

JAPANESE-TO-CHINESE SPOKEN LANGUAGE TRANSLATION BASED ON THE SIMPLE EXPRESSION¹

Chengqing ZONG[†], Yumi WAKITA^{*}, Bo XU[†], Kenji MATSUI^{*} and Zhenbiao CHEN[†]

[†]National Laboratory of Pattern Recognition, Institute of Automation,
Chinese Academy of Sciences, Beijing, China
{cqzong, xubo, zbchen}@nlpr.ia.ac.cn

^{*}Advanced Technology Research Laboratories, Matsushita Electric Industrial Co., Ltd., Kyoto, Japan
{yumi, matsui}@crl.mei.co.jp

ABSTRACT

This paper describes a Japanese-to-Chinese spoken language translation (SLT) method based on simple expression and presents the experimental results. The method is aimed at developing a compact speech translation system, which is robust for spontaneous spoken language phenomena, including the recognition errors and different expression from various speakers. The idea of translation method based on simple expression is that the mechanism interprets speech-act rather than the direct translation of the speaker's words. The method is realized by mapping the simple expression instead of deep parsing. In this method, only keywords in speech recognition results are extracted, and the corresponding target sentences are extracted from the database by selecting similar example sentences with the keywords. All training sentences in the bilingual corpus are rewritten into the simple expression and grouped by rules. The rules are specially designed to develop the compact size example database for translation. Comparing with other example-based approaches to SLT, the method based on simple expression is easy to realize, and especially it is practical to develop the SLT systems limited in specific domains.

1. INTRODUCTION

To achieve the robust spoken language translation, various example-based speech translation methods have been used widely and the effectiveness for spoken language processing has been confirmed^[1,2,3]. However, the system still suffers from the performance limitation. For the practical use of spoken language translation, it is necessary to develop more robust mechanism for spontaneous language phenomena.

As we know in the spontaneous utterances, many words are redundant, and the linguistic grammar is not crucial factor. The speaker's intention is mainly expressed by keywords. For that reason, speech-act based translation method has been proposed

in some system^[4,5]. However, the system needs complicated mechanisms for both source language parsing and target language generation, also a bulky knowledge base is required. But until now the capability of approaches to source language parsing and target language generation is still very limited.

Based on the motivation, we propose a simple expression-based method, which has been employed in our experimental system of Japanese-to-Chinese spoken language translation. The method is aimed at developing a compact speech translation system, which is robust for spontaneous language phenomena, including the speech recognition errors and different expressions from various types of speakers. Comparing with other example-based approaches to SLT, the method based on simple expression interprets speech-act rather than the direct translation of the speaker's words, and the method is realized by mapping the simple expression instead of deep parsing.

Remainder of the paper is organized in the following way: *Section 2* describes the survey of our Japanese-to-Chinese speech translation system. *Section 3* explains how we generate the simple expression. The experimental results are presented in *Section 4*. *Section 5* finally reaches the concluding remarks.

2. SURVEY OF THE JAPANESE-TO-CHINESE SPEECH TRANSLATION SYSTEM

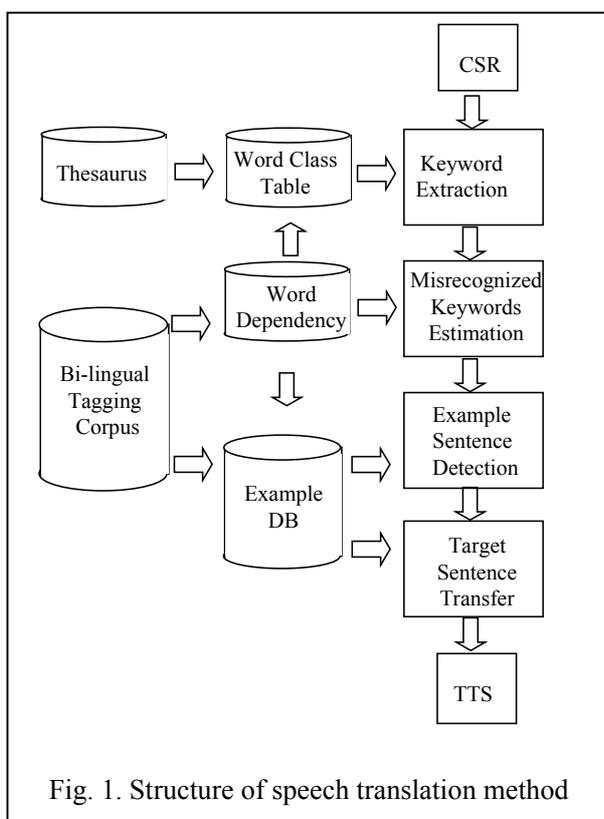
For the practical use of speech translation, it is necessary to develop a robust speech translation technique able to deal with sentences involving recognition errors. To achieve the goal, we have been applying an example sentence driven method to language translation part in case of domain using only simple and limited expressions, such as in travel conversation domain.

