

Example-based Machine Translation using Structural Translation Examples

Eiji Aramaki*

Sadao Kurohashi*

* University of Tokyo

Proposed System



Proposed System

INPUT
英語の新聞を下さい

SELECTED EXAMPLES

1	あの、私は英語がよく話せません。 84.31% (=43/51)	Look, I do n't speak English well. 英語が English
2	新聞をください。 66.66% (=2/3)	Give me a newspaper. 新聞を ください。 Give me a newspaper

COMBINED EXAMPLES

1+2	Give me english [a] newspaper	P(E J)=28.1% P(J E)=95.55% Give me a english newspaper
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OUTPUT
1+2 give me a english newspaper

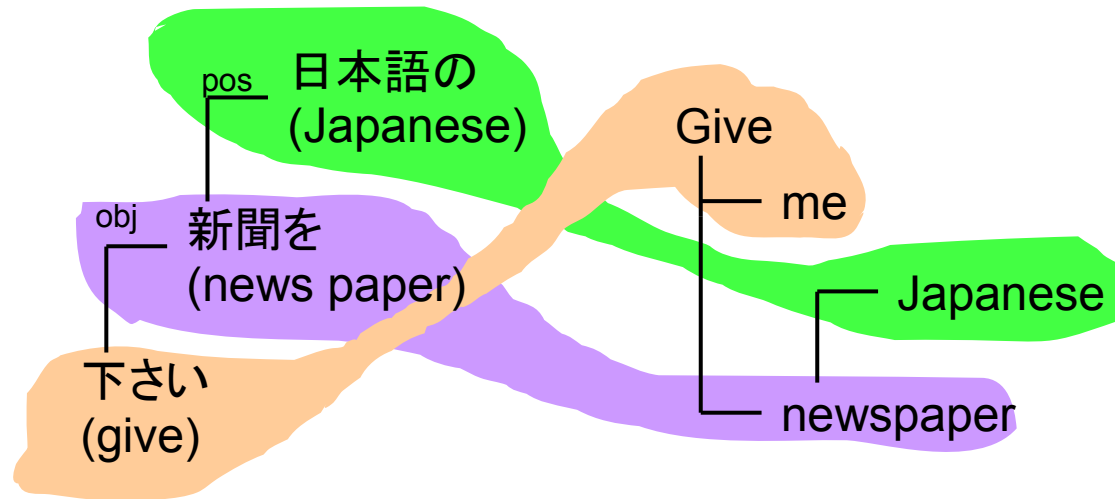
Parses an Input Sentence

Selects
Structural Translation Examples

Combines them
to generate an output tree

Decides the word-order

Structural Translation Examples

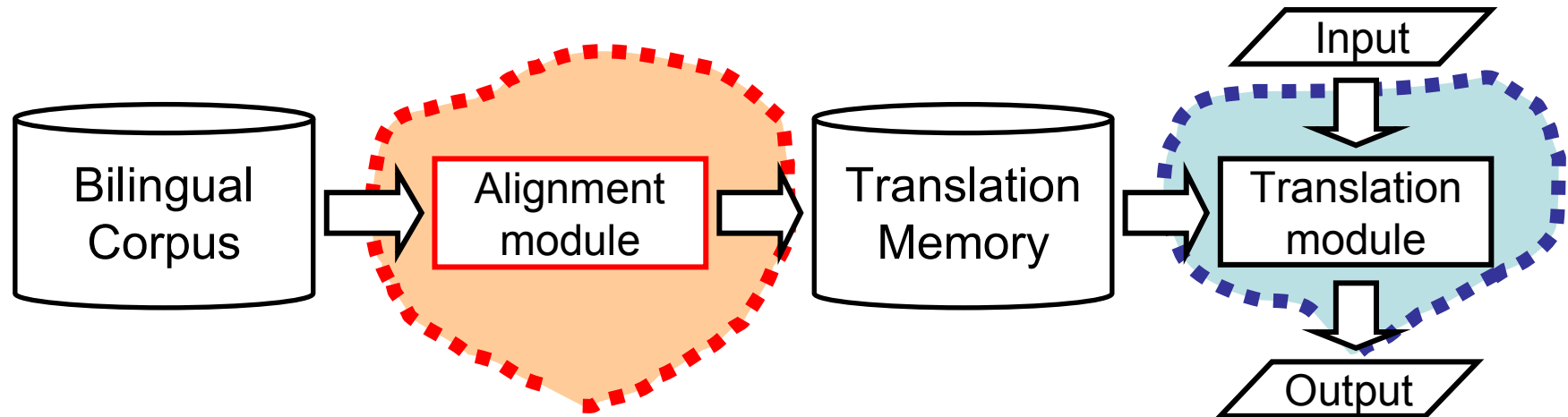


- The Advantage of High-Usability
 - BUT: It requires many technologies
 - Parsing & Tree Alignment (are still being developed)
- A naive method without such technologies may be efficient in a limited domain

Outline

- Algorithm
 - Alignment Module
 - Translation Module
- Experimental Results
- Conclusion

