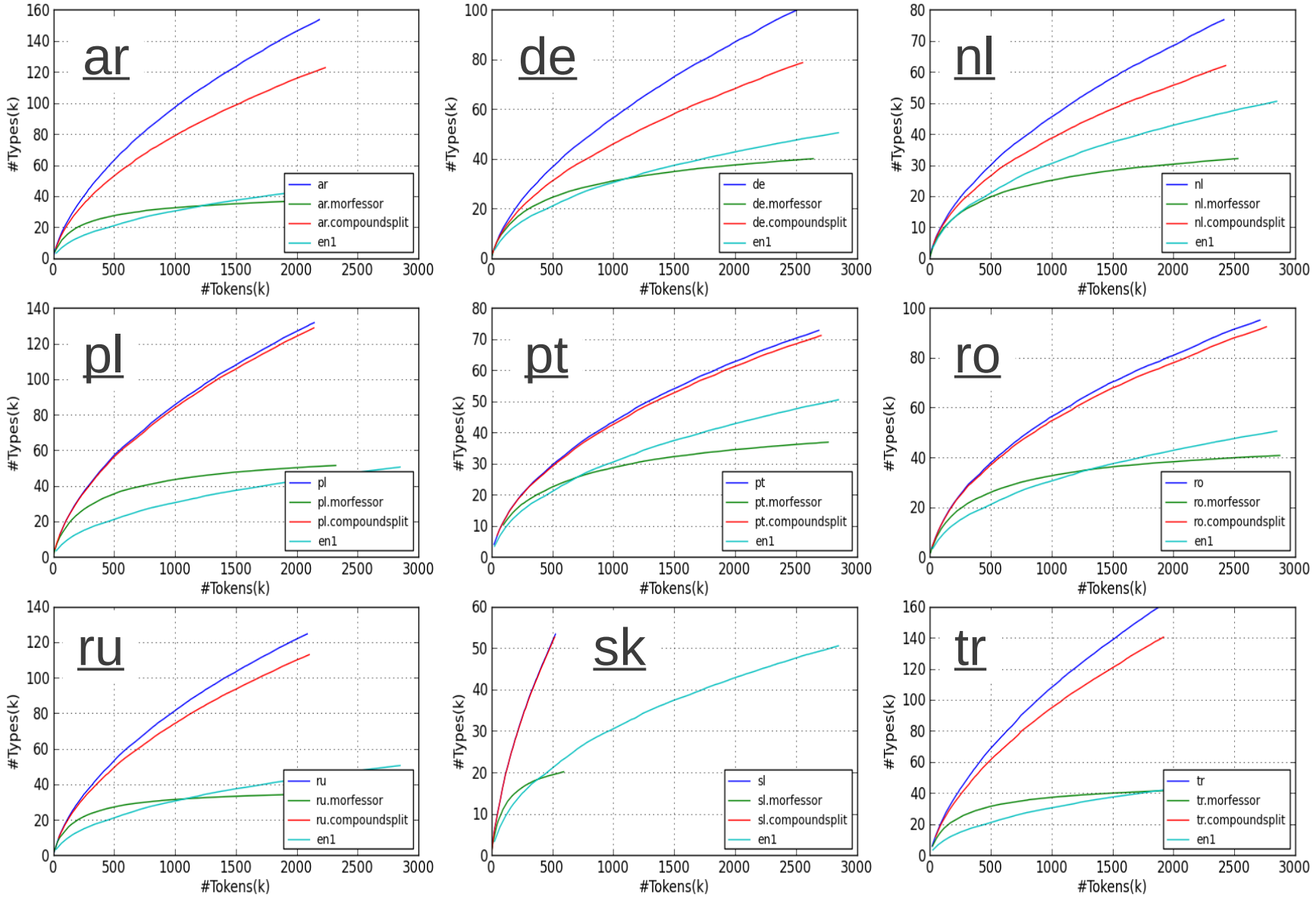
Summary of XXX-English Systems

- Common EMS setup: compare performance of existing techniques cross-linguistically
- What worked generally:
  - Unsupervised Morphology
    - Using Morfessor and compound-splitter.perl
  - Gigaword LM

