

Non-factoid Question Answering System of Management Philosophy based on Lecture Transcripts and Writings of a Business Leader

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Abstract—In recent years, companies that commit fraud or misconduct are increasing. It is thought that these things happen due to the lack of corporate rules and philosophy for business management. In this paper, we propose a question answering system of management philosophy using transcribed lecture and writings of Dr. Kazuo Inamori, who is one of the most respected business leaders in the world. In the proposed system, we first analyze the question sentence and use the query of nouns obtained by morphological analysis of the sentence and the expanded query obtained using word2vec, and search the documents using Okapi BM25. Then, we identify and extract the sentences that should be answers to the question by using a deep learning technique, and show the extracted sentences to the user in a ranked form.

Index Terms—Kazuo Inamori, non-factoid question answering, management philosophy

I. INTRODUCTION

IN recent years, a growing number of companies have suffered great loss or trust due to the disclosure of their fraud or misconduct. It is thought that these things happen due to the lack of corporate rules and philosophy for business management. In addition, for those who are still inexperienced as a manager, it is sometimes difficult to know how to manage their business well. It should be useful for them if the information they require can be obtained in a question answering form.

In question answering systems, a question can be classified into two types, one is factoid type and the other is non-factoid type. The factoid type is a question asking for correct answers based on facts such as names, dates, and numerical values. The non-factoid type is a question asking for correct answers based on explanations of reasons and events. The questions often dealt with non-factoid type question answering are definition type questions such as “What kind of person is ...?”, “What is ...”, why type questions such as “Why is ...?”, and how type questions such as “How is ...?” and “How can I do ...?”. Studies are active in each of factoid type and non-factoid type question answering, and many systems are

being developed. However, most of the question answering systems only extract answers by facts, and question answering systems based on the idea of a specific person have not been studied much so far. In order to take into consideration the idea of a specific person, it is necessary to analyze the person’s way of talking, frequently used words and phrases, etc., and it is difficult to realize such a system because it is necessary to gather a large amount of conversation data of the person for these analyses.

With regard to the way of thinking about management, in recent years, the management philosophy has become an interest among business persons, and the number of business persons who manage their companies based on the management philosophy is increasing.

Management philosophy is a management method of Dr. Kazuo Inamori, who is the founder of Kyocera, that weaves management methods and philosophy. His management philosophy is based on “altruistic mind” that thinks not only of oneself but also of the other persons. Many company managers in the world are learning his management philosophy by participating in Seiwajuku, a private management school in which Dr. Inamori himself answers the managers’ questions. With his management philosophy Dr. Kazuo Inamori succeeded in making his company bigger and also contributes to the reconstruction of a company. By implementing the question answering system on management philosophy, it becomes possible for company managers to ask questions according to each manager’s situations, and possible management fraud and corporate damages could be prevented by referring to the answers.

Based on the above, we are developing a question answering system on Dr. Kazuo Inamori’s management philosophy.

II. RELATED WORK

Studies on question answering systems which answer the idea of a specific person do not exist to the knowledge of the authors. Here, we will describe several studies on non-factoid type and why type question answering systems.

Shibusawa et al.[1] implemented a why type question answering system called “RE: Why” which focuses on the positional relationship of sentences representing why type questions and their answers. In this system, the user inputs the search terms and the system acquires the documents by Google search using three kinds of queries, search term itself, search term+“why”, and search term+“how”. The reason words, forward directional words, backward directional words, and question words that are prepared by

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the authors are used for extracting answers from the acquired documents.

By using these characteristic words, the passages which can be the answers to the question in the document are specified. This method achieved the accuracy of 60.7%, which is 19.2% improvement compared to the maximum accuracy of 41.5% by using Google. In our proposed method, we use this method for the extraction of answer candidates.

Cha et al.[2] proposes a why type question answering system using the sentence structures. They rank the answer candidates using Personalized PageRank method against the candidates obtained by the answer candidate search. Personalized PageRank[3] is a method often used for extracting important sentences in documents that incorporates teleportation probabilities that jump to nodes that should be prioritized to Random Surfer Model of PageRank, and the method using Personalized PageRank improved the performance compared with existing methods.