System Frame Work

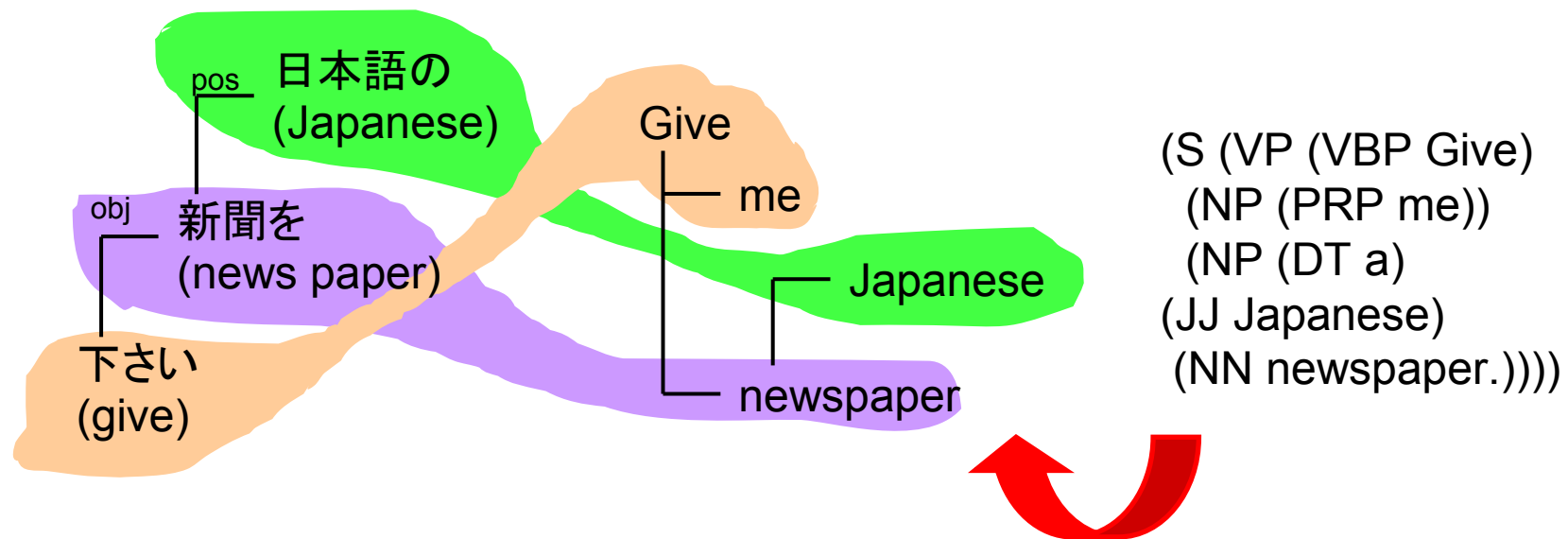


- Alignment module
 - Builds Translation Examples from Bilingual Corpus

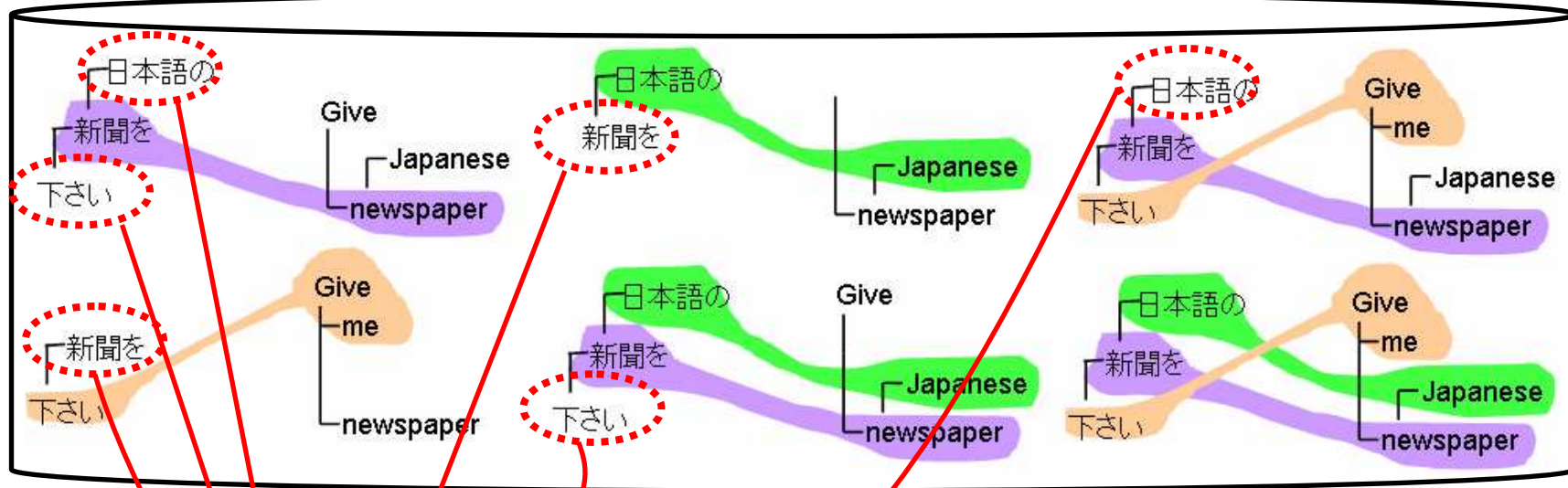
- Translation module
 - Selects Translation Examples
 - Combines them into a Translation

