

Study on Rumor Detection in Twitter

Participants

Qiyuan Zheng

- 1) Select topic
- 2) Design and program the method to detect rumor
- 3) Collect data

Yangzhi Hong

- 1) Research and build up rumor spreading model
- 2) Collect data
- 3) Prepare PPT

Qianqi Guan

- 1) Research and create sentimental dictionary
- 2) Collect data
- 3) Prepare PPT

Data

For the NBA trade rumor case, we collected totally 17,484 tweets from 7 users by Twitter REST API, each of who is active and has many followers as shown in Table 1:

Screen_name	Number of Tweets	Number of Followers
@BestBballSwag	607K	1236
@ BryantJordan	2598	413
@ InsideHoops	31.5K	1164
@ LakerRumors	1902	753
@ NBAFantasy	15K	111K
@ NBALivenews	194K	1270
@ NBARUMORS	28.3K	61.6K

Table 1

1. Introduction

As a widely used social network tool, the purpose of twitter varies from people to people. Compare with traditional media, Twitter works quickly and effectively. From several years ago, people have used twitter to spread information about disaster such as earthquakes.

However twitter does not always give us its benefits. It also probably brings a negative by-product, rumors. The wider twitter is used, the wider and faster rumors boosts the chances that new rumors are generated. Those rumors may confuse people with the wrong information and affect primary aid required in emergency. If many rumors occupy twitter, and it means that we lose the hopeful media [1]. This motivated us to study the problem of rumors in twitter.

We first investigated the rumor spreading model based on the existing studies, some of which build numeric models to describe the spreading procedure. Those models are mostly simulating the tumor spreading through word-of mouth in real society. The rumor spreads locally in a region and spills over out of the region where it has never been spread with movement of people and information.

Then we introduced a solution that detects rumor and finally distinguish rumors from the correction information. Admittedly, the solution needs manual intervention to some degrees that people have to identify the burst and retweet of tweets manually. Meanwhile, since the attributes of rumors varies in different domain, we have to manually build up the sentimental dictionary manually.

Nevertheless, considering the harmfulness of rumors, it is truly worth paying manually effort to prevent rumors from spreading without efficient prediction.

In section 2, we introduces the spreading model of rumor with three categories: 1) *Igorant*, 2) *Spreader* and 3) *Stifer*

Section 3 gives a detailed description about the method to detect rumor candidates from the tweets and to filter the correction information from the candidates.

In Section 4, we experiment based on the ‘trade rumor in laker’ in NBA.

2. Rumor spreading model

Compared to other social network sites like Facebook, people use Twitter mostly to broadcast news and their status within 140 words. One of the characteristic of Twitter is that there are two kinds of relationship between users instead of one-follow each other, or follow in one direction. This characteristic makes it different when transmitting information through users.

2.1 Directed network

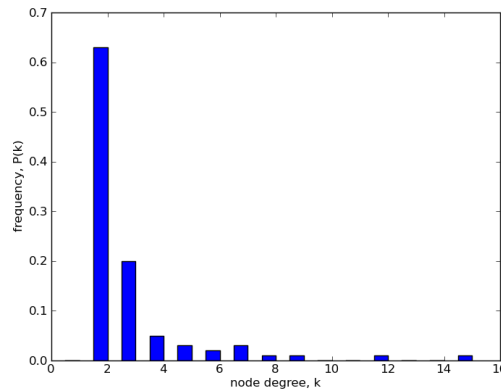
Twitter-like network is a directed network, in which users always searching for those who have more influence. In order to gain more attention and more influence, those users who have many followers usually follow back. So there are two relationships in the network:

- 1) Friendship: Two users follow each other
- 2) Followership: One user follows the other, but the other does not follow back.

2.2 Scale-free network

When you decide to follow someone in Twitter, you may consider how many people are following him/her. The more followers he/she has, the more likely you reasons for them to make the same decision. As a result, there should be a few people who have more followers above the average. Therefore it is reasonable to assume that these people have more influence on others when they spread some information or broadcast their options.

The network described above is called scale-free network. A scale free network is a network whose degree distribution has the “long tail” phenomenon.



2.3 Rumor spreading model

Suppose that we build the rumor spreading model in a scale-free network. People are divided into three different groups: **Igorant**, **Spreader** and **Stifer**

- **Igorant** is who has never heard of the rumor.
- **Spreader** is who spreads the rumor.
- **Stifer** who knows about the rumor but don't spread it.

