Social Media Use during Emergency Response – Insights from Emergency Professionals

Abstract. This paper analyzes issues in organizational needs for extracting information from social media during emergency response. By interviewing 16 Canadian emergency professionals, we gained insight into such things as: how they currently monitor social media; what types of information they are interested in, what challenges they encounter and what strategies they use to overcome those challenges. The most frequent requirements mentioned by participant were the need for prioritization and categorization of social media data to mitigate information overload. These professionals are also concerned about the reliability of information and counteracting the rumors.

Keywords: Social media, Emergency response, Requirement gathering, Information overload, Information reliability

1 Introduction

When an emergency happens, social media may provide information from the public that can contribute to situation awareness of emergency operation centers (EOCs) and impact their decision-making. For example, Twitter reported that during Hurricane Sandy in 2012, people sent more than 20 million tweets about the storm within 6 days. During the event, people actively broadcast different kinds of emergency-related information. The information can be descriptions of the event, impact on the community, requests for help, and expressions of fear [1, 2].

This study describes the current status of the use of social media by Canadian practitioners through semi-structured interviews. We gather requirements elicitation on support tools for those who are monitoring and analyzing social media information posted by public to enhance situational awareness. Our goal is to bring insight into the challenges that these practitioners are facing when trying to extract information from social media, and try to identify what kinds of information types are needed. We discuss strategies that organizations are currently using to tackle those challenges.

2 Related Work

Many recent studies discuss the importance and rise in the usage of social media. A group of studies discuss social media usage by exploring datasets of social media posts across various emergency events [3-5]. Hughes et al. [6] analysis across four emergency events shows the importance of social media in extracting on the ground information and the adoption of people to social media during events. Takahashi et al. [7] explores how ordinary people and organizations use social media and what fac-

tors impact this use by analyzing tweets during Typhoon Haiyan in the Philippines Bruno. An analysis of tweets from hurricane sandy demonstrates that retweet activity increased during the event [8]. Some studies analyze rumors in twitter datasets to extract and analyze propagation patterns and the content of the rumor related tweets [9-11]. Imran et al. [12] surveys different studies for processing social media in mass emergencies.

Another group of studies explore social media usage and the issues around that by gathering requirements from practitioners. Tapia et al. [13] conducted semi-structured interviews to understand the usage of micro blogged data by emergency related organizations. They showed the landscape of the microblogged data usage among different organizations is varied. They found microblogged data useful when responders are in lack of information. However, there are concerns with quality and reliability of microblogged data. Another study [14] discuss the results of interviews with US emergency managers about their barriers and wish lists when using social media. They identify three main barriers for using social media: lack of resources, lack of policies and guidelines for social media use, and concern about the trustworthiness of the posts. A survey [15] of 241 U.S. emergency managers at the county level explores if organizations use social media and discuss how they can improve these usage. This study states that only about half of these organizations use social media in any way.

The use of social media is evolving rapidly and it's different from one event to another and from one organization to another [3, 16, 17]. The use and requirements for social media can vary by geo-political region. As previous studies are mostly US centered, we intend to reveal the usage of social media within Canadian organizations and to understand if the challenges are the same and what specific strategies Canadian organizations have to tackle those challenges. To the best of our knowledge this paper is the first study that focus on requirement elicitation of Canadian practitioners. We target both emergency managers and social media analysts across Canada in the emergency field.

3 Methodology

We conducted semi-structured interviews with 16 participants across different organizations (see **Table 1**). The organizations can be divided to two main types: End users and Service providers. End users belong to public organizations (e.g. Emergency Operation Center, police department, etc.) or private sectors (e.g. Oil and Gas sector). We target participants who have the experience of managing and respond to at least one emergency event (e.g. Slave lake Fire, Alberta Flood 2013, Calgary Snow Storm 2014). The interviews performed starting March 2015 until December 2015. We asked participants about their use of social media, how they monitor and extract information from public posts, and what challenges they are facing when using social media. Each interview lasted between 60-90 minutes and was audio taped and transcribed. To analyze the notes we followed a process inspired by grounded theory [18]. Grounded theory involves iterative coding of concepts (open-coding) and finding patterns apparent in the text (axial coding) in order to form typologies. Our goal is to

determine current usages of social media across different organizations. We used the saturate (http://www.saturateapp.com/notebooks) application to analyze the interview notes.

