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CHARACTERIZATION OF VALUABLE INFORMATION FROM SOCIAL MEDIA NETWORKS DURING NATURAL DISASTERS

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Abstract

Twitter, a microblog site, have emerged as a new source for detecting and monitoring disaster events specifically earthquakes. The data streamed in Twitter can be used to pull actionable data for emergency response and relief operation. However, no effort has been made to classify data in conversational and informative form which has been used as a common reference for the decision-makers to streamline priorities and activities during a disaster. This paper makes an initial effort in classifying tweets by examining more than 10,000 tweets generated using the hashtags, #Lindol, #EarthquakePH, #Mindanao and the word 'Lindol' as a mention. The results are generated using Rapidminer software and deemed as necessary and useful for the disaster management unit. Information generated from the classification can also be used by the social science research communities to study various aspects of preparedness, response, impact and recovery of disaster.

Keywords

Social Media Network, Natural Language Processing, Disaster Management, Sentiment Analysis

1. Introduction

In an era of reciprocal connection between individuals and organizations across the globe, Social Media continues to evolve and play a larger role in day-to-day life. According to the article of Allan Tabell published at Rappler, Social media is already one of the primary sources of information and this is particularly evident during disasters and emergencies. With the rising popularity of smartphones, which have also become very inexpensive nowadays, people turn to social media to get or share public safety information or stay connected with family and friends, or even request assistance from emergency response agencies like Patrol 117 (Tabell, 2017).

An input paper from Neil Dufty for the United Nations Office for Disaster Risk Reduction states that a considerable proportion of people have used and are interested in using social media in emergencies and disasters, according to social research. For example, an American Red Cross study (American Red Cross, 2012) found that four in ten respondents would use social media to let loved ones know they are safe (Dufty, 2014).

Twitter was originally used for social networking and interaction, it was not intended for use during the disaster response and emergencies, but the public and institutions are increasingly turning their attention for dissemination and gathering of vital information (Catanghal et. al, 2017).

Eight percent of all respondents have downloaded a smartphone app that could help in a disaster or emergency. Twelve percent of survey respondents have used social media to share or obtain information during an emergency, disaster or severe weather event. The type of emergency information that they had sought and shared using social media is shown in Table 1.

Table 1: Ways in which people use social media in disasters

Information sought using social media		Information shared using social media	
Weather conditions or warnings	79%	Weather conditions or warnings	58%
Road or traffic conditions	64%	Reassurance that they were safe	55%
Damage caused by the event	62%	Their feelings or emotions about what was happening	55%
The location and status of loved ones	56%	Their location	45%
Information about how others are coping with the disaster	49%	What actions they are taking to stay safe	42%

It has been said that disaster communication is now evident in social media in addition to the coverage made by the traditional media. Television networks in the Philippines are now using Twitter to disseminate information faster. Two of the biggest networks in the country are ABS-CBN and GMA with their Twitter accounts @ANCALERTS or @ ABSCBNNews and @gmanews respectively. Even the government organizations and local government are using social media to address announcements to the public. The state weather bureau of the country, the Philippine Atmospheric Geophysical Astronomical Services Administration (PAGASA) issues color signals that signifies the different levels of rain warnings. PAG-ASA also has Twitter account (@dost_pagasa) which allows them to tweet regularly and update their followers of the everyday weather condition, (Paladin et. al, 2017).

This study will focus on the development of an algorithm to the classification of tweets (posts on Twitter) during the recent earthquakes in 2017 in order to distinguish “informational” from “conversational” tweets.

2. Methodology

2.1 Dataset

Table 2: *Statistics of Data Collected*

Keyword	Number of Tweets	Number of Distinct Users
#Lindol	168	157
#Mindanao	875	208
#EarthquakePh	335	365
Lindol	1287	767

We considered tweets posted during the following recent disaster events – (i) #Lindol: a keyword with a hashtag that means earthquake in Filipino Language, (ii) #Mindanao: a keyword with a hashtag that describes the location where the earthquake took place last April 29, 2017, (iii) #EarthquakePh: a keyword with a hashtag that represents earthquake disaster in the country Philippines and (iv) “Lindol”: A keyword that means earthquake in Filipino Language without the hashtag, a Tagalog word which is the national dialect of the Philippines, and it is relied upon to have different outcomes in the guide of the Philippines (Ventayen, 2017).

