

Exploratory Study of tweets during India's Prime Minister Shri Narendra Modi's visit to United States in 2014

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ABSTRACT

Social networking sites serve as a platform for users to interact with each other through posts, private messages, pictures and videos. Twitter, a microblogging service, is one of the most popular social networking sites, since its inception in 2006. In this paper, we study the tweets posted by users during India's Prime Minister, Mr. Narendra Modi's visit to the United States in the year 2014. Major findings of this paper are – (1) Most popular event during Modi's US visit, (2) life of events that happened during his US visit, (3) different locations from where most users tweeted about this event, (4) public sentiments about his US visit, and (5) correlation between different public sentiments and stock markets' indices (if any), during his US visit.

Categories and Subject Descriptors

H.3.1 Content Analysis and Indexing – Dictionaries; H.3.3 Information Search and Retrieval – Information filtering, query formulation.

General Terms

Algorithms, Human Factors.

Keywords

Twitter, Hashtags, User mentions, API, Python, SQL, Sentiment Analysis, Hadoop, Map Reduce.

1. INTRODUCTION

As the information through social media spread with enormous speed and data is generated at a very fast rate, they have become a valuable source for information retrieval. Twitter, is an example of one of the most popular social networking site, which has been popular, since its inception in the year 2006. As of March 31, 2014, number of average monthly active users (MAUs) on Twitter were 255 million, an increase of 25% year-over-year [11]. Twitter is frequently used by its users to share their opinions about various events, happening around the world. Since Twitter data represents the "voice of the people", it has been widely used for various studies.

In this paper, we study the tweets posted by users during

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India's Prime Minister, Mr. Narendra Modi's United States visit, in the year 2014.

2. BACKGROUND

Social media websites were initially invented only for the social interaction and social participation. However, with their growing popularity and the large data they possess, they are being greatly acknowledged by number of researchers and data scientists. The social media data, in particular, the Twitter data or the tweets, due to their easy availability, have been analyzed in the past for various purposes, such as sentiment analysis [1, 4, 7, 8, 12, 13], crisis informatics [5, 6], situational awareness [9], predictions [2] etc. Research reports that Tweets have been widely analyzed for their sentiments. Sentiment analysis are valuable to determine the success and public attitudes for an event over the other. They are also useful to predict the possible outcome(s) of an event. Studies have been conducted to determine the correlation between the events and their corresponding public sentiments using various available or newly developed frameworks and tools [1, 7]. Several studies concerning the public sentiments across the election campaigns such as towards the Australian federal election 2010 [13], Singapore presidential election 2011 [8] and the US presidential election 2012 [4] have been conducted. Some studies [2] have also investigated if public sentiments on tweets can be used to predict the stock market.

Our study is novel, as so far, at least in our knowledge, there hasn't been any study on India's Prime Minister, Mr. Modi's US visit, 2014. We have not only done the exploratory study of his US visit, but we also found the most popular event, life cycles of various events, public sentiments, and global participation of public during his US visit. We also found the correlation between the public sentiments during different events that occurred during Modi's US visit, with the fluctuations in the stock market during that period.

2.1 Event of Study- India's PM's US visit, 2014

Prime Minister of India, Mr. Narendra Modi visited the United States to attend United Nations General Assembly 2014. His 5 day visit (Sept 26 – Sept 30) grabbed lot of media attention across different parts of the World. The main highlights of his visit were: his address at- the United Nations General Assembly, Madison Square Garden, and Council on Foreign Relations, followed by his meeting with top US Company CEOs and the summit meeting with the US President Mr. Barack Obama. (For detailed itinerary of Modi's US visit [15], see Table 1).

Table 1. Modi's US visit itinerary (Sept 26 – 30, 2014)

Date	Events
September 26	<ul style="list-style-type: none"> - Arrived in NY - Met director of National Cancer Institute
September 27	<ul style="list-style-type: none"> - Visited Ground zero and 9/11 memorial - Addressed the UN General Assembly, 2014 - Met former NY mayor - Addressed annual Global Citizen Festival at Central Park - Met group of eminent Indian-Americans - Met NY Governor, SC Governor and MD Governor
September 28	<ul style="list-style-type: none"> - Addressed Indian-American community reception at Madison Square Garden in midtown Manhattan - Met representatives of the Sikh Community in the US and Canada - Met distinguished Persons of Indian Origin (PIO) - Met members of the US Jewish community - Attended dinner reception by Indian Ambassador to the US
September 29	<ul style="list-style-type: none"> - Had a breakfast meeting with top CEOs of 11 US Companies - Met Bill Clinton and Hillary Clinton - Addressed Council on Foreign Relations - Arrived Washington DC - Had a private dinner with US President Obama
September 30	<ul style="list-style-type: none"> - Visited Lincoln and Martin Luther King Jr. memorial and Gandhi statue in front of Indian embassy in Washington - Had summit meeting with President Obama at the White House - Met with US Vice President Mr. Joe Biden and US Secretary of State John Kerry at the State Department - Met with Congressional leaders - Addressed the US-India Business Council (USICC) - Left for India

3. RESEARCH DESIGN

The following sections discuss about our research motivation and research questions in detail.

