Project 2 : Crawling and Data Collection on the Web

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1) The hashtag we chose for this question is: #brandbowl. The Topsy API was used to obtain the top five tweets. The 'limit' field in the code was set to '5'. The tweets are stored as a list in the object ret['response']['results']['list']. The 'top_tweets.txt' file contains each tweet item in the list in a single line.

The tweet text, user posting the tweet and the posting date of the top five tweets are as follows:

No.	Text	User	Posting Date
1	#brandbowl http://t.co/QoiFznuBKF	darth	1422837061
2	The new McDonald's positioning on Ïm̈ loving YOUïs a good messaging extension from I'm loving it #brandbowl #superbowlads	jowyang	1422837394
3	#GoDaddy goes small with a very tame, sweet ad #BrandBowl	socialmedia2day	1422837650
4	A Fiat just took some Viagra. Yep, that happened. #SuperBowl #BrandBowl	LinkedInQueen	1422837660
5	Last chance to Retweet this for chance to win $100 in #SuperBowl swag. Join #Jet http://t.co/d1dsM3YSWR #brandbowl http://t.co/8ulfL1UkPN	DaveKerpen	1422838470

2) We use a script that, on a given hashtag, queries the topsy API repeatedly to get the entire set of tweets in the chosen time frame of one hour from 16:00 to 17:00 hrs PST on 2/1/2015. We repeat this process for all the five hashtags. However, the aforementioned API can only return a maximum of 500 tweets for

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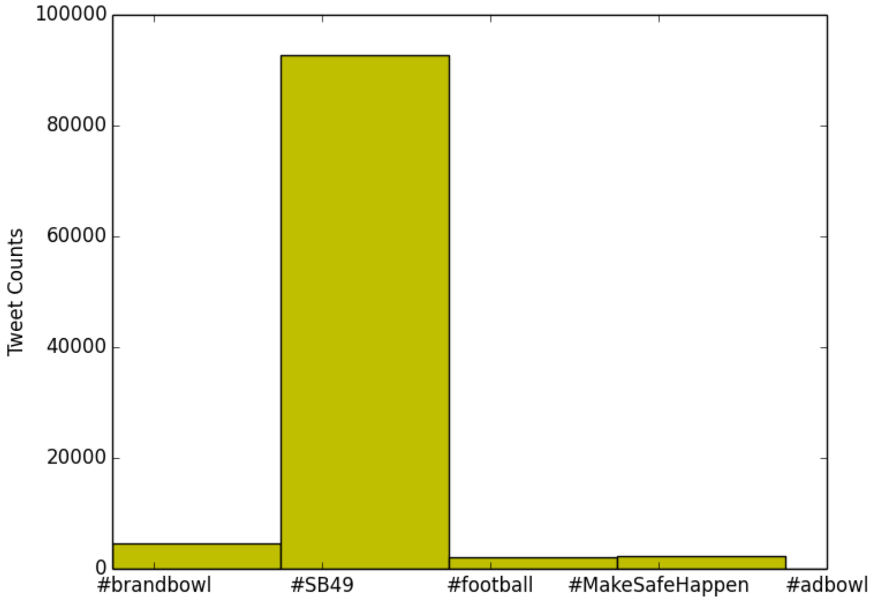
any particular time frame. Thus, to get the entire set of tweets in a time frame, we solve the problem recursively (and dynamically). We first check the number of tweets for the entire time frame. If the number of tweets returned is 500, we recursively solve the problem for smaller segments of the time frame (half in this case) until the number of tweets returned by the API is lesser than 500. This approach ensures that every single tweet in the time frame is collected even for extremely high rate of tweets at any instant. The results are stored in the file 'tweets.txt'. One issue that arises in this method is that we may have duplicates in our file. This is because suppose a tweet had two of our hashtags in it. We would store that tweet on two occassions - once each when we are querying each of those two hashtags. So, we remove duplicate lines from the 'tweets.txt' file. We also log information about the queries made as mentioned in the question in the file 'search_log.txt'. The hashtags with their tweet counts are as follows:

