Twitter Explodes with Activity in Mumbai Blasts!
A Lifeline or an Unmonitored Daemon in the Lurking?

Aditi Gupta and Ponnurangam Kumaraguru

Indraprastha Institute of Information Technology, Delhi
{aditig,pk}@iiitd.ac.in

precog.iiitd.edu.in

Abstract. Online social media has become an integral part of every Internet users' life. It has given common people a platform and forum to share information, post their opinions and promote campaigns. The threat of exploitation of social media like Facebook, Twitter, etc. by malicious entities, becomes crucial during a crisis situation, like bomb blasts or natural calamities such as earthquakes and floods. In this report, we attempt to characterize and extract patterns of activity of general users on Twitter during a crisis situation. This is the first attempt to study an India-centric crisis event such as the triple bomb blasts in Mumbai (India), using online social media. In this research, we perform content and activity analysis of content posted on Twitter after the bomb blasts. Through our analysis, we conclude, that the number of URLs and @-mentions in tweets increase during the time of the crisis in comparison to what researchers have exhibited for normal circumstances. In addition to the above, we empirically show that the number of tweets or updates by authority users (those with large number of followers) are very less, i.e. majority of content generated on Twitter during the crisis comes from non authority users. In the end, we discuss certain case scenarios during the Mumbai blasts, where rumors were spread through the network of Twitter.

Keywords: Online Social Media, Crisis Management

1   Introduction

With the advent of Web 2.0 technologies two major changes have occurred in the landscape of Internet usage. Firstly, Internet has become the first choice as a source of latest news and information for its users, bypassing other traditional media like television. Secondly, it has given a sense of power to common people to express their ideas and promote campaigns. The unmonitored and anonymous nature of this media, makes it a security and privacy threat to its users. A crisis situation creates fear, unrest, possibility of chaos among people. In today's technology and Internet driven world, social media is gaining popularity day

---

This is a technical report version. For any details please contact pk@iiitd.ac.in.

by day. Twitter is one such micro-blogging service, which has also emerged as a major news source and information dissemination agent. Users on Twitter, create their own public / private profiles and post messages which can be viewed by others. The maximum length of user's post can be 140 characters on Twitter. The message posted by a user is called a *tweet*. There have been studies which have highlighted the role of Twitter as a news media and platform to gauge public sentiments [6].

The city of Mumbai (India) had triple bomb blasts on July 13th, 2011. Seventeen people were killed and 130 were injured in these blasts. All three blasts took place within a time period of 10 minutes (the fist took place at 13:24 hours at Zaveri bazaar, second at 13:25 hours at Opera House and third at 13:35 hours at Dadar). [1] What followed the blasts, apart from the loss of lives, injuries and loss of assets, was a complete state of panic and chaos in the entire city of Mumbai. There was commotion on roads, telephone lines were jammed and people were left stranded and helpless. At such times, when telephone and mobile lines were jammed, Internet and social media came to the rescue of many. Soon after the explosions, the activity on online social websites increased manifold, users on Facebook and Twitter posted updates about news, the ground situation, news of their well being and offered help to those in need. [2] [3] Social media platform, emerged as a vast data source of information about what followed as an after math of the events not only in Mumbai but all over the World. In this report, we analyzed the social media website Twitter, for its activity after the bomb blasts in Mumbai.

In this report, we performed content analysis of the tweets to conclude that the percentage of tweets carrying URLs and @-mentions increases during a crisis like bomb blasts. Another observation was that, people with high number of followers tweet very few updates during such an event. In the last section, we discuss certain specific example cases where false rumors emerged during the Mumbai blasts.

The roadmap of this report is as follows: Section 2 explains the related work to our research, highlighting some prior research done on Twitter. Section 3 describes the methodology followed and data collection done for this research. We will discuss the analysis done in Section 4. Section 5 contains the discussion of the observations and results obtained. Section 6 briefly mentions a few additional observations we made during our analysis.

2   Related work

In recent years, many researchers have explored the role and activity of online social media during different types of crisis situation. Mendoza et al. explored behavior of Twitter users for crisis response activity, during the 2010 earthquake

---

[1] All time stamps mentioned in this report are present in GMT.

