IWSLT 2004 Workshop

The ISL EDTRL System

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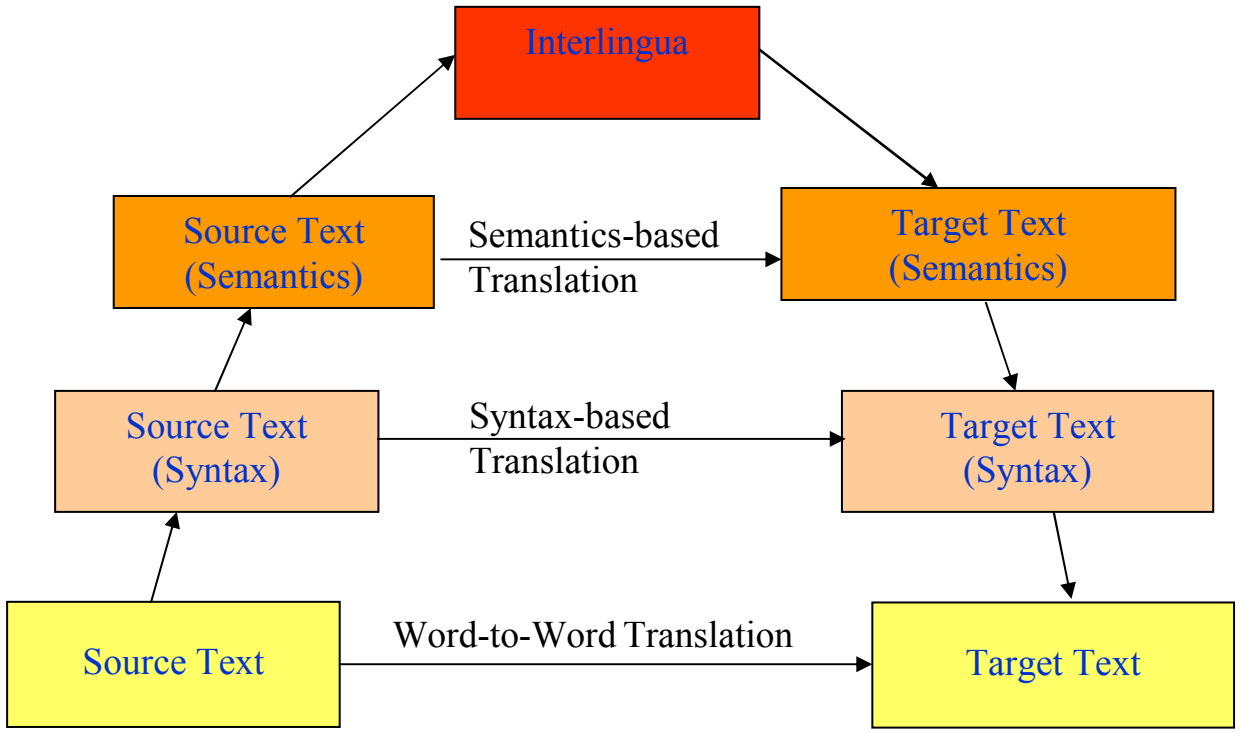
Overview

1. Introduction
2. Basic Ideas of EDTRL
3. Training and Translating
4. Experiments and Results

1. Introduction



level of abstraction

Usage of Knowledge

- Knowledge-based Approaches
  - Grammar writing
  - Expert system
  - Frame-based Machine Translation
- Data-driven Approaches
  - Example-based Machine Translation
  - Statistical Machine Translation
  - Grammar learning

2. Basic Ideas of EDTRL

Combine the Approaches of

- Interlingua Systems
  (2n Modules, NLP, Paraphrases)
- Data-Driven Systems
  (only depends from corpus)
- Knowledge-based Approaches
  (further semantic and morphologic knowledge)

What do we get?