Alignment Module (1/2)

- A sentence pair is analyzed by parsers
[Kurohashi1994][Charniak2000]
- Correspondences are estimated by Dictionary-based Alignment method [Aramaki 2001]

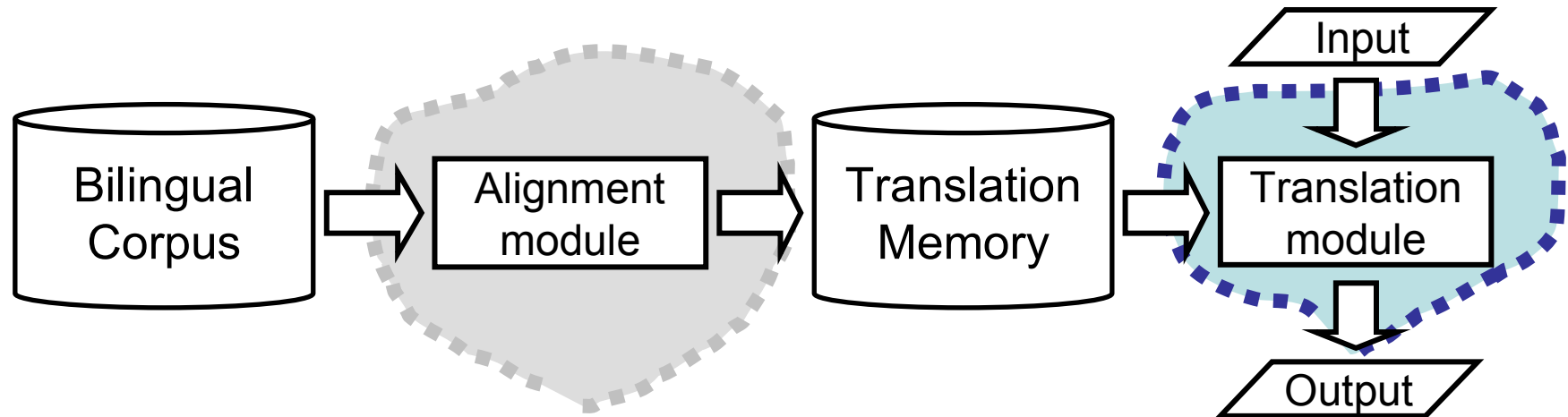


Alignment Module (2/2)



