



Workshop Report

Identification of Key Knowledge Gaps in
Social Media Use During Disasters

July 22–23, 2013

*Department of Homeland Security Science and Technology Directorate
and National Geospatial-Intelligence Agency*



**Homeland
Security**

Science and Technology

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Executive Summary

The Department of Homeland Security Science and Technology Directorate and the National Geospatial-Intelligence Agency hosted a two-day workshop in July 2013 to identify priority operational needs and research gaps in social media use during natural or man-made disasters.

Operational Challenges

- **Identifying Actionable Data from the Massive Volume of Available Data.** Disaster response agencies need tools that can quickly and effectively filter out the actionable data from the massive volume of social media data generated during a disaster.
- **Engaging with the Public.** Effective engagement with the public requires better understanding of the targeted population in terms of which social media platforms they use and what they use them for. Because agencies have a hard time getting people to respond to their message, it is important to develop effective messages that motivate people to act.
- **Information Sharing.** Multiple agencies, organizations, and jurisdictions are involved in disaster response. Effective response and recovery operations require tools that allow data to be aggregated and shared within an agency and among partners during an event.

Social Science Challenges

- **Using Social Media to Facilitate Disaster Response and Enable Post-Disaster Recovery.** The public uses a variety of social media platforms to report in real-time the events leading up to, during, and after a disaster from a variety of perspectives. How can response agencies effectively use these data sources to facilitate response and enable recovery? And how can response agencies effectively engage the public to help?
- **Message Targeting.** Most social media engagement with the public consists of pushing messages out, with very little indication or understanding about how the messages are received or acted upon by the public. What are the most effective messages to motivate people to act? How can message effectiveness be measured?
- **Understanding the Audience.** In order to develop effective messages, response agencies need to better understand their audience. This includes understanding the characteristics (e.g., demographics, culture) of the audience as well as what social media platforms various groups use and how they use them.

Visual and Data Analytics Challenges

- **Enhancing the Data Sharing Environment.** In order to develop effective information sharing tools, researchers and the operational community need to know what social media data are available, where data are kept, and what types of social media are being used.
- **Making Sense of Data.** There is a massive amount of social media data. Tools are needed to quickly and effectively process, filter, interpret, synthesize, and categorize the variety of available data and data sources.
- **Making Data Actionable.** Situational awareness is critical during disasters. Tools and techniques are needed that can filter out actionable data that meet the needs of specific users from the massive volume of incoming data.

Technical Challenges

- **Event Detection.** Being able to detect events through social media could support disaster preparation, response and recovery operations and management. One specific challenge is developing an automated event detection tool that incorporates multiple data sources.
- **Evaluating Messaging and Audience Reaction.** Agencies that push messages out to the public often do not know whether or not the messages were received, who received them, and if the messages were effective. Agencies sometimes need the ability to reach everyone in a targeted population.
- **Anonymizing Data.** Agencies that contend with privacy issues need tools that can anonymize data. In addition, how should this data be stored and managed?
- **Geotagging and Geotargeting.** Many social media messages and images are not geotagged. Specific challenges include developing techniques to extract geographic information from texts and images rather than relying on geotagged data and geotargeting messages to people in a specific geographic location.

Introduction

Social media are ever evolving phenomena that bring in new technologies, create new social communities, and continue to proliferate. Worldwide, 4.2 billion people use their mobile device to access social media,¹ and in the U.S. forty percent of cell phone owners currently access social media on their phones and 72 percent of adult internet users use social networking sites.²

Over the past several years, use of social media in the United States by government and disaster response agencies has increased exponentially. A 2012 survey of state, county, and local emergency management agencies assessed emergency managers' experiences and uses of social media and found that all state emergency management agencies, 68 percent of county emergency management agencies, and 85 percent of local response agencies use social media in some capacity,³ mainly to push information out to the community through agency websites, Facebook, and/or Twitter.⁴

Superstorm Sandy saw widespread use of social media by a variety of individuals, groups, and organizations, from the general public to private sector companies to disaster response agencies. Individuals and groups were requesting aid, relaying information and updates, and coordinating response efforts and the distribution of resources. During Sandy, social media use by response agencies was more strategic and tactical than during past disasters. For example, nonprofit organizations and volunteers aggregated information into central hubs online, informed communities about available resources, created ad hoc volunteer efforts to help local communities, developed maps to capture damage and track the resolution of issues, and provided temporary communications infrastructure. Social media facilitated information sharing among multiple public and private sector agencies and groups.