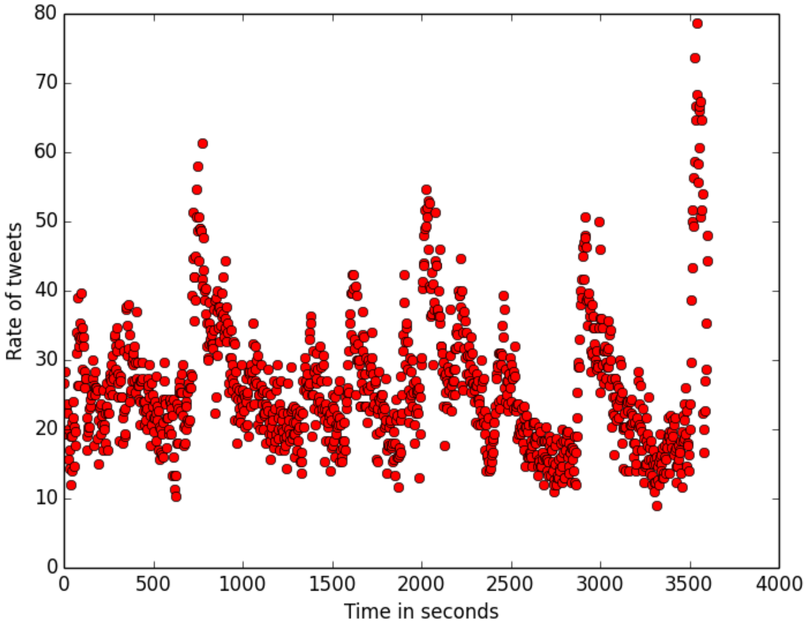
- #brandbowl - 4648
- #SB49 - 92574
- #football - 2084
- #MakeSafeHappen - 2390
- #adbowl - 0

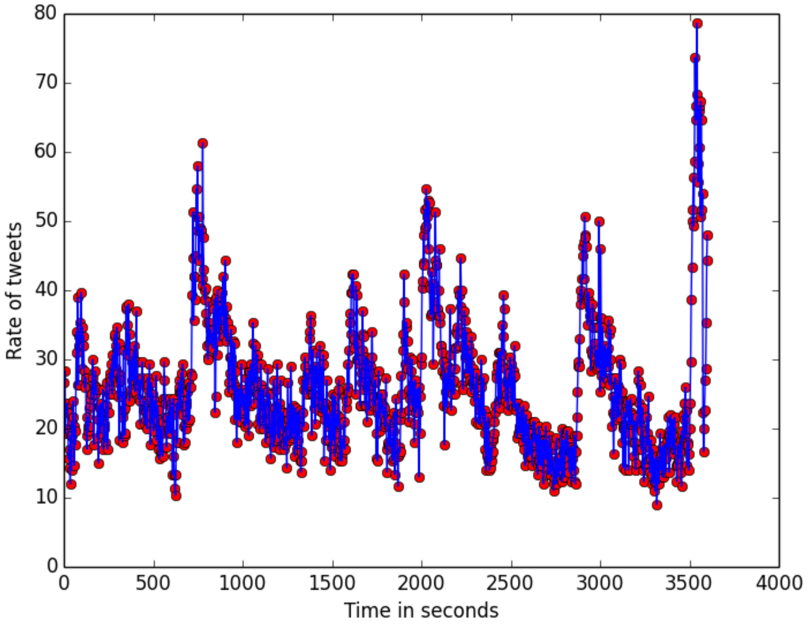
Also, from the results we observe that our dynamic approach is highly efficient and does not use too many queries. For instance, the final hashtag #adbowl has 0 tweets in the given period and this is solved in just 1 single query. If we had split the timeframe into several slots, the smallest of which ensures that no hashtag has more than 500 tweets in any such slot, then we would have to query the API several more times unnecessarily leading to the execution becoming much slower.

3) In this question, we first compute a count of the number of tweets for each of the five hashtags in the time interval from 16:00 to 17:00 hrs (PST) on 2/1/2015. This has essentially been calculated in the previous question itself. Then, we plot a bargraph with the hashtags on the x-axis and the number of tweets on the y-axis.