Table 1. Requirement Elicitations User Profiles

Participant	Title	Years of Experience in Emergency Field	Type of Organization
P1	Researcher at Center of child, family, and community research	4-5	Service Providers
P2	Police officer	19	End Users- Public org.
P3	Director, national security and strategic foresight	6	Service Provider
P4	Director of emergency communication	30	End Users- Public org.
P5	Fire chief	24	End Users - Public org.
P6	Senior safety coordinator	20	End Users- Private sector
P7	Emergency manager	16+	End Users – Public org.
P8	Emergency manager	12	End Users – Public org.
P9	Police officer	20	End Users – Public org.
P10	Executive director of operations	28	End Users – Public org.
P11	Police officer	unknown	End Users Public org.
P12	Emergency center communications officer	unknown	End Users – Public org.
P13	Strategic communications specialist	unknown	End Users- Private sector
P14	Team lead communications	10	End Users –Public org.
P15	Digital communications officer	11	End Users –Public org.
P16	Vice President	unknown	Service Provider

4 Results

We will describe our findings in this section. In our results, we will not use any percentages or "statistics" since this would not be suitable for the size and nature of the sample studied. Instead, we will describe the main themes, based on counts of coding categories, and then give examples of descriptions of these themes in the words of the interviewees themselves.

4.1 Patterns of Use

Most of the participants agreed that social media has became a central element in emergency response planning. *"It's not a part you can ignore or a piece that can wait."* They were familiar with the potential and importance of using social media during an emergency event. *"Manage public relation if you do not manage it, it manages you."* Twitter, Facebook and Instagram were the mostly used social media services mentioned by participants. Depending on the resources and the size of the organization they were managing, the degree of their involvement with social media was different. Some mentioned that they monitor social media "very intensively" and others mentioned that they only communicate out and do not monitor social media, mainly because of "lack of resources" due to the sheer volume of information.

Public sector end-users mostly monitor social media for *"watching the conversation, communication and identify trends, reporting urgencies, ... [seeing] impact on community."* They care about people and their safety, properties and environment. It is important for these organizations to know the topics that people talk about and how they feel about those topics. *"We push information but we are also very interested and keen on what people are talking about."* However the usage differs between everyday monitoring and when an emergency happens. As many participants stated during an emergency the volume of messages increases but a participant pointed out another interesting difference: *"during a crisis event that conversation is very elevated and very focused ... in non-crisis in 5 minutes I see 20 different topics that people are talking... maybe there is a higher need for filtering during non-crisis event since the conversation is much wider... [while during the crisis] it comes about how to filter out the noise."* On the other hand emergency events have more challenges as they usually happen fast and it takes time for authorities to get a grip of the online story. For example, one participant stated about a shooting, *"Social communication was huge and it took authorities three hours to become part of that conversation. Speculations and accusations were occurring; investigators were required on follow up noise to track the efforts. It's a mess and we don't know what the formula is"*.

The police social media analysts described some additional usages in regards to social media. Their tasks include general enquiries tasks such as *"less formal questions, legal advice type questions",* proactive community policing such as *"sharing infographics about the latest crime trends",* reactive to crimes for example *"ask public to help find and identify suspects",* and investigative support for example: *"the officers are reaching out to me asking for assistant on social media... They found a wallet they have a name but they can't find the contact detail of the owner... Can we find this person on Facebook?"* Another police officer stated that when there is a risk of further incidents, they monitor social media intensively to determine where and what is being said to help mitigate the risks.

We also interviewed few private sector end-users. They pointed out that their companies usually do minimal monitoring on a daily basis. One of them stated that during an emergency event they are looking for information about what people are saying about the emergency, what negative comments or inaccuracies are being reported about the company then craft a response to the posted information. She mentioned, *"[The company] hired a public relations company to monitor the social media feeds in the recent oil spill because traffic was so high. Otherwise [the company] do very minimal monitoring on a day-by-day basis, really only during an emergency."*

4.2 Types of Information:

We asked participants what kind of information social media provides that they are interested in. We extracted the following categories from their responses:

1. Detail: As a communication officer mentioned in an emergency event they try to extract the impact of event on people and environment. A social media post can contain information that shows this impact. People can provide details in messages, photos, and videos as a participant commented: *"People post about things they're in the middle of or post pictures, videos, comments"*. According to our participants Details can be regarding properties, their conditions, and damages during an event. Details can also be regarding affected people, their injuries, their evacuation, their needs of resources such as food, blankets, water, etc.