⇒Domain only depends from training corpus

⇒No handcrafted work

⇒Easily add new language

⇒Reduce Parallel Data Sparseness Problem

- Very few

  Spanish – Chinese

- Large amount of

  Chinese – English

  English – Spanish

-> use Chinese – English – Spanish

Enriched and Formalized English as Interlingua

1. Cascaded translation
2. Preserve translation alternatives
3. Confidence Measures / Probabilities
4. Standardized and Simplified English
5. Linguistically enriched English

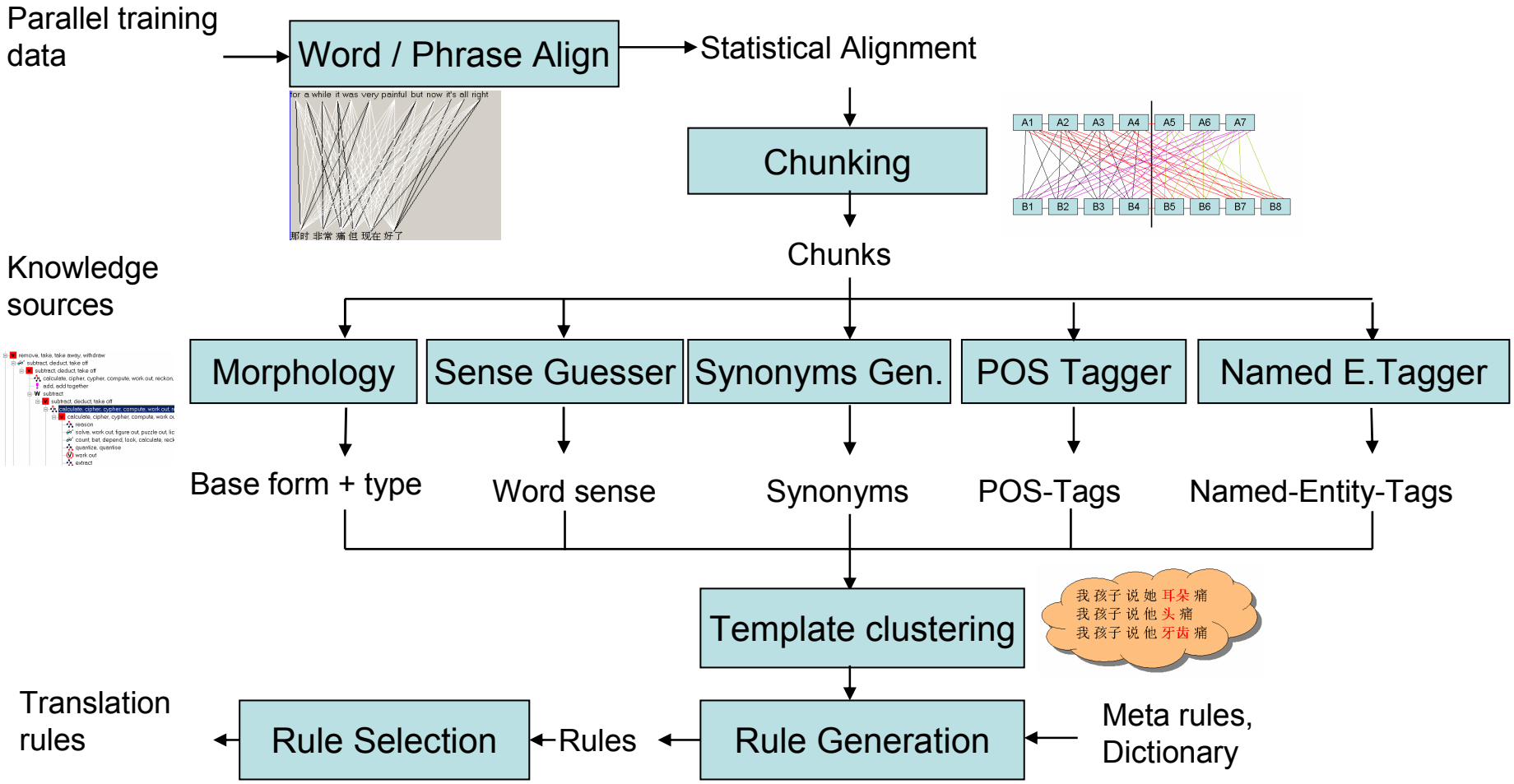
Formalizations & Enrichment

- Simplified English (common used alternative)
- Standardized word order (please give me … -> give me … please)
- Added Attributes
  - Morphological knowledge
  - Sense
  - Synonym Generator
  - Part-of-Speech Tags
  - Named Entity Tags
  - (sentence type, active/passive, politeness, domain, category, …)

Statistical Translation Rules

- Transfer knowledge from English to the foreign language using the statistical Alignment
- Error-Driven Learning (learn from errors)
- Interactive learning modus
- Translation error tracking and correction
- Small memory/time footprint (scalable)