3.1 Research Motivation

Mr. Narendra Damodardas Modi- the 15th and the current Prime Minister of India, joined his office in May 2014. He is known to be very active on social media, and is at times, referred as social media politician [10]. He has an official online account on Twitter, Facebook, Google+, Pinterest, Flickr, YouTube, LinkedIn etc. His communications on social media are widely acknowledged and are responded by large number of people. Mr. Modi is the most followed Asian leader and the third most followed world leader (behind US President Barack Obama and Pope Francis) on Twitter [3]. Among the politicians, he also has the second most number of fans (behind US President Barack Obama) on Facebook [10].

Narendra Modi's visit to the United States in year 2014 is considered as one of the most important milestone in his tenure of

being the Prime Minister of India. Mr. Modi reportedly used his active Twitter account for all his public communications, during his US visit. He also created and promoted his own hashtag “#ModiInAmerica” for his US visit. Since his Twitter account is one of the fastest growing politician account, we suspected that he would share some of the important information and garner immense responses from the public there. Tracking these public communications gave us important information about the public sentiments on the announcements made by Modi during his US visit.

3.2 Research Questions

This study answers the following research questions:

- What was the most popular event during Modi's US visit?
- When was a particular event most discussed, during or after Modi's US visit?
- What were the different locations, from where most users tweeted about Modi's US visit?
- What were the overall public sentiments during Modi's US visit?
- What were the public sentiments during different events that happened during Modi's US visit?
- How did public sentiments during Modi's US visit, affect stock exchange?

4. RESEARCH METHODOLOGY

The following sections discuss data collection and data analysis in detail.

4.1 Data Collection

Twitter data around Modi's US visit in year 2014 were collected during the timeframe Sept 26 (the first day of Modi's visit) to Oct 4 (four days, post the event). Data were collected by running a python script, using a Twitter streaming API. To capture the most relevant tweets, appropriate hashtags and user mentions were used as filters. And to keep up with the trending topics, these filters were updated regularly. The data collected were stored as JSON in a .csv file for preprocessing. Total collected data was more than 4.5 GB, which comprised of a total of approximately 1.5 million tweets. Following sections discuss the hashtag and the user mentions filters in detail.

4.1.1 Hashtag Selection

Hashtag selection played a major role in the data collection. As we began with the data collection, we initially started looking at the higher level hashtags such as #NaMO, #Modi, #Feku, #ModiSir, #PMNaMO, #ModiSpeech, #Obama, #BarackObama, #India, #America, #US, #BJP, #ProudOfNamo, #LionNamo, #modimania etc. However with the event progress and the arrival of new hashtags, we got more specific with our hashtag filters. Later added hashtags included: #PMNaMoVisitsUS, #ModiInAmerica, #ModiInUSA, #ModiInUS, #ModiMeetsAmerica, #PMUSvisit, #Namoste, #namosteamerica, #KemChhoAmerica, #UNGA2014, #UNGA, #NaMoinUN, #ModiAtUN, #MadisonSquare, #MadisonSquareGarden, #MODIson, #ModiAtMadison, #PMModiAtMadison, #namoInMadison, #MakeInIndia, #WSJModi, #NewYorkCity, #RajdeepSlapped, #ShameAbroad,

#AntiNationalistRajdeep, #ISTandWithRajdeep, #ModiMeetsCEOs, #ModiAtCFR, #ModiAtWashingtonDC, #ModiAtWhiteHouse, #NaMoMeetsObama, #NaMowithObama, #IndiaUSPartnership, #USIndiaPartnership, #ModiObamaMeet, #ModiMeetsObama etc. After deciding on the most relevant hashtags, all other broader and/or irrelevant keywords such as #India, #America, #US, #Obama, #BarackObama, #NewYorkCity, #RajdeepSlapped, #ISTandWithRajdeep etc. were removed. These continuous filter updates were necessary for robust data collection. Hashtags were decided both intuitively and from the online services like <http://whatthetrend.com/>, <http://talltweets.com/trends/>, <http://trendsmap.com/>, <https://www.hashtags.org/>. Table 2 shows the list of event related hashtags.

