Utilizing Social Media Data for Enhancing Decision Making during Emergencies

Ioannis Kotsiopoulos

European Dynamics S.A., Marousi, Greece
ioannis.kotsiopoulos@eurodyn.com

Lemi Baruh

College of Social Sciences & Humanities, Koç University, Turkey
lbaruh@ku.edu.tr

Alex Papadimitriou

Hellenic Rescue Team, Thessaloniki, Greece
apapadimitriou@dotsoft.gr

Abstract. Extant literature suggests that while members of the public may prove valuable as "intelligent sensors" that can provide information to response organizations from locations, public in return often lacks information regarding the larger context of response to a specific incident. This presentation examines the use of social media as a decision support tool that can serve strategic purposes such as enhancement of situational awareness and communication between first responders and the public. The paper will first start by discussing recent operating procedures of organizations like FEMA, Hellenic Rescue Team, AKUT in utilizing social media for information gathering and help determining rescue missions. While in sudden onset incidents being able to determine areas that are in need of help via social media is becoming a common practice, the paper will also discuss recent examples which suggests that social media can also be utilized for predicting the onset of crises (including political crises and diseases). Despite this potential, however, an important problem concerning the use of social media as a source of information for decision-making pertains to the unreliability of information. The presentation will draw on techniques and technologies utilized, particularly in news institutions that utilize citizen reporting, for information verification and filtering.

Keywords. Social media, decision support, crises, situational awareness, response, preparedness, standard operating procedures, adverse use, technology support

1   Introduction

An essential component of any decision-making process is knowledge of the environment within which the relevant action (operation) takes place. The collective term used to describe this knowledge is "situational awareness"; more formally defined, following Endsley and Garland,[1] as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future". All these are essential elements in crisis management and emergency response; therefore, situational awareness is an indispensable support to such decision-making processes.

In this paper we examine the role of communication between citizens and responders and among citizens themselves in building situation awareness during a crisis. Increasingly, within the last decade, this communication has been realized mostly via social media over the Internet. Hence, our goal in this paper is to discuss the role that social media play in supplementing situational awareness and, in turn, in supporting the decision-making process.

The results reported here stem out of work done under the COSMIC (The Contribution of Social Media in Crisis Management)[2] Support Action, jointly funded by the European Commission under FP7 and executed by a consortium of seven partners from 5 countries.

2   Social media in the response phase

As reported by COSMIC[3], there is a symbiotic relationship between responders and the public in the effective management of crises: members of the public need to be informed by responders and they, in turn, somehow rely on members of the public for, where possible, additional information. It is the latter that supports decision-making. Two examples reported there are indicative:

- The US Federal Bureau of Investigation (FBI) used their Twitter account to request photographs and video footage sent to them by those at the scene of the attacks in the 2013 Boston marathon.
- Similar information was requested after Hurricane Sandy in the US in 2012, to help build situational awareness.

COSMIC partners argue[4] that an important function in building situational awareness during the response phase is to ensure the reliability of information collected via social media. Ways to achieve this are discussed in a subsequent section. This activity can have wider benefits in building situational awareness among the public. For example, the Queensland Police used social media to quell rumours (rumour control) following the floods caused by Tropical Cyclone Tasha in December 2010. They found this to be an effective way of "mythbusing".[5]

3 Social media in the preparedness phase

Although there is widely spread acceptance on the role social media play in crises, this is not always translated to formal acceptance by response organizations. A good way to examine this is to look at the provisions for such use reserved in the Standard Operating Procedures (SOPs) of such organizations. "SOPs detail the regularly recurring work processes that are to be conducted or followed within an organization".[6] In emergency responders, detailed, tested and realistic SOPs also correspond to the level of preparedness built within the organization.

At European level, for example, there are "no general EU-wide guidelines and preparedness plans publicly disseminated and available to guide stakeholders and actors involved in the crisis chain of events"[7]. This is accompanied by a lack of systematic measures aimed at preparedness for naturally occurring crises[8]. It is therefore not surprising that at EU policy or guidelines level there are no references to the use of social media as a tool in aid of decision-making.

In contrast, the Federal Emergency Management Agency (FEMA) in the US, in Annex R of its SOPs[9] refers explicitly to digital and social media and to web-based and other interactive communication with the public. Also, Article 5.0 refers explicitly to "Social Media Monitoring and Reporting for Situational Awareness". There is explicit reference[9] to "use publicly available social media sites for situational awareness" and to "search on appropriate keywords, hash-tags, and other search terms on digital channels to find information for situational awareness."

A notable example of application (taking us to the response phase) was Hurricane Sandy in 2012 where more than 15 staff from multiple FEMA offices at the peak of the storm supported the social media operation. Situational awareness was also aided by shared "social media discussions on power outages, volunteering and donations, and sentiment about the response efforts." It is interesting to note that an important feature of the operation was "rumour control" in an effort to avoid misinformation.