Spreaders spread rumors to one or some of his neighbors. If the receiver is an ignorant, he will turn to be a spreader by a chance based on the ratio of his followings who have believed the rumor (in our simulation, we set the ratio to be 0.6). And any spreader is supposed to spread the rumor M times (in our simulation, we set M to be 2).

Then we use networkx function `nx.scale_free_graph ()` to build the directed scale-free network. This function uses three different parameters to modify the outcome network. In our first approach we use $\alpha=0.3$, $\beta=0.3$, $\gamma=0.4$ to build a 50 nodes network in Figure 2.1 and get the degree distribution in Figure 2.2

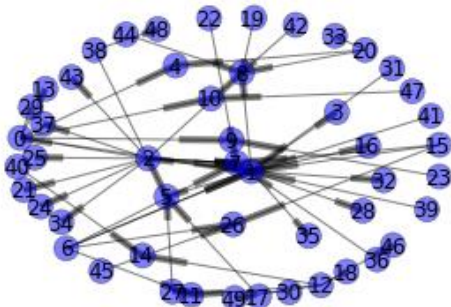


Figure 2.1

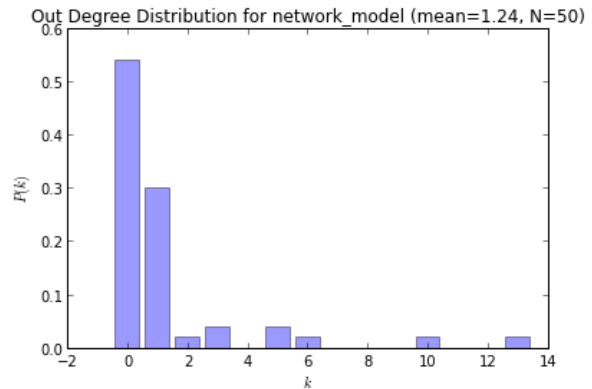
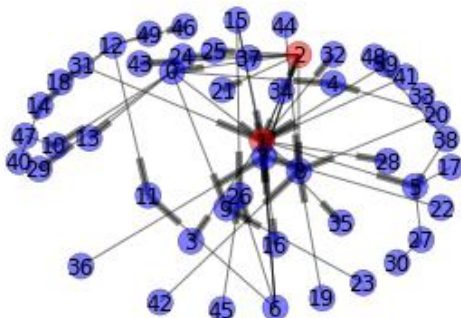
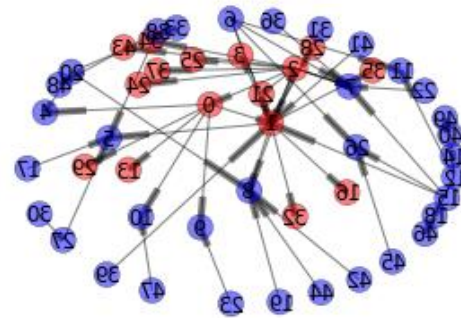


Figure 2.2

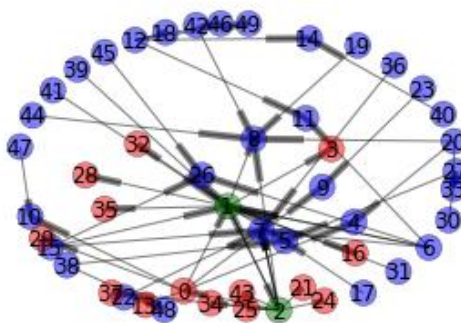
Then we choose two nodes which have the most followers and make them the earliest believer (red circles). They spread the rumor to their neighbors (red circles). After 5 rounds, the rumor stops in some stiflers (green circles).



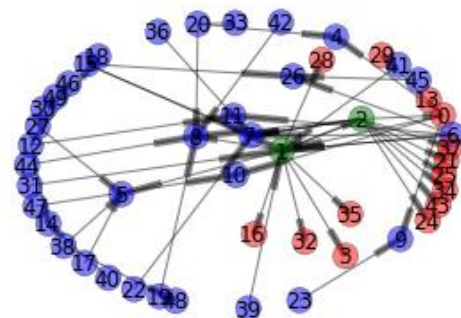
Round 1



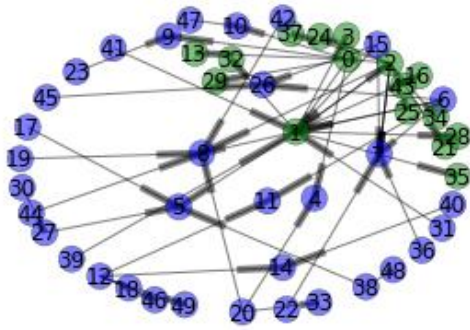
Round 2



Round 3



Round 4



Round 5

Rumor spreads at a tremendous speed at first round, where 14 nodes become new spreaders and then the speed drops down to zero. Figure 2.3 shows the spreading speed in the network.

