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CASIA SMT System for IWSLT'09

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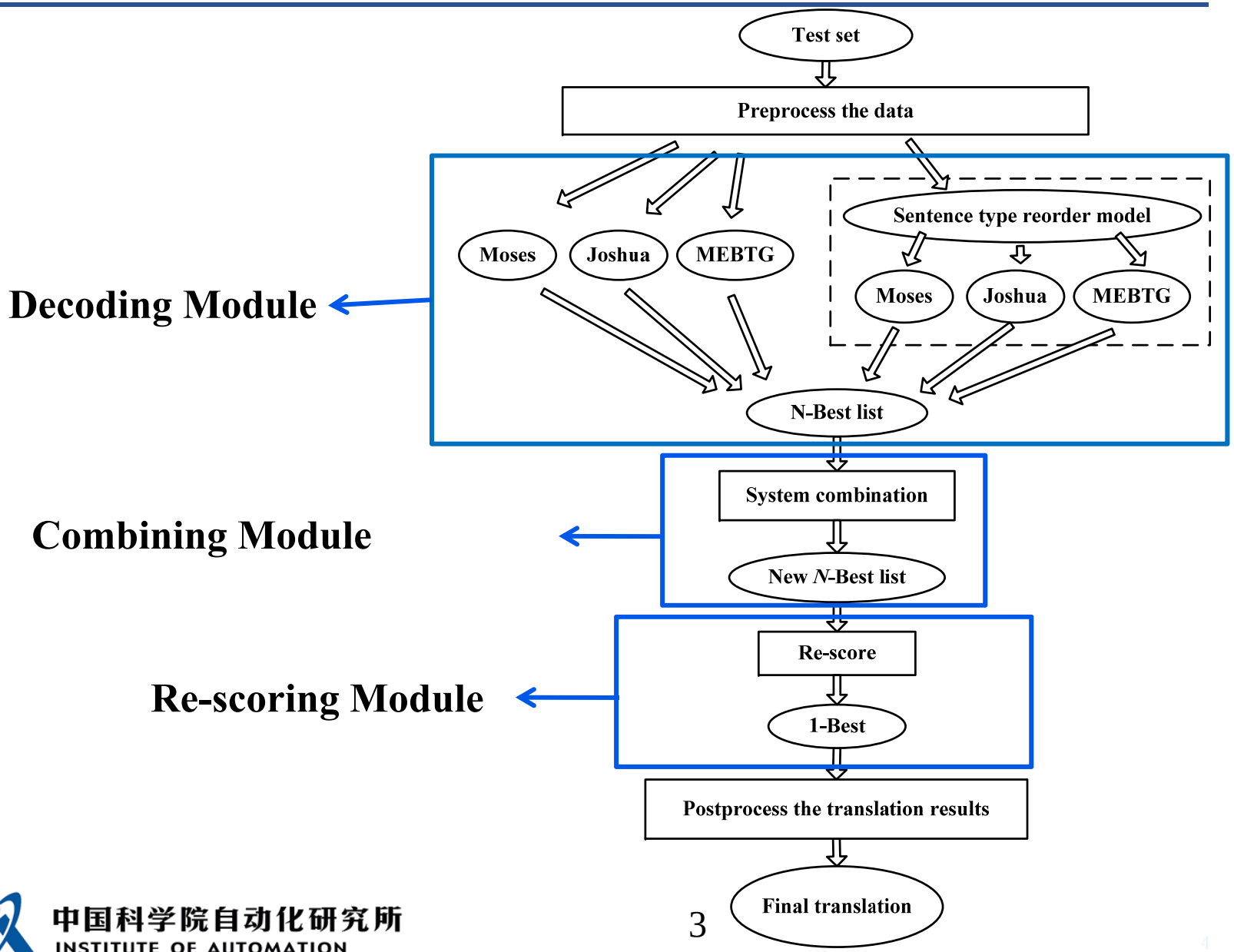
Introduction

1. In IWSLT 2009 Evaluation Campaign, the tasks that we participated in include:

- Challenge translation tasks:
  - ✓Chinese-to-English: CT_CE (CRR and ASR)
  - ✓English-to-Chinese: CT_EC (CRR and ASR)

- BTEC translation tasks:
  - ✓Chinese-to-English: BTEC_CE

System Architecture



System Implementation

--Prepare the data 1

1 An important difference

Training corpus are limited to the released corpus for each translation task.