- Translation example
 - = A combinations of correspondences which are connected to each other
 - With **Surrounding phrases** (= the parent and children phrases of correspondences)
 - for Selection of Translation Examples

System Frame Work

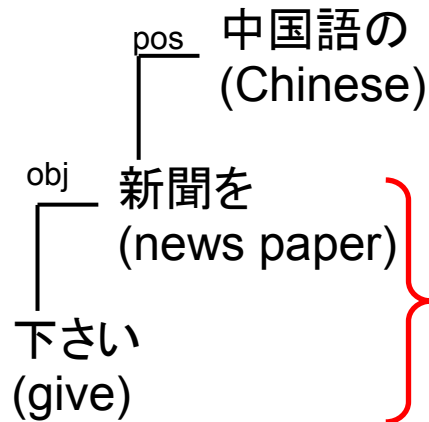


- Alignment module
 - Builds Translation Examples from Bilingual Corpus

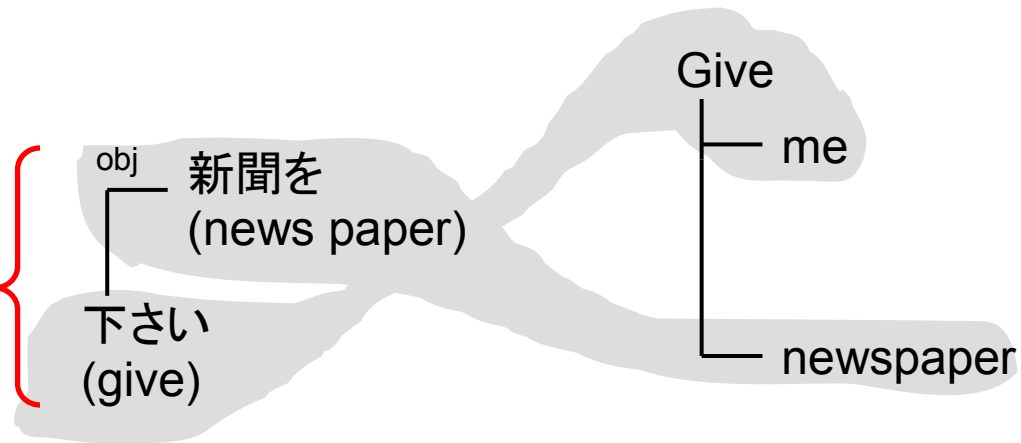
- Translation module
 - Selects of Translation Examples
 - Combines them into a Translation

Translation Module(1/2)