[2] http://articles.timesofindia.indiatimes.com/2011-07-13/mumbai/29768846_1_blast-victims-mumbai-blasts-twitter-and-facebook

[3] http://www.economist.com/blogs/babbage/2011/07/online-crisis-management

in Chile [7]. They also proposed a machine learning classification mechanism to automate detection of tweets related to rumors. Longueville et al. analyzed Twitter feeds during forest fire event in France and showed how location based social networks to acquire spatio-temporal data [4]. Prominence of Twitter as a news media was established by Kwak et al., according to their work, 85% topics discussed on Twitter are related to news [6]. They extracted patterns between users profile properties like number of followers and followees to the tweeting / re-tweeting activity on Twitter.

Another closely related work, was done by Oh and Agrawal, they analyzed the Twitter stream during the 2008 Mumbai attacks [8]. They applied social awareness theory to show how information available on online social media during the attacks aided the terrorists' decision making. Their project was funded by NSF, to explore the role of Twitter during the 2008 Mumbai attacks. [4] A team at NICTA is working at developing a focussed search engine for Twitter and Facebook that can be used in humanitarian crisis situation. [5] Aparna Basu in her paper analyzed the social network of terrorist organizations in India, to detect influencers in the network [1]. Hughes et al. in their work on behavior of Twitter users during crisis, compared the properties of tweets and users during an crisis and normal situations [5]. They showed that the use of URLs in tweets increase and @-mentions decrease during emergency situations. An automated framework to enhance situational awareness during emergency situations was developed by Vieweg et al. They extracted geo-location and location-referencing information from users tweets [9].

During the Mumbai blasts on 13th July, 2011 there was a surge in activity on Twitter and Facebook as quoted by many national level newspaper daily. [6]

3   Data collection

The three serial blasts in Mumbai occurred on 13th July, 2011 between 13:24 and 13:35 hours. As soon as the news of blasts spread, there was a surge in activity on the social networking websites like Twitter. Trends related to Mumbai blasts soon became *trending topics* [7] on Twitter in India and other countries all around the globe (for e.g. United Kingdom, Canada and Australia).

We collected our data using the trending topics in India, as they provided us with a more varied range of query parameters. Castillo et al. also used a similar technique, of collecting tweet data using current trending topics, in their research work assessing credibility of news topics on Twitter [3]. We queried Twitter *trends API* after every 3 hours for new trending topics, and collected

---

[4] http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0926376

[5] http://leifhanlen.wordpress.com/2011/07/22/crisis-management-using-twitter-and-facebook-for-the-greater-good/

[6] http://articles.timesofindia.indiatimes.com/2011-07-13/mumbai/29768846_1_blast-victims-mumbai-blasts-twitter-and-facebook

[7] Trending topics on Twitter is a set of ten most popular topics currently on Twitter. http://support.twitter.com/entries/101125-about-trending-topics

tweets corresponding to them as query search parameters for the *streaming API* of Twitter. Few of the trending topics related to Mumbai blasts were *#mumbai, #mumbaiblasts, dadar, opera house, andheri, #needhelp, #here2help*. We collected data on the Mumbai attacks from July 13th till 17th July, that is till the time *#mumbaiblast* remained as a trending topic in India. As the majority of tweets were posted just after the incident, the data set we will consider for this report is for the tweets which were posted on Twitter for the Mumbai blast on 13th, 14th and 15th July, 2011. In total we collected 2,711,061 tweets by 1,172,766 unique users. Out of these tweets related to Mumbai blasts were 100,075 tweets, tweeted by 51,633 unique users during these three days.

Table 1 gives the descriptive statistics of these tweets. On 13th July, there were 53,809 tweets and retweets posted on Twitter related to Mumbai blasts. On 14th and 15th July, 45,162 and 973 posts related to Mumbai blasts were tweeted respectively.

Table 1. Descriptive statistics for the Twitter dataset for 13th, 14th and 15th July, 2011.

Total tweets	2,711,061
Total unique users	1,172,766
Total tweets for Mumbai Blasts	100,075
Total unique users for Mumbai Blasts	51,633
First tweet in our dataset at	Wed Jul 13 13:40:44 2011
Last tweet in our dataset at	Fri Jul 15 21:41:21 2011
Unique URLs shared	19,173
Number of singleton tweets	68,739
Number of retweets	31,336

Before we begin the analysis of our dataset, we assess the quality of the data. Figure 1, represents the number of tweets per user for all the users who tweeted on Mumbai blasts. Since, the difference in range of number of users and average number of tweets per user was very high, we applied log function on the X-axis and Y-axis values, to improve the visual effect of the graph. We clearly observe a power law curve for the number of tweets per user, which is in agreement with previous research work on Twitter [6]. In the next section we present the detailed analysis of our work.