Despite a more comprehensive and sophisticated use of social media during Sandy by disaster response agencies, several operational challenges and research gaps remain.⁵ Additionally, there is still much research that is needed to better understand how the general public uses social media during disasters.⁶ As social media use continues to grow, methods, tools and policies need to be developed to help first responder and disaster response agencies more effectively harness social media during disasters.

The Department of Homeland Security (DHS) Science and Technology (S&T) Directorate and the National Geospatial-Intelligence Agency (NGA) hosted a two-day workshop from July 22 to 23, 2013, to look at current uses of social media by public and private sector disaster response agencies and research being conducted by academic institutions. Participants included officials from government agencies, researchers from the academic community, and users of social media from disaster response agencies.

1 See *digitalbuzz blog* at <http://www.digitalbuzzblog.com/infographic-social-media-stats-2013/>.

2 See *Pew Internet: Social Networking* at <http://pewinternet.org/Commentary/2012/March/Pew-Internet-Social-Networking-full-detail.aspx>.

3 Because response rates from county and local level agencies were low, these percentages may not represent trends across the United States.

4 Su Y.S., Wardell C., and Thorkildsen, Z. June 2013. *Social Media in the Emergency Management Field: 2012 Survey Results. A report funded by CNA Analysis & Solutions and the National Emergency Management Association.* Available online: http://www.cna.org/sites/default/files/research/SocialMedia_EmergencyManagement.pdf

5 *Department of Homeland Security Virtual Social Media Working Group and First Responders Group.* June 2013. *Lessons Learned: Social Media and Hurricane Sandy.* Available online at: https://communities.firstresponder.gov/DHS_VSMWG_Lessons_Learned_Social_Media_and_Hurricane_Sandy_Formatted_June_2013_FINAL.pdf

6 *National Consortium for the Study of Terrorism and Responses to Terrorism.* December 2012. *Social Media Use during Disasters: A Review of the Knowledge Base and Gaps. A report funded by DHS S&T.* Available online at: http://www.start.umd.edu/start/publications/START_SocialMediaUseduringDisasters_LitReview.pdf

The overall goals of this workshop were to: 1) provide situational awareness on the current social media efforts by disaster response organizations and academic institutions; 2) identify priority operational needs and research gaps; and 3) develop a set of research questions for future consideration by NGA and DHS research programs and their university partners. The workshop focused on four main topic areas: 1) operational challenges; 2) social science challenges; 3) visual and data analytics challenges; and 4) technical challenges. This report summarizes the main operational challenges and research gaps identified within these four areas.

The following agencies, organizations, and institutions were represented at this workshop:

<ul style="list-style-type: none"> ▪ American Red Cross ▪ Carnegie Mellon University ▪ Department of Health and Human Services ▪ Department of Homeland Security Science and Technology Directorate ▪ Fayetteville State University ▪ Federal Emergency Management Agency (FEMA) 	<ul style="list-style-type: none"> ▪ Humanity Road, Inc. ▪ Institute for Defense Analyses ▪ Johns Hopkins University ▪ National Geospatial-Intelligence Agency ▪ Progeny Systems Corporation ▪ G&H International Services, Inc. ▪ General Services Administration ▪ George Mason University 	<ul style="list-style-type: none"> ▪ Howard University ▪ Purdue University ▪ Rensselaer Polytechnic Institute ▪ Rutgers University ▪ Stevens Institute of Technology ▪ University of Kentucky ▪ University of Maryland ▪ University of Wyoming
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Overview

Current Uses of Social Media

Invited speakers discussed how their organizations are using social media.