INPUT



TRANSLATION EXAMPLE



- **Equality** : The number of equal phrases

- **Context Similarity:**

 - calculated with a Japanese thesaurus

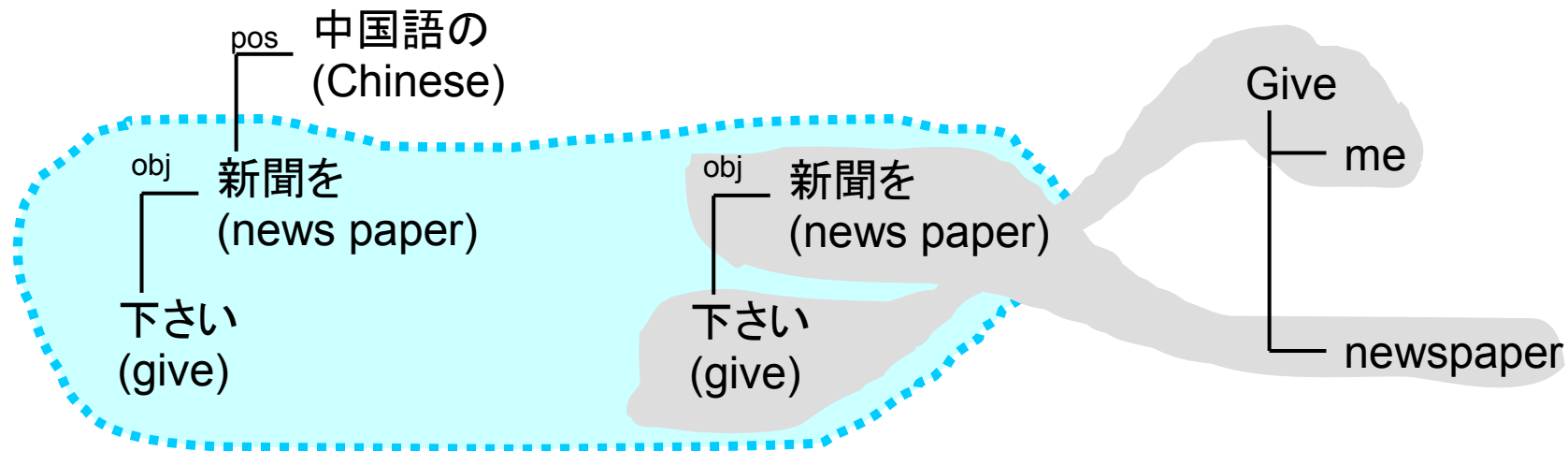
- **Alignment Confidence:**

 - the ratio of content words which can be found in dictionaries

Translation Module(1/2)

INPUT

TRANSLATION EXAMPLE



- **Equality** : The number of equal phrases

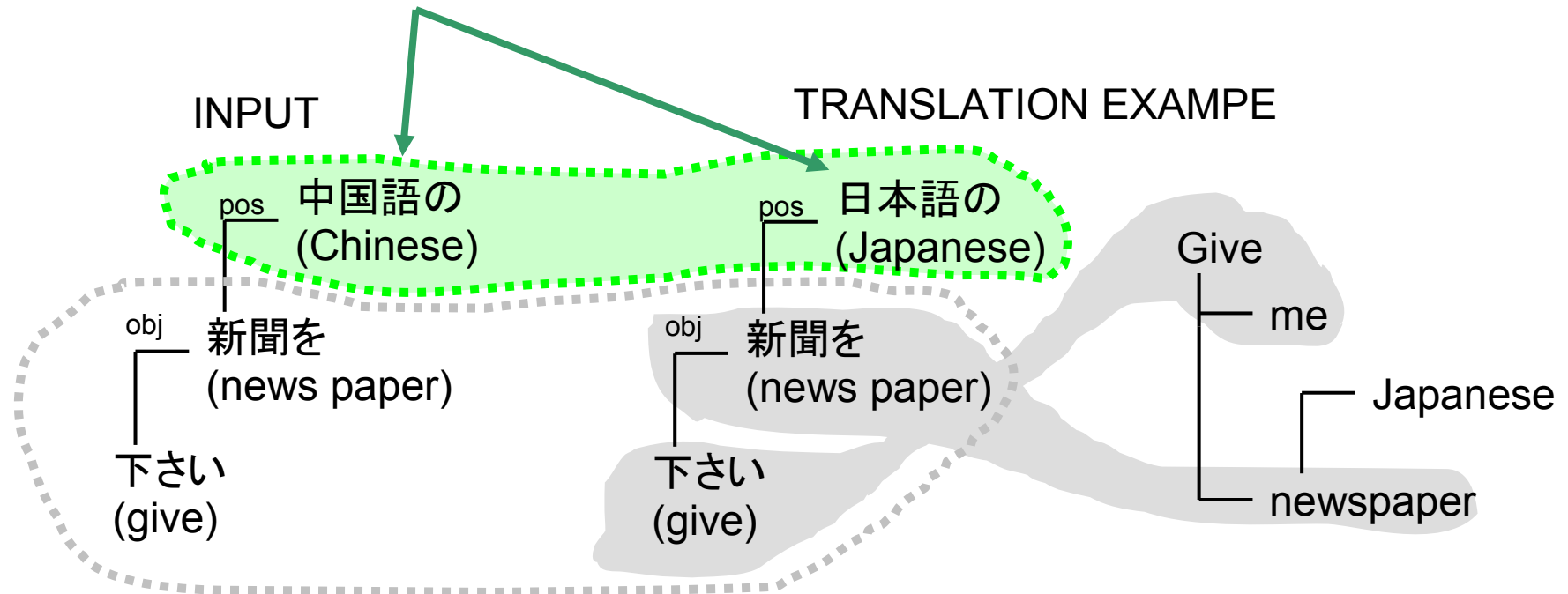
- **Context Similarity:**

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Context = surrounding phrases



