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Summarization and Visualization of Deliberation in E-mail Communication

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1 Background and Purpose

E-mail is one of the fundamental and important communication tools on the Internet. E-mail users tend to send an e-mail message that include several topics. Therefore, several topics will be communicated in parallel in subsequent e-mail messages. Communicating the parallel topics makes it difficult for participants to couple corresponding passages in consecutive e-mail messages. Tools to visualize e-mail messages to solve this problem are proposed. Our research group has already proposed a model, called a deliberation structure model, that represents streams of relevant messages in email communication. And our group implemented a tool, called a deliberation structure extraction engine, that extracts and stores the deliberation structure from the e-mail messages. Our group also implemented a client for referring to the structure. However, it is difficult to refer all deliberation streams using the client at once. In this paper, we propose a method for summarizing deliberation automatically. We also implement a tool for visualizing deliberation structure. Concretely, we implement the following deliberation summarization engine and a tool for visualizing the deliberation structure.

1. Deliberation Summarization Engine

When several topics are communicated in parallel, it is difficult for a participant to search useful argument by referring to the streams of argument. So we implement an tool for summarizing deliberation, in order to search argument which users need. Concretely, this tool extracts information including the talking point and the conclusion from complete deliberation stream. This tool also extracts information including the talking point and the last suggestion from incomplete deliberation stream.

2. Visualization Tool

We design and implement a tool for visualizing deliberation structure. This tool visualizes the summarization of deliberation and its deliberation structure to which

the participant is related. This tool also visualizes all summarization of deliberation and its deliberation structure.

2 Automatic Summarization of Deliberation

In this paper, we implement an tool, called a deliberation summarization engine, that uses deliberation streams extracted from the deliberation structure extraction engine. The method for summarizing deliberation uses $tf*idf$ which is the method for calculating the weight of a word in a field of information retrieval. Index terms in each utterance are calculated by using the $tf*idf$. And Important utterances are extracted by using the $tf*idf$. Based on this method, we implemented the deliberation summarization engine for summarizing automatically. The following shows outline of algorithm.

1. This engine extracts utterances and the information(WhoPr, WhomPr, etc) on its utterance from a UMML file.
2. This engine extracts the information of the relation between utterances from a Linkbase file.
3. This engine performs a morphological analysis with a ChaSen to the extracted utterance. It also extracts index terms by using the result.
4. This engine calculates the $tf(t,d)*idf(t)$ per index term in each utterance.
5. This engine sorts the $tf(t,d)*idf(t)$ per index term of each utterance in deliberation in high order. It also extracts two utterances of a high $tf(t,d)*idf(t)$.
6. This engine outputs two extracted utterances to XML files.

We evaluated the method for summarizing deliberation by using the deliberation summarization engine. We evaluated our method by two kinds of measures. About complete deliberation stream, we investigated the rate that the utterance including the talking point and the conclusion was extracted. And, about incomplete deliberation stream, we investigated the rate that the utterance including the talking point and the last suggestion was extracted. As the result, we acquired about 70% rate in both of deliberation. Therefore, we concluded that this method was suitable for summarizing deliberation. And we concluded considering two utterance as important utterance.

3 Visualization Tool

We implemented a tool for visualizing deliberation structure by using the summarization which deliberation summarization engine extracts. This tool visualizes the summarization of deliberation and its deliberation structure to which each participant is related to a browser for the purpose of visualizing useful information in deliberation to the participant. This tool also visualizes all summarization of deliberation and its deliberation structure.

4 Conclusion

We designed and implemented two tool as the method for visualizing deliberation structure in E-mail communication. Our tool consists of the deliberation summarization engine and visualization tool. The deliberation summarization engine extracts summarizations from deliberation automatically. The visualization tool visualizes the summarization of deliberation and its deliberation structure to which each participant is related by using the summarization which deliberation summarization engine extracts. The following shows future works.

- We need to improve the method of choosing an index term and accuracy of method summarizing deliberation.
- We need to confirm whether our visualization tool is useful for smooth E-mail communication by actually employing visualization tool.