Table 3: *Example of Tweets*

Informative Posts	<ul style="list-style-type: none"> ● #earthquake in #philippines M6.8 14 min offshore #Mindanao #Lindol More info soon
	<ul style="list-style-type: none"> ● Map of felt reports received so far after M7.2 #earthquake #lindol #Mindanao https://t.co/diyzvu0gJv
	<ul style="list-style-type: none"> ● RT via emsc Update: M6.8 #earthquake (#lindol) strikes 191 km SE of #Budta (#Philippines) 29 min ago. https://t.co/PiZU82D5n6
	<ul style="list-style-type: none"> ● RT phivolcs_dost: #EarthquakePH #EarthquakeSouthCotabato ● Earthquake Information No. 1 ● Date and Time: 29 April 2017... https://t.co/SEUflx5ESK
	<ul style="list-style-type: none"> ● RT @philredcross: #EarthquakePH:PRC Chapters in GenSan,S.Cotabato,DavaoDelSur,N.Cotabato & Davao City were all alerted & on stand by for po...
	<ul style="list-style-type: none"> ● #EarthquakePH #EarthquakeSarangani ● Earthquake Information No. 1 ● Date and Time: 29 April 2017 - 6:14 PM

	<ul style="list-style-type: none"> ● Magnitude... https://t.co/83PpRBozAc ● Wave warning after quake off #Philippines #Mindanao #Indonesia... ● https://t.co/Z5uhD3Ypqr https://t.co/MSMngI0NBa
Casual Posts	<ul style="list-style-type: none"> ● Danaya, wag mo nang ulitin muli ang paglindol!???? Nakakaistorbo ka sa pagtulog namin eh???? <p>#earthquake #lindol #7.3</p>
	<ul style="list-style-type: none"> ● holy S! ● ang lakas ng lindol ● #generalsantos ● #lindol
	<ul style="list-style-type: none"> ● One of worst #nightmare #baddream almost came true -_- 7.0 #EarthquakePH happening & u n@ked during! #horror #scaryday
	<ul style="list-style-type: none"> ● Yikes! #EarthquakePH #earthquake #philippines https://t.co/0INrm1loDG
	<ul style="list-style-type: none"> ● Now I'm dizzy. ?? #EarthquakePH
	<ul style="list-style-type: none"> ● Si crush parang lindol, magpaparamdam tapos maglalaho agad. ● Buti pa yung lindol, nararamdaman??
	<ul style="list-style-type: none"> ● Okay lang na magising dahil sa lindol, kaysa naman sa hindi na magising??. https://t.co/O2z7tVXriC
	<ul style="list-style-type: none"> ● Buti pa ang lindol may intensity, si crush kaya kailan nya maramdaman ang intensity ng tibok ng puso ko.. LoL

The dataset used was the recent earthquakes in Mindanao, the latest tweets was dated April 29, 2017. The dataset collects traces of the earthquakes in different locations such as Surigao, Davao del Norte, Davao Occidental, for duration of 24 ours. Data is collected from a variety of platforms such as mobile phones and laptops.

2.2 Data Mining

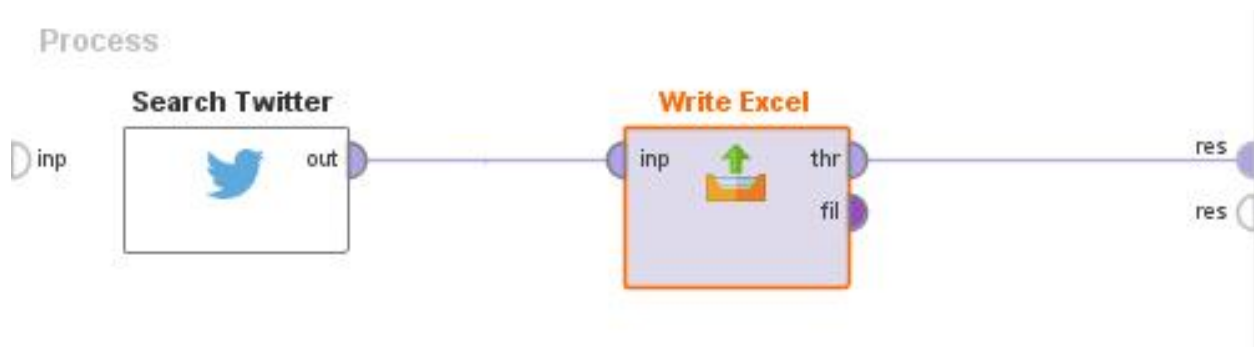


Figure 1: Data Mining

Keywords #Lindol, #EarthquakePh, #Mindanao, Lindol where used in Data Extraction via Rapid Miner.