III. PROPOSED METHOD

This section describes our proposed method. In this research, we aim at realizing a non-factoid question answering system specialized in management. In the future, it corresponds to how type, what type, but this time it deals with why type. The outline of the proposed method is shown in Fig. 1. The question sentence is a sentence inputted by the user, and it is processed in the flow of question sentence analysis, document search, answer candidate extraction, and answer selection, which are the same as ordinary question answering systems.

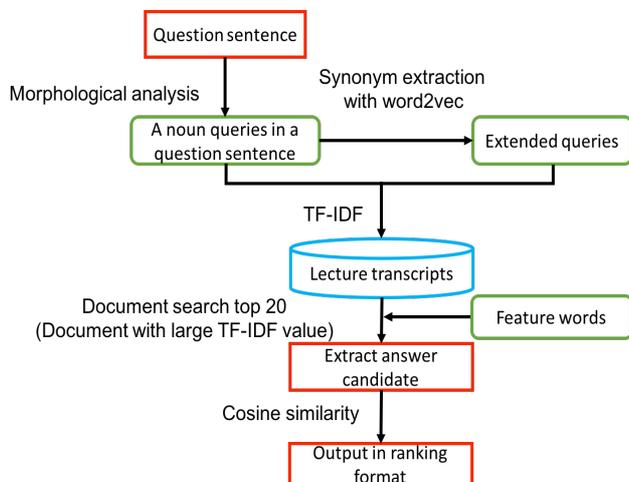


Fig 1. Overview of the proposed system.

A. Question Analysis

In our method, the type of the question entered by the user is classified by Support Vector Machine (SVM) into one of three types, i.e., why type, how type, or what type. The training data used for the question type classification is Yahoo! Chiebukuro (Japanese version of Yahoo! Answers).

B. Training Data

300 cases of Yahoo! Chiebukuro were acquired manually as the training data used for question analysis. Table I shows the breakdown of the labels of 300 Yahoo! Chiebukuro cases.

TABLE I
QUESTION TYPE LABEL AND NUMBER OF CASES

Type	Number
Why	100
How	100
What	100

C. Documents Search

Okapi BM25 is used as the document search method. Query expansion using word2vec is performed on nouns extracted from question sentences. Word2vec[4][5] is a distributed representation of words using a neural network, allowing semantic computation on words. The Okapi BM25 value for the documents and each query including the query terms expanded by word2vec is calculated, and the documents exceeding the threshold are extracted as the answer candidate documents. Besides, if there is at least one query whose Okapi BM25 value is 0 in the query extracted from the question sentence, the document is excluded from the answer candidate documents. This is because if the query extracted from the question sentence does not exist in the document, the possibility of the document containing the answer to the question is low.

D. Management Philosophy based on Lecture Transcripts and Writings

In this study, we use the text data of management questions/answers, lecture transcripts, and the writings of Kazuo Inamori as the training data. The numbers of each data are as follows.

- Management questions/answers: 137
- Lecture transcripts + writings: 3320

E. Extracting Answer Candidates

In the proposed method, answer candidate extraction employs answer feature words as clues for extraction. Some examples of the answer feature words are shown in Table II.

F. Feature Words

In our method, we use feature words such as question words in why type question answering. The feature words are selected based on the characteristic words used in the “RE: Why” system of Shibusawa et al.[1]. If there is a sentence containing a forward instruction word and a reason word, we assume that the reason or cause sentence appears above that sentence.

TABLE II
ANSWER FEATURE WORDS

Types of feature words	List of feature words
Question words	why, etc
Forward directive word and reason word	so, therefore, then, etc
Reason word	reason, etc
Forward directive	that, this, that kind, over, etc
Backward directional word	below, it will be shown, described later, etc

G. Answer Selection

In this section, we describe the method of computing the similarities between extracted answer candidates and question sentences, ranking them in descending order of scores, and returning the answers. We use cosine similarity between vectors of nouns in the question sentences and nouns

in the answer candidates for similarity calculation. Regarding the answer output, since this is a question answering system that answers the idea of Dr. Kazuo Inamori, there will not necessarily be a single correct answer. Besides, even for the same question, depending on the current situation and idea of the user, the most useful answers for her/him could be different. Therefore, we return the answers as the ranking form, instead of returning only the answer which has the highest score.