4 Analysis

We first analyzed the content of the tweets like the words, URLs and @-mentions in a tweet. Next we explore the relationships between tweets, users and their attributes like number of followers, friends, etc.
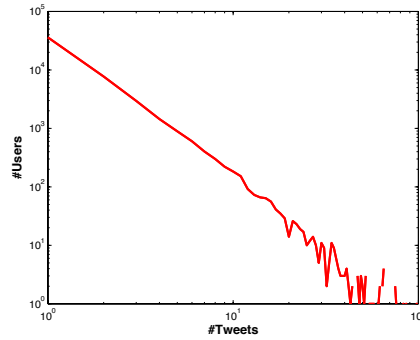
Fig. 1. The above graph shows the log distribution of number of tweets per user in our dataset. We get a power law graph which is in agreement with the previous research done on Twitter [6].

4.1   Content Analysis

There have been previous work on Twitter, to analyze properties of tweet content during normal circumstances versus crisis situations. We analyzed the URLs, @-mentions and the vocabulary of words in the tweets in our dataset and compared them to earlier work done on the subject.

URLs and @-mentions The posts on Twitter can contain URLs along with text in the tweets. Users share URLs of news articles, images, etc. In the 100,075 tweets we collected, for the analysis that follows we will consider only 68,739 tweets, which are not retweets. We observed that nearly 40.28% of tweets (27,693) contained URL links and 28.16% tweets (19,363) contained @-mentions in them. In the work done by Hughes et al., they showed that during a crisis situation the number of tweets containing URLs increase than in normal situations (40-50% tweets contained URLs in case of crisis situation, while 25% in normal situations) [5]. The number of tweets containing @-mentions decrease to a 6-8% in crisis scenarios than in normal, where 22% tweets contained @-mentions. The percentage of tweets containing URLs agrees with previous literature, but the percentage of tweets containing @-mention is not in line with the previously known facts. We got around 28% tweets excluding retweets that contained @-mentions in them, which is slightly higher than what Hughes et al. found for normal circumstances. Hence, our results highlight the fact that a higher number of people share external resources via URLs and reply or mention other users in their tweets. Hence, we can conclude that, during the time of a crisis there resources (like URLs) and users (@-mentions) who are referenced by people in their tweets. Thus, monitoring these resources and users can indicate the quality of information flowing in the network.

There were 19,173 unique URLs that were shared on Twitter from 13th to 15th July is posts related to the Mumbai blasts. Most of the URLs on Twitter

use URL shortener services, and currently we are not expanding the URLs to check their uniqueness in the expanded form, hence there may be some URLs in our dataset which point to the same website.

Vocabulary Analysis We performed a vocabulary analysis of the tweets by studying the frequency of words in tweets day-wise for the three days under consideration. A tag-cloud of such terms indicates the thoughts and sentiments of people on each day. We saw some characteristic differences in the terms in tweet on all three days. Words like *injured, attack, help, here2help and hospital* were among the most prominent words on day 1. There were tweets of mainly two topics popular on day 1, first which propagated news about the attack and number of people injured and the second which were from users who were trying to coordinate help to those affected during the blasts. The tag cloud of day 3, presented a different composition of topics than day 1, which users tweeted regarding Mumbai blasts.

4.2 User Analysis

In this section, we try to analyze the user profiles on Twitter. We use certain metrics like number of retweets, friends and followers of a user, to act as indicators to the truthfulness / reliability of tweet posts done by a user. Secondly, we use another property of network of users, known as @-mentions in Twitter. @-mentions may be used by a user in his / her tweets if its a re-tweet, a reply to someone's tweet or marking certain user in one's tweets.

We will now explore the relationship between the number of followers and the tweet activity by users and the re-tweet counts of their tweets. Figure 2 shows the relationship between tweets / retweets and the number of followers and friends a user has. Since, the number of followers varied from 1 to 6 million, the number of tweets by each user had a maximum value of 121, and the number of re-tweet count varied from 0 to 1600, we took log of values while plotting the graph, to improve the visualization.