2.2.1 Search Twitter

Four (4) Search twitter has been used with queries #Lindol, #EarthquakePh, #Mindanao, “Lindol”.With the Search Twitter operator, query has been specified and Twitter posts containing this query has been acquired. The list of posts contains additional data with the context of its posts. A Twitter connection has been specified with a Twitter account for the Twitter API access. An example set consisting of data from the Twitter API. This comprises the tweet text, the tweet ID, the number of retweets, the date of creation, the language, the geo-location, the used source of the tweet, and user information which can be seen in figure 1.

2.2.2 Write Excel

The operator wrote Example Sets to an Excel spreadsheet files. The Write Excel operator has been used for writing an ExampleSet into a Microsoft Excel spreadsheet. Four (4) Example Sets has been generated with filenames DataHashtagEarthquakePH, DataHashtagLindol, DataHashtagMindanao, DataLindol as excel sheet of xlsx format.

2.3 Data Cleansing

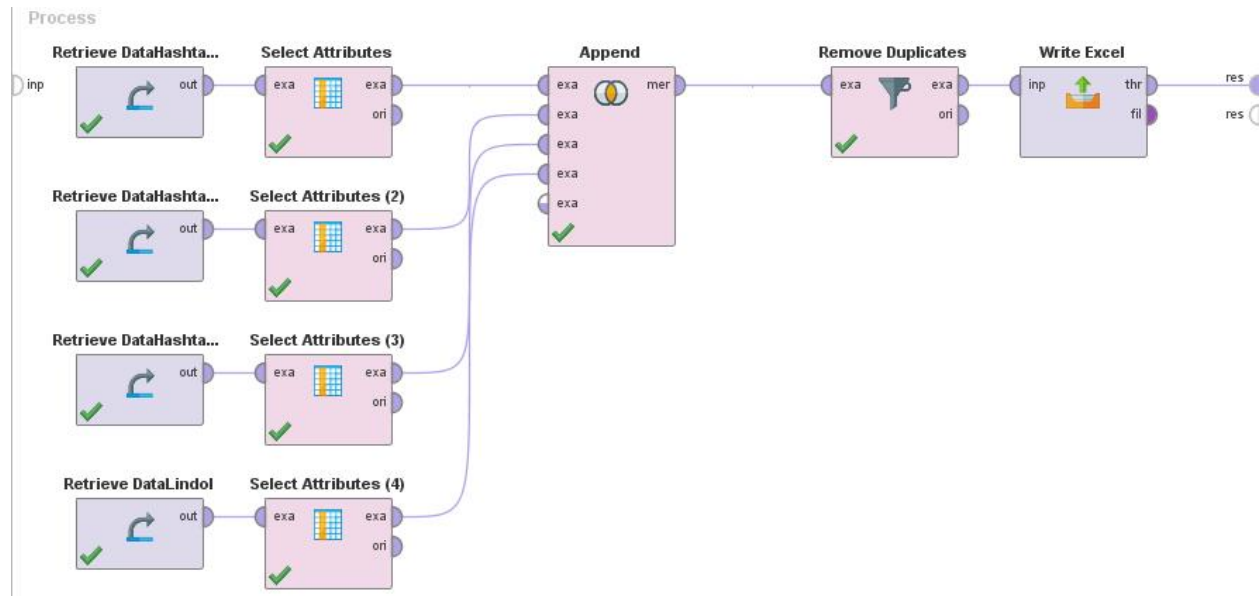


Figure 2: Data Cleansing

2.3.1 Retrieve Operator

The operator has been used to read an object from the data repository. In contrast to accessing a raw file, the operator provides the complete meta data of the data, to which all meta data transformations are possible.

