A Bootstrapped Interlingua-Based SMT Architecture

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Outline

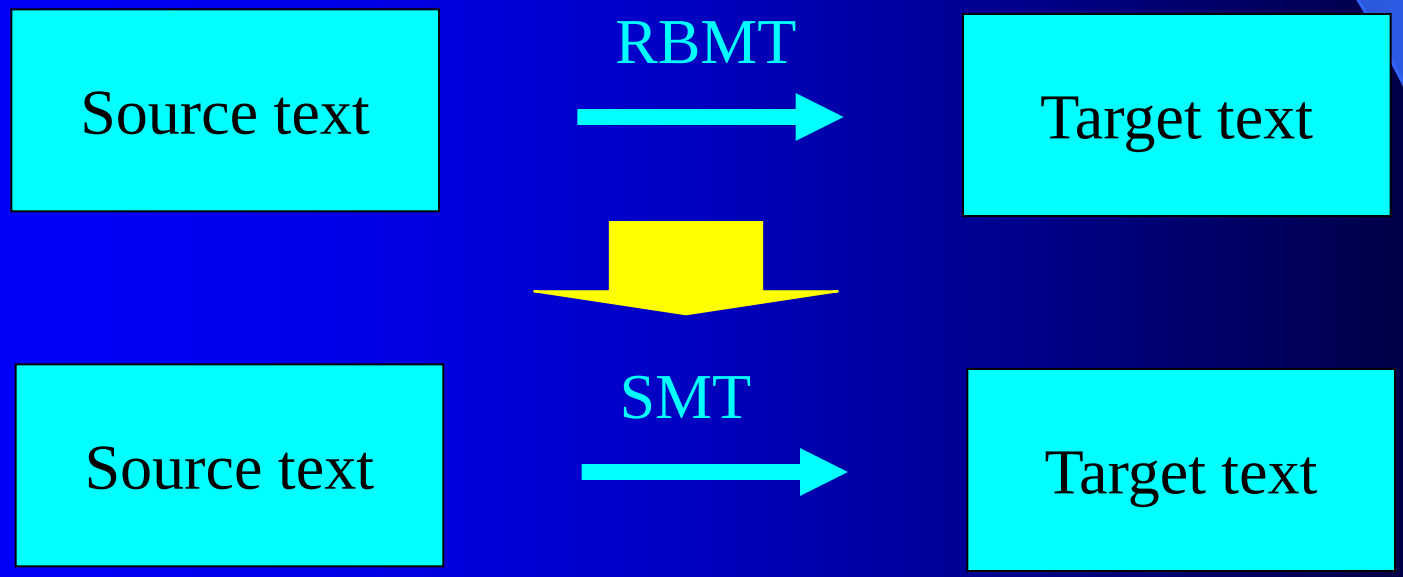
- Goals of paper
- Background
- Bootstrapping an interlingua-based SMT
- Experiments

Goals of Paper

- « Relearning Rule-Based MT systems »
  - Usual goal: add robustness
  - E.g. Dugast et al 2008 with SYSTRAN
- Can we do it with a small-vocabulary high-precision system?
  - Our GEAF 2009 paper: it’s not so easy
- Can we do better if we use interlingua in the right way?

« Relearning RBMT »

- Use rule-based MT system to generate training data
- Train statistical MT system