Figure 1 shows the ideas of our speech translation method. Instead of the direct translation of a recognition result by using the conventional language translation methods, an example

¹ The research work described in this paper was supported by the project that is jointly developed by the Advanced Technology Research Laboratories, Matsushita Electric Industrial Co., Ltd., Japan and the National Laboratory of Pattern Recognition, Institute of Automation, Chinese Academy of Sciences, China.

sentence is selected among a fixed number of pre-stored sentences by use of the dependency between only keywords in a recognition result, and then the translation is carried out by substituting constituent words in the selected sentence. Once keywords are correctly recognized, this selection method is free from the misrecognition of any other words and the insertion of unregistered words.

Furthermore, in case the keywords are misrecognized, our system can also estimate the misrecognized words and delete the possible error words from the candidate list of keywords. The strength of the dependency between recognized keywords are decided by comparison of the keywords, whose dependency relations are already analyzed. If the dependency of a recognized keyword with all of other recognized keywords is not strong, the keyword is estimated as an error. After deleting the errors, the keywords are used for searching the example sentences.



For the domains using only simple and limited expressions, it is possible to collect translation pair examples covering almost all expressions, but it is difficult to collect examples covering all keywords used in the domain. A suitable keyword clusters are defined by use of the dependency between keywords in the example DB and the thesaurus dictionary^[6].

3. SIMPLIFICATION OF THE EXPRESSION

In case of spoken language, the same meaning expressions may be represented by various different spoken phrases. However,

the utterances generally contain the same keywords. For example, the expression in Chinese “请您给我一杯咖啡，好吗？(Would you please give me a cup of coffee.)” may be simplified as “请来一杯咖啡(coffee, please)”. The noun “咖啡(coffee)” and verb “请(please)” are the keywords. As we see in daily communications, we occasionally use the simplified expressions. That is, it is possible to rewrite the expressions into simple formats on the semantic level. Thus, it becomes easy to understand the simple and concise expression instead of understanding the original long and complex utterances. This inspires us to find a way to extract the key words from the different expression.

Based on the ideas, first we collected 960 Japanese sentences in the travelling conversation domain, and then translated the sentences into the target language (Chinese). For simplification of the Chinese sentences, we fixed the main principles as following two items:

- (a) To use the same expression for each speech-act;
- (b) To omit the redundant expression.

Under the principles and according to the characteristics of Chinese expression, we designed the simplification rules like the examples given below:

- 1). Delete the words or phrases for expressing euphemistic mood or complex manners. For example, the Chinese expression “如果您愿意的话，请+VP (If you like, please + VP)” is simplified as “请+VP (Please + VP)” or “N, + please”. Where, VP means verb phrase, and N means noun.
- 2). Delete the repeated words and combine the first part of expression with the explanation, and rewrite several sentences into one short expression. For instance, the Chinese expression “我想打高尔夫球，附近有高尔夫球场吗？(I want to play golf, is there a golf court near here?)” is simplified as “这有高尔夫球场吗？(Is there a golf court near here?)”.
- 3). If the expression meaning is the same, the longer phrase will be replaced with the shorter one. For example, the phrase “可不可以 + VP (Could I + VP)” is rewritten as “能 + VP + 吗？(Could I + VP)”
- 4). After an utterance is simplified, the writer checks if the simple expression already exists. If it already exists, it will be deleted, but its ID number will be kept identical with the previous same one’s.

After the design of simplification rules, we have summarized 8 general rules and 22 specific rules. And the 960 Chinese sentences are simplified by use of the rules.

4. SYSTEM EVALUATION

To get realistic data to evaluate the SLT method based on simplified expression, we tested the experimental system on the following three aspects: (a) How many the database size is reduced? (b) Comparing with the original expression, does the simplified expression express the original meanings clearly? And (c) Comparing with the translation results by use of

original express, how about the translation results by use simplified expressions? The tested results are separately reported as follows.

4.1. Reduction Rate of the Database

By comparison of the number of phrases in the original 960 sentences with the simplified ones, we compute the reduction rate of the database. The results are shown in the *Table 1* below.

CASES	BEFORE SIMPLIFICATION	AFTER SIMPLIFICATION
Number of Phrases	1445	1043
Reduction Rate	0.278	

Table 1. Reduction Rate of the Database

We also compare the text file size before simplification and after simplification, the reduction rate is computed as the following formula:

$$((20KB-15KB)/20KB)*100\% = 25\%$$

From the results we see the database is reduced over 25% by the simple expression.

4.2. Understandable Rate Comparing with the Original Expression

The evaluation of understandable rate here is used for confirmation of the quality of simplified expressions. As we described in *Section 3*, our goal is to make the simplified expressions keep their naturalness and understandability as good as the original expressions. Here, we evaluate the quality of simplified expressions by checking two factors: the naturalness of expressions and the understandable rate of expressions.