2 Chinese word segmentation

- ORI: Original Chinese word segmentation
- ICT: the free software toolkit ICTCLAS3.0 *(http://www.nlp.org.cn)*

Approaches	ORI	ICT	ORI+ICT
BLEU	35.31	36.24	36.63

Table1. The performances with different Chinese word segmentation approaches

System Implementation

--Prepare the data 2

3. English word Lowercased and tokenized

- A word in different positions of a sentence may have different morphology.
- To avoid data sparse, we use the lowercased and tokenized scripts of the open source toolkit Moses to do this job.

System Implementation

--Prepare the data 3

4. Named Entities process

- A hybrid named entity recognizer to identify Chinese NEs.
- Person names and location names are translated word by word.
- Organization names are translated by a structure-based translation model.
- A rule-based approach to translate the temporal and numerical NEs.

System Implementation

--Decoding module 1, three original SMT decoders

- Moses
- Joshua
- MEBTG:
  - ✓ An in-home maximum entropy-based reordering model decoder.
  - ✓ The prediction of relative orders of any two adjacent blocks is considered as a problem of classification.
  - ✓ A MaxEnt classifier is trained according to the training data.
  - ✓ A CKY algorithm is exploited to decode the test set.
  - ✓ We limits the phrase table within 40 and the partial hypotheses within 200.

System Implementation

--Decoding module 2, three deformed SMT decoders

- For Chinese to English translation, a preprocessing module, namely **Bandore**, reorders the Chinese sentences before decoding.
  - ✓ An SVM is used to classify Chinese sentences into three types exploiting all the words occurring in the sentence as features.
  - ✓ Corresponding reordering model is developed for specific sentence types.
  - ✓ Reordering the Chinese sentences of training set and test set.
  - ✓ Pass the reordered sentences into the original SMT decoders.
- We called them: Moses-Reorder, Joshua-Reorder and MEBTG-Reorder.

System Implementation

--Decoding module 3, SMT decoders setting

1 Decoder version selecting:

- ✓ Joshua 1.1 – the only version at that time.
- ✓ Moses 2009-04-13.

Tasks	Version 2009-04-13	Version 2008-07-11
CT_CE	35.64	35.37
CT_EC	33.70	33.53

Table 2. The performance on the Challenge CRR tasks with different Moses version

2 Decoder option: closest or shorest ?

Tasks	closest	shortest
CT_CE	36.56	35.64

Table 3. The performance on the development set with different Moses tuning option

Tasks	closest	shortest
CT_CE	38.00	36.58
CT_EC	31.96	31.03
BTEC	47.05	45.66

Table 4. The performance on the development set with different Joshua tuning option

System Implementation

--Combining module, a word-level system combination approach

- Our approach is similar to A.-V. I. Rosti etc. presented in ACL 2007.

- We improve the system combination performance by substituting a word reordering alignment (WRA) for alignment produced by TER.

- The 10-Best lists are used for system combination.

System Implementation

--Re-scoring Module

- The re-scoring method that we used this year is the same as last year.

- We merge the 100-Best hypotheses produced by the combining module and all the original 10-Best hypotheses generated by each single decoder.
  - ✓ Note that the 100-Best hypotheses produced by the combining module might include some original hypotheses, so we delete the repeated ones.

System Implementation

--Post-processing

- For Chinese to English translation tasks:
  - ✓ Re-case: train a re-caser with Moses and re-case the outputs.
  - ✓ De-tokenize: done by the de-tokenizer scripts of Moses package.
  - ✓ Tokenize the final submitted translation with the official tool: “ppEnglish.case+punc.pl” script.

- For English to Chinese translation task, evaluation by Chinese Character.
  - ✓ Transform segmentation into characters by the official tool: “splitUTF8characters.pl” script.

System Implementation

--For CT-CE ASR 1, replace Chinese character with Chinese Pinyin for CT-CE ASR task

- The mistakes made by ASR often focused on:
  - ✓ Homophone Chinese character. Such as "玲(ling2)" or "铃(ling2)"
  - ✓ Different Chinese character pronunciation tone. Such as "**直(zhi2)**" or "**智(zhi4)**" or "**知(zhi1)**".

- The supplied corpus is very small, this often lead to:
  - ✓ A lot of OOV words emerge.
  - ✓ The data sparse is very severe.

System Implementation

--For CT-CE ASR 2

- Add Chinese Pinyin for Chinese character in the training data and the test data.

