Predictability or Early Warning: Using Social Media in Modern Emergency Response

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Mariluz Congosto and her colleagues[1] recently mentioned the possibility of predicting natural disasters using social media data. They support their claims by adding references to two works that employed Twitter data for the detection of earthquakes.[2,3] Within this context, we feel that the references to these two other works[2,3] might be overstated. For instance, in our work,[2] we discussed a system for the detection and damage assessment of earthquakes in Italy. Similarly, in Takeshi Sakaki and his colleagues' work,[3] they propose a system for detecting earthquakes as well as detecting and estimating the trajectory of tornadoes in Japan. In both works, no claims are made about the systems' capabilities to predict earthquake occurrences, but more about their ability to detect and report. We believe this opens an even more interesting discussion.

A potential source of ambiguity, and a possible reason for this claim by Congosto and her colleagues could lie in the meaning given to "predict," when the definition "say or estimate that a specific thing will happen in the future" is interpreted as the action of figuring on (and notifying) the imminent arrival of the shake, following a significant earthquake that has occurred far away. However, this isn't true prediction; rather, this is an early warning system enabled by the difference existing between the propagation speed of communication media and that of seismic waves. Instead, adhering to a more genuine interpretation, the hypothesis of predicting earthquakes using social media data can be ruled out straightaway as the relevant data are produced and shared as a result of the earthquake itself. As such, it's not available before the earthquake occurs.

Another source of ambiguity could be a few references in Sakaki and his colleagues' work[3] mentioning research efforts aimed at investigating the possibility for intermediate- and short-term earthquake prediction. However, in this work,[3] there's no specific reference to the results of such studies, and ultimately, neither the effectiveness nor the applicability of such predictive techniques are supported.

Over the course of more than 100 years, the potential promise of earthquake prediction has attracted researchers in seismology as well as amateurs and impostors. Many theories have been tested and systematically rejected.[4] Recent works in seismology have demonstrated once more that current knowledge in this field is unable to predict earthquake occurrences in any way,[5] let alone using Twitter (or other social media) data. Answering the question raised by Robert Geller and his colleagues as to whether earthquake prediction is "inherently impossible or just fiendishly difficult" will probably require other decades of research in seismology.[4]

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What social media data actually can contribute to is assisting emergency responders in assessing and mitigating natural and manmade disasters. The most promising application for crowdsourced and fast-paced social media data is in the time span between the disaster's occurrence and the impact/damage assessments performed by means of traditional — and typically less responsive — technologies. Indeed, this is supported by the growing interest of civil protection agencies, such as the US Federal Emergency Management Agency (FEMA), in social media emergency communications.[6]

Furthermore, state-of-the-art approaches in social media-based emergency response have recently led to the first results in the fields of qualitative and quantitative damage assessment,[7,8] and to important advances in the fields of situational awareness and crisis mapping.[9] Among the most notable findings of such works are the evidence of moderate-to-strong correlations between tweet-derived predictors and earthquake intensity. Other interesting results are about the possibility of producing impromptu crisis maps solely from social media, in a real-time fashion, thus allowing unpredictable disasters to be tracked as they unfold. However, quantitative and verifiable results in these fields are still few and far between, and despite these compelling findings, many questions still remain unanswered. Among the most pressing research challenges are the evaluation of the extent to which models developed for a type of disaster (such as an earthquake) can be carried over to other disasters (for example, floods or wildfires), and the design of hybrid solutions that combine the strengths of social media with those of traditional emergency-response technologies.

The achievement of reliable results in this critical field involves designing a system based on past disasters and then thoroughly testing it against future ones, which requires a great deal of effort and time. Meanwhile, current societal and environmental challenges, such as climate change, are bound to cause more frequent and more severe

Introducing "Editor's Select"

Perhaps one of the greatest aspects of being the Editor in Chief of a magazine that's central to my own research area is the ability to read early work on the most innovative topics. As EIC, I also get the opportunity to experience firsthand the interplay between our researchers as they develop new approaches to real-world problems.

Often, contributions from one article can provide significant insights into other works, even when the approaches are different. Other times, authors get to challenge the work of others in such a way that a greater understanding for both projects can be attained.

In this issue of *IEEE Internet Computing*, I'm using the "From the Editors" column as a special "Editor's Select" feature — a platform similar to letters to the editor, but with adequate space for discussion. This "Editor's Select" highlights insights from authors who read one of our earlier published articles and want to express a deeper insight. I hope that you enjoy their comments and appreciate the scholarly spirit of what they observed from reading the works of *IEEE Internet Computing*.

I would also like to take a moment to thank the guest editors for this issue, Kaustubh Joshi and Theophilus Benson. This special issue focuses on network function virtualization (NFV), a burgeoning area of interest to many.

— M. Brian Blake, Editor in Chief

disasters. Thus, globally we must increase scientific and technological efforts in this direction, because it's destined to be of crucial importance for years to come.

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