2.3.2 Select Attributes Operator

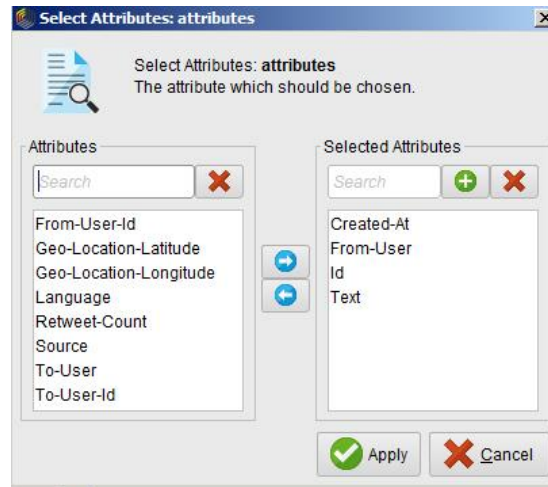


Figure 3: Attribute Selection

The operator has been used to select which attributes of an ExampleSet should be kept and which attributes should be removed. This is used in cases when not all attributes of an Example Set are required; it helps you to select required attributes. Only the selected attributes will be delivered from the output port and the rest will be removed from the Example Set. As seen in figure 3, attributes From-User-Id, Geo-Location-Latitude, Geo-Location-Longitude, Language, Retweet-Count, Source, To-User, and To-User-Id has been removed from the list.

2.3.3 Append Operator

The append operator has been used to build a merged Example Set from the four (4) compatible ExampleSets namely DataHashtagEarthquakePH, DataHashtagLindol, DataHashtagMindanao, DataLindol.

2.3.4 Remove Duplicates Operator

The operator has been used to remove duplicate Text from the merged ExampleSet by comparing all Text attribute content with each other on the basis of the specified attributes. Two Text attribute is considered duplicate if the selected attributes have the same values in them.

2.3.5 Write Excel Operator

The operator has been used to write ExampleSets to an Excel spreadsheet files. The Write Excel operator has been used for writing an ExampleSet into a Microsoft Excel spreadsheet. Four(4) ExampleSets has been generated with filenames DataHashtagEarthquakePH, DataHashtagLindol, DataHashtagMindanao, DataLindol as excel sheet of xlsx format.

The first stage done in this research is data cleaning which involves removing duplicates and inconsistent data, followed by data integration where we look at combining multiple data sources. The original dataset was imported into Rapid Miner 7.4. Attributes that appeared as inconsistencies were ignored and duplicates were removed.

In this research, we adopted the data mining reference model presented by (Hadzic et. al, 2011). The reference model shows the seven stages of the knowledge discovery process in Figure 4.

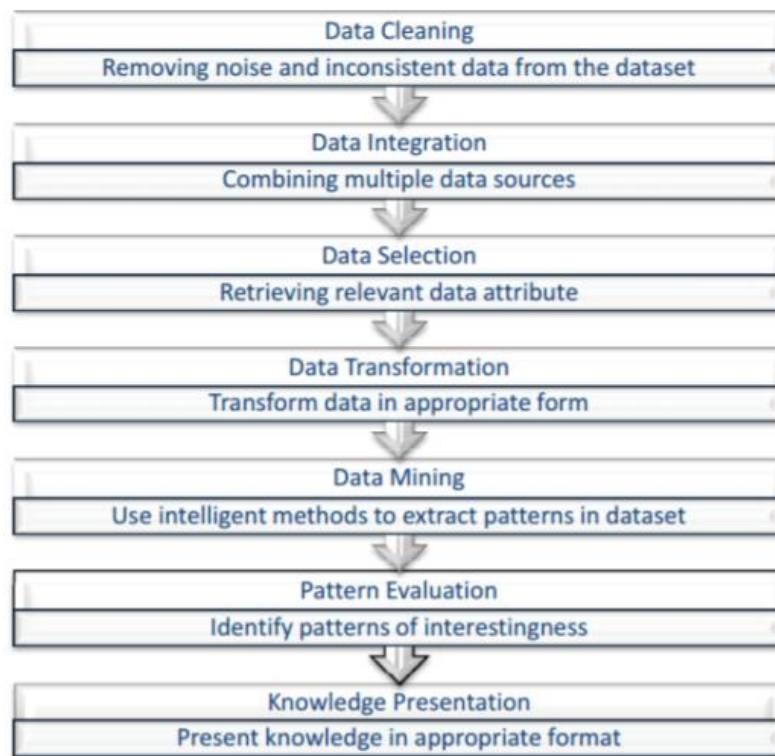


Figure 4: Reference Model for Data Mining Process

The Remove Duplicate operator removes duplicate tweets from the hashtags, #Lindol, #Mindanao, #EarthquakePh and “Lindol” as a mention word. By comparing all these hashtags as

a dataset with each other based on the specified attributes. Two hashtags are considered duplicate if the selected attributes have the same values in them.