IV. EVALUATION EXPERIMENTS

We conducted experiments to evaluate the effectiveness of our proposed question answering system. In this experiment, we set to return 20 answers from a question input. Whether the answer was suitable for the question was judged by the first author. Among the 20 answers, Table III shows the answers that are considered to be suitable to the questions. Because the answer itself is long, the answer descriptions are partially omitted.

V. DISCUSSION

As shown in the experimental results in Table III, we can see that appropriate answers are sometimes at the lower rank. The longer answers are more likely to be ranked higher. Since the extraction range is fixed at 20 sentences above and below from the answer feature word, sometimes it does not extract the sentences to be acquired or unnecessary sentences are extracted.

VI. FUTURE WORK

As future research, we will consider question answering using deep learning. The outline of the future system is shown in Fig. 2. We plan to use BiDAF[6] for selecting answer candidates. BiDAF is an answer prediction model based on deep learning, which predicts the start position and the end position of the answer to be extracted and outputs the word string of the span with the highest probability. We are planning to use the sentences extracted by this method as answer candidates.

In answer selection, the method proposed by Shashi et al.[7] will be used as the ranking method. Shashi proposed a method to learn the ranking of importance for each sentence in the documents by reinforcement learning. In their study, the ranking of importance is done by one sentence as the unit, but in our method we will rank the importance by several sentences extracted as answer candidate as the unit. Since it is reinforcement learning, we expect that our question answering system could be extended in the future to correspond to each individual user by selecting the answer(s) that the user thought appropriate from the answer set in the ranked form and feeding it back to the system.

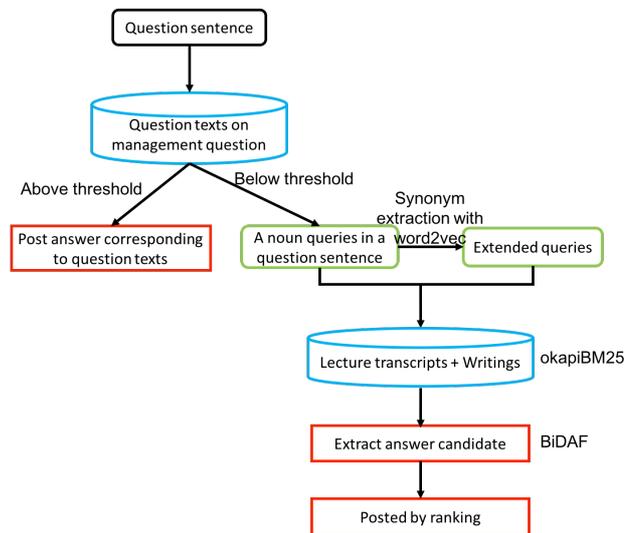


Fig 2. Overview of the future system.

VII. CONCLUSION

In this paper, we proposed a method for query analysis, document search, answer candidate extraction, answer selection for the question answering system on management philosophy. In the future, we will implement the deep learning-based methods described in section VI, and conduct experiments to compare it with the current method. Besides, in the ranking of selected answers, we only use the importance of the extracted documents, and the question sentence is not taken into account, so we are planning to make the ranking by considering the question sentences in the future.

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TABLE II
 QUESTIONS AND PART OF ANSWERS IN THE EVALUATION EXPERIMENT

question	Why do we need altruism in management?
1st	If you expect good results, I wish for your partner ... In other words, it is essential to conduct business with a spirit of altruism and a heart of compassion
4th	I decided things with a mind-boggling thought, it will also cause harm to society and also cause serious inconvenience to working employees.
11th	Because strong self-interest is indispensable for doing business. ... Therefore, we must make sure that altruism comes out.

question	Why do employees not get together well?
4th	Even in management, if you work hard for everyone with a beautiful heart ... If you do not feel like being able to work happily, the company will not work.
10th	What will come out at the beginning of the section "doing better work" ... I was able to build a wonderful group because I did not spare my efforts for everyone.

question	Why cannot you do business with selfishness?
4th	Depending on our judgment, the rise and fall of the company is ... If that judgment is only selfishness, it will not differ.
10th	I am preaching the importance of the heart of altruism to everyone ... And eventually we will not be able to gain social support, and we will achieve a downfall. There are many such cases.

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