Letter-to-Editor

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Volunteered geographic information (VGI) in disaster management

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Disasters are devastating natural events that take thousands of lives every year. The calamities associated are mostly interpreted in terms of loss of infrastructure by any means, ultimately, leaving behind low access to people in need. “Disasters management comprises four phases, viz a viz, preparedness, response, recovery, and mitigation” (Reichenbacher et al, 2016). Among these phases, recovery and response can be made possible by a collaborative activity of massive information production and exchange on social media /internet, known as a crowdsourcing (CS) during a panic situation. Utilization of volunteered geographic information (VGI) may help in preparedness as a relief; that one has been achieved by employing as a map overlay of Open Street Map (OSM), which started at University College London (UCL) 2004. However, as OSM does not have any content restrictions on the tags to be assigned, anybody can participate who has access without any prior skills (OSM, 2009). It is also that most of the smartphones have better accuracy global positioning system (GPS), hence every information is being geo-tagged. The situation has been intensively observed in U.A.E where 75% of the peoples are connected to the internet through their smartphones (Yagoub, 2015). Therefore, CS is intensively utilized able in an emergency.

The natural disasters attract volunteers and associates around the world to prepare necessary dataset (Grchenig, Brunauer, and Rehrl, 2014). An example is the working body of volunteer mappers of the Humanitarian Open Street Map Team (HOT) that secures workers by giving free and updated maps immediately after the happening, e.g., the Haiti Earthquake 2010. Nevertheless, numerous concerns arise with the quality of VGI due to the free access of internet associated data along with the role of social media that results into production of gray literature (Foody et al, 2014; Flanagin and Metzger, 2008). Notwithstanding, the disaster preparedness requires precise and accurate information which can be achieved by using several techniques such as VGI and CS e.g. Ushahidi (OSM, SMS, Twitter, Flicker) (Goodchild and Li, 2012; Surowiecki, 2005). Hereby, limited objectives are being focused where VGI is standing in the emergency and how come insufficiencies can be overcome by different means. There is huge potential for VGI to help mapping regions. VGI, for example, can be employed to map gigantic areas with proficiency and economically, if not uninhibitedly (Grchenig, Brunauer, and Rehrl, 2014).

Moreover, application of VGI in an emergency is growing to overcome available commercial and costly options, were being prepared by a group of authorities; which is due to faster up gradation and easily map-able capabilities. The successful examples are usage of Ushahidi geospatial database in Brisbane flooding of 2012 and of U.A.E floods in 2014. Nevertheless, quality control of the volunteered and/or CS data has been a subject of impressive research in the general domain of citizen science (Foody et al, 2014). Grchenig, et al., (2014) describe it in such a way that availability of data for a disaster through VGI/CS takes place in the following stages: No Data, Start, Evolution, and Inundation (Hesse 2010; Ma et al, 2014). Among them, inundation has been given a significant importance for disaster mitigation and therefore concerned organizations are struggling with the accuracy of available saturated data. However, handling of such a data is always a problematic task for decision makers.

The missing features of self-correction and tag assigning system in OSM data makes it less significant, incomplete and patchy particularly in an emergency (Haklay et al, 2010). Although everyone can play the roles of either fabricator, distributor, or consumer (Ma et al, 2014); however, selection of reliable volunteer sources is of prime importance. Possible solutions could be, the involvement of skilled volunteers in a people-centred approach, which can help correcting the data either before or during an ongoing emergency (Roche, Propeck-Zimmermann and Mericskay, 2013; Harvard Humanitarian Initiative, 2010). However, it is always important to consider their regional heterogeneity and cultural differences along with the technological constraints (Goodchild and Glennon, 2010; Neis and Zielstra, 2014). For instance, during Haiti earthquake, Haitian expats volunteered in Boston to prepare spatial content and geo-referenced after translating life and death messages; which nevertheless remained unsuccessful to achieve the accuracy level of more than 50% (Camponovo and Freundschuh, 2014). See et al, (2016) confirmed that the failure was due to the lack of early training and no categorization of volunteers. It is also verified that, based on the contributed data by volunteers, their involvement in stages to check the data quality and regularly updating can bring better accuracy of up to 98.26% (Foody et al, 2014).