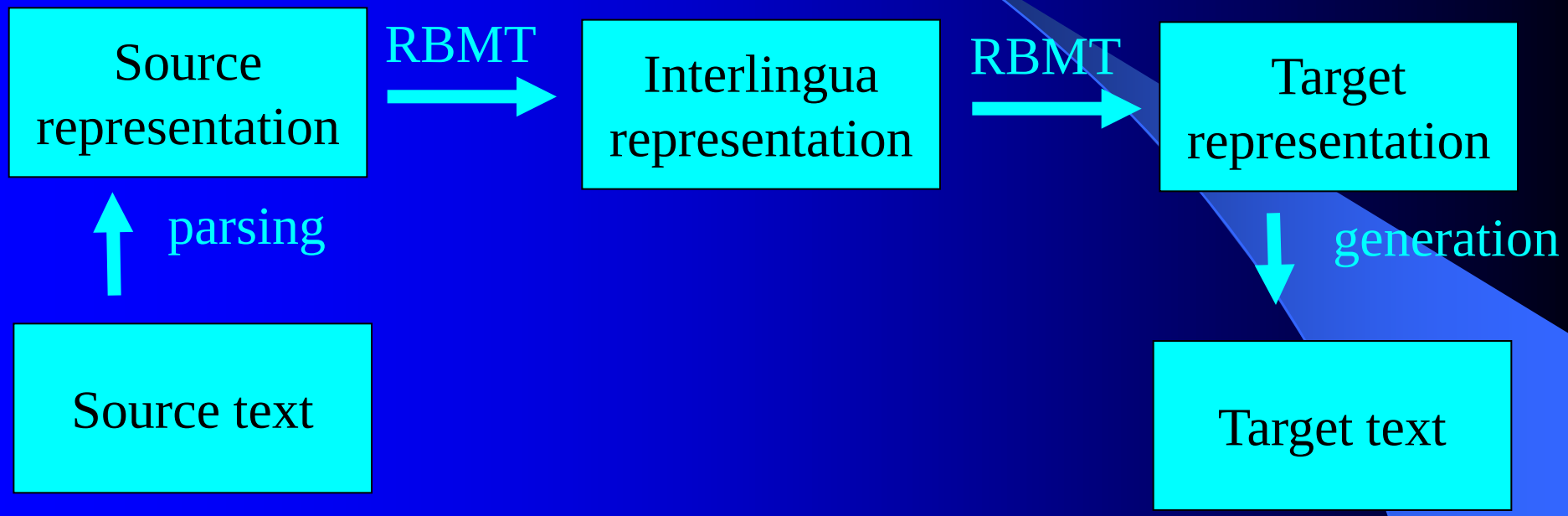


Naive approach

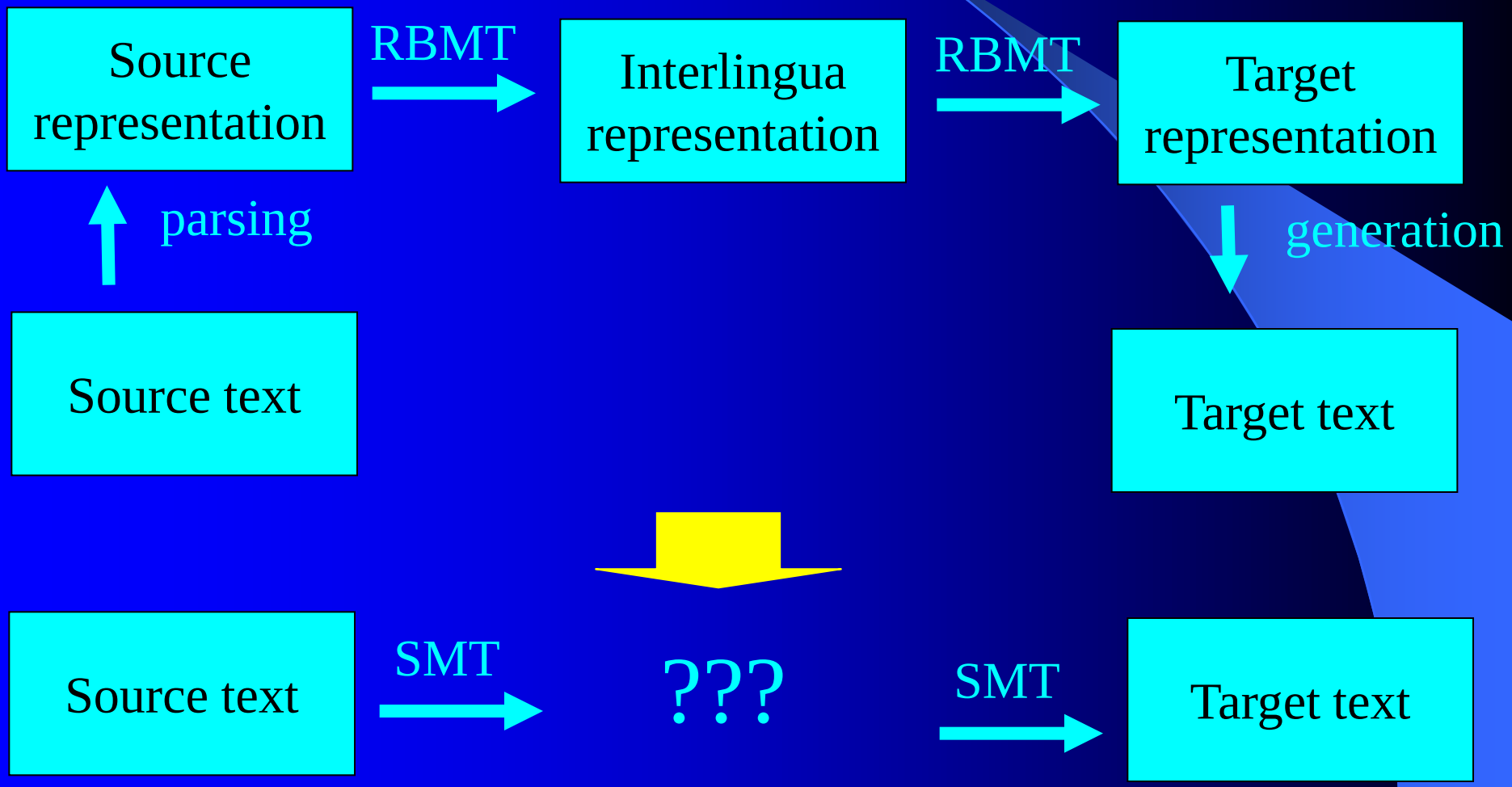
(GEAF 2009 paper)

