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Yūji Matsumoto
Richard Sproat
Kam-Fai Wong
Min Zhang (Eds.)

Computer Processing of Oriental Languages

Beyond the Orient: The Research Challenges Ahead

21st International Conference, ICCPOL 2006
Singapore, December 2006
Proceedings



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Message from the President

“Beyond the Orient: The Research Challenges Ahead”

The International Conference on Computer Processing of Oriental Languages (ICCPOL) is a regular conference series of the Chinese and Oriental Languages Computer Society, COCLS (formerly known as the Chinese Language Computer Society, CLCS), which was established 30 years ago, to be exact on June 9, 1976. The society's name change was made in the winter of 2005 in response to the growing international demand in Chinese and oriental languages research and applications. The new vision of the society was also launched at the same time. COLCS was set "to be the international computer society driving the advancement and globalization of the science and technology in Chinese and oriental languages processing." On this front, the society's conference, ICCPOL, and journal, namely, the *International Journal on Computer Processing of Oriental Languages* (IJPOL) provide two effective platforms.

This year marked the 21st meeting of the ICCPOL conference. I was delighted that despite his heavy workload, Kim-Teng Lua kindly accepted my invitation to host ICCPOL 2006 in Singapore. He put together one of the most energetic organizing committees: Minghui Dong, who looked after the local organization including the conference Website, Hui Wang the registration and Min Zhang the publication. Without their dedication and professionalism, ICCPOL 2006 would not have been so successful.

I am grateful to the Department of Systems Engineering and Engineering Management at The Chinese University of Hong Kong not only for allowing me to take up the conference chairmanship but, even more importantly, for providing financial aid for students in need. I am thankful to my colleague, Chris Yang, for working closely with me to assess every application in detail.

I would also like to thank the program Co-chairs Yuji Matsumoto and Richard Sproats, who jointly worked out an inspiring program. The combination of Asian and American scientists supported our theme of "Beyond the Orient." Many high-quality papers from all around the world were received and unfortunately due to limited space, only a few were accepted for publication in this year's proceedings. The accepted papers truly highlighted "The Research Challenges Ahead" in Chinese and Oriental language processing.

Kam-Fai Wong
Conference Chair ICCPOL 2006
and
President Colcs

Message from the Program Co-chairs

As the Co-chairs of the technical program of the 21st International Conference on Computer Processing of Oriental Languages (December 17-19, Singapore) we are delighted and honored to write the introduction to these proceedings.

The subtitle of this year's convocation was "Beyond the Orient: The Research Challenges Ahead," the goal being to broaden the scope of ICCPOL beyond its origins in East Asia, to become a truly international event. We believe that we made a very successful first step in this direction both in the composition of the Program Committee, which is made up of members from countries around the world and the accepted papers, which include a large number of contributions from outside ICCPOL's traditional home base.

We received 169 submissions from a variety of countries. We initially accepted only 38 full papers (30 oral presentations and 8 poster presentations determined by the authors' preference), but since this was a fairly small set, we decided to accept another 20 papers as short papers, all of which were presented as posters. Thus, the acceptance rate of full papers is 23% (38/169), and that of all accepted papers is 34% (58/169). Since two papers were withdrawn after the notification, this volume includes 56 papers (36 full papers and 20 short papers) presented at the conference.

As Technical Co-chairs we can claim but a small amount of credit for the success of the technical program. Our main thanks go to the Program Committee members who worked diligently to give fair reviews of the submitted papers, and most of whom spent additional time coming to a consensus on papers where there was a wide amount of disagreement.

We also thank the many authors who submitted their work for inclusion in the conference. Needless to say, the conference would not exist were it not for the technical presentations. We are mindful of the fact that there are many computational linguistics conferences and workshops available, and we are therefore happy that so many papers were submitted to ICCPOL 2006.

We would also like to thank our invited keynote speakers Gerald Penn, Claire Cardie and Hwee-Tou Ng for agreeing to present their work at ICCPOL.

In this year's conference, we used the START Conference Manager System for most of the paper handling process, that is, paper submission, paper reviews and discussion, notification of acceptance/rejection of papers, and uploading of final manuscripts, all of which went very smoothly. Thanks are especially due to Rich Gerber, the maintainer of the system, who was always quick to answer our queries, and even modified the system to handle the specific needs of our conference. We would also like to thank the committee members of ICCPOL, especially Kam-Fai Wong for his continuous support and timely advice, Minghui Dong for preparing very beautiful Web pages, and Min Zhang and Wai Lam for handling all the final manuscripts that are included in this volume.