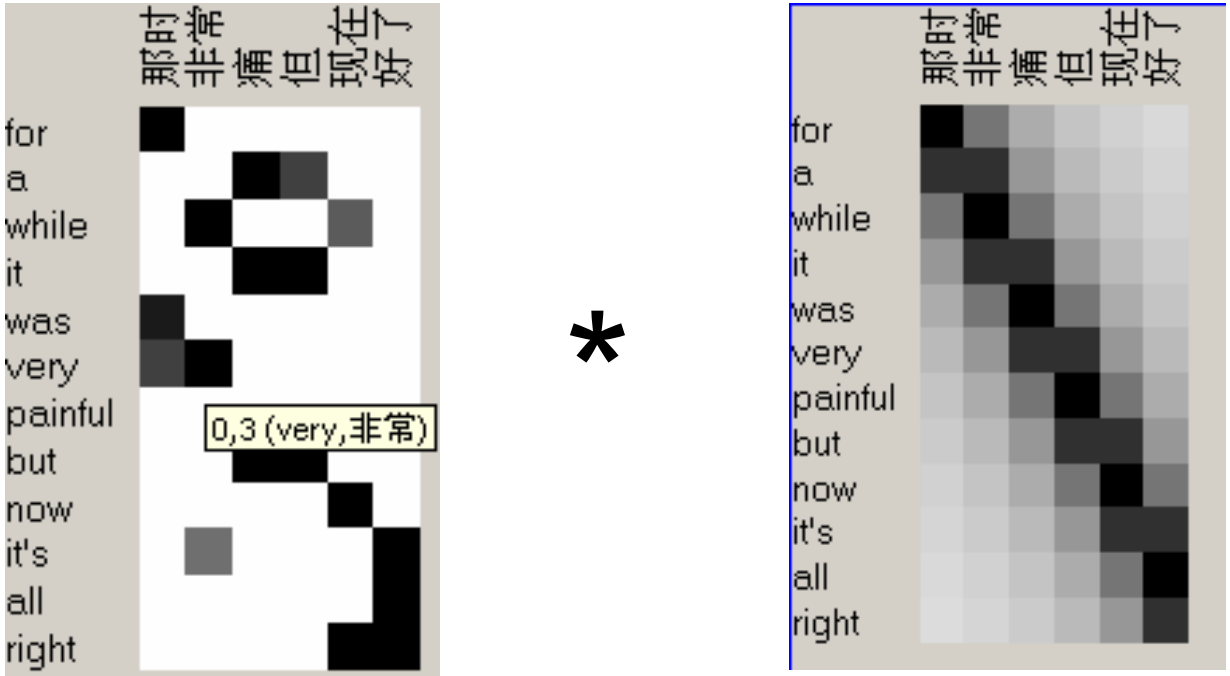
3. EDTRL Training



Weight functions for Alignment

1. Weight Position factor

$$\frac{1}{\left| WordPos1 - \left(WordPos2 \bullet \frac{\#Words1}{\#Words2} \right) \right|}$$