American Red Cross

The American Red Cross started tracking social media about seven years ago, and started with conversations about the Red Cross, which included to a large extent, opinion and sentiment. About 1.5 years ago, the American Red Cross built out the DigiDOC to expand the organization's tracking to include general mentions about disasters. The American Red Cross relies heavily on workers to analyze the data and identify trends and actionable information using a variety of social media tools. This has contributed to the organization's increased situational awareness during disasters.

Some of the American Red Cross's operational challenges include training its 70,000 volunteers, many of whom are retired and have little to no experience using social media; effectively using crowdsourcing; identifying actionable information to help people who are in urgent need of aid; getting people to engage with the American Red Cross through social media (i.e., most organizations send out tweets during disaster events, but the challenge is getting people to respond to those tweets, especially if they are in need of help); and coordinating and collaborating with local organizations and groups that use social media to help within their communities during a disaster.

Humanity Road

Humanity Road started in 2010 and has monitored 300 to 400 events to date. Humanity Road trains organizations on emerging technology and tools to help them accelerate communications with the affected public during disasters. During disasters, its volunteers provide public safety information and direct the public to government agencies and aid agencies that are providing disaster assistance.

National Geospatial-Intelligence Agency

Social media encompass many types of interactions during disasters, including data collection and technical support, collaborative efforts, or engaging and working with the public. NGA is developing an enterprise-wide social media effort to enable better collaboration across its departments and units.

NGA's Readiness, Response and Recovery Group conducts damage assessments after a disaster using open source images. Using social media data during time-sensitive disasters is valuable because event tracking and updates by social media users are so fast. Recently, NGA used open source images and video to conduct immediate post-event damage assessment of the Moore, Oklahoma tornado for FEMA that was 85 to 95 percent accurate 18 hours after the tornado (official photos take a long time to become available).

Department of Homeland Security

DHS S&T established the Virtual Social Media Working Group (VSMWG) to provide guidance and best practices to the emergency preparedness and response community on the safe and sustainable use of social media technologies before, during, and after emergencies. Social media are used in a variety of ways in public safety, including engaging with the public, providing situational awareness, evaluating public information and messaging, disseminating alerts and warnings, soliciting donations, and sharing information. By leveraging its membership, the VSMWG has produced several publications related to public safety and social media (see Resources).

FEMA is actively engaged in social media. During Superstorm Sandy, FEMA consolidated U.S. government Web content related to Sandy onto a single website (see <http://www.usa.gov/Topics/Weather/Hurricane/sandy.shtml>) and all relief and recovery resources onto the FEMA website (see <http://www.fema.gov/hurricane-sandy>). FEMA was also involved in rumor control during Sandy, posting and disclaiming rumors on its website.

Department of Health and Human Services

The Department of Health and Human Services led a discussion about leveraging the Emergency Support Functions (ESFs) as a potential framework for developing and implementing multiagency social media efforts. The ESFs provide the structure to coordinate Federal interagency support for a Federal response to declared disasters and emergencies.⁷ Though each of the 15 ESFs⁸ is owned and managed by a specific federal agency, they are all supported by multiple agencies and government levels and have relationships with emergency operations centers. ESFs could serve as a bridge for social media efforts and information sharing among all agencies and organizations during a disaster.

Current Social Media Research Efforts

Current social media research efforts being conducted by invited university researchers are briefly summarized below.

Howard University

Terri Adams, Howard University

Presentation: “An Examination of the Challenges Faced by First Responders During the 2010 Chile Earthquake/Tsunami and the 2011 Tohoku Earthquake/Tsunami Disasters”

Dr. Adams presented findings about the challenges faced by first responders during the 2010 earthquake in Chile and 2011 tsunami in Japan. First responders play a pivotal part in the preservation of resilience in the midst of disasters as they address the immediate dangers to citizens. Unfortunately, citizens do not always respond to the requests of first responders, which often complicates their ability to effectively protect the public. Common challenges first responders faced, during the 2010 and 2011 earthquakes and tsunamis in Chile and Japan, respectively, included power outages that affected communications and water supply, blocked roadways, looting, limited living necessities, and mental strain. Some first responders used social media to establish social connections that allowed them to share their stories, which helped foster a sense of resilience.

