Using artificial intelligence to manage extreme weather events

January 19 2021

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Can combining deep learning (DL)—a subfield of artificial intelligence—with social network analysis (SNA), make social media contributions about extreme weather events a useful tool for crisis

managers, first responders and government scientists? An interdisciplinary team of McGill researchers has brought these tools to the forefront in an effort to understand and manage extreme weather events.

The researchers found that by using a noise reduction mechanism, valuable information could be filtered from social media to better assess trouble spots and assess users' reactions vis-à-vis extreme weather events. The results of the study are published in the Journal of Contingencies and Crisis Management.

Diving into a sea of information

"We reduced the noise by finding out who was being listened to, and which were authoritative sources," explains Renee Sieber, Associate Professor in McGill's Department of Geography and lead author of this study. "This ability is important because it is quite difficult to assess the validity of the information shared by Twitter users."

The team based their study on Twitter data from the March 2019 Nebraska floods in the United States, which caused over $1 billion in damage and widespread evacuations of residents. In total, over 1,200 tweets were analyzed and classified.

"Social network analysis can identify where people get their information during an extreme weather event. Deep learning allows us to better understand the content of this information by classifying thousands of tweets into fixed categories, for example, 'infrastructure and utilities damage' or 'sympathy and emotional support,'" says Sieber. The researchers then introduced a two-tiered DL classification model—a first in terms of integrating these methods in a way that could be useful to crisis managers.

The study highlighted some issues regarding the use of social media analysis for this purpose, notably its failure to note that events are far more contextual than expected by labeled datasets, such as the CrisisNLP, and the lack of a universal language to categorize terms related to crisis management.

The preliminary exploration performed by the researchers also found that a celebrity call out was featured prominently—this was indeed the case for the 2019 Nebraska floods, where a tweet from pop singer Justin Timberlake was shared by a large number of users, though it did not prove to be of use for crisis managers.

"Our findings tell us that information content varies between different types of events, contrary to the belief that there is a universal language to categorize crisis management; this limits the use of labeled datasets on just a few types of events, as search terms may change from one event to another."

"The vast amount of social media data the public contributes about weather suggests it can provide critical information in crises, such as snowstorms, floods, and ice storms. We are currently exploring transferring this model to different types of weather crises and addressing the shortcomings of existing supervised approaches by combining these with other methods," says Sieber.

"Using deep learning and social network analysis to understand and manage extreme flooding," by Renee Sieber et al., was published in the *Journal of Contingencies and Crisis Management*.

Provided by McGill University

Citation: Using artificial intelligence to manage extreme weather events (2021, January 19) retrieved 16 July 2024 from https://phys.org/news/2021-01-artificial-intelligence-extreme-weather-events.html