- **Equality** : The number of equal phrases

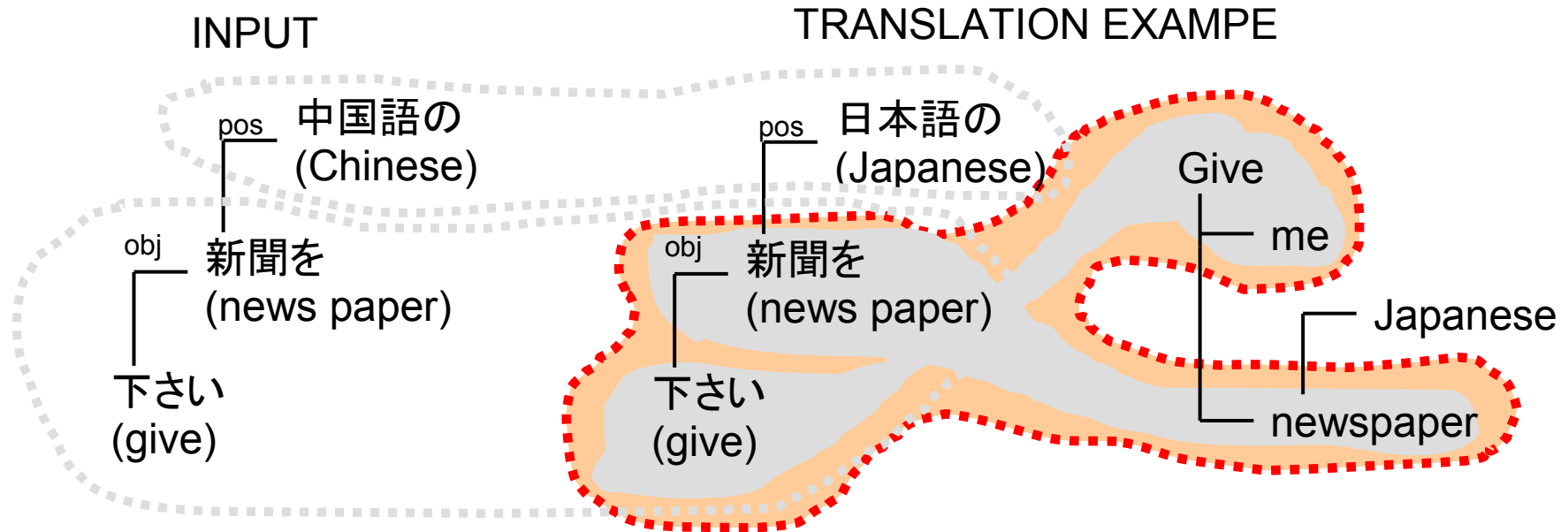
- **Context Similarity:**

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Translation Module(1/2)