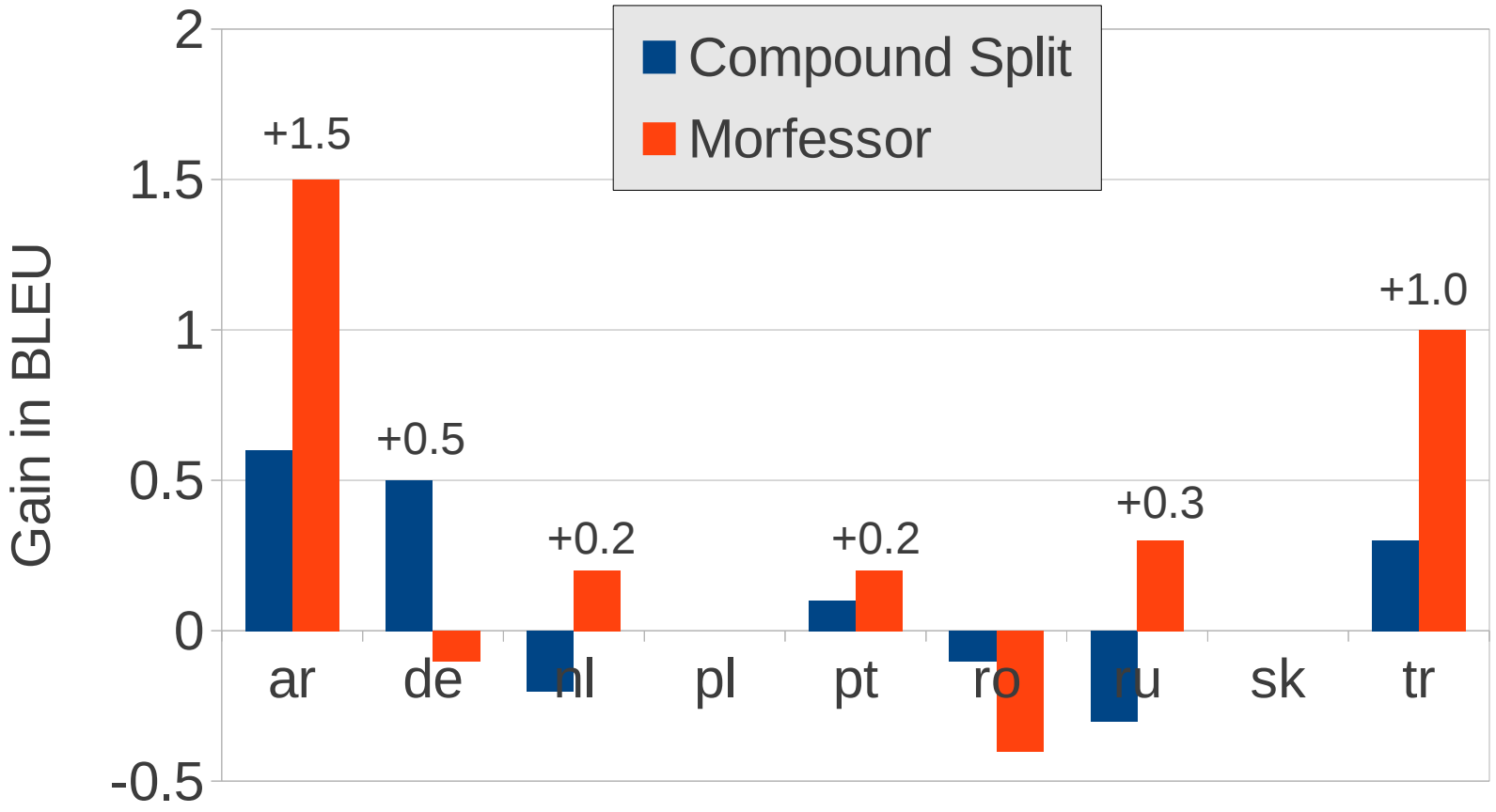
Unsupervised Morphology

- Compound-splitter.perl [Koehn 03]
  - Breaks apart words if subparts are seen in training data over a certain frequency
- Morfessor 1.0 [Creutz 02]
  - Use Minimum Description Length principle to find a small set of morphemes that covers the training words
  - Discovers both free & bound morphemes
  - Small modification: Morfessor segments too aggressively for unknown words, so keep OOV as is