- Naive approach is unimpressive
- If bootstrapped SMT translation different from RBMT translation, usually wrong
- Very poor for English → Japanese
  - Better for English → French
- Tops out quickly, then no improvement

« Relearning Interlingua-Based Machine Translation »



« Relearning Interlingua-Based Machine Translation »



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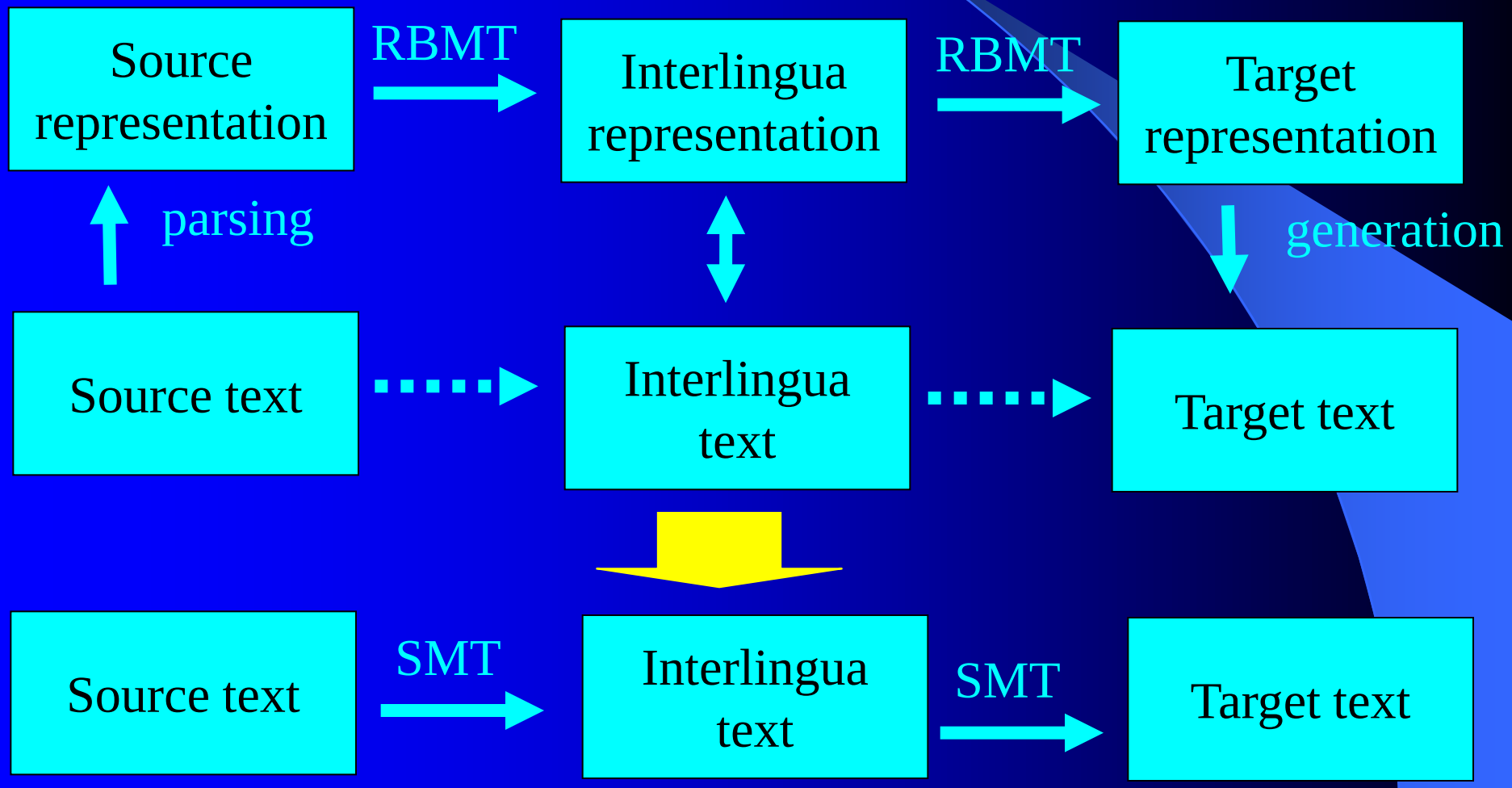