我 的 名字 是 铃木 直子
wo3 de5 ming2 zi4 shi4 **ling2** mu4 **zhi2** zi5

我 的 名字 是 铃木 智子
wo3 de5 ming2 zi4 shi4 ling2 mu4 **zhi4** zi5

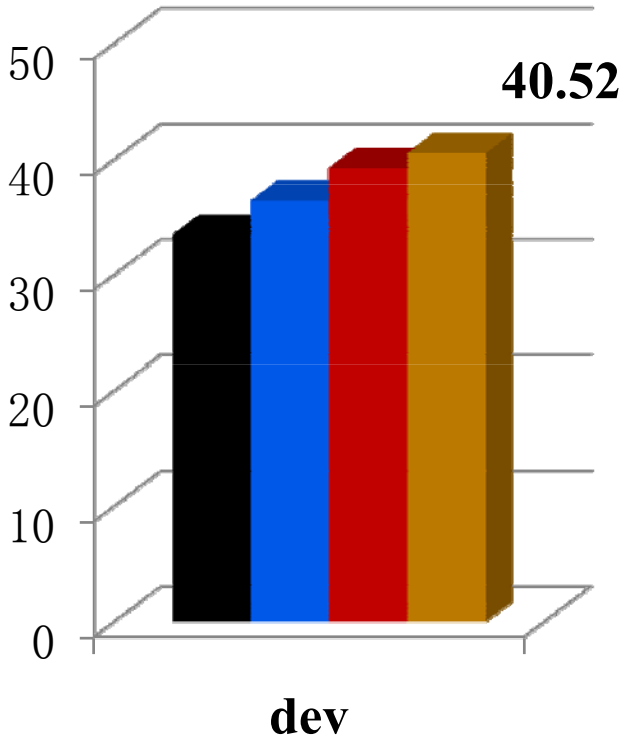
我 的 名字 是 铃木 知子
wo3 de5 ming2 zi4 shi4 ling2 mu4 **zhi1** zi5

我 的 名字 是 玲木 智子
wo3 de5 ming2 zi4 shi4 **ling2** mu4 **zhi4** zi5

- Use Chinese Pinyin to train the model.

System Implementation

--For CT-CE ASR 3, performance on the development set



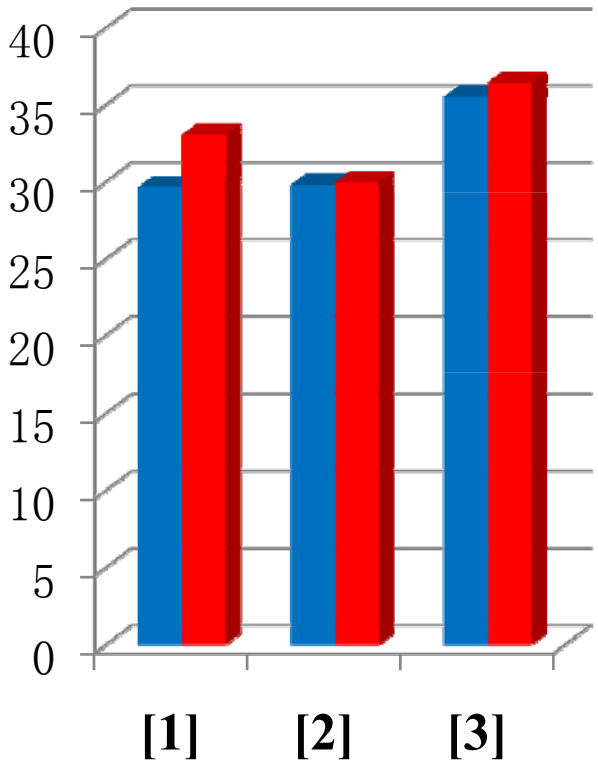
CT-CE-ASR	DEV	
ASR	33.48	
ASR-Pinyin	36.43	↑ 2.95

CT-CE-CRR	DEV	
CRR	39.24	
CRR-Pinyin	40.52	↑ 1.28

Table 5. The translation performance of substituting Chinese Pinyin for Chinese character on the DEV9 for CT-CE task

System Implementation

--For CT-CE ASR 4, performance on the test set



	ASR-Pinyin	CRR
no_case + no_punc [1]	29.65	33.04
case + punc [2]	29.81	29.95
Primary case + punc [3]	35.52	36.44

Table 6. The translation performance of substituting Chinese Pinyin for Chinese character on the test set for CT-CE task

Experimental Results

-- Corpus statistics 1

- When tuning the parameter:
  - ✓ We merge all individual development sets given a translation task.
  - ✓ We use the same pre-processing approach to deal with the source sentences and the reference translations.