4 Adverse use of social media

As outlined by several reports developed by COSMIC, while social media may present an important opportunity for increasing situational awareness, it is also prone to intentional as well as unintentional spread of misinformation. For example, in the aftermath of the Boston Bombings in 2013, there was extensive use of social media outlets citizens to gather pictorial evidence that Boston Police requested from the scene of the attacks.[10] In one particular instance, users of the social network site Reddit wrongfully identified Sunil Tripathi, who was eventually discovered as a suicide victim, as well as two young men as culprits of the attack. This misidentification was not limited to the social media sphere; it was quickly picked up by mass media outlets, like the *New York Post,* to further disseminate the false information.

As this example, and many others like these suggest, the ease with which (mis)information spreads on social media and is quickly used by mainstream media may often create what can be characterized as rumour mills that further incite panic,

harm individuals and even strain financial markets. For example, again in the aftermath of the Boston Bombing attacks, a single, fake, tweet posted on the Associated Press official Twitter account,[11] announcing that there were explosions at the White House and that President Obama was injured led to a 140 points drop in the Dow Jones Index. As such, standardization and widespread adoption of information verification tools for response personnel, journalists and members of the public is a prerequisite for maintaining the viability of social media as a source of information. The next section discusses in further detail some of the tools that can be used in this respect.

5   Technology support

As observed in COSMIC[12], "social media data is intrinsically inter-referenced: the handling of relationships is the main differentiator between social networking services and the older Web; often, the entities whose relationships are defined in social media data are real-world entities, such as people." Other features of this data is its vast size, fast update and semantic richness, albeit at representations which are usually semi-structured mirroring human relationships (via "likes", tags etc.).

There are no commonly accepted (standardized) ways to represent such data, although attempts have been made. Linked Data[13] is a suitable (structural) representation mechanism with the drawback however that it is agnostic to the specific semantics of social media data. It needs to be supplemented with semantic models. In fact, as COSMIC partners note[12] an, as yet unavailable, complete semantic model of all social media data would be a very powerful tool as it will be a substantial aid in extracting reliable and valid information in emergency cases. Existing solutions include mainly ontologies:

- FOAF Ontology[14] - describes people and social relationships on the Web. Particularly well suited for describing people on web-based social platforms (Facebook, Twitter, Blogspot, etc)
- SIOC Ontology[15] - describes online communities such as forums, blogs, mailing lists, wikis; complements FOAF by focusing on the description of the products of those communities: posts, replies, threads, etc
- OpenSocial Data Specification[16] - supports exploring the social graph and application development for social media applications; the most mature standards-based component model for cloud based social apps
- The SocIoS Object Model and the SocIoS Ontology[17] - core of the European project SocIoS on the semantic equivalence among social media networks; supports consistent operations (the SocIoS Core Services) to be performed on social media data, regardless of the Social Networking Site from which the data is drawn (cross-platform applications)

6   References

1. [1] Endsley, M. R, "Theoretical Underpinnings of Situation Awareness: A Critical Review", in Endsley, M.R., and Garland, D.J. "Situation Awareness Analysis and Measurement", 2000, pp. 3–32. [p. 5]
2. [2] COSMIC project, http://www.cosmic-project.eu, 2013-2015
3. [3] COSMIC project, Deliverable D3.3.1, "First report on the strategic use of emerging communication technologies for crisis stakeholders", January 2014
4. [4] COSMIC project, Deliverable D2.3, "Report on the adverse use and reliability of new media", November 2013
5. [5] Queensland Police, "Social Media Case Study", Queensland Police Website, 2013. http://www.police.qld.gov.au/services/reportsPublications/other/socialmedia.htm
6. [6] United States Environmental Protection Agency, "Guidance for Preparing Standard Operating Procedures, EPA QA/G-6", April 2007, http://www.epa.gov/quality/qs-docs/g6-final.pdf
7. [7] COSMIC project, Deliverable D3.3.1, "First report on the strategic use of emerging communication technologies for crisis stakeholders", January 2014
8. [8] Disaster management in the EU – Present and future: Challenges for research, Foresight Security Scenarios – Mapping Research to a Comprehensive Approach to Exogenous EU Roles (FOCUS), July 2012, http://www.focusproject.eu/documents/14976/5d763378-1198-4dc9-86ff-c46959712f8a
9. [9] "Emergency Support Function 15 (External Affairs): Homeland Security, Standard Operating Procedures", FEMA, August 2013, http://www.fema.gov/media-library-data/965d87d8c5ffc4bcccb01979913e01fc/ESF15_SOP_08-30-2013-02.pdf
10. [10] Papadimitriou, Alex, et al., 2013.
11. [11] https://twitter.com/AP
12. [12] COSMIC project, Deliverable D3.2.1, "Political, social and industrial opportunities arising from the use of emerging technologies", October 2013
13. [13] Bizer, C., 2009. The Emerging Web of Linked Data. *Intelligent Systems*, 24(5), pp.87–92.
14. [14] http://www.foaf-project.org
15. [15] http://sioc-project.org
16. [16] http://opensocial.github.io/spec/2.5.1/Core-Data.xml and http://opensocial.github.io/spec/2.5.1/Social-Data.xml
17. [17] http://www.sociosproject.eu/Dissemination/Deliverables/tabid/119/language/en-GB/Default.aspx