George Mason University

Arie Croitoru, George Mason University

Presentation: “Social Media Use in Emergencies”

Dr. Croitoru is investigating social media use during emergencies. Social media content spans a broad thematic spectrum, from personal observations and commentaries to the reporting of breaking news. Accordingly, social media functions as a hybrid form of a sensor network, with humans acting as sensors to transmit information from the scene of events of interest. This is of particular importance during disasters, where social media content can be analyzed to gain advanced situational awareness and improve our understanding and response to such events, or to disseminate up-to-date information to the general public. Croitoru’s research team developed the GeoSocial Gauge system prototype (<http://geosocial.gmu.edu>), a “geosocial approach” to analyzing social media content that combines “geospatial, social network, and content analysis” to

⁷ For more information about the ESFs, see <http://www.fema.gov/pdf/emergency/nrf/nrf-esf-intro.pdf>.

⁸ ESF 14 has been superseded by the National Disaster Recovery Framework.

understand the human landscape and gain situational awareness. A geosocial approach links three categories of data: maps, people, and news/events. Croitoru identified three social media challenges: detecting events, verifying the quality of data/information, and linking cyber communities to physical space.

University of Maryland

Brooke Fisher Liu, *University of Maryland and the DHS S&T National Consortium for the Study of Terrorism and Responses to Terrorism*

Presentation: “Social Media Use During Disasters”

Dr. Liu is investigating social media use during disasters, specifically looking at how and why individuals use (and do not use) information from social media during disasters. Some key findings from a pilot field experiment with 871 university students include: 1) Students deemed disaster information received through specific government social media sources as significantly more credible than the same information disseminated by (a) the government via traditional media and (b) by the news media via traditional or social media; 2) Students were more likely to view disaster information as credible when it was from the federal government (e.g., FEMA) than from the local government (e.g., San Francisco Department of Emergency Management) but deemed information provided by government and news media sources (e.g., San Francisco Chronicle or USA Today) as equally credible; and 3) Females were significantly more likely to report intent to seek further disaster information using traditional media and engaging in offline social interactions about a disaster than were males. Liu’s research team is currently testing these findings, and others, in a nationally-representative field experiment.

Johns Hopkins University

Jon Parker, *Johns Hopkins University, Georgetown University, and the DHS S&T National Center for the Study of Preparedness and Catastrophic Event Response*

Presentation: “A Framework for Detecting Public Health Trends with Twitter”

Mr. Parker developed a framework to detect public health trends with Twitter. The main goal of this project was to develop a method to mine Twitter for health information without previously specifying the type of health information being sought (i.e., identifying health trends without limiting the types of trends discovered). The method involved extracting trending or frequent term sets from highly purified health-related tweets and using them as queries in a Wikipedia article index. When medically-related Wikipedia articles were retrieved due to multiple independent queries, those articles could plausibly be considered a trending health-related topic. In summary, Parker was able to detect shifts in public health conditions and concerns over time without specifying a topic of interest prior to the analysis. Compared to existing approaches, this framework provides a general a priori identification of emerging public health conditions rather than searching for a specific illness (e.g., influenza). Using this methodology, Parker was able to detect flu season, allergy season, and even summertime ice cream headaches.

Rensselaer Polytechnic Institute

William Wallace, *Rensselaer Polytechnic Institute and the DHS S&T Coastal Hazards Center of Excellence*

Presentation: “Social Media in High-risk Environments”

Dr. Wallace is investigating social media in high-risk environments. He developed a methodology using natural language processing and social network analysis to discover communication patterns, key players, and messages that are being propagated through Twitter during an event. The methodology automatically finds communities, evaluates its members’ behaviors, authenticates cohesive behaviors of the community members during emergencies, and efficiently finds the leaders of the communities and identifies their roles within communities.