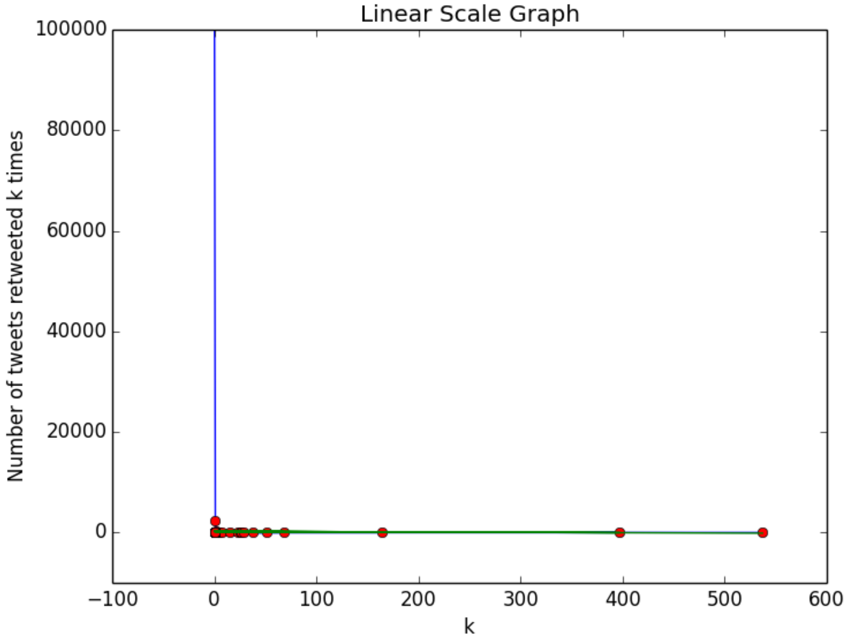


The next part of the question involves calculating the number of tweets/second for different ranges of time (within that one hour) for the most popular hashtag. From the results of the first part of the question, we observe that the most popular hashtag is #SB49. We choose a time interval of 3 seconds and query the API 1200 times (dividing one hour into 1200 slots of 3 seconds each) obtaining the number of tweets in each of those slots. We then plot a graph with the start time of each slot on the x-axis and the number of tweets/second within that slot on the y-axis. Actually, we plot two graphs - one has just the points alone while the other also contains a curve fit between the points.

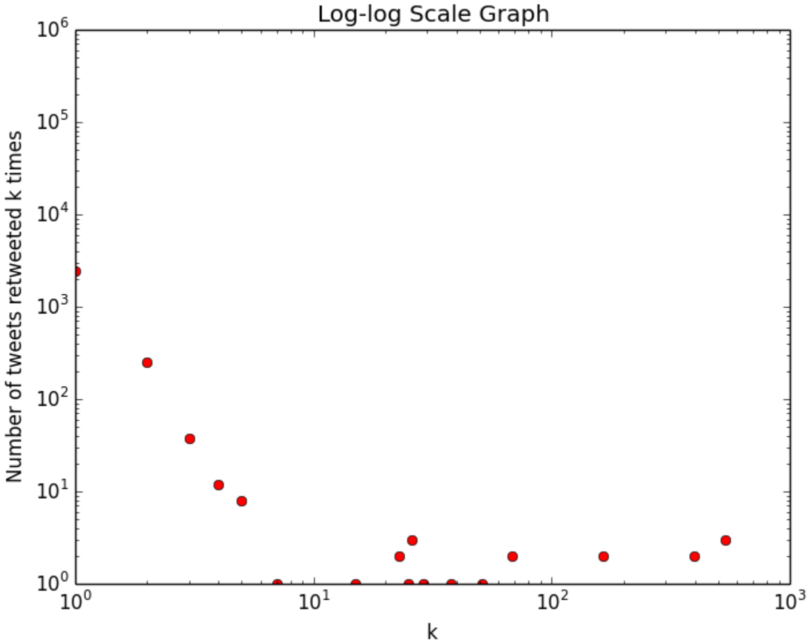

80
70
60
50
40
30
20
10
0
Rate of tweets
0
500
1000
1500
2000
2500
3000
3500
4000
Time in seconds


80
70
60
50
40
30
20
10
0
Rate of tweets
0
500
1000
1500
2000
2500
3000
3500
4000
Time in seconds

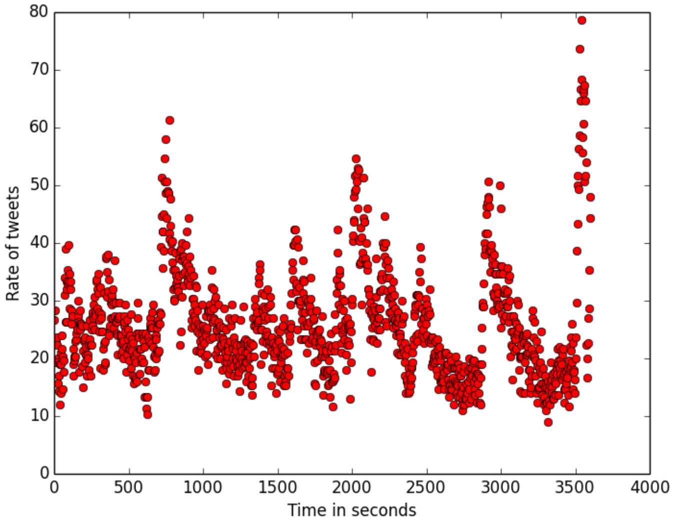
4) In this question, we compute the number of retweets for each tweet. First, we calculate the maximum number of retweets for any tweet and this turns out to be 537. Then, for each $k \in \{1, 2, \ldots, 537\}$ we compute the number of tweets which have been retweeted k times. We plot a graph with the x-axis containing the number of retweets k (running from 1 to 537), and the y-axis containing the number of tweets retweeted k times. We use the polyfit function from the numpy library to see if we can fit a line to this plot. The line is also displayed in the same figure along with the plot. The green line denotes the line we are trying to fit and the blue line is the original plot.



