

Tracking Storms of Misinformation Spread amid Disasters

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Article overview: In recent years, misinformation has plagued social media platforms during disasters, causing unnecessary chaos and confusion. In order to create a safer online environment, major agencies and accounts often have to debunk misinformation to offer the public with updated and correct news. Given this, advanced technology such as machine learning can be used in order to detect and track misinformation, and assist agencies in their decisions to debunk misinformation.

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Over the last decade, social media has been increasingly employed for sharing opinions, personal updates, and breaking news. This is because platforms, such as Twitter and Facebook, allow for the delivery of important information at extreme speeds, facilitating the efficient dissemination of content to millions of users around the world. Given these benefits, social media platforms are often utilized to spread emergency communications such as evacuation plans, shelter information, and weather updates. During natural disasters, acts of terrorism, chemical threats, and other crisis situations, millions of people around the world turn to social media to get the information they need, or stay current during plight situations.

Unfortunately, due to the unmoderated nature of social media, misinformation has plagued the networks of platforms such as Twitter. Over the last few years, “fake news” has been a trending phrase and topic across mass media, and is often identified in politics and other controversial domains. Regrettably, misinformation and fake news are also spread across social media when information integrity is crucial to the safety of the public, such as during natural and man-made disasters. During these events, timely and credible information is of the utmost importance to those affected by the disasters, and also those following the disaster-related news.

Misinformation during Natural and Man-made Disasters

On April 15th, 2013, the United States was struck by an act of terrorism. Two homemade pressure cooker bombs were detonated near the finish line of the Boston Marathon, killing three people, and significantly injuring many more. During the chaos that ensued, many false rumors were spread. One the most prominent false rumors stated that an 8-year-old girl was killed in the bombings while she was running in remembrance of the 2012 Sandy Hook school shooting victims. Another false rumor took direct advantage of Twitter. A fake account named @_BostonMarathon was created and posted a tweet which read "For every retweet we receive we will donate \$1.00 to the #BostonMarathon victims." Many users ended up retweeting the post, believing that it would aid in the recovery from the disaster. In fact, this account had no intentions to donate any money. Twitter eventually suspended the fraudulent account, and warnings spread throughout Twitter to look out for other accounts similar to this one. Between these two cases, millions of Twitter users were exposed to the false information.

On May 22nd, 2017, Ariana Grande was performing in the Manchester Arena in England. When the concert concluded and attendees were beginning to leave the venue, a suicide bomber detonated explosives that were attached to his body. The bombing led to 23 deaths and over 139 injuries, and was the deadliest terrorist attack in England since the 2005 London bombings. After the bombing, a rumor was spread on Twitter and Facebook claiming that unaccompanied children were being taken to safety at the local Holiday Inn. Soon after the rumor was spread, a Holiday Inn representative had to make a statement informing the public that this rumor was false, and there were no unaccompanied children at the hotel.

Later in 2017, on August 25th, Hurricane Harvey made landfall in Texas. During Hurricane Harvey, there was legislation due to be passed in Texas that was aiming to increase anti-immigration policies. As some people began to inquire about eligibility requirements at evacuation shelters, a false rumor began to proliferate throughout social media and Texas that stated shelters were going to be checking IDs. This rumor proved to be very dangerous, as many undocumented immigrants were afraid to go to shelters due to their lack of citizenship and the potential threat of deportation.

On the heels of Hurricane Harvey, Hurricane Irma was generating immense damage across the Caribbean on its path towards Florida. On September 10th, 2017, Hurricane Irma made landfall in Cudjoe Key, Florida, bringing along deadly storm surges and rainfall. Before Irma's landfall, a Sheriff in Florida posted on Twitter saying that he would be checking identifications at all evacuation centers in his jurisdictional county. Although the Sheriff did not spread any false information, many citizens and undocumented immigrants inferred that he was checking IDs to primarily scare undocumented immigrants from seeking safety in those shelters, and this false rumor began to spread both online and offline. The Sheriff later clarified his tweet, reassuring the community that he was not targeting the undocumented population. Many additional tweets were posted by other agencies and accounts in order to help comfort the population, and deliver the correct information.

The plethora of evidence showing the spread of misinformation during disasters is proof that social media users should proceed with caution when believing, posting, or reposting information on these platforms. In many cases, major governmental and non-governmental organizations intervene when misinformation is spread in order to provide the public with updated and valid information.

The Importance of Major Agencies and Verified Users

In most cases, misinformation propagates throughout social media and other online platforms at extreme speeds, reaching millions of people around the world. Given this threat, social media consumers need timely and valid information in order to create a safer online and offline environment. In most cases, the postings which debunk misinformation are made by major governmental organizations, and in some cases even non-governmental organizations.

When the false rumors, which stated that undocumented immigrants could not enter shelters, spread during both Hurricane Harvey and Hurricane Irma, many agencies posted to Twitter in order to comfort the public and offer correct information. Some of the governmental agencies who posted were the Federal Emergency Management Agency (FEMA), the United States Department

of Homeland Security Customs and Border Protection, (DHS CBP), DHS Immigration and Customs Enforcement (ICE), the City of Houston, and the City of Miami. Many news organizations also posted information to let the undocumented population know that it was safe for them to seek shelter, including The Miami Herald, The Washington Post, CNN, The Hill, among many others. Governmental officials, such as Sylvester Turner who is the Mayor of Houston, also had to make public announcements in order to disprove the threatening information.