- When decoding the test set:
  - ✓ We add the development sets to the training corpus to re-train the models.

Experimental Results

-- Corpus statistics 2

Corpus statistic for BTEC CE task

corpus	Size
Train corpus	19,972 sentence pairs
Development set	2,508 sentence with 16 references
Test set	469 sentence

Corpus statistic for CT-CE tasks

corpus	Size
Train corpus	30,033 sentence pairs
Development set	4,447 sentence with 16 references
Test set	405 sentence

Corpus statistic for CT-EC tasks

corpus	Size
Train corpus	30,033 sentence pairs
Development set	1,465 sentence with 7 references
Test set	393 sentence

Experimental Results

-- Word aligning 1, combine different word alignments

- We combine the word alignments produced by GIZA++ and BerkeleyAligner.
  - ✓ We use GIZA++ and BerkeleyAligner to generate different word alignment files.
  - ✓ We merge the two files into a big word alignment file by concatenating one alignment file to the other.
  - ✓ The big word alignment file is exploited by the decoders to generate the translation models.
- Improvement with combining word alignments

Challenge CT_CE CRR	Moses	Joshua
Baseline (GIZA++)	36.24	36.83
Combining word alignment	38.09	39.24

Experimental Results

-- Word aligning 2, a two-step word alignment approach

- In the first step:
  - ✓ We use GIZA++ to produce word alignment and phrase table;
  - ✓ We set a threshold value, such as 0.5, to filter the phrase table, and extract some phrase tables.
- In the second step:
  - ✓We add the reliable bilingual phrase tables into the training data and re-train the model.

Moses decoder	BLEU
Baseline	36.24
Two-step word alignment	36.83
Combining word alignment+ two-step word alignment	38.26

Experimental Results

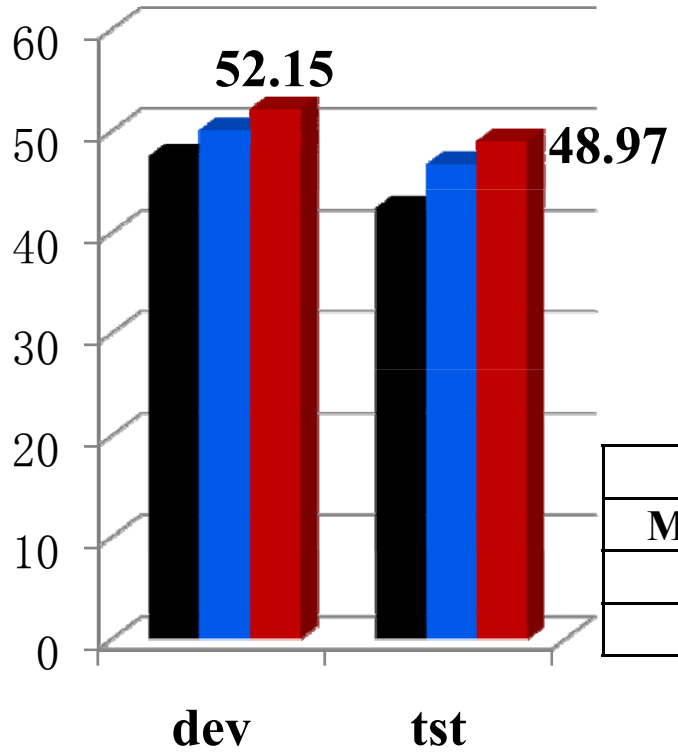
--Performance 1

- For each task, we submit three system running results:
  - ✓ Re-score result (primary).
  - ✓ System combination result (contrastive 1).
  - ✓ The results of the best individual system on the development set (**contrastive 2**).

- The performance on the development sets is case-insensitive, while on the test set is case-sensitive, which is released by the official.