4.1.2 User Mentions Selection

Other than hashtags, we also used the user mentions as our filters. We initially began looking at more generic user mentions like @BarackObama, @narendramodi, @narendramodi_in, @NamOINDIAPM, @Trustnamo, @Narendramodi_PM, @ForceNamo, @Narendramodi_G, @PMOIndia, @BJPGujarat, @BJPcentralmedia, @BJP4India and @BJP_Gujarat. Later to improve our data collection, we removed all the irrelevant user mentions and tracked only the following user mentions- @narendramodi, @narendramodi_in, @NamOINDIAPM, @TrustNamo, @Narendramodi_PM and @PMOIndia.

4.2 Data Preprocessing

The collected data through Twitter streaming API was initially stored in the JSON format. These JSON files had the information of all the fields provided by the twitter API. These JSON files were first formatted using a JSON formatter and all the relevant fields were extracted from it. Thereafter, a database with all the relevant tables and columns was created. All the extracted data were then pushed into these tables. Next the data were cleaned by removing all the off-topic tweets. The off-topic tweets were the tweets either with irrelevant hashtags or user-mentions, or context.

4.3 Data Analysis

The cleaned data were then used to answer our research questions. Following sections discuss the data analysis per research question in detail.

4.3.1 Event's Popularity

Once the data was preprocessed, it was analyzed to see what event during Modi's US visit, was most popular. To learn about popularity of events, we determined the event with the most tweets, the hashtag with the most tweets and the day with the most tweets.

4.3.2 Event's life

Next, we analyzed to see the life of events that happened during Modi's US visit, for example, when did the chatter about specific event began, and how long did it stay? This information is useful in determining the overall success of an event.

4.3.3 Location participation

Next, the preprocessed data was analyzed for deriving the location information. Only the tweets with valid location information were considered and the location(s) provided by user(s) was (were) assumed to be true. Since, there is no uniformity in the standards of mentioning one's location, people mention their location in their own ways. For example, different people wrote different things for a same location, such as "USA", "US", "The U.S.", "US of A", "America" and so on. And thus we manually assigned each tweet with a given location, a location with our required standards.

Table 2. Event related Hashtags

Events	Twitter Hashtags
Sept 26 - 30, 2014 Modi's US visit	#PMNaMoVisitsUS, #ModiInAmerica, #ModiInUSA, #ModiInUS, #ModiMeetsAmerica, #PMUSvisit, #KemChhoAmerica, #NaMoInUS, #Namoste
Sept 27, 2014 Modi addressed United Nations General Assembly	#UNGA2014, #UNGA, #NaMoinUN, #ModiAtUN
Sept 28, 2014 Modi addressed Madison Square, Manhattan	#MadisonSquare, #MadisonSquareGarden, #MODIson, #ModiAtMadison, #PMModiAtMadison, #namoInMadison
Sept 29, 2014 Modi met CEO's of 11 US Companies	#ModiMeetsCEOs
Sept 29, 2014 Modi addressed Council on Foreign Relations (CFR)	#ModiAtCFR
Sept 29, 2014 Modi had a private dinner with President Obama Sept 30, 2014 Modi did summit meeting with President Obama at the White House	#ModiAtWashingtonDC, #ModiAtWhiteHouse, #NaMoMeetsObama, #NaMowithObama, #ModiObamaMeet, #ModiMeetsObama

4.3.4 Sentiment Analysis

The preprocessed data was further analyzed for their sentiments. We used Hive and Hadoop to compute the tweet's sentiments. The sentiment of each tweet was calculated based on the words in it. The scores were read from a dictionary. This dictionary contained all the words and each word had a score (0, 1, 2). This dictionary was taken from Hortonworks website (hortonworks.com). Based on these scores, a tweet was analyzed for each word and according to a cumulative score of a tweet, a sentiment score for negative, neutral and positive, a score of 0, 1, and 2 was assigned respectively.

4.3.5 Public Sentiments and Stock Exchanges

In order to study the correlations between Modi's US visit and stock market, we collected data around the most important stock exchanges across India and America. We studied National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) from India, and DOW JONES and National Association of Securities Dealers Automated Quotations (NASDAQ) from America. Stock markets for their sentiments along with the highs and the lows of the exchange indices were studied in the timeframe 15th Sept - 17th Oct, 2014. Analyzing stock exchanges for a month was important as the event occurred during the weekend and the stock exchanges are closed on Saturdays and Sundays, thus the effect of Modi's visit could have only been observed after few days on the stock market. Other reason was to know how did the indices of the markets behaved when the event was approaching or settled down.