   Questions: A post can contain a question that the author seeks an answer for. As an emergency manager stated they *"Try to answer questions quickly – before someone non-authoritative can answer."* They may ask questions regarding different subjects such as evacuation orders, volunteering and donation, or rescue processes: *"For flood people asking us with evacuation areas. there were 3 communities that they want to evacuate and then 4,5 were going to be and then they started asking ... people started asking questions where should we go, where are the community help centers,…"*
2. Misinformation: A post can contain a rumour or false information. According to recent analysis on emergency-related social media posts [9], a considerable portion of emergency-related microblogs can be incorrect. Rumours or false information can spread quickly, either purposefully or accidentally, and lead to wrong decisions and actions by the public. Hence, identifying microblogs that contain false information can help analysts to counteract them. A participant mentioned: *"Another critical piece, [we] need to be able to dispel rumors. In tornado, there were two rumors: I heard that there [were] two separate touchdown points."*
3. Urgencies: An emergency related posts can contain request for help. For example, somebody needs help or rescue immediately. These kinds of posts are highly prioritized for emergency people. They try to find these posts by scrolling through lists of incoming messages but are challenged by the high volume of incoming posts, e.g. *"We had posts like I can't find my mom, can somebody go and check the house OR my neighbour has been handicapped can someone go and check;"*

4. Sentiment: The public perception regarding an event was another category that the participants mentioned. While these posts often do not have any operational information, understanding the public sentiment can help the authorities prioritizing resources. One participant mentioned the importance of sentiment, which helped discover problems that are about how people feel and react to the situations the authorities were already familiar with.

4.3 Information Overload – The Need for Filtering and Categorization

One of the obvious problems that all participants mentioned was the volume of information coming from the public. According to the interviews, analysts receive thousands of messages every day and the situation is worse during an emergency. The Calgary flood infographic [19] shows there were 857,000 tweets for the most popular hashtags during the first two weeks of flooding. A considerable percentage of incoming messages are operationally irrelevant which makes it hard to extract urgency type posts: *"Got 10s of thousands of messages of support from around the world. People would report people who might need to be checked on, but this could get overwhelming fast." "If somebody needs help we should make sure to catch that by scrolling through and its challenging and things get messed up."*
Another participant stated sometimes businesses try to promote themselves by attaching their advertisement to the trending hashtags in twitter. As an analyst stated one drawback of current tools is that they represent posts in a reverse-chronological order that makes it challenging for them to make sense of thousands of incoming posts with a short amount of time in an emergency situation. Another participant mentioned: *"It takes a significant amount of time and effort to sort through the incoming posts, we get thousands of incoming messages on a daily basis, we try from a corporation perspective to acknowledge or respond messages, right now we are performing about 3%!"* On the other hand, the use of social media by the public has enormously increased during the last decade and community members now expect help when they send a social media message, *"There is an increase in the expectation from public that if they tweet asking for help they will generate help or a response, we are not there yet!"*

Some organizations have strategies to mitigate the information overload. For example, one participant mentioned that they were creating a role called "Audience Intelligence". The role monitors news and streams to determine what the trends are and understand what people are saying. This can help the rest of the social media monitoring team to catch stories online. The digital communication officer in the police department also mentioned that since they lack resources to monitor social media posts during the night shift, they put the geo-tagged ones on the map view so that everybody can see what is going on in social media.

4.4 Degree of Separation

The pressure that people within emergency operation centers face makes the analyst job difficult as the responders are often local people who see their friends and families in danger. The participants who had experienced the Alberta floods in 2013 or the huge fire at Slave Lake in 2011 mentioned that the magnitude around those events were unprecedented. Responders may not sleep for several days and bear lots of pressure. As one participants mentioned *"you may start crying in a corner after working several hours"*. As they stated, having a degree of separation and use the help of outsiders for monitoring social media can be useful, *"during the flood we had one person that worked remotely, I think that was one of the keys in the success, having that degree of separation... since that person was not influenced by the crazy energy that was present in the Calgary Emergency Operation Center"*.

4.5 Collaboration and Communication

We frequently heard from participants that communication and collaboration among people is more important than technology. In emergencies, integration between different organizations happens through people. Some participant mentioned that emergency managers might satisfy their informational needs through their trustworthy sources of information. Hence, it is important to establish those links before an emergency happens. This could also be applied in the social media space by helping analysts identify active users within a community. It is important to be involved in social media before an emergency happens and establish the communication links. As a participant explained, *"One of the big messages that we've been getting again and again in emergency management is that relationships in terms of people and organizations sits above technology and capability, even if you do have technology unless you have personal relationships build and trusted ahead of time still you are going to struggle!"* Another participant mentioned that during the Alberta Flood 2013, twitter shut down the Calgary police twitter account as it was treated as spam due to exceeding the daily limit of tweets.

