Studies on Generation of a Response to Users in Interactive Question Answering System

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February 8, 2007

Keywords: Question Answering, Dialogue, Information Extraction, Sentence Generation, Ambiguity of Word Sense.

This paper describes a concept of an open-domain interactive question answering system. Ambiguous questions in this research indicate ones that cannot choose only one answer, because a meaning of keyword in question is ambiguous. For example, a question "world cup no yuushoukoku ha dokodesuka(Which country won the world cup?)" is ambiguous, because there are some meaning in "world cup" as soccer, rugby, volleyball or something. Therefore, system cannot choose only one answer. When an user asks such a question, the system ask back to a user "donna sports no world cup desuka(What kind of sports of world cup is it?)" to determine the meaning of "world cup". In this paper, we mainly describe the way to detect ambiguous word in user's query and to generate a response to a user.

The flow of the process of the system is shown below. First, user's query is analyzed and texts including keywords are extracted. Answer candidates are extracted from these text. Next, specializing expressions in the same sentence are extracted by pattern matching from text including answer candidates. "Specializing expression" is an expression that limits the meaning of a ambiguous keyword, "soccer" , "rugby" and "volleyball" of the example are the specializing expressions. Nouns related highly to keyword in same sentence, nouns have a dependency relation

with keyword, nouns in beginning of a document and so on are extracted as specializing expressions. Multiple triplets (a_i,k_j,s_k) are provided at this stage. a_i is answer candidates, k_j is the keyword in user's query, s_k is specializing expressions of k_j. The subsets of these triplets where the keyword is common and s_k has some common attributes $attr$ are discovered as the answer groups. Examples of $attr$ are "N characters at ending"(N characters at ending of s_k is common), "semantic class of thesaurus"(semantic class of thesaurus of s_k is common), "extraction pattern"(extraction pattern of s_k is common) and so on. Answer group is expressed in a form of $AG(k, attr) = \{(s_i, a_i)\}$. For example, answers group such as AG(world cup, semantic class of thesaurus:sports) = {(soccer, Italy), (rugby, New Zealand), (volleyball, Cuba)} is made for that question "world cup no yuushoukoku ha dokodesuka". Specializing expressions "succer","rugby","volleyball" correspond answer candidates "Italy","New Zealand","Cuba" respectively and these specializing expressions have semantic class of thesaurus of "sports". Because multiple answer groups are generally generated, answer groups are given score to choose the most appropriate one which stands for ambiguous meaning of keyword. The score of answer group is defined as specializing expressions and answer candidates are equivalent to 1 by 1, keyword of the query and specializing expressions in answer group are related semantically, answer group includes extracted specializing expressions by a highly reliable extraction pattern. Making of answer group is equivalent to detecting ambiguous keyword(k) included in a user's query. At the same time, making of answer group is also to decide contents of a system's response to a user. Because, if a user points out specializing expressions in answer group, a correct answer is automatically decided uniquely.

Next, we describe that processing to generating a response sentence to a user from answer group. An interrogative sentence to get specializing expression of ambiguous keyword from a user are basically generated by templates. Three kinds of templates are prepared. The first template generates an alternative interrogative sentence, when the number of specializing expression in answer group is two. The second template generates a query includes in subject of a response. "Subject of a response" is the expression added an interrogative(ex. what kind of) to a word(ex. sports)

to point at the whole specializing expression in answer group. For example of subject of a response is "donna sports(what kind of sports)". The third template generates a query does not include in subject of a response. In the case that cannot generate subject of a response from an answer group, an interrogative sentence is generated using only ambiguous keyword. 23 templates for generating response sentences are prepared in this research.

Multiple candidates of response sentences from templates are generated and scored according to frequency of n-gram. In other words, as much as frequency of substring of a query in newspaper articles have high score, in order to choose a natural sentence as Japanese. Interrogatives do not almost appear in newspaper articles, subject of a response including an interrogative is chosen the most suitable one with the number of the hits of Web search engine. In addition, the order of a specializing expression and a keyword cannot be determined with score of frequency of n-gram, it is decided by referring to position relations of both in the newspaper article from which answer candidates were extracted.

Using 50 ambiguous questions, we carried out experiments on generation of responses to a user. As a result, accuracy of a correct answer group was 64%, accuracy of a correct response sentences was 76%. The effectiveness of proposed method was confirmed by this experiment.