Maintaining Homogeneity of Severity Rating among Triage Officers in Collaborative Information Triage

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Abstract

When a large-scale disaster occurs, a great deal large amount of information is transmitted within a short time a brief time. This information often consists of overlapping or unclear importance and authenticity. Under such circumstances, this research focuses on information triage as a framework for supporting the distinction and organization of information within a limited time, and aims to realize a computing environment in which multiple stakeholders can collaborate and tackle these tasks. In this paper, we focus on the discrimination and importance judgment of the person in charge, who conducts the information triage, and consider the method of performing a unified importance evaluation.

Keywords: information triage, information system, decision support, CSCW

1 Introduction

The growth of the Internet has made it possible for us to access substantial amounts of information; however, with increased information the time margin for examining the information is reduced. It is necessary to identify useful information for problem-solving and decision-making among the enormous amount of information under a temporal limit. We therefore propose "information triage," which is useful in the case described above. Triage is a method for determining treatment priority by classifying victims based on severity and urgency. It is used at disaster medical sites, where resource restrictions are severe, and its purpose is to maximize life-saving effects. Information triage is a methodology for information access based on the process for medical treatment[1]. Most studies that have utilized information triage have aimed to improve the efficiency and facilitation of personal information access. However, fewer studies have applied it to the case of multiple stakeholders cooperating to solve problems. Collaboration among multiple stakeholders requires adjustment of members and role division. Therefore, simply improving the efficiency of personal information access, as in previous research, does not necessarily lead to collective gains.

We propose "collaborative information triage", which deals with information triage considering large numbers of people. This method enables efficient decision-making by assessing enormous amounts of information to identify the most critical information; for example, in the cases of creating a business model through market analysis, or drafting a disaster relief policy in the event of epidemics or large-scale disasters. In this paper, we propose the collaborative information triage framework, in order to enable the gathering and assessing of information by multiple people and rapid decision-making. We determine the reliability of the information importance rating of triage officers, and consider how to create a unified information importance rating.

2 Related Works

Research on information triage is primarily conducted in the field of information retrieval and natural language processing. The primary focus of these studies is to support individual information access activities more efficiently and effectively. For example, Marshall et al. proposes a system, named VIKI, for visually organizing information[1]. This system intends to support a user's decision-making by enabling evaluation and organization of massive amounts of information under time constraints, which could help the user make appropriate decisions. In addition, research was conducted on value assignment of information considering anticipated situations[2], and support for exploratory

information-browsing on various media [3].

While conventional information triage has dealt with the support of personal information search behavior, this paper focuses on problem-solving cooperatively performed by a group, which is what happens in the real world, and providing assistance to improve the group's problem-solving efficiency. In the latter approach, because process loss caused by interaction among group members is assumed, the method of simply combining the former approaches cannot be applied to the group's problem-solving.

Research to support information sharing and information access among group members is conducted in the fields of Computer-Supported Cooperative Work (CSCW) and Computer-Supported Cooperative Learning (CSCL). Several studies targeting information search by groups have been conducted. These include research helping users in remote locations to share search results and information preferences (e.g., GroupViewer [Shiozawa 95], SearchTogether[4]), studies to encourage sharing of search results and collaborative search in scenarios where multiple users surround one information terminal (e.g., TeamSearch[5], CoSearch[6]), and studies to support sharing/systematizing knowledge by multiple users[7].

In particular, cooperative search behavior has some benefits, such as supporting a user ' s recall and improving search skills by observation of others ' behaviorMorris:2013. Shah et al. experimented on the synergic effect when performing cooperative search behavior[8] This experiment compares four conditional search situations, namely: a pair of search actions performed by a single user, a pair of search actions performed sitting side by side, a pair of users performing search actions in the same place on separate computers, and a pair of remote users performing search actions. As a result, it is clarified that cooperative retrieval behavior can formulate a wider range of queries and discover unique and useful information.

In these researches, the positions and roles of the constituent members of the group are similar. Thus, assignation of the search space and mutual sharing of the search results are regarded as crucial points to be supported. This means that role-sharing required in situations where information triage is required and the methods to summarize and share information at the time of decision making under strict constraints are not considered. Based on the preceding studies, this study considers a framework for supporting collaborative information triage conducted under restricted condition of time and resources.

