The ISI/USC MT System for IWSLT 2004

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Overview

- ISI/USC MT System
  - Overview
  - Model components
    - Simpler version of 2004 NIST Evaluation System
  - Training data
- Results

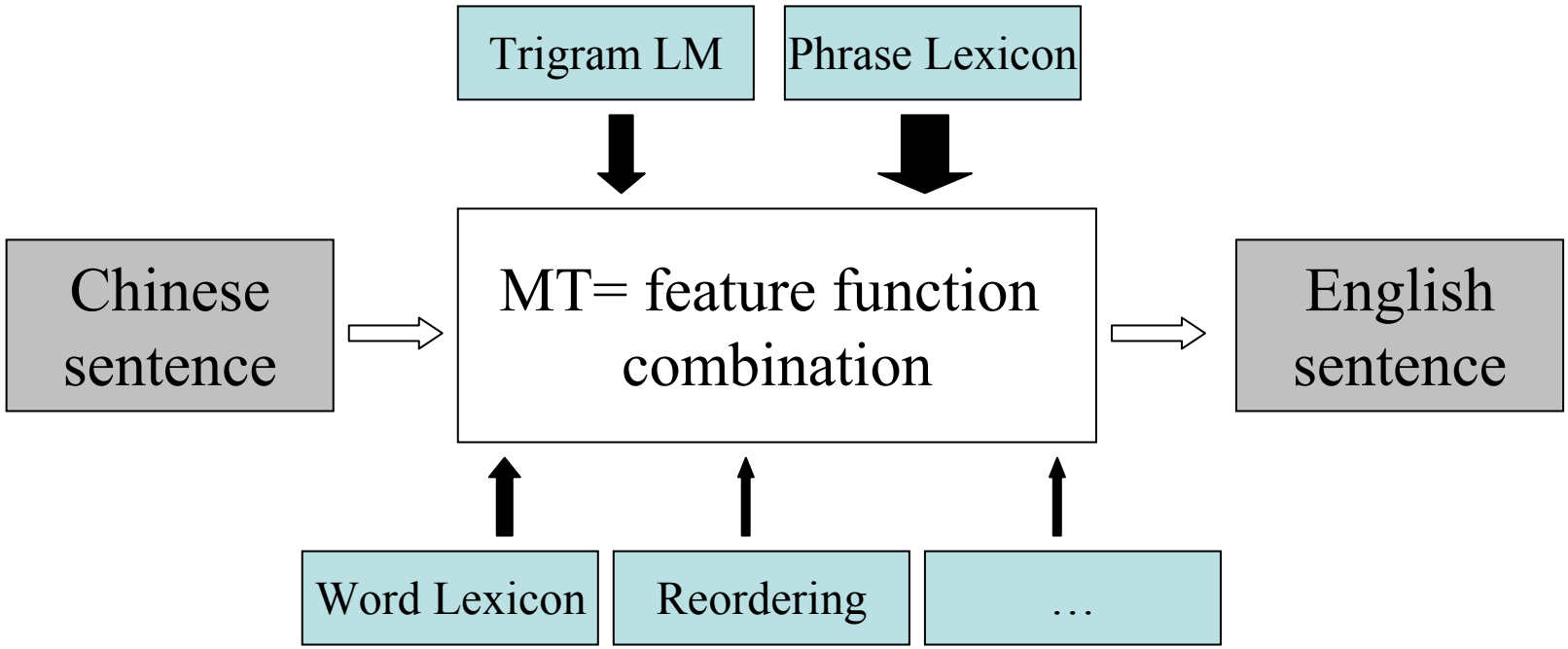
MT as Noisy Channel

- Translate source sentence *f* into target sentence *e*
- Noisy Channel
  - *P(e)* - language model
  - *P(f|e)* - translation model
  - *P(e|f) = P(e)P(f|e)/P(f)*
- Translation is search
  - argmax_e *P(e|f)* = argmax_e *P(e)P(f|e)*

Log-Linear Model

- Translate source sentence *f* into target sentence *e*
- Direct Model
  - Feature functions $h_m(e, f)$
  - Feature weight λ_m
  - $P(e|f) = exp(\sum_M \lambda_m h_m(e, f)) * Z(f)$
- Translation is search
  - $\text{argmax}_e P(e|f) = \text{argmax}_e \sum_M \lambda_m h_m(e, f)$