Key Questions

- What is «interlingua text»?
- How can we use it to relearn an interlingua-based system as an SMT?
- How well does it work in practice?

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MedSLT

- Unidirectional doctor → patient spoken translation
- Controlled language, grammar-based
  - Implemented using Regulus platform
- Multi-lingual, interlingua-centred
  - Current prototype: 6 languages, any-to-any
  - English, French, Japanese, Arabic, Catalan, Swedish
- System checks correctness by backtranslating

English MedSLT examples

Where is the pain?

Is the pain in the front of the head?

Do you often get headaches in the morning?

Does bright light give you headaches?

Do you have headaches several times a day?

Does the pain last more than an hour?

Backtranslation

- Source: Do you have headaches at night?
- B/trans: Do you experience the headaches at night?
- Target: Vos maux de tête surviennent-ils la nuit?
- Target: Yoru atama wa itamimasu ka?

Interlingua text

- Think of interlingua as a language
  - Define using formal grammar
  - Associate text form with representation
  - Text form is simplified/telegraphic English
- Functions of interlingua grammar
  - Allows us to induce an SMT
  - Constrains semantic content of input language
  - Surface form useful in development/debugging

Interlingua and Text Form

English sentence

“Does the pain spread to the jaw?”

Interlingua representation

[null=[utterance_type,ynq],
arg1=[symptom, pain],
null=[state, radiate],
null=[tense,present]],
to_loc=[body_part, jaw]]

Interlingua Text

“YN-QUESTION pain radiate PRESENT jaw”

Different Forms of Interlingua Gloss

- Current gloss is simplified English
  - Word-order is English-like
- Can have simplified forms of other languages too
  - In particular, Japanese

Different Forms of Interlingua Gloss (2)

EN	does the pain last for more than one day
IN/E	YN-QUESTION pain last PRESENT duration more-than one day
JP	ichinichi sukunakutomo itami wa tsuzukimasu ka
IN/J	more-than one day duration pain last PRESENT YN-QUESTION

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Bootstrapping an interlingua-based SMT

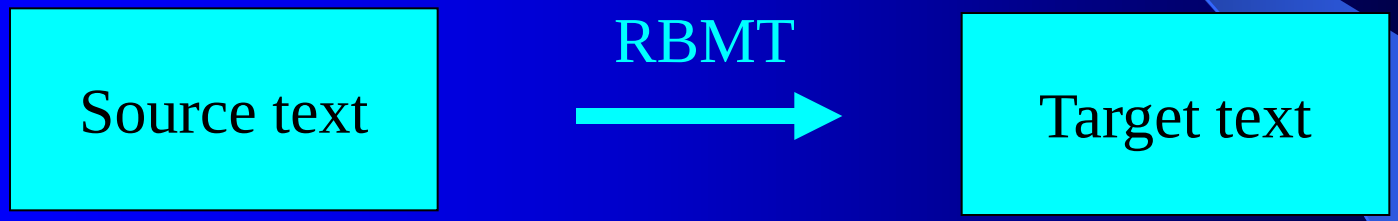
- Randomly generate 1M sents source data
- Translate using EN-FR and EN-JP RBMT
- Save interlingua in text form
  - Both English (IN/E) and Japanese (IN/J) forms
- Train SMT models using Moses etc
  - EN-FR, EN-JP, EN-IN/E, IN/E-FR, IN/J-JP