3 Collaborative Information Triage

In medical treatment triage during disasters, there are two roles, namely the "triage officer," who quickly judges the degree of injury, and "medical staff," who treat the transported victims based on the judgment. Collaborative information triage is based on the former triage model, and consists of two roles: the triage officer and director. Triage officers are personnel who search for information by sharing roles, and collect and assess information for problem-solving. The director is a single person who organizes the triage officers and determines the information gathering direction.

The majority of research on collaborative information searching has focused on search results, the search process, and preference sharing. For example, Shiosawa et al. clarified the minimum requirements to be satisfied in a collaborative search, namely "mutual understanding of search purpose, " " mutual grasp of search history," and "mutual exchange of information evaluation". Furthermore, Ueda et al. considered that sharing and comparing each person's search history with others is key to effective cooperative search, and proposed a method for supporting information retrieval by visualizing the search history. As described previously, the current collaborative information search style does not share roles among searchers, but the information is searched exhaustively and systematically in its entirety, and shared among members. Information triage takes into account the addressing of these issues under time constraints. In a situation where information triage is required, the value of the information changes continually. Furthermore, it is assumed that constraints change, such as increasing or decreasing the number of members, and tasks occur suddenly that need to be resolved preferentially. Therefore, members are required to act autonomously, based on behavioral guidelines and according to circumstances, and not to keep in tune with one another. As mentioned, role sharing is clear in collaborative

information triage, so all that individual triage officers need to do is collect useful information for judgment and present it to the director. Therefore, information sharing among triage officers is one means for efficiently collecting useful information within a limited time.

In disaster medical treatment triage, there are certain judgment guidelines for assessing the severity of a patient, such as the simple triage and rapid treatment (START) method. Therefore, it is possible to obtain the results of a generally unified judgment even if the triage officer changes. However, in the case of information triage, simply providing guidelines cannot result in a unified importance rating, because the value of information often depends on context. In order to address this problem, we need to conduct simulative collaborative information triage, and clarify what types of criteria to apply for judging the value of information. In this study, we reveal the influence of communication in information sharing on task performance and decision quality. In order to realize this purpose, we provide tasks for evaluating importance to the simulated information triage with or without information sharing through communication, and analyze ”task achievement time” and ”match rate of importance rating”.

4 Interactions between Triage Members

When collaborative information triage is carried out(Figure.1), director subdivides tasks the team should solve and assign partial tasks to triage officer. Each triage officer gathers information and distinguish based on importance or urgency to solve a given task. Therefore, director is required to grasp the big issues of tasks and triage officer is required to grasp details of partial tasks.

There are two types of models of collaborative information triage. One is a model to minimize interaction between triage officers to reduce the overheads of member as possible. This model only considers interaction between triage officer and director, and the interaction between each triage officer is done only to adjust overlap of search space. This interaction model can be expected to reduce the overhead by using the reranking technique [6] of search results according to searchers. However, There is concern to adopt a complete division of labor is not necessarily lead to the performance as a group. For example, it has been pointed out that “meta-knowledge”

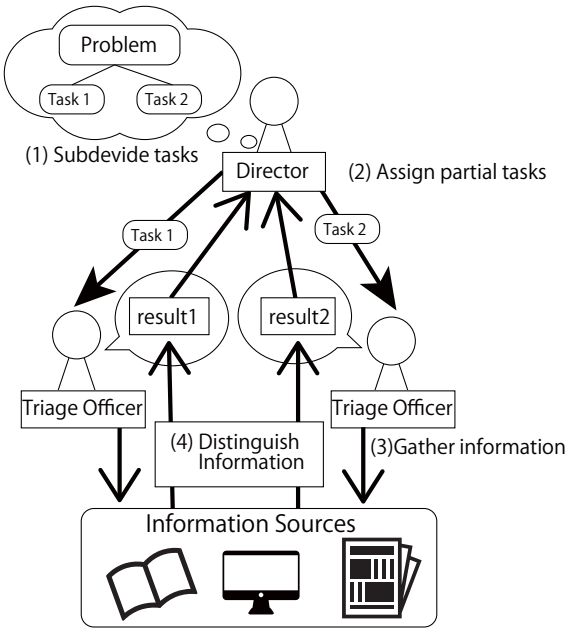

Figure 1. Interaction model of collaborative information triage

is the key of problem-solving in the scene of requiring to demonstrate ability as a group beyond individual capacity. Meta knowledge is not about “what each member knows”, but about the location of knowledge among members such as “who knows what” and “what kind of ability.” Another model of collaborative information triage is to consider meta-knowledge, and can be backed up mutually as necessary under moderate division of labor. It aims to ensure homogeneity of evaluation by sharing “meta-knowledge” like tasks assigned to other triage officer and their progress for each member.