- **Equality** : The number of equal phrases

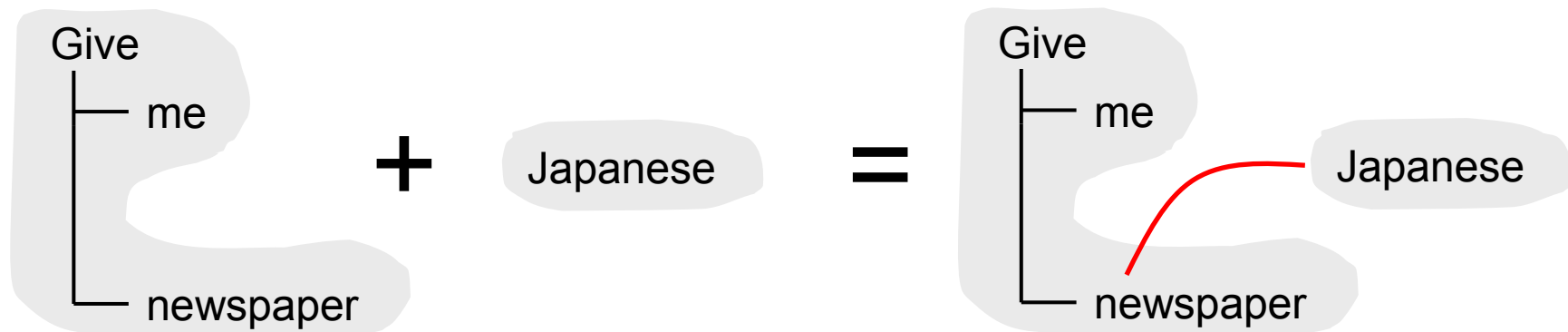
- **Context Similarity**:
 - calculated with a Japanese thesaurus

- **Alignment Confidence**:
 - the ratio of content words which can be found in dictionaries



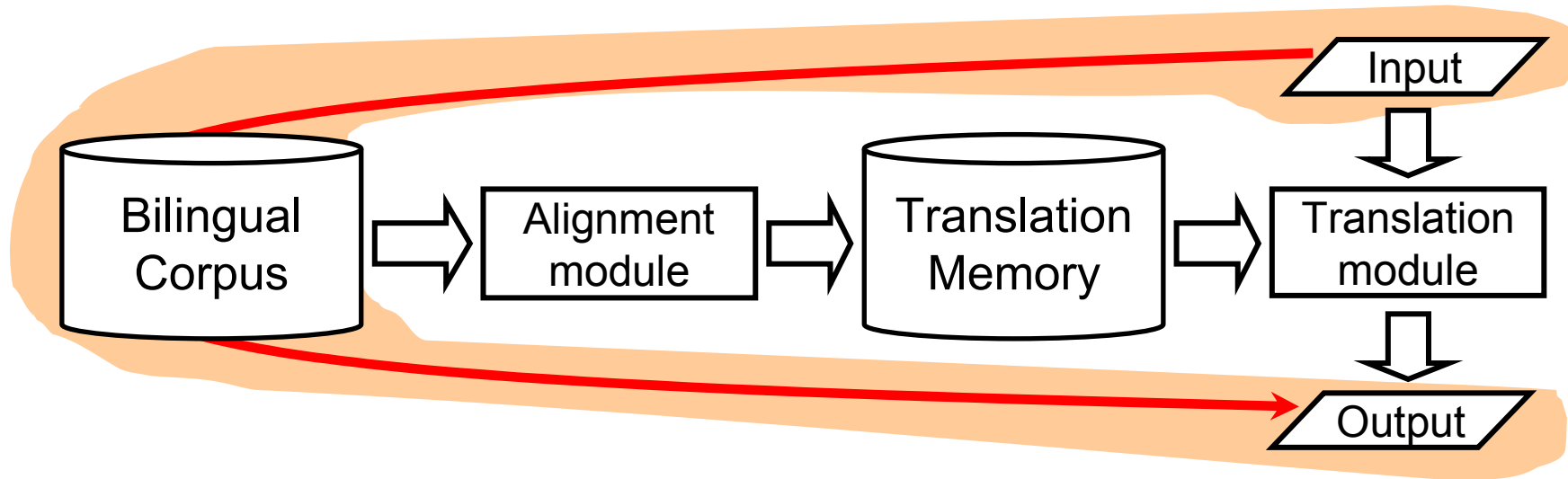
Translation Module(2/2)

- Selection
 - Score:= (Equality + Similarity) x (λ + Confidence)
- Combine
 - The **dependency relations** & the **word order** in the translation examples are preserved



- The **dependency relations** & the **word order** between the translation examples are decided by heuristic rules

Exception: Shortcut



If a Translation Example is **almost equal** to the input
⇒ the system outputs its target parts as it is.