Ways to exploit interlingua text

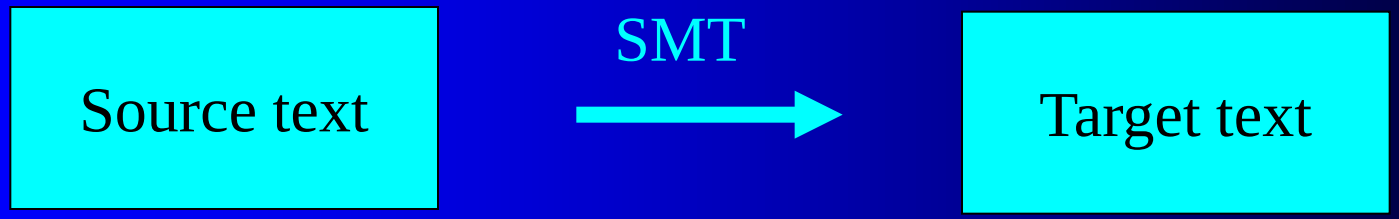
- Rescoring
  - Do Source → Interlingua in N-best mode
  - Prefer well-formed interlingua text
- Reformulation
  - Split up EN-JP as EN-IN/E + IN/J-JP
  - Use interlingua grammar to do IN/E-IN/J
  - SMT translation only between languages with similar word-orders

Processing pipelines

- (Plain RBMT)



- (Plain SMT)



Processing pipelines

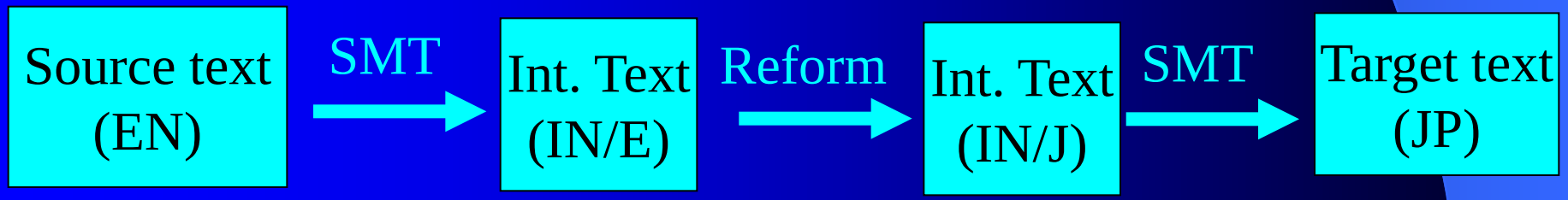
- SMT + SMT

- SMT + RBMT

Processing pipelines

- SMT + rescoring + SMT

- SMT + interlingua-reformulation + SMT



Processing pipelines

- Other combinations
  - SMT + rescoring + int-reformulation + SMT
  - SMT + rescoring + RBMT

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Experiments

- Evaluate relative performance of different processing pipelines
- Evaluate on held-out part of generated data
  - Measure agreement with RBMT translation
  - GEAF 2009 paper: when SMT and RBMT different, SMT often worse and hardly ever better
- Evaluate best pipelines on real out-of-coverage data
  - Use human judges

Results on generated data

(Metric: agreement with original RBMT system)

Configuration	EN → FR	EN → JP
Plain RBMT	(100%)	(100%)
Plain SMT	65.8%	26.8%
SMT + SMT	76.6%	10.5%
SMT + int-reformulation + SMT	---	74.1%
SMT + int-rescoring + SMT	78.5%	10.8%
SMT + int-rescore + int-reform + SMT	---	78.5%
SMT + RBMT	83.5%	81.9%
SMT + int-rescoring + RBMT	87.0%	87.1%

Results on real data (EN-FR)

(Use best versions: SMT + rescoring + SMT/RBMT)

358	out-of-coverage utterances
245	well-formed interlingua
81	good backtranslation
75/81	SMT + RBMT translations
75/75	good SMT + RBMT translations
81/81	SMT + SMT translations
76/81	good SMT + SMT translations

Results on real data (EN-JP)

(Use best versions: SMT + rescore + reform + SMT/RBMT)

358	out-of-coverage utterances
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Summary

- Goal: relearn small RBMT system as SMT
- Not trivial if high precision required
- Much better results if we use interlingua
- Key idea: text form of interlingua
  - Use interlingua to reorder SMT output
  - Use interlingua to handle word-order problems
- Good results on EN-FR and EN-JP