5. RESULTS

This section describes the findings of this paper in detail.

5.1 Event's Popularity

To learn the event's popularity, first we determined the most tweeted day during Modi's US visit (see Figure 1). Result showed that the most tweeted day was September 28, 2014 – the day of Modi's Madison Square address. We realized that the most tweeted day during Modi's US visit, was not self-sufficient measure of event's popularity, as there might be a possibility that most people who tweeted on September 28, talked about Modi's US visit in general and not Modi's Madison Square address in particular.

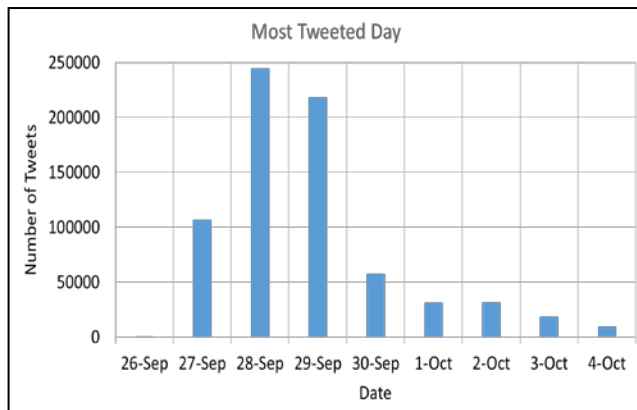


Figure 1. Most Tweeted Day during Modi's US visit.

Thus a decision was made, to analyze the event's popularity with the hashtag popularity. Number of tweets per hashtag were calculated (see the top most popular hashtags, Figure 2), and it was learnt that hashtag #ModiAtMadison was the most popular hashtag, which might imply that Modi's Madison Square address was the most popular event.

But since #ModiAtMadison was not the "only" hashtag specific to Modi's Madison Square address, and there were other hashtags, specific to this event as well, which include #MadisonSquare, #MadisonSquareGarden, #MODison, #PMModiAtMadison, and #namoInMadison. Thus we suspected if the most popular hashtag was enough to judge the event's

popularity or not. As a result we decided to combine the hashtags related to a particular event (for combined hashtags, see Table 2), and then we further determined the total number of tweets per event (see Figure 3). Our results indicate that Modi's Madison Square address was the most talked about event, rather the most popular event.

Thus, with all our above analysis, we conclude that Modi's address to the Indian – American community at Madison Square Garden, New York on September 28, 2014 was the most popular event during Modi's US visit.

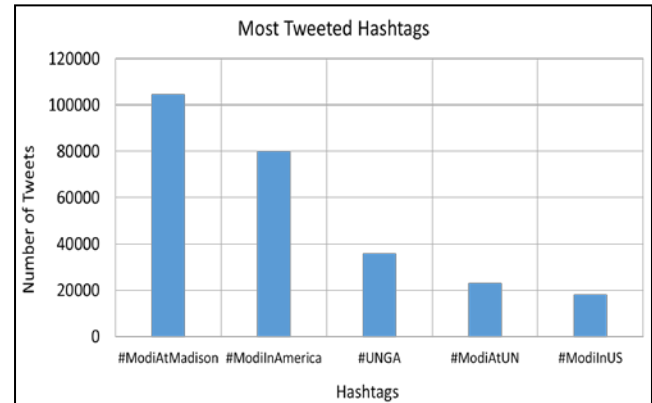


Figure 2. Most Tweeted Hashtag.

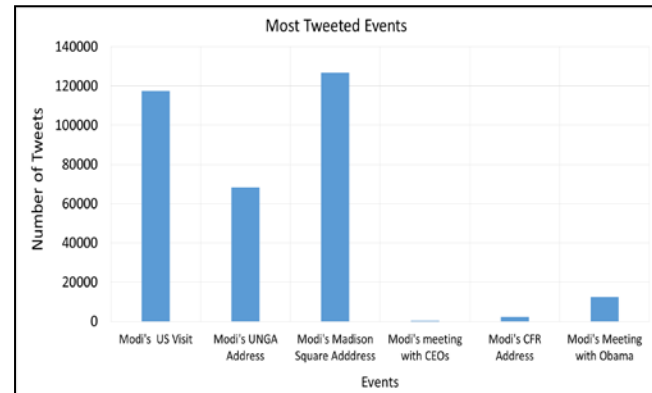


Figure 3. Most Tweeted Event of Modi's US visit.