The hashtags as data set is loaded using the Retrieve operator. A breakpoint is inserted here so that we can have a look at the dataset. The Remove Duplicates operator is applied on this dataset to remove duplicate examples on the basis of the Lindol, #Mindanao, #EarthquakePh hashtags. The attribute filter type parameter is set to ‘value type’ and the value type parameter is set to ‘nominal’, thus two examples that have same values in their attributes are considered as duplicate.

Created-At	From-User	From-User-Id	To-User	To-User-Id	Language	Source	Text	Geo-Location	Geo-Location	Retweet-Count	Id
#####	Victory	#####			-1.0 en	<a href="r	Let's pray for the protection &			57.0	###
#####	Philippine	#####			-1.0 en	<a href="r	#EarthquakePH:PRC Chapters in			18.0	###
#####	Philippine	#####			-1.0 en	<a href="r	LOOK:PRC Hazards App gave ea			6.0	###
#####	jalanis111	#####			-1.0 en	<a href="r	RT @robertolaprade: 143 volun			1.0	###
#####	Robert Lap	#####			-1.0 en	<a href="r	143 volunteers from @philredc			1.0	###
#####	Rochelle L	#####			-1.0 en	<a href="r	RT @victoryph: Let's pray for th			57.0	###
#####	Kate Tafur	#####			-1.0 en	<a href="r	RT @victoryph: Let's pray for th			57.0	###
#####	jenny	#####			-1.0 en	<a href="r	RT @victoryph: Let's pray for th			57.0	###
#####	MJItalia	#####			-1.0 en	<a href="r	RT @victoryph: Let's pray for th			57.0	###
#####	Charm Lay	#####			-1.0 und	<a href="r	#EarthquakePH ????			.0	###
#####	nixonng	#####			-1.0 en	<a href="r	RT @victoryph: Let's pray for th			57.0	###
#####	Jocelyn Te	#####			-1.0 en	<a href="r	RT @victoryph: Let's pray for th			57.0	###
#####	HaNDA	#####			-1.0 en	<a href="r	RT phivolcs_dost: #Earthquake			.0	###
#####	Inquirer R	#####			-1.0 en	<a href="r	RT @phivolcs_dost: #Earthquak			3.0	###
#####	Volcano V	#####			-1.0 en	<a href="r	RT @phivolcs_dost: #Earthquak			3.0	###
#####	PHIVOLCS	#####			-1.0 en	<a href="r	#EarthquakePH #EarthquakeSo			3.0	###
#####	K	#####			-1.0 en	<a href="r	RT @victoryph: Let's pray for th			57.0	###
#####	HaNDA	#####			-1.0 en	<a href="r	RT phivolcs_dost: #Earthquake			.0	###
#####	Volcano V	#####			-1.0 en	<a href="r	RT @phivolcs_dost: #Earthquak			2.0	###
#####	Inquirer R	#####			-1.0 en	<a href="r	RT @phivolcs_dost: #Earthquak			2.0	###

Figure 5: Raw Data Extracted with Keyword #EarthquakePh

Created-At	From-User	From-User-Id	To-User	To-User-Id	Language	Source	Text	Geo-Local	Geo-Local	Retweet-Count	Id
#####	EMSC	#####			-1.0 en	<a href=""	Map of felt reports received so			51.0	##
#####	EMSC	#####			-1.0 en	<a href=""	#earthquake in #philippines M			21.0	##
#####	EMSC	#####	LastQuake	#####	en	<a href=""	This earthquake (#lindol) was v			12.0	##
#####	sunrise af	#####			-1.0 en	<a href=""	RT @LastQuake: Map of felt re			51.0	##
#####	Brien Mha	#####			-1.0 en	<a href=""	RT @LastQuake: Map of felt re			51.0	##
#####	??	#####			-1.0 tl	<a href=""	RT @idgfelaika: Nawawala, bur			1.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	Magnitude 2 Earthquakes Now			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The TERRORISTS inside 2315 MI			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The subwoofer speakers inside			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The subwoofer speakers inside			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The TERRORISTS inside 2315 MI			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The subwoofer speakers inside			.0	##
#####	Marie♥??	#####			-1.0 en	<a href=""	RT @LastQuake: #earthquake in			21.0	##
#####	Rebuild H	#####			-1.0 en	<a href=""	The latest Rebuild Haiti Better!			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The subwoofer speakers inside			.0	##
#####	kathleen r	#####			-1.0 en	<a href=""	God is watching us from a dista			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The subwoofer speakers inside			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	The subwoofer speakers inside			.0	##
#####	Pasig City	#####			-1.0 en	<a href=""	Earthquakes in Progress from s			.0	##
#####	Guardian_	#####			-1.0 en	<a href=""	RT @dahboo7: Powerful 7.2 #E			17.0	##