For checking the naturalness of expression, following four levels of expression are divided:

- (A) The expression is very natural.
- (B) The expression is natural.
- (C) The expression is little strange.
- (D) The expression is very unnatural.

For the total original 960 sentences, the evaluation results are given in *Table 2*. Letters A, B, C and D respectively refer to the four types of expressions listed above.

TYPES	A	B	C	D
Ratio (1) (%)	42	50	7	1
Ratio (2) (%)	60	35	5	0

Table 2. Comparison of the Naturalness

Where, 'Ratio (1)' means the ratio that each type of simplified sentences takes, and 'Ratio (2)' means the ratio that each type of original sentences takes.

From *Table 2* we can find the naturalness of original expressions is a little better than the naturalness of simplified expressions.

Similarly, for testing the understandable rate of expressions, four levels of expressions are classified as follows:

- (A) The expression is very easy to understand as the same as the expression of source language.
- (B) The expression is able to understand, but the expression is slight awkward.
- (C) Most of meanings of the expression are understandable, but it is unable to understand the whole meanings.
- (D) Most of meanings of the expression are not expressed clearly. It is impossible to understand the meanings completely.

The test results are shown in *Table 3*. Where, letters A, B, C and D separately stand for the four types of expressions listed above. 'Ratio (1)' means the ratio that each type of simplified sentences takes, and 'Ratio (2)' means the ratio that each type of original expressions takes.

TYPES	A	B	C	D
Ratio (1) (%)	85.0	13.9	1.1	0
Ratio (2) (%)	86.3	12.5	1.0	0

Table 3. Comparison of the Understandable Rate

Table 3 shows that on understandable rate, both quality of original expressions and quality of simplified expressions are almost same. So, From *Table 2* and *Table 3* we may get the conclusion that the simplified expressions can transfer the meanings of sentences as well as the original expressions.

4.3. Evaluation of Translation Results

To evaluate our Japanese-to-Chinese translation system, we first trained the system separately by use of the original 960 sentences and simplified sentences, and then tested the system by use of another 140 different sentences but still in the domain of travel conversation. In the results, 30 test sentences are rejected because almost all keywords of the 30 sentences are unknown, and the target sentences can not be addressed. 44 sentences, each one of which includes only one keyword, are translated into the same results under the two conditions that the system was trained respectively by the original sentences and the simplified sentences. Other 76 sentences, each one of which contains two or over two keywords, are translated as the results shown in *Table 4*.

TYPES	A	B	C	D
Num. of Sentences (1)	13	34	20	9
Num. of Sentences (2)	19	29	19	9

Table 4. Comparison of the Understandable Rate

Where, letters A, B, C and D are of the same meanings as in *Table 3*. ‘Num. of Sentences (1)’ means the number of sentences that were translated after the system was trained by only the simplified sentences, and ‘Num. of Sentences (2)’ means the number of sentences that were translated after the system was trained only by the original 960 sentences.

Obviously, the results in *Table 4* also indicate that the translation performance is almost the same in the two cases that the system was trained by the original corpus and by the simplified corpus.

5. CONCLUSION

The simple expression based SLT method and the preliminary experimental results described in the paper have provided us with a solid foundation for developing the compact SLT system for the specific domain. From the current work we can see that the simple expression based SLT method is of the following characteristics:

- The quality of translation results is almost the same as that is gotten by use of the original expression.
- The database size is reduced because of the simplified expression.
- The expression format is simple, so it is easy for the system to avoid generating the results of disorder structure and unnatural expression.

Anyway, our current work involves incremental improvements in adding corpus, and the system performance is remained to further improve.

6. REFERENCES

- [1] Eiichiro Sumita, Setsuo Yamada and Kazuhide Yamamoto, Solutions to Problems Inherent in Spoken-language Translation: The ATR-MATRIX Approach. Proc. *MT Summit VII*, Sept. 1999. 229-235.
- [2] Satoshi Sato, MBT2: a Method for Combining Fragments of Examples in Example-based Translation. *Artificial Intelligence* 75(1995) 31-49.
- [3] Hiroaki Kitona, Speech-to-Speech Translation: A Massively Parallel Memory-Based Approach, *Kluwer Academic Publishers*, Boston, 1994.
- [4] Thomas Bub, Wolfgang Wahlster, Alex Waibel, *Verbmobil: The Combination of Deep and Shallow Processing for Spontaneous Speech Translation*. Proc. *ICASSP'99*. 71-74.
- [5] Alon Laive, Alex Waibel et. al., JANUS-III: Speech-to-Speech Translation in Multiple Languages. Proc. *ICASSP'97*, 99-102.
- [6] Yumi Wakita, Kenji Matsui, Yoshinori Sagisaka, Fine keyword clustering using a thesaurus and example sentences for speech translation. To appear in Proc. *ICSLP'2000*.