5.2 Event's Life

With our huge tweets collection, we now know that Modi's US visit was a very popular event. Particularly, Modi's Madison Square address that grabbed a lot of media attention, gained the popularity on Twitter as well. Thus, with so far analysis, we can report huge number of tweets per event. However, it would be interesting to see when a particular event became popular? When people started talking about a particular event, and when did people left their discussion on a particular event and moved to another event? It will be useful to see how popular an event was, and for how long did it maintained its popularity. To answer it, we determined number of tweets per event, per day from September 26 – October 4, 2014. Table 3 shows the life of events that happened during Modi's US visit. Numbers in the bold italic fonts are the numbers of tweets on the

Table 3. Life of Events that happened during Modi's US visit

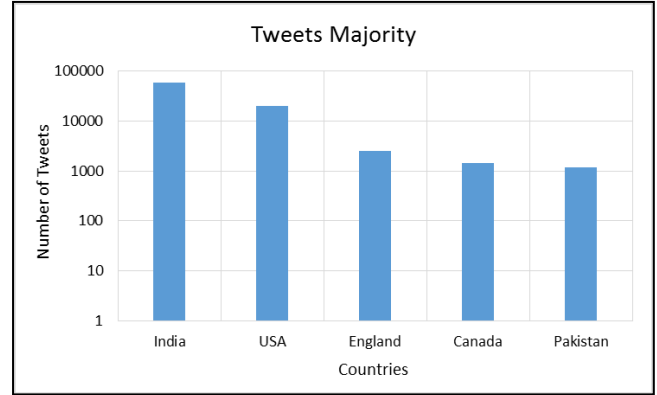
Event	09/26	09/27	09/28	09/29	09/30	10/01	10/02	10/03	10/04
Modi's UNGA Address	4	19296	14340	23380	4601	3064	1951	1429	273
Modi's Madison Square Address	0	38	71261	45774	3973	2027	1168	672	1796
Modi's meeting with CEOs	0	0	0	272	60	7	0	0	1
Modi's CFR Address	0	0	0	2016	225	8	1	0	0
Modi's Meeting with Obama	0	1	7	318	5892	5593	400	110	30

day of event. As can be inferred from the table, most number of tweets on a particular event, were posted on the day of event. However, the next most number of tweets on a particular event were posted on the following day of event. Thus, it can be said that most of the people tweeted about an event, on the day of event. And soon as the days passed, the discussion on the event started dying. Another observation is that soon after the end of event day, people started tweeting about the next happening thing. For example: we see that most people on Sept 27 – the day of Modi's address at the United Nations General Assembly, tweeted about UNGA, but soon after Sept 27, i.e., on Sept 28 – the day of Modi's Madison Square address, not only did people less tweeted about UNGA, but they also tweeted heavily for Modi's Madison Square address.

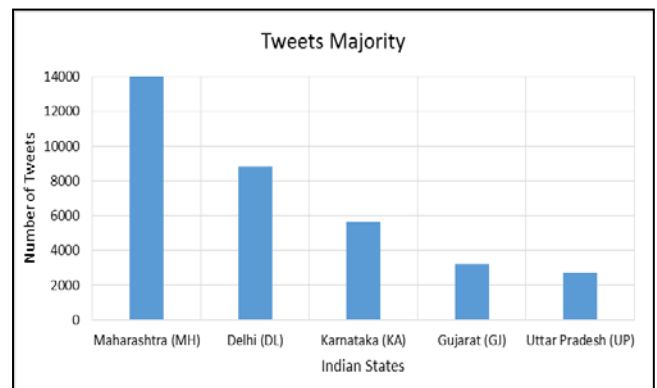
5.3 Location Participation

After analyzing event popularity and its life, we shifted our focus to the user's location. We were interested to see if Modi's US visit was a local, semi-global or global event. We were interested to see if only the people in India, tweeted about it. If not, what other countries tweeted about this event. Thus, we began with the location analysis for each tweet. After analyzing locations, we learnt that Modi's US visit gained a global popularity, it was tweeted by the people in 117 different countries. Countries that tweeted most about Modi's US visit were India, USA, England, Canada and Pakistan (see Figure 4). As can be inferred from the results, most tweets originated from India and US, likely because the event involved India's Prime Minister visiting to the United States, which in turn might have caused excitement through the people of India and the USA. Followed by India and USA, the event was most tweeted in England and Canada, likely because these countries have huge number of Indian immigrants [14]. Also, Pakistan being India's neighbor, it is not a surprise to see it on number 5.