Figure 6: Raw Data Extracted with Keyword #Lindol

Created-At	From-User	From-User-Id	To-User	To-User-Id	Language	Source	Text	Geo-Local	Geo-Local	Retweet-Count	Id
#####	EMSC	#####			-1.0 en	<a href=""	major #earthquake shakes #Mi			83.0	##
#####	EMSC	#####			-1.0 en	<a href=""	major #qu	5.5	125.2	41.0	##
#####	EMSC	#####			-1.0 en	<a href=""	Map of felt reports received so			51.0	##
#####	Al Jacinto	#####			-1.0 en	<a href=""	The Mindanao Examiner Regioi			.0	##
#####	Australia	#####			-1.0 en	<a href=""	Wave warning after quake off #			.0	##
#####	sunrise af	#####			-1.0 en	<a href=""	RT @LastQuake: Map of felt re			51.0	##
#####	@Ambra	#####			-1.0 it	<a href=""	RT @Emergenza24: BREAKING [19.0	##
#####	Kashif Aze	#####			-1.0 en	<a href=""	RT @yenisafakEN: Strong #earth			1.0	##
#####	Yeni Şafak	#####			-1.0 en	<a href=""	Strong #earthquake jolts #Minc			1.0	##
#####	MDG	#####			-1.0 en	<a href=""	RT @anadoluagency: Strong ea			2.0	##
#####	ANADOLU	#####			-1.0 en	<a href=""	Strong earthquake jolts #Mind			2.0	##
#####	Brien Mha	#####			-1.0 en	<a href=""	RT @LastQuake: Map of felt re			51.0	##
#####	Travel + V	#####			-1.0 en	<a href=""	RT @Coolmon2009: Popular Pla			14.0	##
#####	Oman Obs	#####			-1.0 en	<a href=""	A strong #earthquake measurin			.0	##
#####	IW1PRT	#####			-1.0 it	<a href=""	RT @Emergenza24: BREAKING [21.0	##
#####	IW1PRT	#####			-1.0 it	<a href=""	RT @Emergenza24: BREAKING [19.0	##
#####	Mags	#####			-1.0 en	<a href=""	Let's keep praying for our broth			.0	##
#####	jérôme kc	#####			-1.0 fr	<a href=""	RT @sputnik_fr: Un #tremblem			19.0	##
#####	Benoit Cai	#####			-1.0 en	<a href=""	RT @IFRCAsiaPacific: .@philrec			18.0	##
#####	Nicole Ro	#####			-1.0 en	<a href=""	RT @PeninsulaQatar: 7.2-magn			1.0	##