We observe from Figure 2(a) that the number of tweets by people with large followers (who are generally like celebrities, media companies and government owned account) are quite less. Though the number of posts were less by such users with large number of followers, these posts registered high number of retweets.

Next, we find out which users on Twitter post maximum status updates, or who are the top Twitter users. Here we consider only the new tweets being generated, excluding retweets. We can observe the relationship between the top users and their number of followers and friends in Figure 3. In an earlier work done by Mendoza et al., they showed a very steady decay in number of tweets as the number of followers decrease. In our results, though we find that the average number of followers of top 50 users is above 9,000, but after that there is a sharp decline in number of posts. For top 100 and 350 users, we see the average number of followers is quite low.
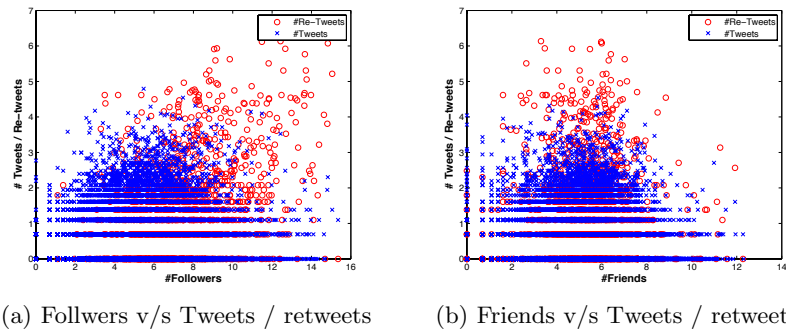
(a) Follwers v/s Tweets / retweets   (b) Friends v/s Tweets / retweets

Fig. 2. The above graphs shows the log of number of followers / friends on the X-axis and the log of number of tweets/retweets on the Y-axis. The left graph shows that the number of tweets by authority users (i.e. users with a large number of followers) are very less. Yet, the number of retweets for the tweets done by them are quite high.

Though we must point out, that most of earlier work done was on developed nations like US, France and Japan, hence the differences may be this may be attributed to the fact that government and media in developing nations like India, have only recently started becoming active on social media like Twitter.

4.3   Rumors on Twitter During the Mumbai Blasts

At the time of such crisis, malicious elements can take advantage of such situations in various ways. Like they can take advantage of the emotional and sentimental vulnerabilities of people at such times to exploit them.

Some more rumors which propagated on Twitter during the Mumbai blasts:

- Rumors were spread about a fourth blast. Some tweets even specified locations of 4th blast as lemington street, Colaba and Charni. Around 500+ tweets and retweets were posted about this.
- False blood required news spread Twitter. They were initiated by a user, and around 2000 tweets and retweets were made regarding this by Twitter users. It led a lot of chaos, as many people reported at specified hospitals to donate blood, but were turned back by the hospital authorities as there blood-banks were sufficiently filled [8].

5   Discussion

It is the first attempt to do an India-centric study of the response and activity stream on Twitter in an crisis situation. For this case study, we consider the

---

[8] http://blogs.wsj.com/indiarealtime/2011/07/15/mumbai-blasts-did-twitter-really-help/
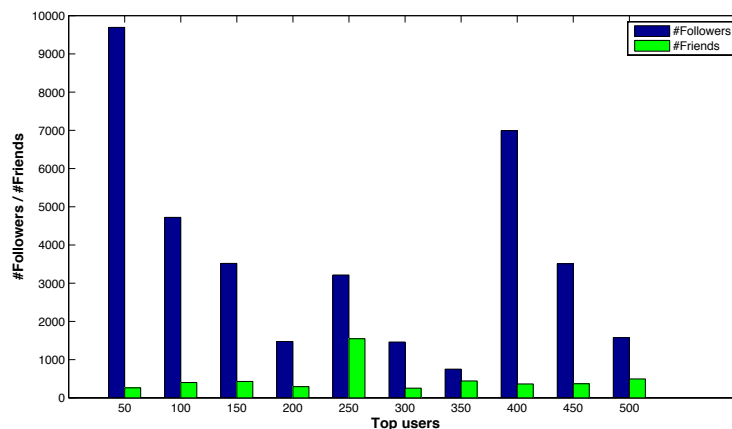
Fig. 3. This graph shows the variation in average number of friends and followers for the top 500 users (maximum number of tweets) during the Mumbai Blasts. We observe that the average number of followers of top 500 users of Twitter during the Mumbai blasts are very low. For users among the top 100 to top 350 the number of followers are less than 5000.