After completing the country-wise location analysis on Modi's US visit, we decided to take next step by exploring what parts of India tweeted most about the event. Thus, for all the tweets that were from India and provided either the name of city or state, we manually assigned them the states and later we determined the number of tweets per state. It was interesting to see that people from 27 states and 3 union territories (out of total 29 states and 7 union territories) in India, tweeted about Modi's US visit, which implies that the event was popular in almost all parts of country and people from different walks of life took active part in it. It may also imply that people of India are starting to take interest in the politics of the country and twitter is being used widely in India as opposed to the belief that it is not as

**Figure 4. Countries that Tweeted most about Modi's US visit.**

popular in India as in other countries. Figure 5, shows the top 5 places from India that tweeted most on this event- Maharashtra, Delhi, Karnataka, Gujrat and Uttar Pradesh. Though, without full investigation, it is difficult to state why people were more involved in the above mentioned states than the people from other states, it can be suggested that the reason for this heavy contribution can be the large geographical area or the heavy population supported by these states. Possible reasons for more number of tweets from Delhi (capital of India) and Gujrat (Modi's hometown) could be that people at these states, due to more closeness with Prime Minister Modi, might have felt it as their own event. Possible reason for Maharashtra, Karnataka and Uttar Pradesh, could be because of their high economic status, in terms of annual GDP growth, which in turn could have possibly encouraged more use of technology for public discussions.

**Figure 5. Indian States that Tweeted most on Modi's US visit.**

5.4 Public Sentiments

Following event's popularity and life, and location analysis, we further analyzed the data for its sentiments. We first began with the sentiment analysis per day, during Modi's US visit. Figure 6 shows that for most of the days during Modi's US visit, public sentiments were neutral, with an exception to September 28, 2014 – the day with most positive sentiments – which may or not be because of Modi's Madison Square address.

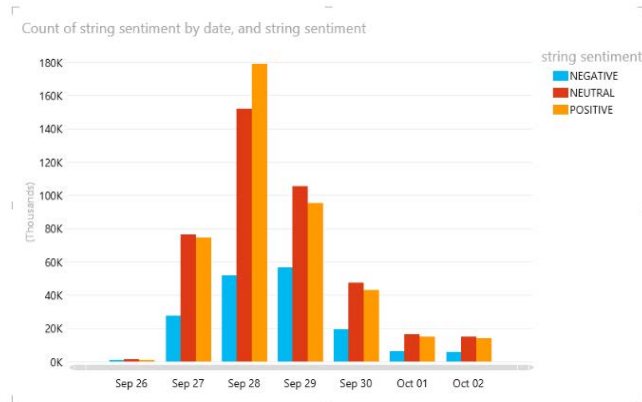


Figure 6. Public Sentiments during Modi's US visit.

Thus to explore more, we determined the public sentiments, during various events that happened during Modi's US visit. As can be inferred from figure 7, majority of tweets within all the events during Modi's US visit contained positive sentiments, which implies that almost all the events and event agendas were appreciated by the public at Twitter. Figure 7, shows the highest peak of positive sentiments on Sept 28 – the day of Modi's Madison Square address, thus it can be justified that the above positive sentiments for Sept 28, were most likely because of Modi's Madison Square address.

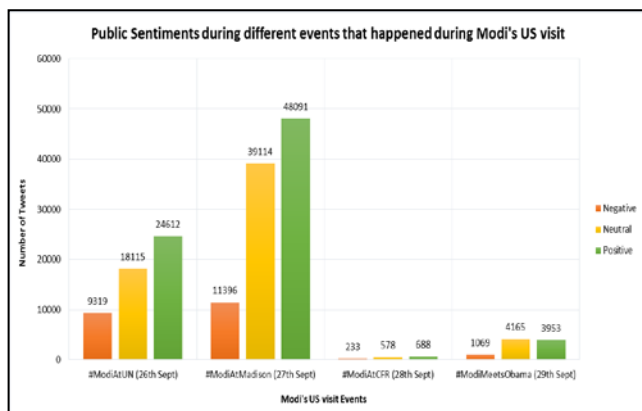


Figure 7. Public Sentiments during various Events that happened during Modi's US visit.

Next, as we know that Modi's US visit was an event of global discussion, we analyzed public sentiments worldwide.

Figure 8 shows the World map with user locations and tweet sentiments, across the World.

Also, as we know that this was an India – US event, and was most tweeted by the people living in India and the USA. We decided to study the public sentiments on this event across India and USA. Figure 9 and 10, shows public sentiments across India and USA respectively. As can be inferred from the two plots, figure 9 and 10, the overall sentiments across India and United States were positive, which in turn would be very good for the relationship between these two countries.