5 Experiment

In this experiment, we impose the simulation task of rating importance sent to the countermeasure office, under the assumption that an earthquake occurred near Kyoto Station. The information is composed of ”date and time of occurrence of the event”, ”place of occurrence of the event”, ”information source”, and ”contents of the event”. We prepared 60 pieces of information, each of which included the damage conditions (for example, fire, building collapse, transport disorder) and information source (for example, government announcement, disaster relief headquarters, Twitter, a railroad company). 10 of the pieces were incorrect information.

The experimental setting was defined based on actual information gathering complications during large-scale disasters. When a disaster occurs, diverse types of information are unsystematically gathered from multiple media such as telephone, e-mail, and social networking services . The information collected includes incorrect information (e.g., fake news, false recognitions, and canards)[9]. To mimic the confusing situation, we interlarded several pieces of incorrect information and observed how the participants identified and excluded them. In this experiment, we described the information on paper cards and distributed these to each collaborator in order to focus only on the importance rating by excluding temporal imbalance as a result of the operation of media. The experiment participants were tasked with rating this information according to the following four levels of importance:

- Level 0: Not absolutely important
- Level 1: Not very important (not preferred)
- Level 2: Important and needs to be resolved as soon as possible
- Level 3: Very important and must be dealt with soon

This was a simulation task, and its authenticity could not be confirmed by searching and inquiries. Therefore, we prepared an experimental reference to simulate the process of confirming authenticity. This reference is stored in the directory format, and only true information is stored in each genre. The pieces of information are classified as the following genres: ”earthquake information,” ”traffic information,” ”information on supporters,” ”incident, accident,” ”weather, alarm ,” ”damage situation, restoration report,” ”evacuation center information,” and ”others”. Experimental participants were tasked with verifying the truth of the information with the information ’ s authenticity being suspected.

The experiments were conducted using two groups. Group 1 performed importance ratings alone, while group 2 included a pair of people performing importance ratings with communication. The experimental collaborators were students enrolled in the Department of Information Systems and graduate school. The participants of group 1 were six people and those of group 2 were six pairs of people. In this experiment, we measured the time required for the task and the number of confirming references. Following the experiment, we provided participants with a questionnaire and asked about the judgment criteria for information rating importance. Furthermore, the participants of group 2 responded to what type of content they communicated with their partners.

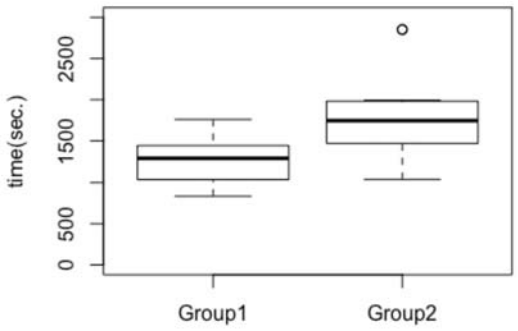

Figure 2. Average task completion time

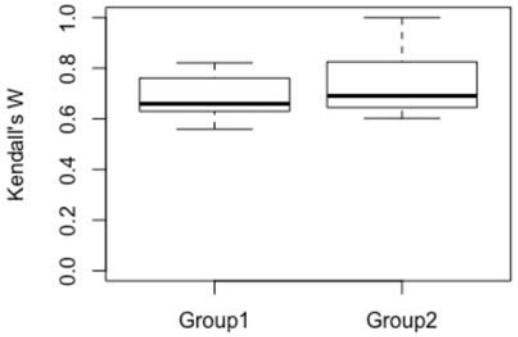

Figure 3. Average coincidence rates

6 Results

As illustrated in Figure 2, the average task completion time was 1274.8 seconds for group 1 and 1813.8 seconds for group 2, with an average of 539 seconds less for group 1 (Welch T-test, p = .022). As a result of examining the coincidence ratio, the intra-group coincidence rate of the importance rating was determined to be 0.481 for group 1 and 0.408 for group 2 (Kendall’s W). Similarly, the intra-group coincidence rate was examined for incorrect information only, which was determined as 0.487 for group 1 and 0.400 for group 2, which indicated almost the same coincidence rate as when all information was considered. When comparing coincidence rates be-

