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Crowdsourcing in Crisis Informatics for Disaster Relief

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Abstract. In this paper, we present observations and lessons learned in crowdsourcing from our experiences with the Great East Japan Earthquake and Tsunami. Based on our experiences, we identify a set of future crowd sourcing research directions in Crisis Informatics for disaster relief.

Introduction

The destruction of the Great East Japan Earthquake and Tsunami on March 11th, 2011 created a challenge in crisis informatics. It became much more difficult to find and share necessary information as needed in the disaster area compared to normal times. The main cause was that information was posted in many different media types (e.g. text, audio, PDF, images) across many different websites. As a result, information was inaccessible to many users

Social networking services like Twitter showed that crowdsourcing services were most robust and effective for refugees to know and share a part of the distributed information like information about emergency shelters and delivery of relief supplies [1]. But the existing crowdsourcing services did not satisfy all of people's

information needs. Therefore, there will be good opportunities for research to provide more effective crowdsourcing solutions for better support of disaster relief efforts.

In this paper, we present some lessons learned in crowdsourcing from our experiences with the recent Japan large disaster. Based on our experiences, we identify a set of future crowdsourcing research directions in crisis informatics for disaster relief.

Case Study of East Japan Earthquake and Tsunami

The Great East Japan Earthquake and Tsunami on March 11th, 2011 created over 300,000 refugees in the northeast area. Many of them were forced to live awkwardly in emergency shelters for 3 to 5 months until temporary housing could be built.

Immediately after the disaster, many refugees were in shelters without knowing whether their family was alive or not. They needed to visit many other shelters by themselves until they confirmed their family's safety because each shelter posted a handwritten list of refugees' names in the shelter on its wall. Under this very stressful situation, we found refugees tended to rely on paper media for information exchanges because of lack of electricity, vulnerable telephone networks as shown in [1], and lack of people skilled at retrieving information online. Google deployed a mashup of Picasa with the Person Finder [2] very quickly to support refugees' effort to find their families (See Figure 1). This allowed anyone to share photos of the lists of refugee names. Crowds of people could digitize the names in the lists and post them into Person Finder.

Figure 1. Screen image of Picasa-based crowdsourcing.

Offices in some towns visited refugees' living places and surveyed their sensitive personal information (family members, living environment, health and mental condition, and so on). The survey results were managed in handwritten forms, making it difficult to reuse the information and find people who needed mental care. We worked with a town in the disaster area and deployed a crowdsourcing service to digitize these handwritten survey forms. We also preserved privacy by employing only a limited number of IBM employees and exchanging data using a secure protocol among a server, the town office and IBM because it was important to protect sensitive personal information even during emergency.

The tsunami also caused the terrible failure of cooling systems at Fukushima Daiichi Nuclear Power Plant, resulting in a large nuclear disaster. Due to the disaster, some electric power companies were forced to do planned blackouts to keep the supply of electric power stable. In this situation, refugees needed to gather a wide variety of information from various types of data sources by reading a poster on the shelter's wall, hearing it from the radio or another person, or using their mobile phones. The data sources included the local government (relief goods, temporary housing), the national government (radiation dose), electric companies (planned blackouts), and so on.

Some refugees could use Sinsai.info [3], a mashup of the crowdsourcing Web platform Ushahidi [4] and the free geographic database OpenStreetMap [5], to gather the above information linked with locations on the map (See Figure 2). Sinsai.info was useful for finding some local information, but it did not emerge as the primary information source for disaster relief. Many other competing websites also provided similar information and refugees did not know which service to use

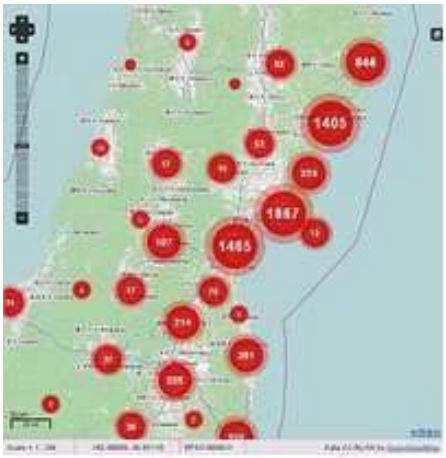

Figure 2. Screen image of sinsai.info.