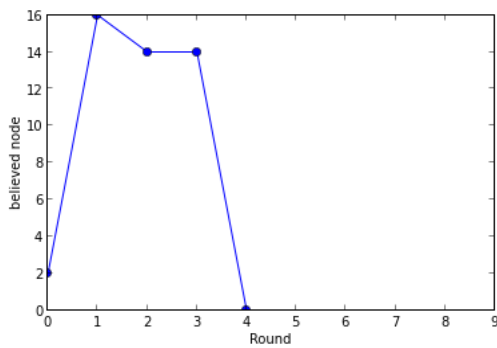


Figure 2.3

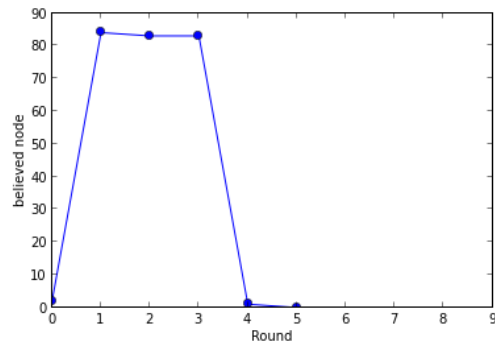


Figure 2.4

Moreover, we built a 5000 nodes network. Figure 2.4 shows a similar result to the previous network with 50 nodes

We can modify the parameters of function `nx.scale_free_graph()` or choose different starting nodes or change the believing mechanism to learn the way rumor spreads in different conditions.

3. Rumor detection in Twitter

3.1 Clues for detecting Rumor

Generally speaking, a rumor has 3 clues: Burst and Retweet volume and a correction signal.

1) Burst: a rumor is always a popular topic, where people have much interesting to publish in the Twitter. As a result, some tweets burst suddenly indicates a chance of rumor.

2) High Retweet volume: according to previous study [5], while the general retweet ratio is only about 8%, the retweet ratio of rumors can be very high. This indicates this topic is spreading wide and deep in the network. So a high volume of retweet is another clue we are using to detect rumors.

3) Correction signal: people usually spread rumor when they believe it's true or want someone to confirm whether it's true or not. So after an official rumor dismiss come out, people will stop spreading rumor. When this phenomenon mapped into the view of data, the retweet volume dropped down to normal after rumor correction. This is the third characteristic we used to detect rumor.

3.2 Rumor detecting approaches

First, we filtered these tweets by the keywords: “laker”, “trade”, “join” and “sign”, In Figure 3.1, we can see the tweets with the keywords has a burst distribution and high retweet count.

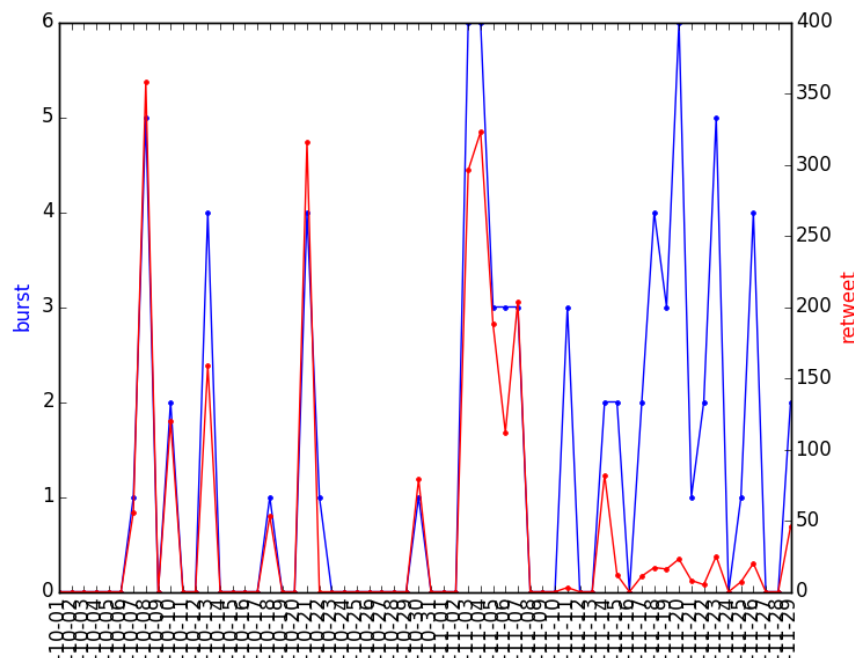


Figure 3.1

Then we use sentimental analysis to find which ones is tweet and which one is the correction of tweet. We built 2 simple lists of words, one is for rumor, and the other is for the correction of rumor, as shown in Figure 3.2. For each tweet, iteration through all words, add 1 to the score when found a word in file “rumor_dict.txt” and minus 1 to the score when found a word in “correction_dict.txt”. Score all the tweets using this method, we find a correction of rumor in Figure 3.3