Experimental Results

--Performance 2

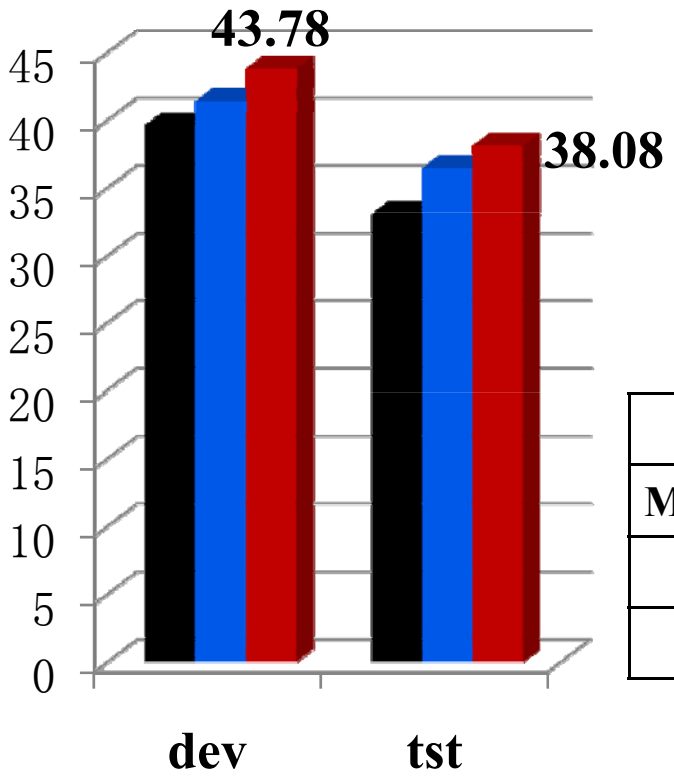


	DEV		TST	
Moses_Reorder	47.52		42.39	
SysComb	50.08	↑ 2.56	46.68	↑ 4.29
Re-score	52.15	↑ 4.63	48.97	↑ 6.58

The translation performance on the development set and the test set for BTEC CE task

Experimental Results

--Performance 3

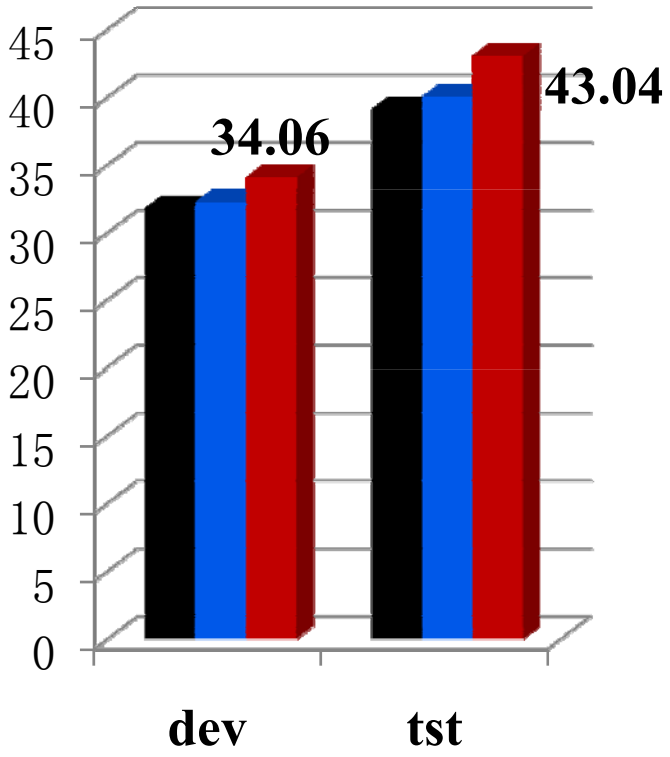


	DEV		TST	
Moses_Reorder	39.60		33.04	
SysComb	41.39	↑ 1.79	36.44	↑ 3.40
Re-score	43.78	↑ 4.18	38.08	↑ 5.04

The translation performance on the development set and the test set for CT-CE CRR task

Experimental Results

--Performance 4



	DEV		TST	
Moses	31.80		39.10	
SysComb	32.28	↑ 0.48	40.03	↑ 0.93
Re-score	34.06	↑ 2.26	43.04	↑ 3.94

The translation performance on the development set and the test set for CT-EC CRR task

Conclusion 1

- The combination module and rescoring module are effective, ↑ 3~6 Bleu points.
- Replace Chinese character with Chinese Pinyin are effective for CT-CE ASR, ↑ 3 Bleu points.
- Combine different word alignments are effective, ↑ 2 Bleu points.
- The two-step word alignment are effective, ↑ 0.6 Bleu points.
- Combine different Chinese word character improve the system performance, ↑ 1 Bleu points.
- Processing NE to the correct formats improves the translation quality.

Conclusion 2

Details determine success or failure!

Thanks for your attention!

Any questions?