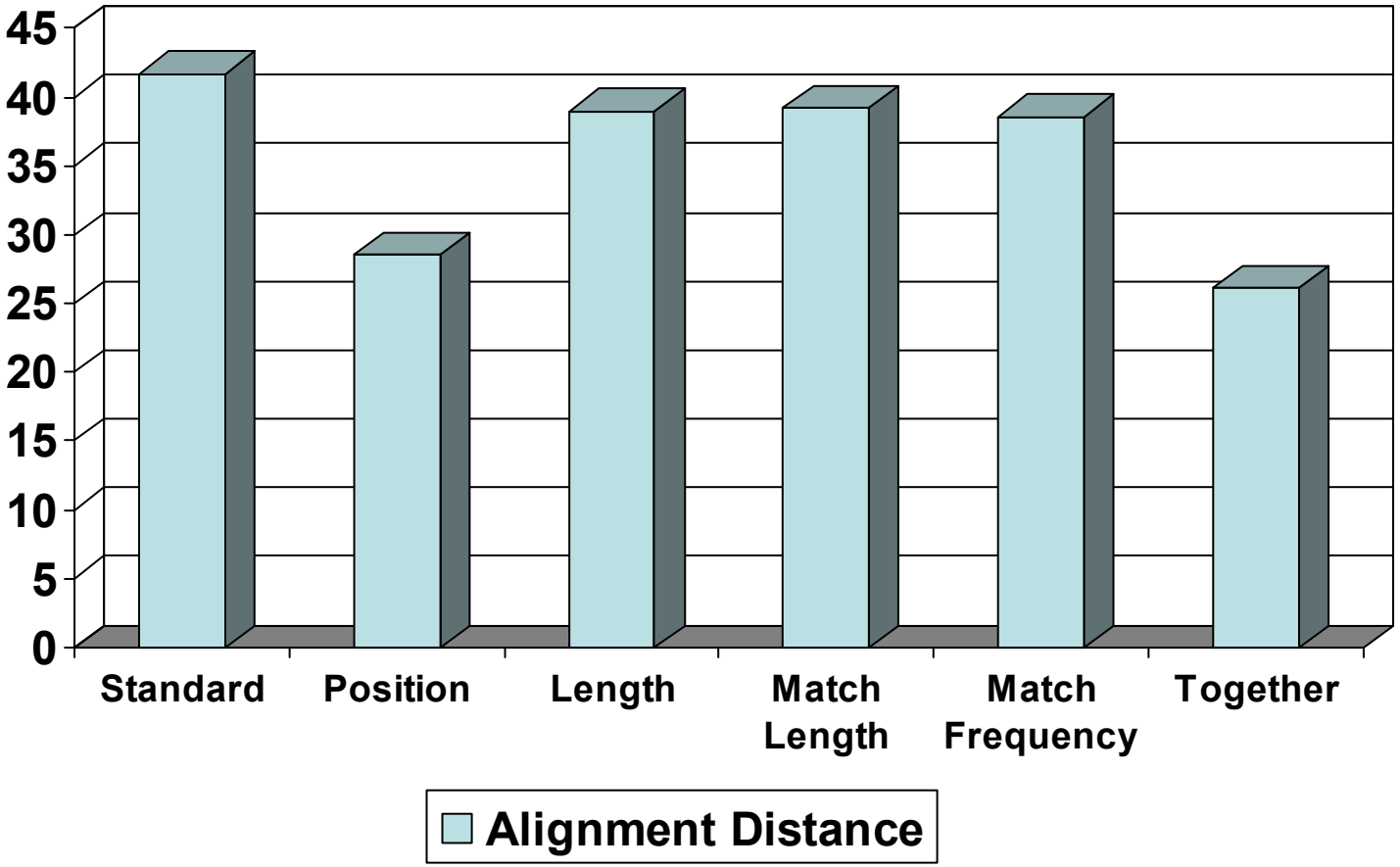


Weight functions for Alignment

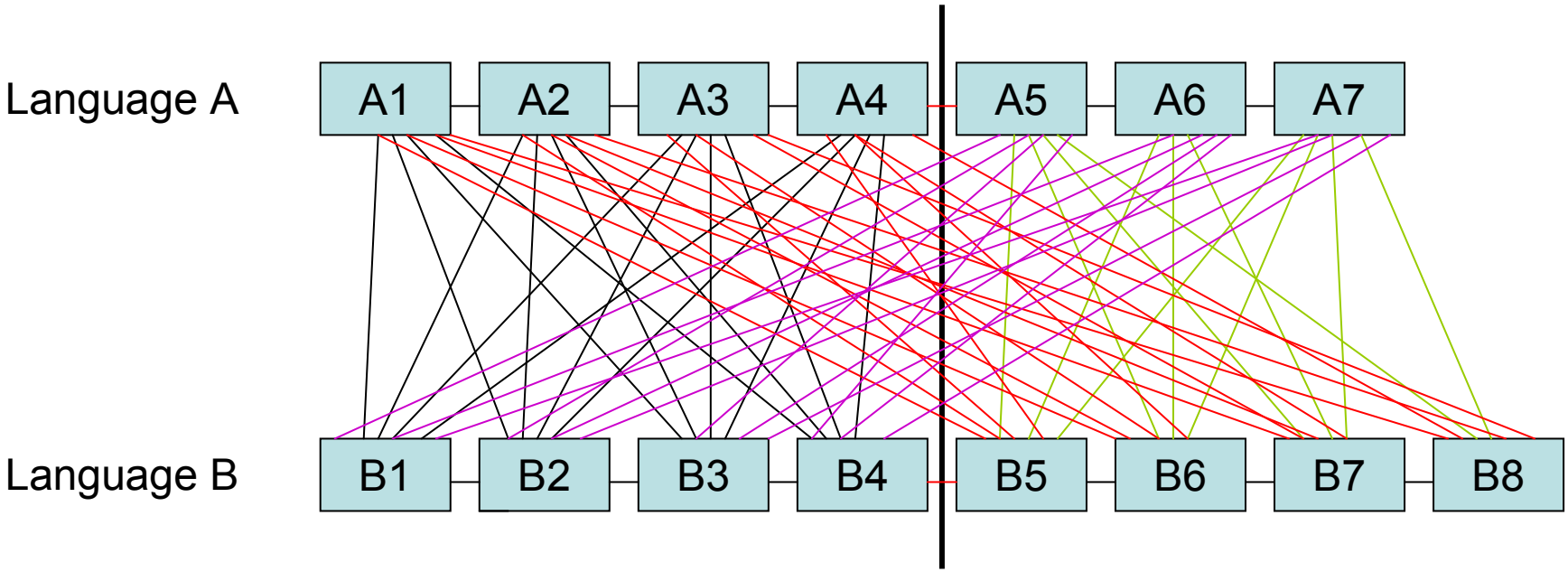
2. Length penalty $\frac{k}{\log(len)}$
3. Matching Length factor (prefer same length) $\frac{\#LenA+\#LenB}{2\cdot\max(\#LenA,\#LenB)}$
4. Frequency Weight (prefer alignment between words with similar frequency)