Likewise, in the Manchester Arena (2017) and Boston Marathon (2013) bombings, many agencies, celebrities, and public figures had to make announcements and postings to debunk the misinformation that penetrated social media platforms.

Research has shown that it is the verified users (users that are acknowledged by Twitter as accounts of public interest) who receive the most interaction when posting misinformation debunking messages. In many cases, over 100,000 users interact with these postings by retweeting, liking, and commenting on the content. This behavior helps to further spread the accurate and needed information through Twitter's network. Likewise, many users and agencies cite information from external sources, such as news websites and government websites, in order to offer credibility in their misinformation debunking posts. This information is vital to the safety of social media platforms.

For Hurricane Sandy (2012), Hurricane Maria (2017), Hurricane Harvey (2017), Hurricane Irma (2017), Hurricane Michael (2018), and Hurricane Florence (2018), false rumors and misinformation were exposed on FEMA's "Rumor Control" pages. On these web pages, which were created during or immediately after the hurricanes, FEMA kept a record of hurricane-related false rumors, and also offered the valid information alongside the different rumors. These web pages are important resources for the public, and especially social media users, to be aware of and explore before trusting disaster related information.

Assisting Agencies via Machine Learning

Social media platforms have proven to be a successful and important medium to stay connected with family and friends, as well as share opinions, news, and personal updates. Due to the speed, breadth, and depth of information diffusion across social media, it is increasingly important to develop and utilize tools that can assist in the monitoring of information, and ultimately promote a safer online environment.

Technologies such as machine learning can be used to assist agencies in the tracking of misinformation. In many disasters, there are multiple false rumors being spread, and agencies will have to choose which rumors they combat due to their limited resources. A machine learning framework offers organizations and agencies a tool to track identified misinformation on platforms such as Twitter, and make informed decisions on whether or not to use their resources in order to debunk the false information.

By collecting Twitter data from previous disasters where misinformation spread, machine learning models can be trained to learn which tweets are spreading true information, which tweets are spreading false information, and which tweets contain opinions or comments on the subject matter. Supervised machine learning models as basic as random forests, to more architecturally

complicated models such as deep neural networks, have performed with over 90% accuracy in deciphering the differences between true tweets, false tweets, and tweets which contain opinions and comments. Upon training these models with enough historical data, they can be deployed to predict the veracity of newly emerging tweets.

As misinformation is detected on social media, or even in offline social networks, agencies can deploy these trained machine learnings models on live stream tweets. By querying a certain misinformation topic on Twitter, and feeding these tweets to the models, the incoming tweets will be automatically labeled as either true, false, or other (opinions or comments). The agencies can then monitor these tweets and analyze how many users are spreading the false information, and how many users are posting true tweets regarding the false information. If enough users are already posting valid information, and not many users are continuing to spread the false information, the agency may choose not to utilize their resources to debunk. If many users are continuing to spread the misinformation, and not many users have posted the truth, then the agency may choose to debunk the misinformation and clarify any confusion or rid any malicious intentions. Machine learning offers an extremely high speed and efficient method to facilitate this. As long as there is a demand for credible information, major emergency organizations and decision makers could benefit greatly from machine learning and its broad applications.

Improvements in disaster research and disaster practices, whether small or large, can make a significant impact on the lives of people around the world. Having knowledge and awareness of modern threats, such as false information spreading on social media platforms, can create a safer environment for the public. Employing advanced technologies to improve the current state of disaster management can offer modern and dynamic solutions that are readily adoptable by agencies and companies around the world.

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Puneet Agarwal Bio: Mr. Puneet Agarwal is a PhD student with specialization in operations research in the Department of Industrial and Systems Engineering at University at Buffalo. His research interest lies in the field of disaster risk management and strategic decision-making. Currently, he has four papers published in international journals. His collaborative efforts have received many acknowledgements, and his team's research has been widely covered by media

agencies. In 2019, he received the Geohazards Research Award from the University at Buffalo's Center for Geohazards Studies to support his research on misinformation diffusion during disasters. He was also awarded with a Graduate Achievement Award for his excellent performance in graduate studies.

Jun Zhuang Bio: Dr. Jun Zhuang is a Professor, Department of Industrial and Systems Engineering, School of Engineering and Applied Sciences (SEAS) at the University at Buffalo (UB). Dr. Zhuang received a Ph.D. in Industrial Engineering in 2008 from the University of Wisconsin-Madison. Dr. Zhuang's long-term research goal is to integrate operations research, big data analytics, game theory, and decision analysis to improve mitigation, preparedness, response, and recovery for natural and man-made disasters. Other areas of interest include applications to health care, sports, transportation, supply chain management, sustainability, and architecture. Dr. Zhuang's research has been supported by the U.S. National Science Foundation (NSF), by the U.S. Department of Homeland Security (DHS), by the U.S. Department of Energy, by the U.S. Air Force Office of Scientific Research (AFOSR), and by the National Fire Protection Association. Dr. Zhuang has published 90+ peer-reviewed journal articles in Operations Research, IISE Transactions, Risk Analysis, Decision Analysis, and European Journal of Operational Research, among others.