4.6 Reliability of Social Media

Although social media contains information that can contribute to situation awareness, one of the concerns is the reliability of the information. Almost all participants had concerns regarding the reliability of a source when talking about social media.
"Can you verify the information, who is the source of the info?"

Source Reliability.

One aspect of reliability was regarding how much the source of information is reliable. When asked about what characteristics they consider to assess the reliability of a source, the answers were: is the twitter account valid? Do they follow their organization? Is there a known/verified follower? What past posts does this user have? How recent was the account made? What is the number of followers/friends? How active is

the user? How many times is the user being reposted? Is the user an eyewitness or inside the emergency region? How old is the user account? What is the profile picture of the user? As one participant mentioned, going through all these characteristics takes time.

Dispel Rumors.

Another concern that many of participants mentioned was the spread of rumors over social media. As mentioned by many participants, one of the tasks of a social media analyst is to counteract rumors. A rumor is information where the analyst knows that the information is wrong. According to our participants, rumors might spread intentionally by malicious people but they can also spread unintentionally by lack of understanding or technical information, accidental misinformation or simply people's frustrations. For example, a communication officer stated that during the Calgary flood, there was a rumor that the drinking water is not safe in the city. One person found a boil water advisory from the same day but different year on the city website and tweeted that the water was not safe. This incorrect information spread rapidly. The city responded by dispelling the rumor but needed to repeat this many times. Some participants mentioned this concern that sometimes by counteracting a rumor, the number of people that hear about it increases – which might undesirably spread the rumor. Authorities need to target a select audience when counteracting a rumor. One participant wished that they could filter social media recipients based on different factors like geographical location or demographics so that they could target communities of interest. *"During a crisis who is your audience? ... We are less interested to counteract the rumour to a global audience. Need to know that and ensure the messaging and efforts are directed to those audience members and not spend energy dispelling rumours that are unrelated to the event and that audience."*

5 Current Tools

In this section we are going to discuss what are the practitioners expect from social media monitoring tools and what are the state of current tools to manage these expectations. Most of the participants expected two common features from a social media monitoring tool: simplicity and the ability to manage multiple social media sources. They were using commercial tools: geo-feedia[1], Radian 6[2], Hootsuite[3], and Sprout-Social[4]. Hootsuite and Sprout Social are broadcasting tools. They let users schedule updates to communicate with public. Radian 6 lets users listen and engage within multiple social media sources. In the listening part, users can track specific keywords. Finally, Geo-feedia's main advantage is to provide location-based filtering of geo-tagged posts and keyword based filtering. One of the participants commented that in

[1] https://geofeedia.com
[2] https://login.radian6.com
[3] https://hootsuite.com
[4] http://sproutsocial.com

an emergency situation they usually prefer Hootsuite because of its simplicity. However none of these tools help users automatically prioritize the social media posts based on their importance or the level of information. The chronological order makes it challenging for analysts to make sense of thousands of incoming posts within a short period of time in an emergency situation. End users currently lack advanced filtering tools to help identify and categorize relevant information. The tools should let analyst identify and track key influential users within their community. Future tools should be able to view the sequence of posts not just based on time but also based on the amount of information the posts are carrying. We noticed that none of the tools that are currently being used by these big emergency related organizations has been developed specifically for emergencies but they have been built for a broader market. This reveals that there is a need to design and develop practical tools specifically for emergency response and management.

Assessing the reliability of sources is another requirement that analysts need. Although participants knew some characteristics that can determine how much a source is reliable, they did not have enough time to check those characteristics in emergency chaos. Exploring how we can assign reliability scores to social media sources is a current research direction to address this issue. Researchers are exploring different features (e.g. user profile characteristics, content of a message) to be able to derive a reliability scores for social media users [20, 21].

6 Conclusion

This paper addresses the organizational requirements in response to emergency events. We conducted semi-structured interviews and gathered information about the usage and challenges of social media in emergencies. Based on our interviews we realized that social media information is considered both essential and high risk. It was essential as it helped people communicate easier, faster and opened a two-way communication road. It is considered high risk, as there were lots of speculations regarding what has happened. We discussed what strategies the practitioners are using to mitigate the current challenges and what can be the features of future tools to help them in identifying situational awareness information. Social media analysts require tools that help them automatically prioritize and categorize social media posts according to their informational needs. They also require tools to facilitate quickly assessing the reliability of sources. Finally they need to be able to target communities of interest to dispel the rumors.

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