tween pairs, as shown in Figure 3, the average between pairs of group 2 was 0.742. This result indicates no significant difference compared to the average of 0.688 when an arbitrary two participants of group 1 are regarded as a pair (Welch T-test, $p = .426$). From the post-honors questionnaire, we obtained the following findings.

- Importance Rating Tendency

  It was confirmed that participants have a tendency to rate new information as having high importance, and old information as having low importance, based on the information time stamps. Moreover, opinions such as "Information related to human life, such as fire and accident, is of high importance" and "Information for which damage is expected to expand is highly important" were obtained.

- Information with Different Ratings

  Conflicting opinions were obtained regarding information on earthquakes themselves (for example, type of occurrence mechanism), namely for "The occurrence of an earthquake is impossible to prevent and it is necessary to resolve it in the long term, so it is less important" and "It is important to consider measures against secondary disasters". It was confirmed that individuals did not unify the importance standards.

- Confirming Information Authenticity

  In terms of information authenticity, some participants confirmed the truth in the following cases, "information with information sources as SNS" and "important information on human life in particular". A total of 16 participants out of 18 confirmed the authenticity of information when Twitter was used as the information source, while the remaining two did not confirm the information's authenticity. From the above results, it is suggested that the information source has a very strong influence on credibility.

- Communications

  The main topics of communication between the pairs of group 2 were "information sharing when discovering incorrect information," "adjustment of importance rating criteria," and "importance rating concerning specific genre." In group 1, defining the importance rating direction for each genre beforehand and discussing information about disagreement were observed. In this group, although the task completion time was the longest, the coincidence rate between pairs was highest.

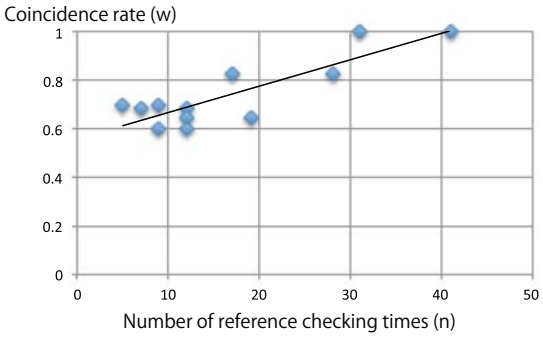

Figure 4. Reference confirmation frequency

7 Discussion

From the experiment, it was determined that the time required for triage was longer for the group with communication than that without. This characteristic was predicted in advance, suggesting that communication cannot be neglected as an overhead. There was no difference with or without communication regarding the coincidence rate and evaluation of incorrect information for the pairs. In terms of the relationship between the reference confirmation frequency and coincidence rate, it was found that the coincidence rate increased with the number of reference checking times (Figure 4). From this, it is suggested that supporting the confirmation of information authenticity contributes more to a unified importance rating than match rating in communications.

8 Conclusion

In this paper, we have proposed "collaborative information triage," assessed information in a group to enable smooth decision-making under temporal limits, and determined the influence of communication in information sharing on task performance and decision quality. The experimental results indicate that there was no difference in the importance rating in cases where the triage officer performed the rating alone and the

same information was rated by multiple people. However, it is suggested that the more the information authenticity was confirmed, the more consistently importance can be rated in the case of rating by multiple people. This research aims not only to improve the efficiency of information access for individuals, but also to enable the triage officer to work either autonomously or complementarily. For this purpose, it is necessary for the triage officer to share the progress and situation of other members and establish information circulation in a simple manner. The experiment carried out in this study clarified the premise for such cooperation to take place. In future, we plan to implement a system for information triage, and consider its interaction design, focusing on which types of tasks are targeted and how to operate the system.

Acknowledgment

This work was supported by JSPS KAKENHI Grant Number 15H02780.

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