Figure 7: Raw Data Extracted with Keyword #Mindanao

Created-At	From-User	From-Use	To-User	To-User-Id	Language	Source	Text	Geo-Local	Geo-Local	Retweet-Count	Id
#####	EMSC	#####			-1.0 en	<a href="	Map of felt reports received so			51.0	###
#####	GMA New	#####	gmanews	#####	tl	<a href="	LOOK: Pinsala ng lindol sa isang			22.0	###
#####	EMSC	#####			-1.0 en	<a href="	#earthquake in #philippines M			21.0	###
#####	chai	#####	californiar	#####	tl	<a href="	@californiamaki Onga e. Feelir			.0	###
#####	dane D-8?	#####			-1.0 tl	<a href="	a 7.2 magnitude earthquake wa			.0	###
#####	Thea Vale	#####			-1.0 tl	<a href="	Quotang quota ang Davao toda			.0	###
#####	DZMM Tel	#####			-1.0 tl	<a href="	Magnitude 7.2 lindol, niyanig a			.0	###
#####	Ryjer Ram	#####			-1.0 tl	<a href="	Sinong naka pansin sa lindol ka			.0	###
#####	daniel	#####			-1.0 tl	<a href="	sana nasira ang school sa lindol			.0	###
#####	Kate Petal	#####			-1.0 tl	<a href="	RT @imfranzdacs: Mga mahal k			53.0	###
#####	daniel	#####			-1.0 tl	<a href="	sana nasira ang school pagkata			.0	###
#####	Daselle Ac	#####			-1.0 tl	<a href="	RT @Ichancaarl: Magnitude 7.2			79.0	###
#####	Remz ??	#####	fayevnln	#####	tl	<a href="	@fayevnln Kung paulit ulit naka			.0	###
#####	DaVinci Q	#####			-1.0 tl	<a href="	Si crush parang lindol, magpap			.0	###
#####	heVrea	#####			-1.0 tl	<a href="	RT @TVPatrol: Magnitude 7.2 li			7.0	###
#####	érika ??	#####			-1.0 tl	<a href="	di man ma predict ang lindol ag			.0	###
#####	taguro ??	#####			-1.0 tl	<a href="	tapos ako nagising lang tapos k			.0	###
#####	Allen Cay	#####			-1.0 tl	<a href="	RT @TVPatrol: Magnitude 7.2 li			7.0	###
#####	taguro ??	#####			-1.0 tl	<a href="	grabe react nila kanina sa lindo			.0	###
#####	Nikka??	#####			-1.0 tl	<a href="	Napahimbing ang tulog ko kani			.0	###

Figure 8: Raw Data Extracted with Keyword “Lindol”

Created-At	From-User	Text	Id
2017-04-29 07:07:50	Maca3rdYear kc	RT @phivolcs_dost: #EarthquakePH #Earth	####
2017-04-29 07:05:29	HaNDA	RT phivolcs_dost: #EarthquakePH #Earthq	####
2017-04-29 07:05:28	HaNDA	RT phivolcs_dost: #EarthquakePH #Earthq	####
2017-04-29 07:05:13	PHIVOLCS-DOS	#EarthquakePH #EarthquakeDavaoOccider	####
2017-04-29 07:03:23	PHIVOLCS-DOS	#EarthquakePH #EarthquakeDavaoOrienta	####
2017-04-29 07:01:06	teddy brul	#EarthquakePH measuring 6.8 hits off Min	####
2017-04-29 07:00:19	MJ Evalarosa	7.2M EQ struck PH early AM.Altho offshore	####
2017-04-29 06:58:52	Aline	RT @HumanityRoad: #Philippines #Earthq	####
2017-04-29 06:50:33	NCT ♡ CONH	RT @phivolcs_dost: #EarthquakePH #Earth	####
2017-04-29 06:47:11	Dylan Quinnell	#Tsunami warnings issued for #Indonesia,	####
2017-04-29 06:46:53	Lyneth Grace	#EarthquakePH #EarthquakeDavaoOccider	####
2017-04-29 06:44:27	Xavier Johanss	RT @SuPerWolf_: #EarthquakePH #Sarang	####
2017-04-29 06:40:38	HaNDA	RT phivolcs_dost: #EarthquakePH #Earthq	####
2017-04-29 06:37:20	markruiz	thoughts and prayers go out to all my relat	####
2017-04-29 06:36:48	Ella Hermonio	INGAT PO TAYONG LAHAT#EarthquakePH #	####
2017-04-29 06:33:31	PHIVOLCS-DOS	#EarthquakePH #EarthquakeDavaoOccider	####
2017-04-29 06:31:16	Nicole Rodovsk	RT @HumanityRoad: #Philippines #Earthq	####
2017-04-29 06:29:45	AlterStation™	#EarthquakePH #Sarangani Sarangani #Ear	####
2017-04-29 06:21:58	Jolo Fries ??	Dahil marami pang tulog, hindi pa nagte-ti	####
2017-04-29 06:17:17	Humanity Road	#Philippines #EarthquakePH #Earthquake	####

Figure 9: Data Cleansed

3. Conclusion

In this research, we used hashtags relative to earthquakes as dataset to train and validate the classifier. In future, data from different extreme natural hazard events should be examined and integrated to create a common classifier so that it can be applied to automatically categorize the tweets into various categories during a disaster.

This method of data cleaning could help support real-time disaster management and investigation by monitoring consequent events while tweets are streaming, and mining useful information to help in the decision-making of the Local Government Units in the Philippines. This paper presents methods to classify tweets for establishing geographic situational awareness, and a framework that can be applied to separate tweets into those categories.

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