Stevens Institute of Technology

Elizabeth Lennon, *Stevens Institute of Technology and the DHS S&T Center for Maritime, Island and Remote and Extreme Environment Security*

Presentation: “Social Media During Disaster Response: Forwarding Behaviors, Self-Organization of Crowds, and Relevant Information Retrieval”

Dr. Lennon and the research team at Stevens Institute of Technology are investigating social media use during disaster response. They have ongoing research efforts in three main areas: the psychology of message forwarding, self-organization of crowds, and relevant information retrieval. The research in the first area focuses on the spread of rumors through social media during disasters; the research team aims to understand people’s information sharing behaviors in order to develop techniques to minimize the spread of false information during disasters. Findings indicate that criticism or exposure of rumors curtails the spread of rumors. It is important to expose false facts so incorrect information (i.e., rumors) does not spread in crises; instead, correct information should continue to be shared among social media users. Some research findings from all three efforts include: 1) A crowdsourcing critical thinking and credibility evaluation can be effective in minimizing the spread of misinformation; 2) Wikipedia can be used as a collaborative knowledge base to yield the context of information in messages; and 3) Message content can be mapped to Wikipedia to build ontologies in multiple languages. The second two findings are being further studied to automate the understanding and filtering of textual content in social media, especially when the textual content exists in multiple languages.

Rutgers University

Paul Kantor, *Rutgers University and the DHS S&T Center for Visualization and Data Analytics*

Presentation: “Social Media Research at CCICADA”⁹

Dr. Kantor and the research team at Rutgers University have worked on several social media projects, including event detection and analysis in Twitter, understanding and analyzing opinions, and tracking human dissemination behavior during disruptive events. Several key findings resulted from this research: 1) As predicted by general social science models that describe reactions to a disruptive event, people respond namely by using communication channels to seek confirmation of the event; 2) During a university campus Twitter experiment, groups effectively organized in a variety of ways to accomplish specific tasks; and 3) In an analysis of survivor Twitter messages in the wake of the Haiti earthquake in 2010, it was determined that tens of thousands of lives could have been saved if resource distribution points were co-located in areas where geo-tagged messages clustered.

The research team has identified several challenges. First, there is no mechanism for capturing all communications during naturally occurring events. Second, because of the requirements for protection of human subjects and the general concern for public safety, researchers cannot create actual threats. Thus, individuals participating in an experiment lack the emotional aspects that accompany real threats. Third, none of the experiments conducted provides an objective assessment of the effectiveness of messages pushed out to specific populations. The research team’s next steps are to develop more sophisticated experimental designs and assess the effectiveness of alternative message systems.

⁹ CCICADA (Command, Control, and Interoperability Center for Advanced Data Analysis) is a co-lead of the DHS S&T Center for Visualization and Data Analytics.



Carnegie Mellon University

Eduard Hovy, *Carnegie Mellon University and the DHS S&T Center for Visualization and Data Analytics*

Presentation: "Two Important Classes of Problems in Social Media for Homeland Security"

Dr. Hovy is investigating the potential use of social media in disaster monitoring and response planning, anomaly detection and recognizing problems before they occur, and tracking down perpetrators. These uses involve two classes of problems. First, the issues surrounding data for real-time situational monitoring include filtering unwanted messages to focus on the event of interest, identifying sender location, and verifying the accuracy/truth of messages. Second, issues surrounding data for ongoing group or individual monitoring include filtering and classifying messages according to their content and identifying the social roles of people in group discussions to see who are the leaders, motivators, and information providers.

Challenges and Research Gaps

Social media use has grown rapidly over the past decade. In order to get a handle on this constantly changing and fast-paced phenomenon, researchers would benefit from a collaboration tool that collects information about current research, projects, tools, and technologies in one place. Also needed are best practices and lessons learned related to social media use during disasters. Addressing operational needs and research gaps of social media use during disasters will require multidisciplinary collaboration and engagement with the operations community. Researchers need access to the operational community to test the methods and tools they develop in the field (e.g., working with National Voluntary Organizations Active in Disaster to test apps).