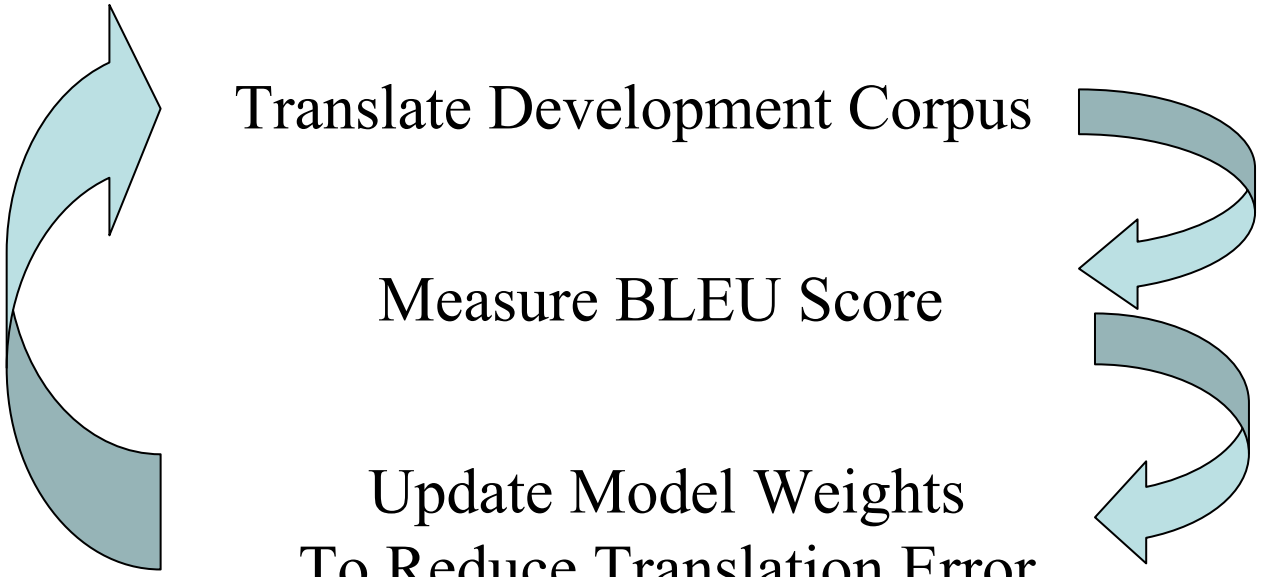
Log-Linear Model



Training

- Feature functions trained individually
  - Specific training criterion for each FF
    - Phrase Probability: Relative Frequency
    - Language Model: Smoothed ML
    - …
- Feature function weights are optimized to increase BLEU score

Minimum Error Rate Training



Och, F. J. “Minimum Error Rate Training
for Statistical Machine Translation”, ACL 2003.

Alignment Template Model

- Corpus is word aligned
  - Uni-directional word alignments are merged
- Phrase pairs are collected
  - A phrase is only collected if words on both sides are only aligned to each other
- Probability determined by relative frequency
  - $p(e|f) = C(e,f)/C(f)$

Language Model

- Smoothed trigram
  - Kneser-Ney smoothing
- SRI Language Modelling Toolkit

Other Feature Functions

- 10 other feature functions used for scoring
  - Length Bonus - encourage longer sentences
  - Jump Penalty - discourage non-monotonicity
  - …
  - Full list in paper
- Fewer feature functions that NIST 2004 system

Search

- Dynamic programming beam-search
- Generate translation hypothesis word-by-word
- Heuristic rest-cost estimate
- Reordering constraints:
  - < 8 word jumps

Training Data - Supplied

- 20K lines BTEC corpus J-to-E, C-to-E
- LM trained on English half

Training Data - Additional

- 20K lines BTEC corpus C-to-E (x5)
  - Re-segmented with LDC segmenter
- 6 of allowable LDC corpora
- LM trained on English half
- LM trained on 800M words news text
- Punctuation removal
  - No other rule-based translations/postprocessing

Training Data - Unrestricted

- 20K lines BTEC corpus C-to-E (x5)
- 167M words political+news data (NIST eval corpora)
- LM trained on English half
- LM trained on 800M words news text
- Punctuation removal
- No minimum error training
  - Model weights from “Additional” system were used.

BLEU Results

	C-to-E	J-to-E
Supplied	37.42	40.08
Additional	44.05*	N/S
Unrestricted	24.3**	N/S

* previously reported as 31.16

** no minimum-error rate training

Conclusion

- Applied our translation system to speech expressions
- Excited to learn more about spoken-language translation