Vocabulary Growth Rate

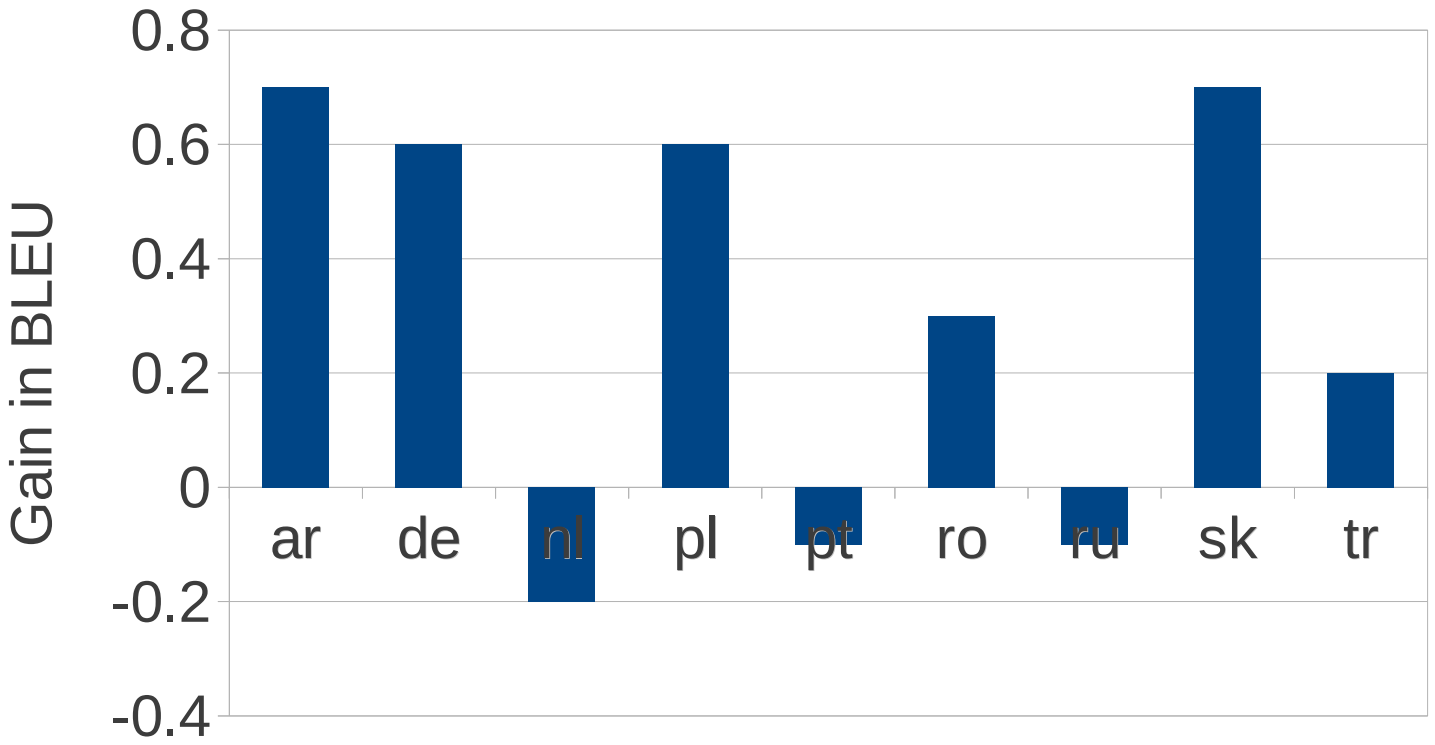


Morphology Results



Language Model Addition

- Added additional Giga-Word language model



Other Methods Investigated

- Out of domain TM data
- Lattice-based MBR

See the paper for more details!

Thank You!