Operational Challenges

The top priority operational challenges are:

1. **Identifying Actionable Data from the Massive Volume of Available Data**

With the huge amount of data generated through social media before, during, and after a disaster, response agencies need fast and effective tools that filter out noise and identify actionable data. For example, how can we identify people who are in urgent need of help or where critical resources are needed? How can this data be organized into a format that is useful to decision makers?

2. **Engaging with the Public**

During disasters, many organizations send out messages to the public through a variety of media including Twitter, Facebook, or their own Web pages. A significant challenge is how to get people to respond to these messages, especially if they are in need of help. Part of this requires a better understanding of the audience. How do we know if messages are effective? Recognizing that most people will not respond to messages, how do we know if the message was received and acted upon? For example, if people are required to evacuate, did they? Is there a way to send geospecific messages to targeted groups? Is there a way to reach audiences from different social media platforms?

In some instances, specific features of social media can be barriers. For example, there is a limit to the number of tweets an individual can send out per hour or per day; once this limit is reached, the individual is placed in Twitter “jail.” In Facebook, the EdgeRank algorithm only pushes information out to 40 percent of Facebook followers.

On the flip side, not everyone is familiar with or uses social media tools, nor does everyone have access to these tools. Additionally, during many disasters communications infrastructure may be damaged. How does an agency reach people when communications networks are down? How does an agency reach people who may not have access to or know how to use smartphones or the Internet?

3. **Information Sharing**

Disaster response involves multiple agencies, organizations, and jurisdictions. Which agency or organization is monitoring what social media data, and how can the data be gathered into a common operating picture that can be shared within an agency and among partners during an event? It is especially important to develop methods to coordinate and collaborate with local organizations and groups that use social media to help their communities during a disaster. Other aspects of this challenge are identifying and understanding what information partners need and ensuring the right information gets to the right people.

Other operational challenges identified:

- **Discoverability of Data:** What data are available and how do we find out about them? How do we find and access data from sources other than Twitter or Facebook)?
- **Policy Issues:** Popular social media sites such as Twitter and Facebook have technical barriers that may reduce or hinder the ability of an organization to engage with its followers (e.g., Twitter jail, limits on how many followers can receive messages). Engaging in a dialogue with these popular sites to develop solutions or new capabilities would be beneficial. For example, the federal government could work with Twitter and/or Facebook to build new capacities for government accounts that specifically allow agencies and organizations to bypass normal rules during emergencies and disaster events. Other policy-related issues include the need for leadership buy-in if an agency wants to effectively use social media tools and analysis and for agencies to develop a social media strategy or policy to identify how social media will be organized, managed, and executed.
- **Training Volunteers and Responders to Use Social Media:** Many nongovernmental organizations rely heavily on volunteers to help during disasters. For example, the American Red Cross has about 70,000 volunteers, many of whom are retired and have little experience using social media. Emergency management agencies also have limited experience with social media use. In a 2012 survey of emergency management agencies, 100 percent of state agencies, 68 percent of county agencies, and 85 percent of local response agencies use social media in some capacity.¹⁰ Social media use among these agencies consists mainly of pushing messages out to the public, mainly through Facebook, Twitter, and YouTube. However, these agencies are largely unfamiliar with crowdsourcing, other types of social media tools such as Nixle, and social media capabilities provided by other organizations such as Ushahidi.¹¹
- **Processes and Standards:** Developing standards and processes in social media is needed. How should key actors collaborate during emerging disasters when assessing communications infrastructure, collecting information, filtering and anonymizing data, and sharing information? Who or what type of entities may view non-anonymized data or monitor social media data? What are the legal issues or obstacles surrounding data ownership, records retention, privacy, and security? What standards are needed to maintain data integrity to preserve and heighten confidence in the chain of social media situational information collected? How should social media be incorporated into existing operations, procedures, and information flows? At what point does social media fall within the responsibilities of the incident command center?
- **Data Integration:** There is a lack of knowledge about what is being done in the social media space across agencies, and many agencies are doing the same things. How can social media data be integrated and consolidated across platforms to better manage the data and avoid duplication of efforts? For example, during Superstorm Sandy about 45 groups and organizations made just as many maps, which were posted in different places.