$$\frac{\#wordsA+\#wordsB}{2\cdot\max(\#wordsA,\#wordsB)}$$

Weight functions for Alignment



Chunking

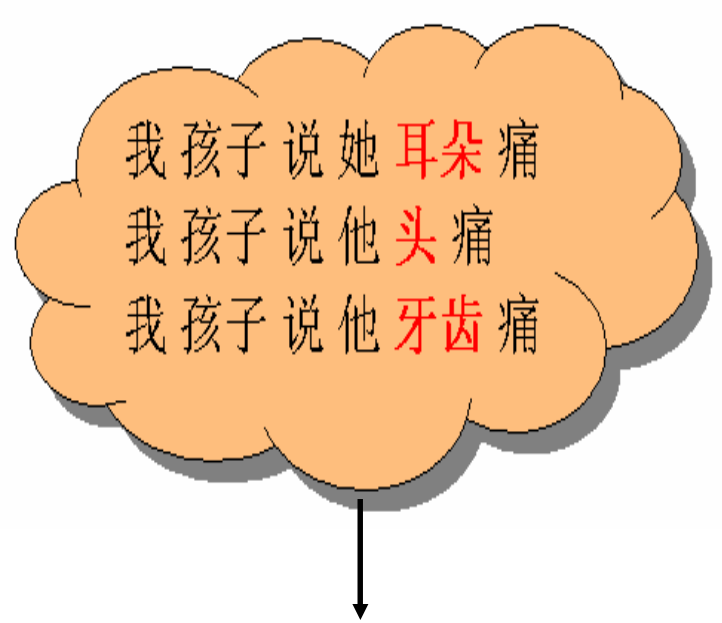


Align Dependence = (align weigths + align weights) / (align weigths + align weights)