Moreover, mobile information access was made more difficult due to the wide variety of data formats used to make information available: handwritten paper, images, video, audio, PDF, and so on. For example, one government website provided only PDF files of scanned images of papers immediately after the disaster with no textual transcription. Refugees with typical feature phones were unable to read the information because their devices could not support displaying PDF files.

These services showed that crowdsourcing has the potential to make image-based media types more accessible and the ability to gather local information efficiently from various data sources. But the existing crowdsourcing services did not satisfy all of people's information needs. Therefore there will be good opportunities for research to provide more effective crowdsourcing solutions for better support of disaster relief efforts.

Our Research Directions

Based on our experiences, we present a set of future crowd research directions in crisis informatics for disaster relief.

(R1) Creation of powerful and efficient crowdsourcing service: We plan to use crowdsourcing to break two of the major barriers to information availability: transcribing various media types into text information to make it more accessible and gathering information from multiple websites to make it available in one place. Our experience with crowd-based digitization of handwritten survey forms gives us a basis for exploring the first challenge. For the second, we plan to build on the CoScripter web scripting system [6] (See Figure 3) to enable the crowd to create scripts for scraping information from multiple websites by demonstration.

Figure 3. Screen image of CoScripter web scripting system.

(R2) Support of quick development and deployment: Getting a system up and running quickly after a disaster can prevent distribution and duplication of the same information. The ability to respond quickly after a disaster occurs may be improved by having common components for crowdsoucing services, such as an execution engine for CrowdLang [7].

(R3) Creation of reliable and secure crowdsoucing service: Gao et al pointed out that appropriate verification process are required for generation of reliable information in crowdsourcing [8]. We also found that preserving sensitive personal information will be required to prevent leakage of the information in digitization based on our experiences in development of our form digitization. For example, we can ensure quality assurance by assigning the same small task to multiple people recursively until all of them return the same result or adding a validation by domain experts. We can also preserve privacy by separating a large task into smaller pieces, each of which does not have sufficient information to identify a person. Figure 4 shows an example of digitization processing flow

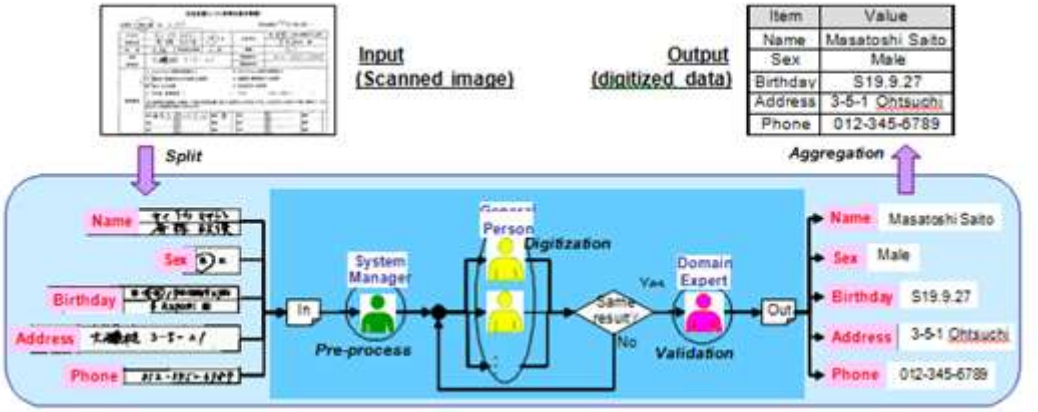

Figure 4. An image of digitization processing flow.

(R4) Optimization of work assignment: Since many of the affected people in crowd have a variety of abilities, optimized work assignment to the appropriate persons' group based on their skills and their experiences will be required to utilize the power of crowdsourcing efficiently. For example, we can reuse the concept of efficient workforce deployment in a service development shown in [9].

(R5) Sustainable service support: Support of collaboration and coordination among people in crowd is missing in the existing crowdsourcing services as shown in [8]. For a sustainable service, it is important to provide the service with collaboration and coordination support even at normal times for smooth collaboration among people in crowds. This enables seamless transition from at

normal times to in emergency case with less training under stressful situation as pointed out in [10].

Summary

In this paper, we presented lessons learned in crowdsourcing from our experiences with the recent Japan disaster. Based on our experiences, we have identified a set of future crowdsourcing research directions in crisis informatics for disaster relief.

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