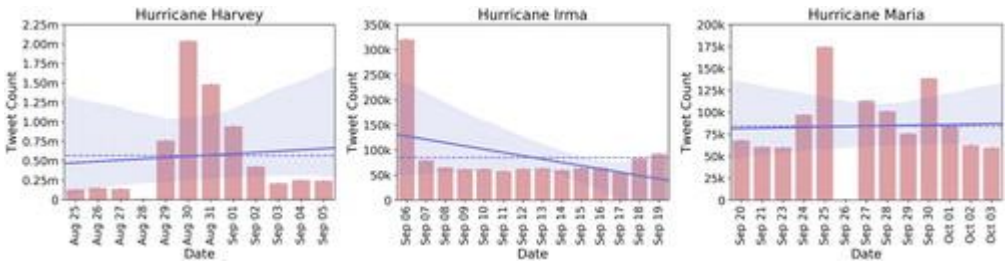
IDEATION

ABSTRACT

People increasingly use microblogging platforms such as Twitter during natural disasters and emergencies. Research studies have revealed the usefulness of the data available on Twitter for several disaster response tasks. However, making sense of social media data is a challenging task due to several reasons such as limitations of available tools to analyse high-volume and high-velocity data streams, dealing with information overload, among others. To eliminate such limitations, in this work, we first show that textual and imagery content on social media provide complementary information useful to improve situational awareness. We then explore ways in which various Artificial Intelligence techniques from Natural Language Processing and Computer Vision fields can exploit such complementary information generated during disaster events.

The total number of tweets collected for each event per day – Hurricane Harvey (left), Hurricane Irma (centre), and Hurricane Maria (right). Horizontal dashed lines show the *average* number of tweets per day, whereas the solid lines indicate the trends in the daily tweet data volume.



Suicide is a leading cause of death that defies prediction and challenges prevention efforts worldwide. Artificial intelligence (AI) and machine learning (ML) have emerged as a means of investigating large datasets to enhance risk detection. A systematic review of ML investigations evaluating suicidal behaviors was conducted using PubMed/MEDLINE, PsychInfo, Web-of-Science, and EMBASE, employing search strings and MeSH terms relevant to suicide and AI. Databases were supplemented by hand-search techniques and Google Scholar. Inclusion criteria: (1) journal article, available in English, (2) original investigation, (3) employment of AI/ML, (4) evaluation of a suicide risk outcome. N = 594 records were identified based on abstract search, and 25 hand-searched reports. N = 461 reports remained after duplicates were removed, n = 316 were excluded after abstract screening. Of n = 149 full-text articles assessed for eligibility, n = 87 were included for quantitative synthesis, grouped according to suicide behavior outcome. Reports varied widely in methodology and outcomes. Results suggest high levels of risk classification accuracy (>90%) and Area Under the Curve (AUC) in the prediction of suicidal behaviors. We report key findings and central limitations in the use of AI/ML frameworks to guide additional research, which hold the potential to impact suicide on broad scale.