¹⁰ Because response rates from county and local level agencies were low, these percentages may not represent trends across the United States.

¹¹ Su Y.S., Wardell C., and Thorkildsen Z. June 2013. Social Media in the Emergency Management Field: 2012 Survey Results, p. 2. A report funded by CNA Analysis & Solutions and the National Emergency Management Association. Available online: http://www.cna.org/sites/default/files/research/SocialMedia_EmergencyManagement.pdf

Social Science Challenges

The top priority social science challenges identified are:

1. **Using Social Media to Facilitate Disaster Response and Enable Post-Disaster Recovery**

The use of social media by the general public during disasters is increasing exponentially. People share photos; document events; tweet their status; reach out to friends and family; and relay information leading up to, during, and after a disaster. First responders, disaster relief organizations, and other response agencies and groups are also increasingly using social media to monitor disasters, reach out to the public, and identify individuals in need. How can social media help first responders and disaster response agencies in real time? What types of social media platforms should responders use for which types of disaster? What types of social media platforms do individuals and groups currently use for which types of disasters? Is crowdsourcing effective? Can virtual communities be set up in advance of disasters and mobilized if disasters occur? Can people be motivated to register ahead of time, for example, in areas such as the Arctic where specialized expertise would be needed?

How can the public be trained to use social media in emergency situations so that responders can more quickly and easily identify individuals in need and better prioritize assistance and recovery? How can first responders leverage local groups that have a social media presence (e.g., churches, Parent-Teacher Associations, volunteer organizations) to help in emergencies? In addition, how can responders leverage local communities to access vulnerable populations or groups that speak a different language? How can local communities reach groups or individuals who do not use or have access to social media?

Finally, how can social media help communities recover from disasters? For example, can social media be used to prioritize recovery efforts, allocate resources, foster community collaboration, or provide emotional support? How can social media be used to motivate communities to self-mobilize? For example, do time banks or other online cooperatives prove effective in emergency situations? Alternatively, in past emergencies, which already-created communities proved most effective in mobilizing effective disaster recovery efforts?

2. **Message Targeting**

Many first responder and disaster relief agencies use social media to engage with the public. Yet, challenges remain when it comes to effectively reaching out to the public and targeting specific groups. How can the government effectively engage with people through social media and not just push messages out? What messages are effective, when should they be pushed out, and how often? What messages motivate people to act? What is effective visual messaging, and when should visual versus text messages be used? How can response agencies measure message effectiveness?

3. **Understanding the Audience**

Effective message targeting requires understanding the audience. How does social media use differ among various demographic groups? What groups use which social media platforms? Who are the influential leaders in social media, and how can these individuals be identified before a disaster? Also, how can the trustworthiness of the data source and message content be verified? How can rumors be managed?

Data and Visual Analytics Challenges

The top priority data and visual analytics challenges identified in the workshop are:

1. **Enhanced Data Sharing Environment**

Social media use and the amount of social media data generated have grown rapidly over the past decade. In order to develop information sharing tools for decision makers, researchers need to know what data are available, where the data are kept, and what social media resources are being used. Understanding what data are available will enable researchers to develop data taxonomies and key word lists.

2. **Making Sense of Data**

Because massive amounts of data are generated from multiple social media sources and platforms, tools are needed to quickly and effectively process data. These tools will need to be able to incorporate a variety of data sources, filter data, synthesize language idioms into keyword searches, interpret message content, and categorize data (videos, images, and text). Many researchers and analysts look at data from Twitter. Because most Tweets are not geotagged, how can these tweets be validated or contextualized? Can a flexible learning system be developed that accesses and updates diverse datasets and changes in social media over time?

3. **Making Data Actionable**

Situational awareness is the most important use of social media during disasters. Most social media data sources are unclassified and provide open source information. Therefore, tools and techniques are needed that can process data for specific content, detect events, filter out actionable data from the massive volume of incoming data, and verify and validate data and data sources. Additionally, tools are needed that can categorize a variety of data and images into easy-to-use visual displays.