Figure 8. Public Sentiments across the Globe.

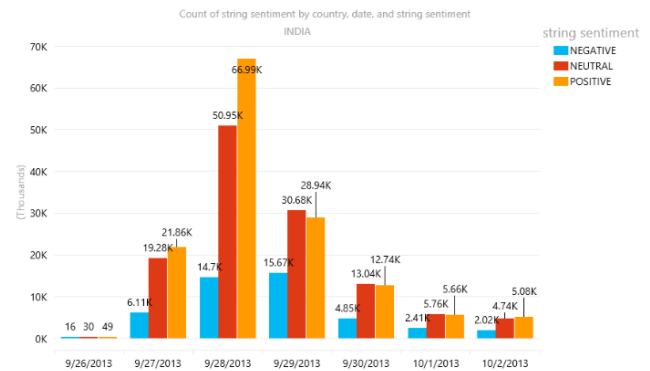


Figure 9. Public Sentiments across India.

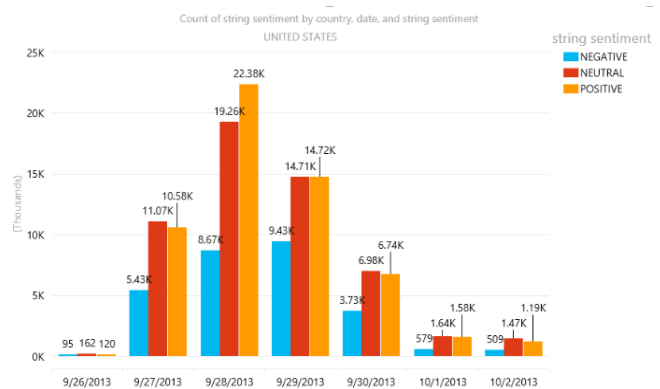


Figure 10. Public Sentiments across the United States.

5.5 Public Sentiments and Stock Exchanges

Finally we analyzed the public sentiments and stock exchanges, to see if there exist any correlation between the two. Figure 11, Figure 12, Figure 13 and Figure 14, depicts the plots between public sentiments and BSE, NSE, Dow Jones and NASDAQ's stock indices respectively. Though the numbers are different for all the indices, we observed a common trend in the rise and fall of indices. This may indicate that this event had an effect on the world market. This does not mean that this was the only thing that affected these stock markets. There might have been other reasons for the fluctuations but one cannot rule out that Modi's visit and his announcement was not one of the reasons.

A striking observation is that the Indian markets' (BSE and NSE) high increased dramatically. Since India is 12 hours ahead of USA, even though positive sentiments' high is observed 28th September and 29th being a holiday, the high on 30th September can be correlated with the positive sentiment that is seen on 28th September. On the same day, the low has also dipped considerably indicating that the market jumped from that low. This can be correlated with Modi's visit and his announcements made during the event. The hypothesis that Indian market, if not the international markets, depends partly on the sentiments of its people, regarding the government and its policies holds true. We can say that Indian markets' success depends partly on the sentiments of the people and fluctuates with it.

Other striking observation is the Indian markets' indices just before the Modi's US visit (22nd September to 26th September), the lowest low point was dipping and the graph worm is seen to be going down. Just after the visit the worm representing the lowest indices of the day, shot up considerably. This indicates that whatever happened during the visit made people happy which can be observed from the sentiment analysis. And since people felt happy, the stock market boomed and the low risen. A week after when effect of Modi's visit started to diminish, the markets' indices' low again reached to the same level as before the visit, in fact it went lower. Since there is a considerable time between the end of the event and the worm of the indices going low, this can be attributed to other possible events and policies as well and not just Modi's visit to the US.

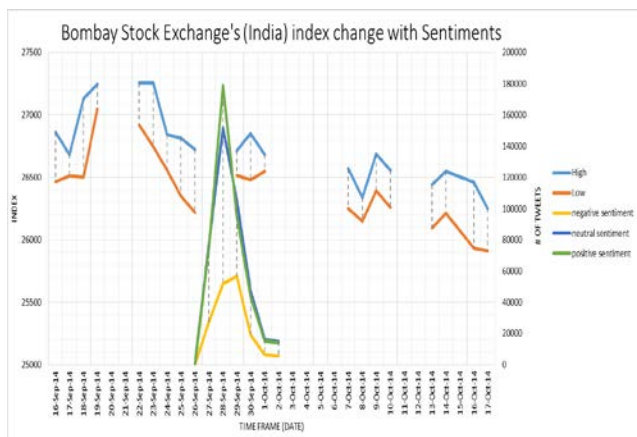


Figure 11. BSE Index and Public Sentiments.