<pre>? ! always must 100% if</pre>	<pre>official dismiss rumor deny truth real story shoot down not true unfounded nonsense check not sure verify denies</pre>
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Figure 3.2

Moreover, we found in Figure 3.3 that after Nov 14, the retweet volume dropped down. It is largely due to the correction of rumor like this:

```
USER:NBARUMORS  
CREATE AT:Fri Nov 14 17:45:51 +0000 2014  
TWEET:RT @JasonLloydABJ: Kevin Love denies any interest in joining Lakers next season: http://t.co/k3I8H1Z1bP  
=====
```

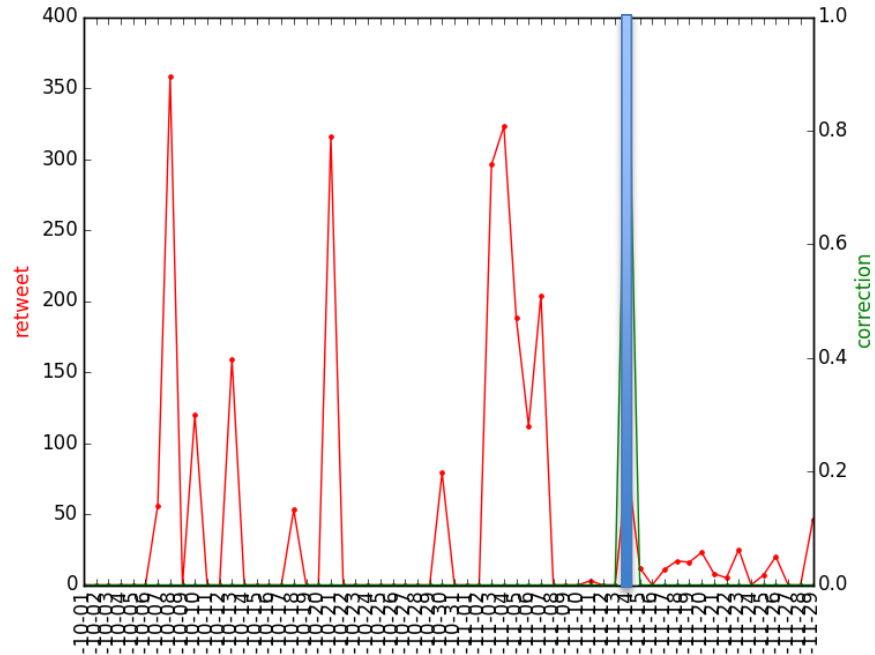


Figure 3.3

4. Conclusions

In this project, we first built up a model to research the spreading behavior of rumor. Then we tried to design and develop a system to detect the rumor with three steps:

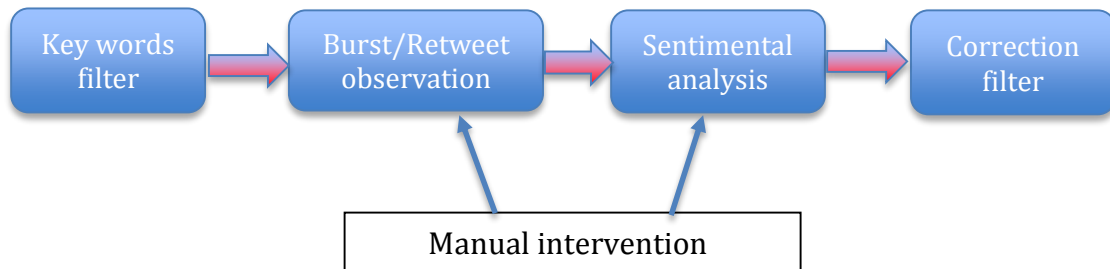


Figure 4.1

5. Future work

For now, the medium steps in Figure 4.1 needs manual intervention. In order to achieve the total automation, we need more complicated machine learning method to analysis the attributes of rumor.

References

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