December 2006

Yuji Matsumoto and Richard Sproat
ICCPOL 2006 Program Co-chairs

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Answering Contextual Questions Based on the Cohesion with Knowledge *

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Abstract. In this paper, we propose a Japanese question-answering (QA) system to answer contextual questions using a Japanese non-contextual QA system. The contextual questions usually contain reference expressions to refer to previous questions and their answers. We address the reference resolution in contextual questions by finding the interpretation of references so as to maximize the cohesion with knowledge. We utilize the appropriateness of the answer candidate obtained from the non-contextual QA system as the degree of the cohesion. The experimental results show that the proposed method is effective to disambiguate the interpretation of contextual questions.

1 Introduction

In recent years, *contextual question-answering (QA) systems* have gained attention as a new technology to access information. In this paper, we propose a method to construct a Japanese contextual QA system using an existing Japanese non-contextual QA system¹. Although a contextual question generally contains reference expressions², we expect that the non-contextual QA system will be able to find answers for such a question if reference expressions are appropriately completed along with their antecedents.

The completion of a question may be performed in the following steps: (1) detect reference expressions, and then (2) find an antecedent for each reference expression. However, there are ambiguities in these steps, and we may have multiple interpretations, namely, multiple *completed question candidates*, for one question. In the research area of discourse understanding, there exist many studies of the reference resolution in terms of *the cohesion with the context*. The

* This study was partially supported by Grant-in-Aid for Scientific Research on Priority Areas (No.18049031) and Scientific Research (C) (No.17500062) from the Ministry of Education, Culture, Sports, Science and Technology, Japan.

¹ We define a *contextual question* as “a question that may have references to the context, i.e., previously asked questions and their answers.”

² In this paper, we use the term “reference expressions” to refer to not only reference expressions themselves, such as demonstratives and pronouns, but also ellipses like zero pronouns. Zero pronouns are ellipses of obligatory case elements.

centering theory is one of the most widely used methods [1]. This type of reference resolution attempts to find an optimal interpretation so as to maximize the cohesion between a newly introduced sentence and the context. Such a method would definitely work in many cases, but it does not provide the method to resolve the ambiguity in the step (1).

In this paper, we propose another approach. It is the reference resolution in terms of *the cohesion with knowledge*. It is based on the fact that the QA system can refer to not only the context of the dialogue but also the knowledge base (i.e. a large text document collection). It is noteworthy that “answering a question” can be regarded as finding an object, i.e., an answer, whose context in the knowledge base is coherent with the question. Therefore, the cohesion with knowledge may be one of the promising criteria for finding the best interpretation of the question. Here, we hypothesize that the degree of cohesion with knowledge is analogous to *the appropriateness of the answer candidate* for each completed question candidate. The completed question candidate with the most appropriate answer can be accordingly considered as the best interpretation of the (original) question.

2 Related Work

2.1 Contextual Question Answering

The contextual QA was introduced as a subtask of the QA track in TREC 2001. However, Voorhees [2] summed up the evaluation as follows: “the first question in a series defined a small enough subset of documents such that the results were dominated by whether the system could answer the particular type of the current question, rather than by the system’s ability to track context.” For this reason, this task was excluded from all subsequent TRECs. On the other hand, a context task has been employed as a subtask of QAC in NTCIR, which is a series of evaluation workshops organized by the National Institute of Informatics, Japan. Kato et al. [3] summarized the lessons from the context task of TREC QA as follows: (1) the number of questions in a series is relatively small, and (2) there is no topic shift in a series. They prepared the test sets for NTCIR QAC according to the lessons, that is, (1) a series is relatively long, about seven questions (QAC3), and (2) two types of series are introduced, namely, *the gathering type* and *the browsing type*. A question series of the gathering type contains questions that are related to one topic. On the other hand, in a series of the browsing type, the topic varies as the dialogue progresses.

The approaches of the systems participating in the context tasks in the NTCIR QAC are mainly based on the cohesion with the context. In general, the approaches are classified into two types. The first type is based on the effort involved in the document/passage retrieval. It expands the query submitted to the IR system with the words/phrases that appeared in the previously asked questions[4]. The second type of approach is based on the completion of questions by resolving reference expressions[5]. One completed question is submitted to a non-contextual QA system. The method that we propose in this paper is

similar to the second approach. However, our approach is based on the cohesion with knowledge as well as the cohesion with the context.

2.2 Reference Resolution

Detection of reference expressions: The detection of zero pronouns is particularly very important and is studied from various viewpoints. One of the most widely used methods is detection using a case-frame dictionary. A case-frame dictionary is used to find unoccupied cases in a sentence.