LM Dependence = Sum $P(W_n|W_{n-1})$ / Sum $P(W_n|W_{n-1})$

Template generation

1. Cluster similar Sentence pairs
2. Generate Phrase Alignment
3. Build templates with classes for the different words



我孩子说她<0:bodypart>痛

Rule Generation/Selection

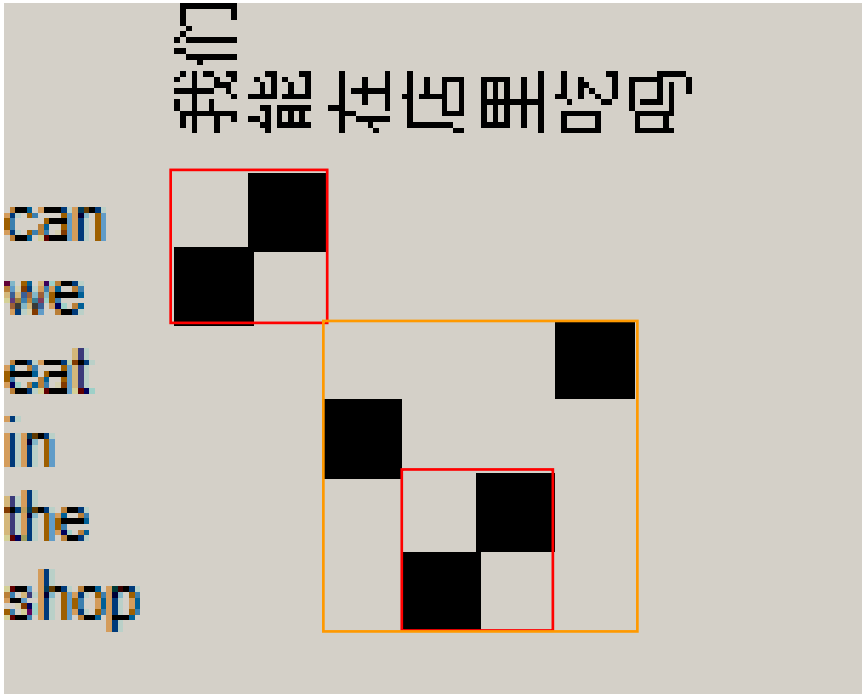
- Rules

  Cond1 | Cond2 | … → Templ1 | Templ2 | …
  Build form: Word, Phrase, Attribute Class

  Scores (Probabilities) for each Template
- Find ‘optimal’ rules
- Evaluate rule on verification set
- Using a class hierarchy
- Using meta-rules for the construction

Learning reorder rules

- Search reorders with a high alignment confidence
- Generalize or specialize the reorder rules by introducing classes and conditions



Translation

- Left to Right
- Find Matching rules -> probability
- Instantiate rules -> probability
- Beam-Search weighted by a trigram
- Pruning

Translation

A) Chinese -> IL (Tagged English):

我 想 我 从 某人 那 传染 上 感冒 了

我 从 某人 那 <1> 上 <2> 了

-> I've <1:VB> a <2:Disease> from someone

传染: infection <NN>0.3, transmission <NN>0.1, infect <VB>0.1, catch <VB>0.2

感冒: cold <Disease>0.3, rheum <Body Substance>0.2, to catch cold <Change>0.4

Instantiation => I think I've caught a cold from someone

Translation

B) IL (Tagged English) -> Chinese/Spanish :

I think I've caught<1:VB> a cold <2:Disease> from someone

I've <1:VB> a <2:Disease> from someone

-> 我 从 某人 那 <1> 上 <2> 了

catch <VB>: 捕捉 0.4, 逮 0.3, 传染 0.1 …

catch <NN>: 陷阱 0.1, …

cold <Temperature attribute>: 冷0.4 ， 凉 0.4

cold <Disease>: 感冒 1.0

Instantiation => 我 想 我 从 某人 那 捕捉 上 感冒 了

4. Experiments and Results

Preprocessing

- IWSLT
- New Segmentation (for Chinese)

Post processing

- a -> an
- removing duplicates
- Some verb form adaption

Database

	Training			Test
	# English Phrases	# Chinese Phrases	# Spanish Phrases	
BTEC	162314	162314	6027	506
Medical	7634	7634	7634	200
Tourism	2003	2003	2003	200
$\sum$	171951	171951	15664	

Experiment: mixing Domains

Train	Test	NIST-score
BTEC (162000)	BTEC (506)	4,7109
medical (6500)	medical (200)	2,8434
tourism (2000)	tourism (200)	3,1706
btec+medical+tourism	btec	4,7617
btec+medical+tourism	medical	2,8952
btec+medical+tourism	tourism	3,1735
btec+medical+tourism	btec (large system)	4,8383

Results

Systems	EDTRL	Systran
C → E	7,34	5,74
E → S	5,17	6,06
C → S	3,17	-
C → E → S	3,41	2,84
C → E_{IL} → S	3,69	-

IWSLT 2004 evaluation Chinese-English unrestricted

Method	Score	Rank (of 9)
fluency	2.93	6
adequacy	3.25	3
BLEU	0.27	5
GTM	0.66	4
NIST	7.50	2
PER	0.42	3

Conclusion

- The EDTRL System has a better performances than simple cascaded multiple MT systems.
- The use of formulized, enriched English as Interlingua can reduce the Parallel Data Sparseness Problem form many languages pairs
- Results from IWSLT 2004 evaluation campaign lie behind the best systems