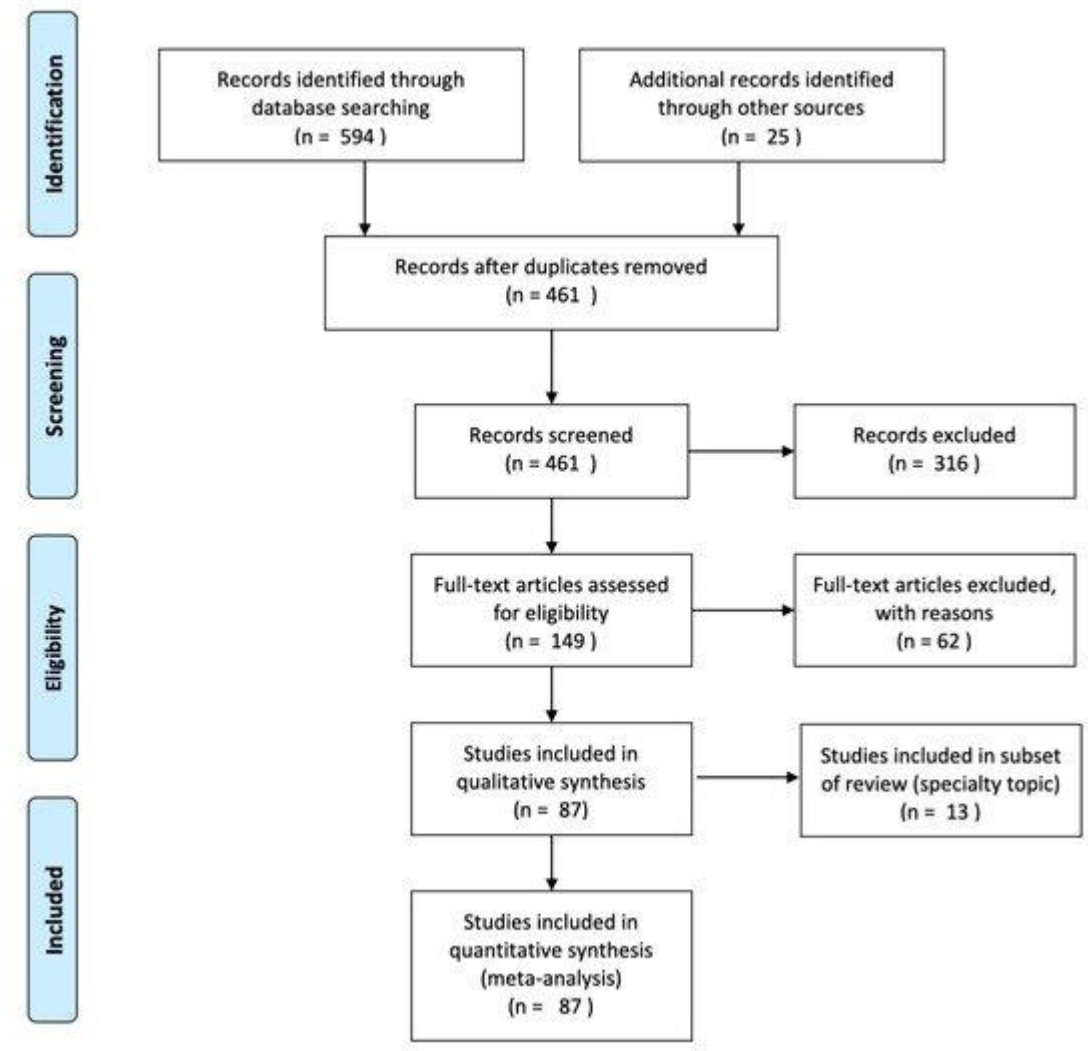


Figure 1

Three devastating natural disasters in 2017, namely Hurricane Harvey, Hurricane Irma, and Hurricane Maria, caused catastrophic damage worth billions of dollars and numerous fatalities, and left thousands of affected people. During such life-threatening emergencies, affected and vulnerable people, humanitarian organisations, and other concerned authorities search for information useful to prevent a crisis if possible or help victims. During disasters and emergencies, humanitarian organisations and other government agencies, public health authorities, and military are tasked with responsibilities to save lives and reach out to people who need help (Gralla, Goentzel, and VandeWalle 2013). These formal response organisations rely on timely and credible information to make rapid decisions to launch relief operations. The information needs of these stakeholders vary depending on their role, responsibilities, and the situation they are dealing with (Vieweg, Castillo, and Imran 2014). However, during time-critical situations, the importance of timely and factual

information increases, especially when no other traditional information sources such as TV or Radio are available (Vieweg 2012; Castillo 2016). The growing use of Information and Communication Technologies (ICT), mobile technologies, and social media platforms such as Twitter and Facebook has provided easy-to-use and effective opportunities to the general public to disseminate and ingest information. Millions of people increasingly use social media during natural and human-induced disasters (Hughes and Palen 2009; Purohit et al. 2014; Castillo 2016). Research studies have demonstrated the usefulness of social media information for a variety of humanitarian tasks such as 'situational awareness' (Starbird et al. 2010; Vieweg 2012). Although, information available on social media could be useful for response agencies, making sense of it under time-critical situations is a challenging task (Hiltz and Plotnick 2013). For instance, due to high-volume and high-velocity of social media data streams, manual analysis of thousands of social media messages is impossible (Hiltz, Kushma, and Plotnick 2014; Ludwig et al. 2015).

Typhoon Haiyan :

This research chose Typhoon Haiyan (or Yolanda locally) as case study. On the one hand, it is the strongest typhoon ever recorded in the northwest Pacific Ocean. At 4:40 a.m. on 8 November 2013, Typhoon Haiyan landed in Samar Province and hit the provinces and cities in the central Philippines. It caused considerable economic losses and casualties and resulted in 6300 deaths, 28,688 injuries, more than 3 million families being affected, and economic losses exceeding 1.9 billion US dollars [30]. On the other hand, The Philippines has one of the largest shares of Twitter users in the world.

There has been an unsettling rise in the intensity and frequency of natural disasters due to climate change and anthropogenic activities. Artificial intelligence (AI) models have shown remarkable success and superiority to handle huge and nonlinear data owing to their higher accuracy and efficiency, making them perfect tools for disaster monitoring and management. Accordingly, natural disaster management (NDM) with the usage of AI models has received increasing attention in recent years, but there has been no systematic review so far. This paper presents a systematic review on how AI models are applied in different NDM stages based on 278 studies retrieved from Elsevier Science, Springer LINK and Web of Science. The review: (1) enables increased visibility into various disaster types in different NDM stages from the methodological and content perspective, (2) obtains many general results including the practicality and gaps of extant studies and (3) provides several recommendations to develop innovative AI models and improve the quality of modeling. Overall, a comprehensive assessment and evaluation for the reviewed studies are performed, which tracked all stages of NDM research with the applications of AI models.

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