Technical Challenges

The top priority technical challenges identified are:

1. **Event Detection**

Being able to detect events through social media and monitor them as they evolve through time has the potential to significantly improve disaster response and management. Can event detection and monitoring be automated, and can it incorporate data from multiple sources? Can social media monitoring be automated? Can disasters be detected from surges of images or tweets on Twitter? Can images and text be merged to provide better accuracy?

2. **Message Evaluation and Audience Reaction**

The most common use of social media for disaster response agencies is to push information out. However, agencies have been uncertain whether or not their messages are being received and who receives them. With some social media platforms, such as Facebook, messages are pushed out to only a percentage of followers. How can an agency reach everyone in a targeted population? Often, agencies have no idea if their messages were effective and whether or not people acted on the messages.

3. **Anonymizing Data**

Recognizing that social media data can improve disaster response and recovery operations, how can data be anonymized so it can be used in analytical tools? This is especially important to agencies that contend with privacy issues. How should data be stored and managed? How can data be validated and data sources assessed for trustworthiness? Can crowdsourcing be used to validate data?

4. Geotagging and Geotargeting

A common operational challenge relates to geotagging and geotargeting. Many tweets are not geotagged and some messages lose their geotags during disasters. Rather than rely on geotagged messages, can geographic information be extracted from texts and images that are not geotagged? How can geographic information be added to crowdsourced images? How can geographic features and latent geographic features be extracted from images to create foundational Geospatial Intelligence? How can all tweets and images from a specific geographic area be harnessed for analysis? How can messages be geotargeted to reach people in a specific geographic location?

Conclusion

The NGA/DHS social media workshop brought together academic researchers and representatives from government agencies, first responder organizations and nongovernmental organizations. The discussion of challenges and research gaps reflects the collective judgment of the participants about the topics that are important and worthy of more attention within the context of two overarching goals: 1) help first responders and disaster response organizations evolve in their ability to understand and incorporate changing methods of communication in social media, and 2) allow analysts to gain a greater understanding of the inherent challenges that stem the ever-increasing data flows of social media.

The use of social media data and platforms by first responder and disaster response agencies can positively impact the preparation for, response to and recovery from disasters. Though many first responder and disaster response agencies use social media and some are actively engaged in and benefit from it, the use of social media by most agencies is newly evolving. And, as identified at this workshop, many operational and research challenges remain.

Moving forward, NGA and DHS will continue to work with their academic partners to advance research in these areas as well as continue to identify how emerging social media trends might impact disaster response.

Resources

The following resources were referenced or recommended by workshop participants:

- Aggregating – <http://tweettracker.fulton.asu.edu/>
- Anonymizing – <http://roguegenius.com>
- Data Integrity Standards – <http://www.humanityroad.org/hr-talk/swba>
- DHS First Responder Communities of Practice – www.communities.firstresponder.gov
- Disaster Innovation Newsletter – disasternet.co/newsletter
- Field Communications, Information Technology Disaster Resource Center – <http://www.itdrc.org>
- Geo-locate – <http://corp.geofeedia.com>
- idisaster 2.0: Social Media and Emergency Management – <http://idisaster.wordpress.com/category/social-media-and-emergency-management/>
- Lessons Learned DHS VSMWG – <http://firstresponder.gov/FRBlog/Post.aspx?ID=187>
- Natural Hazards Observer – <http://www.colorado.edu/hazards/o/>
- Road to the Network Age – <http://www.humanityroad.org/hr-talk/the-road-to-the-network-age-hina>
- Sandy Maps – <http://www.slideshare.net/CatGraham/sandy-maps-24337805>
- Training – <http://www.cna.org/research/2013/social-media-emergency-management-field>
- Testimony – <http://humanityroad.org/hr-talk/humanity-road-testimony-smem-subcommittee-hearing>
- Ushahidi – <http://ushahidi.com>