Identification of antecedents: Nariyama [6] proposed a modified version of the centering theory[1] in order to resolve Japanese zero pronouns. It utilizes a “*salient referent list (SRL)*” that pools all overt case elements that have appeared up to the sentence in question. If a new case element appears with a case marker identical to that of another case element already existing in the SRL, the new case element takes its place because of recency. In an SRL, the case elements are listed in the following order of salience: Topic > Nominative > Dative > Accusative > Others. A zero pronoun is resolved by selecting the most salient case element in the SRL.

3 Proposed Method

Figure 1 shows the overview of the proposed method. The method generates an answer list for each question in a given series by using the following procedure. It should be noted that the non-contextual QA system can perform list-type question answering, as described in Section 3.3. It is the task in which a system is requested to enumerate all correct answers.

Input. A new question and a list of antecedent candidates. The list is initialized to an empty list for the first question.

Output. An answer list and an updated antecedent candidate list.

Procedure

1. Detect reference expressions including zero pronouns in the new question using a case frame dictionary, and then generate question candidates with the zero pronouns. Generally we obtain multiple candidates because a single verb may have multiple case-frame entries of case frame.
2. Find antecedent candidates for reference expressions according to a selected strategy for completing reference expressions. We proposed three strategies: *CRE-C*, a strategy based on a modified version of the SRL-based centering theory; *CRE-H*, a heuristic strategy in which the characteristics of a series of questions are taken into account; and *CRE-A*, a strategy that adopts all possible noun phrases.
3. Generate all possible completed question candidates using the results of Step 2. Then, select the *M*-best completed question candidates according to the semantic consistency in the reference resolution.

- 4. Submit completed question candidates to the non-contextual QA system, and obtain a list of answer candidates for each question candidate. Each answer candidate in the list is associated with its answer score. From the answer scores, calculate the appropriateness of the list. We propose two measures of appropriateness: $AM-D$, a measure defined in terms of the distribution of scores of answer candidates; and $AM-M$, the maximum score of the answer candidates in the list.
- 5. Provide the most appropriate answer list as the final output.
- 6. Using the completed question candidate that provides the most appropriate answer list, update the list of antecedent candidates according to a selected strategy for completing the reference expressions, and output the list for the next question.

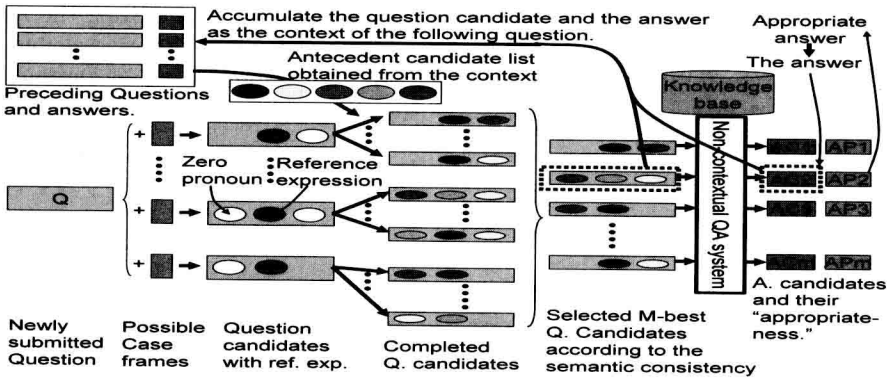


Fig. 1. Overview of the proposed method

3.1 Example

Before we explain the details of each step, we describe the flow of the procedure using the following example series of questions. In this example, we adopt Strategy CRE-C and Measure AM-D as the strategy for completing reference expressions and the appropriateness measure of the answer lists, respectively.

- (1) a.

Shizuoka-sutajiamu	"ECOPA"-no	kokeraotoshi-de	Shimizu-S-Pulse-no
Shizuoka-stadium	"ECOPA"-REL	opening-AT	Shimizu-S-Pulse-REL
taisen-aite-wa	doko	de-su-ka	
matched-team-TOP	where/what	BE-POL-INTERROG	

Which team played a match against the Shimizu S-Pulse at the opening game of Shizuoka Stadium "ECOPA"?
- b.

sono-shuryoku-senshu-ni	dare-ga	i-masu-ka
its-leading-player-AS	who-NOM	exist-POL-INTERROG

Who is its leading player?

Since Question (1a) is the first in the series, it is submitted to a non-contextual QA system without any modification, and obtained the following answer list. The