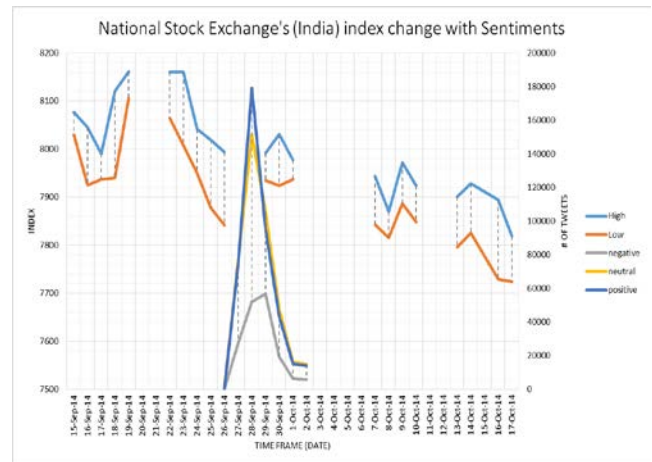


Figure 12. NSE Index and Public Sentiments.

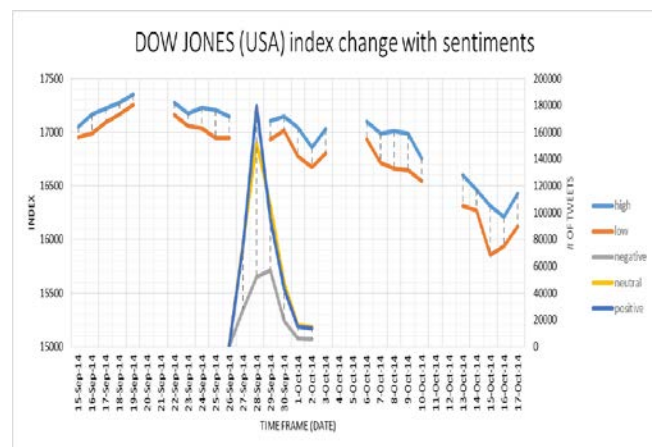


Figure 13. Dow Jones Index and Public Sentiments.

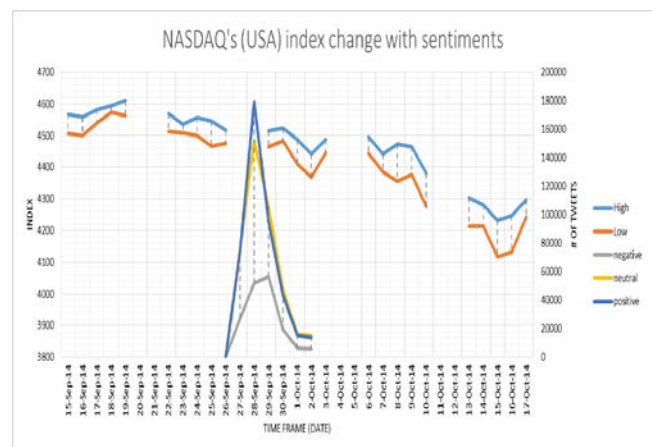


Figure 14. NASDAQ Index and Public Sentiments.

6. CONCLUSIONS

The findings from the location and sentiment analysis indicate that Modi's US visit got public attention and appreciation, across the globe. It not only affected people's sentiments but also had an effect on national and international

economies. The announcements made and various campaigns that were inaugurated during the visit were appreciated by all, and based on the sentiments of the people, it can be inferred that the people really trust the present government and are trying to support Narendra Modi and his plans.

7. LIMITATIONS

The results and conclusions from this study are derived only on the basis of tweets posted by users, using the specific hashtags or user mentions, in the timeframe Sep 26 - Oct 4, 2014. Location analysis was done only on the tweets with a valid location information. It was supposed that the location information provided by users were true.

While correlating the stock markets' indices and PM's visit, all the factors like oil prices, INR vs USD, other policy changes, etc. were not studied.

8. FUTURE WORK

As we learnt that people from 117 countries tweeted about this event, it would be interesting to learn if the people who tweeted on this event outside India, were actual foreigners or were Indian immigrants.

More studies can be done on the users. Various demographics information can be collected about the users who participated in this event.

More factors can be studied while correlating this event's sentiments with the stock market.

9. ACKNOWLEDGMENTS

We acknowledge all the guidance and support, given to us, from our professor, Dr. Kyumin Lee.

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