Classifying Emergency Tweets for Disaster Response

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ABSTRACT

During disaster events such as floods, landslides, earthquakes, tsunamis, fire hazards, etc., social media platforms provide easy and timely access to information regarding the ongoing crisis events and thereby become an essential vehicle of information sharing. During such events, great amounts of such socially generated data becomes available, which can be accessed and processed to extract situational awareness insights. These insights, in turn, can be used to enhance the effectiveness and efficiency of disaster response in order to minimize the loss of lives and damage to property. People actively use social platforms like Facebook and Twitter to post information related to crisis events. Further, these platforms provide people the location and safety status of their family and friends during such events. Twitter, the microblogging platform, witnesses thousands of informally written tweets during crisis events, and since it provides high-level APIs to access its near real-time feed, it has become the primary source of data for researchers. It is generally observed that there is an exponential burst in the number of tweets during an ongoing crisis event. This sudden burst makes the task of monitoring, identifying, and processing each tweet virtually impossible for a human. However, such voluminous data can be processed using various machine learning and natural language processing techniques in coordination with a certain level of human interventions. This paper is focused on designing a semi-automated artificial intelligence-based classifier, which can classify the plethora of disaster-related tweets into various categories such as community needs, loss of lives, damage.

KEYWORDS

INTRODUCTION

Disasters, may it be natural or man-made, lead to significant loss of lives and the destruction of millions worth of property. Floods, landslides, earthquakes, cyclones etc., are the commonly occurring calamities in regions like Nepal and India. These calamities turn into major disasters due to lack of human proactive actions before the occurrence of such hazards. This necessitates proper formulation of policies related to reducing the vulnerability and preventing the extent of adverse effects of disasters by identifying various organizational decisions such as mitigation, preparedness, response and recovery. These four decisions together form the key phases in a Disaster Management cycle. The main phases of activity within the disaster management cycle are pre-disaster phase, during-disaster phase and post-disaster phase. The pre-disaster phase includes activities carried out to prevent/reduce the possible negative effects of a calamity. Activities such as preparedness, mitigation and prevention fall under this phase. The during-disaster phase include activities which is carried out to ensure that

the needs and requirements of an affected population are met, so as to minimize the distress during an on-going calamity. Response related activities fall under this phase. The post-disaster phase generally deals with activities related to performing rapid recovery of the affected area to normalcy as quickly as possible. Therefore, in general there are four different phases in disaster management which focus on managing humanitarian resources in order to minimize the possible adverse effects during occurrence of calamities. The various phases in disaster management cycle are:

1. **Disaster Mitigation:** Disaster Mitigation majorly deals with reducing the risks associated with calamities. Calamities such as underwater earthquake, result in occurrence of Tsunami, become disaster when they harm a concentration of population and property in the affected area. Therefore, proper formulation and implementation of policies help in mitigation against the negative effects of such calamities with the help of various procedures such as providing early warnings, risk mapping of vulnerable areas.
2. **Disaster Preparedness:** Disaster Preparedness deals with the efforts taken to prepare for, and reduce the adverse effects of calamities (IFRC, 2000). In simple terms, Disaster Preparedness constitutes the set of actions taken as precautionary measures against possible harms likely to be caused by potential calamities. United nations define "Disaster Preparedness" as "*forecasting and taking precautionary measures prior to an imminent threat when advance warnings are possible*" (Kent, 1994).
3. **Disaster Response:** Disaster Response deals with providing rescue to the affected population from immediate harm, and stabilize the physical and emotional aspects of the survivors (GOV.UK, 2013). The basic needs and requirements of the affected population is fulfilled until a permanent solution is unreachable. Activities such as dissemination of warnings, performing search-rescue operations and damage assessments fall under the Disaster Response phase.
4. **Disaster Recovery:** Disaster Recovery majorly deals with bringing the affected population and the area to a better or pre-disaster state. The recovery phase is a continuing process that encompasses rehabilitation, reconstruction and development specific activities. *Rehabilitation* focuses on providing temporary housing to the affected population, *reconstruction* is an attempt to re-construct the infrastructures and systems to their pre-disaster form and *development* incorporates long-term plans related to development of the affected area so as to minimize the possible harms likely to be caused in future.

Disaster Management aims to reduce or avoid possible losses from calamities and ensure prompt response to the needs of the effected population in order to achieve rapid recovery by bringing the affected area to normalcy as quickly as possible. Among the four phases of disaster management, the focus of this paper is disaster response. A study is carried out to design a disaster response system using the publicly available conversations posted on Twitter.

During disasters, people tend to use social media excessively. As a result, during an ongoing crisis event, the social platforms like Facebook and Twitter become active sources of information (Imran et al., 2015). These platforms provide easy and immediate means for people to get connected with their family and friends, and query for each other's safety status. As a result, there is an aggregation of a large volume of socially generated data, which can be in-turn processed and analyzed to extract useful situational awareness information. Those publicly available posts, conversations and messages also might contain on-ground situational details posted by the people, who have personally experienced the crisis event or who have heard something regarding the event. Therefore, it is necessary to process and analyze such data to come up with actionable plans, as the on-ground situation unfolds.

Earlier studies (Abel et al., 2012; Ashktorab et al., 2014; Caragea et al., 2011; Imran et al., 2014; MacEachren et al., 2011; Purohit & Sheth, 2013; Sheth et al., 2010; Vieweg et al., 2010; Yin et al., 2015) have pointed out that tweets posted publicly on Twitter contribute to the extraction of situational awareness information regarding an on-going crisis event. The extracted information

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