Though, it has been well established that the application of VGI in fright situations is not a righteous approach (Reichenbacher et al, 2016). Moreover, VGI data has always remained a matter of concern due to the absence of attributes' categorization. Resultantly, it does not meet standard spatial data quality confirmation strategies that may cause hindrances in interpretation for decision makers during the panic situation. Thus, more research on the classification of primary "emergency" and secondary "needs" is required. Also, geo-referencing of each message on map mashup can bring accuracy in data in response to victims (Reichenbacher et al, 2016). Therefore, the XML rules classification were proposed, e.g., separating critical health and food need messages through python scripts (Haklay et al, 2010; Camponovo and Freundschuh, 2014). Morrow et al. (2011) quoted that 64% of incident reports can correctly be classified for Ushahidi/ Haiti spatial platform as per demand. The acquisition cost has given VGI/CS favors to be adopted by the industry (Munro, 2010), e.g., Therefore, United Nations projects started to direct their own research into a VGI's convenience of utilization and vast applications (Standby Volunteer Task Force, 2011). Concern bodies ought to consider other hierarchical frameworks for classification, like the USGS Land Cover System, to set up a more uniform and generally utilized framework (Reichenbacher et al, 2016). In contrast, even after achieving 80.6% better results, still there are hindrances; why only these set of rules have been chosen for data categorization? If no rule for a class exists, then what to do? Many of the studies only focused on standard technologies and resources. The effort in the studies was being done by personal mobiles such as CS. For, example, "Over 100 #UN personnel trapped in collapsed headquarters in #Haiti earthquake…" (Ushahidi, 2011). This tweets saved the life of multiple victims after five days of publishing. However, none of the studies discuss the methodology of utilizing the social data keeping in mind the privacy of individuals (Yagoub, 2015).

Involving a statistically significant number of people in focused regions can bring another solution. Haklay et al, (2010) suggest that the quantity of spatial features in OSM data has a direct relationship with the number of contributors (Girres and Touya, 2010). By contrast, a situation with a lesser number of volunteers can be managed by choosing skilled volunteers. This can bring better accuracy in position and content. The situation has been further explained in Linus's Law. The quantity of individuals occupied with it gets uncommon consideration in what is known as Linus' Law. This states that heterogeneous approach will normally take five people to accurately map OSM data of 1 km^2 for linear spatial features (Haklay et al, 2010, p.321). Positional accuracy of linear features, such as road network is a prime variable to investigate Linus's Law for OSM and study considered 109 roads covering 328 km of Greater London. However, the limitation associated is, spatial data quality needs attention in features attributes quality. Opposite to this, Hakley, et al, (2010) only focuses on the evaluation of the road network data and their positional accuracy, while ignores other spatial features and attribute information completeness (Grchenig, Brunauer and Rehrl, 2014).

Meanwhile, massive consumer capability makes the CS utilizable to vigorously build a professional disaster information management systems (DIMS), which can facilitate accurate information. The CS compatible DIMS requires to defuse processed VGI/CS content and professional content together. Credibility, quality, and fitness for response through such a system are still in process (Goodchild and Li, 2012). If the correct positional information is existing in metadata with the Flicker image, CS has more credibility in disaster (Gao et al, 2013). When fusion is done, data verification leads to transmit usable data to the concern bodies after cleaning procedures and post-processing (Ma et al, 2014). For instance, OSM layers with overlay on the accurate high-quality imagery of area mashup map with a popup of publicly available CS messages can create improved customized DIMS such as Ushahidi (Ma et al, 2014).

Conclusively, centralized management, qualitative approach on volunteers, and efficiently categorization of collected data in combination to authoritative data can be useful to improve disaster mitigation in response and recovery. An arrangement of volunteers into subgroups distinguished by their skills could further embrace an assignment more precisely than when part of a bigger gathering of volunteers. Privacy of CS data is a big concern, which requires precise attention. Also, an organization needs to focus on training of volunteers during normal situations. Along with auto-updating and tracking of inserting information still a confusion for VGI and CS in disaster scenarios (Ma et al, 2014).

Compliance with ethical standards

Conflict of interest

The author declares no conflict of interest.

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