triple bomb blasts on 13th July, 2011 in Mumbai. Understanding the dynamics and behaviors of online social media during a crisis situation, would help in developing technology to manage social media on the Internet, and prevent any damage being inflicted by them in such situations. Knowledge about the impressions and opinions of public helps in making policy-decisions. We performed content based analysis on the tweets collected during and after the Mumbai blasts. While analyzing the URLs present in tweets, we found that around 40% tweets contained URLs. As shown by previous research done on Twitter, a larger percentage of tweets carry URLs in time of crisis as compared to normal situations (where around 25% tweets contain URLs). Thus at times of crisis, like the Mumbai blasts, Twitter is used for discussions as well as sharing external resources through URL links. Further, we found around 28% of tweets containing @-mentions (without retweets). A high number of @-mentions can be explained by the fact, that at times, like the Mumbai blasts Twitter was being used as a medium by its users to exchange and coordinate information / news amongst each other, rather than its usual role as a micro-blogging forum to express one's personal opinion. We observed that the number of tweets generated by people with large follower base were very few. Thus, majority of content generated at the time of crisis was from unknown users. It was also observed that, though the number of posts were less by users with large number of followers, these posts registered high numbers of retweets. We also extracted some false news and rumors that were spread during these blasts on Twitter. With the lack of

any source on Twitter to verify these news as true or untrue, many of them were tweeted and retweeted hundreds of times.

6   Some Further Observations

In addition to the results we observed during our analysis, there were certain other issues like privacy threats during the Twitter activity after the blasts. People openly tweeted their phone numbers on social media websites like Twitter, since at such moment of crisis people wished to reach out to help others. But, long after the crisis was over, such posts still remained publicly available on the Internet. Similarly people also openly posted their blood group, home address, etc. on Twitter to offer help to victims of the blasts. Exploring such privacy issue and breaches are potential research questions.

Acknowledgments

References

1. Aparna Basu. Social network analysis of terrorist organizations in india. *North American Association for Computational Social and Organization Sciences*, 2005. http://www.casos.cs.cmu.edu/events/conferences/2005/2005_proceedings/Basu.pdf.
2. Kathleen Carley, Matthew Dombroski, Max Tsvetovat, Jeffrey Reminga, and Natasha Kamneva. Destabilizing dynamic covert networks. In *Proceedings of the 8th International Command and Control Research*, Vienna, VA, 2003. Evidence Based Research.
3. Carlos Castillo, Marcelo Mendoza, and Bárbara Poblete. Information Credibility on Twitter. In *Proceedings of World Wide Web Conference (WWW)*, pages 675–684. ACM Press, February 2011.
4. Bertrand De Longueville, Robin S. Smith, and Gianluca Luraschi. "omg, from here, i can see the flames!": a use case of mining location based social networks to acquire spatio-temporal data on forest fires. In *Proceedings of the 2009 International Workshop on Location Based Social Networks*, LBSN '09, pages 73–80, New York, NY, USA, 2009. ACM.
5. Amanda Lee Hughes and Leysia Palen. Hughes et al. twitter adoption and use in crisis twitter adoption and use in mass convergence and emergency events.
6. Haewoon Kwak, Changhyun Lee, Hosung Park, and Sue Moon. What is twitter, a social network or a news media? In *Proceedings of the 19th international conference on World wide web*, WWW '10, pages 591–600, New York, NY, USA, 2010. ACM.
7. Marcelo Mendoza, Barbara Poblete, and Carlos Castillo. Twitter Under Crisis: Can we trust what we RT? In *1st Workshop on Social Media Analytics (SOMA '10)*. ACM Press, July 2010.
8. Onook Oh, Manish Agrawal, and H. Raghav Rao. Information control and terrorism: Tracking the mumbai terrorist attack through twitter. *Information Systems Frontiers*, 13(1):33–43, 2011.

9. Sarah Vieweg, Amanda L. Hughes, Kate Starbird, and Leysia Palen. Microblogging during two natural hazards events: what twitter may contribute to situational awareness. In *Proceedings of the 28th international conference on Human factors in computing systems*, CHI '10, pages 1079–1088, New York, NY, USA, 2010. ACM.