- **Almost equal**
= Character-based DP Matching Similarity > 90%

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Experiments

- We built Translation Examples from **training-set**
(only given in IWSLT)

Auto. Eval. Result

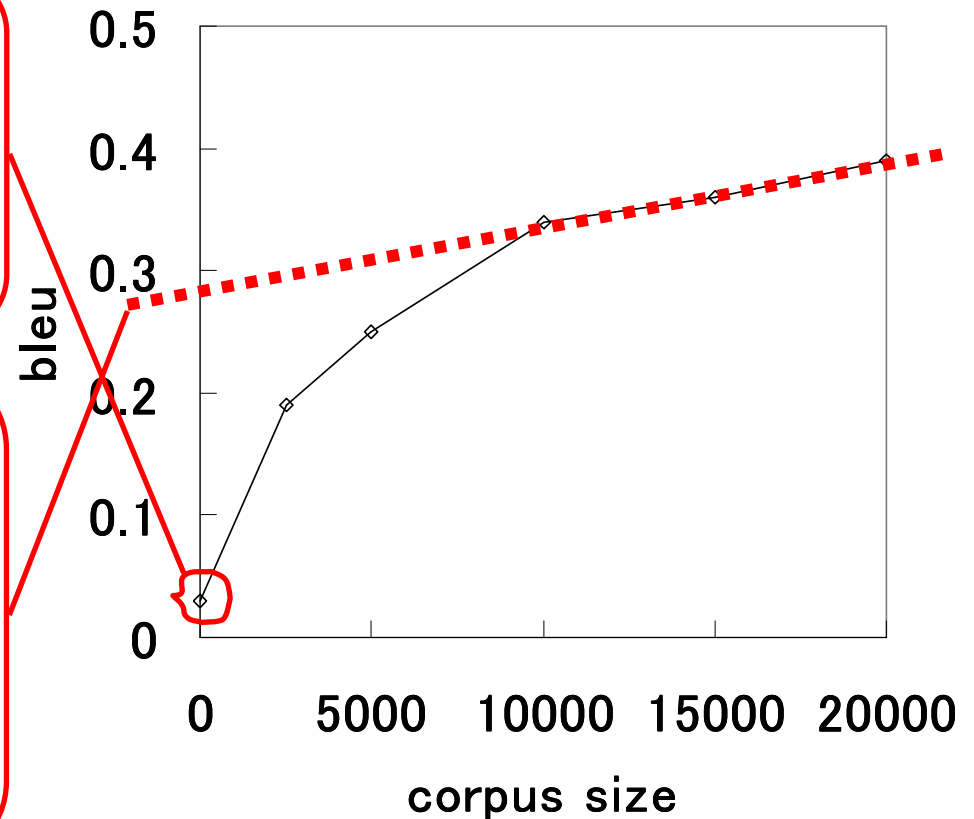
	bleu	nist	wer	per	gtm
Dev-set	0.38	7.86	0.52	0.45	0.66
Test-set	0.39	7.89	0.49	0.42	0.67

- Dev-set & Test-set score are similar
← the system has no tuning metrics for the dev-set.

Corpus size & Performance

The system without a corpus can generate translations using only the translation dictionaries.

The score is not saturated \Rightarrow the system will achieve a higher performance if we obtain more corpora.




Subjective Evaluation

- Subjective Evaluation Result

Fluency	3.650
Adequacy	3.316

5: "Flawless English"
4: "Good English"
3: "Non-native English"
2: "Disfluent English"
1: "Incomprehensible"



- Error Analysis

- Most of the errors are classified into the following three problems:

- (1) Function Words
- (2) Word Order
- (3) Zero-pronoun

Problem1: Function words

OUTPUT	i 'd like to contact my Japanese embassy
Translation Example	I 'd like to contact my bank

- The system selects translation examples using mainly content words
 - ⇒ it sometimes generates **un-natural function words**
 - Determiners, prepositions

Problem 2: Word Order

OUTPUT	is there anything a like local cuisine?
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- The word order between translation examples is decided by the heuristic rules.
 - The lack of rules leads to the wrong word order.
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Problem 3: Zero-pronoun

OUTPUT	has a bad headache.
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- The input includes zero-pronoun.
⇒ outputs without a pronoun.

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Conclusions

- We described an EBMT system which handles Structural translation examples
- The experimental results shows the basic feasibility of this approach
- In the future, as the amount of corpora increases, the system will achieve a higher performance