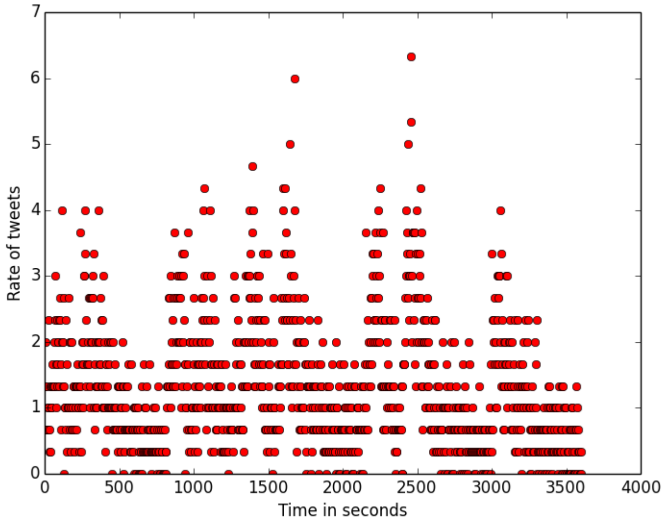
We then repeat the above plot on a log-log graph. We observe from the graph generated that we can't fit a line to this plot.



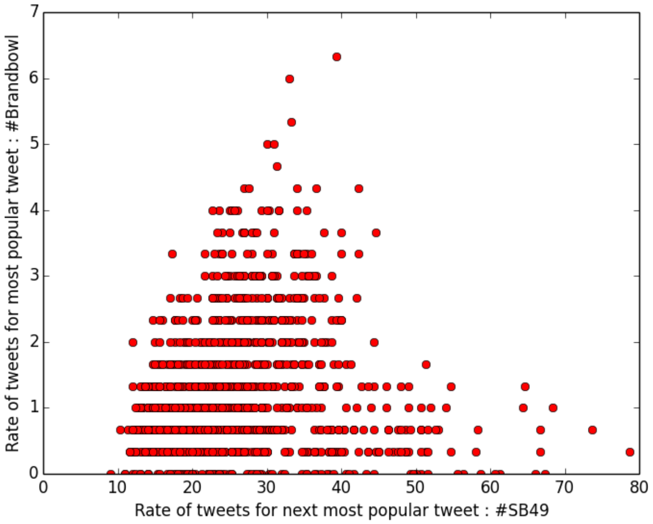
5) The two most popular hashtags are #SB49 and #brandbowl in that order. We queried the API with a time interval of 3 seconds for the number of tweets containing each of those hashtags. The timeframe was chosen as 3 seconds because after running question 2, we observed that for all the hashtags, there aren't 500 or more tweets on any interval of 3 seconds or lesser.
We first plot a graph with the y-axis containing the number of tweets/second for #SB49 and the x-axis containing the start time for each slot.



The second plot has the number of tweets/second for #brandbowl in the y-axis and the start time of each slot in the x-axis.

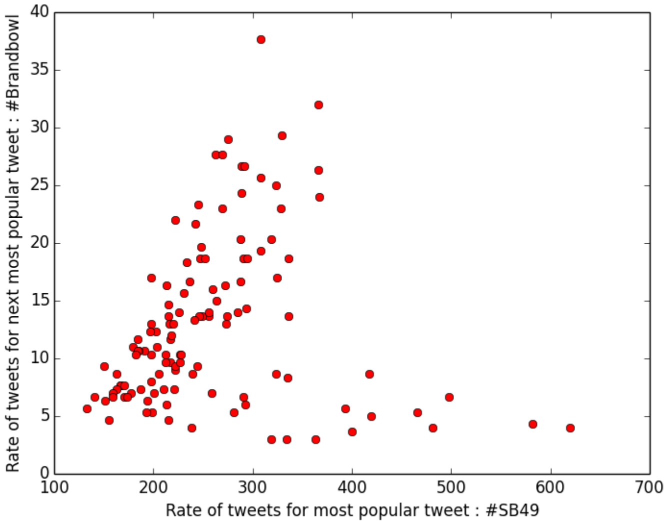


We plot another graph that has the number of tweets/second for #SB49 on the x-axis and the number of tweets/second for #brandbowl on the y-axis.



There are 1200 points in each of these graphs since the overall time interval is an hour and we have slots of 3 seconds each. We observe that these three graphs don't give us enough information to determine the correlation between the two hashtags. As a result, we construct a fourth graph to determine this information more clearly.

We choose time slots of 30 seconds each. For each time slot, we count the number of tweets in that slot for each of the hashtags. We do this not by querying the API but by summing up the values we obtained earlier for the 3 second slots. Querying the API again would be more time consuming and potentially inaccurate as the number of tweets in 30 seconds could exceed 500 and the API would then return that as 500. After that, we cumulatively add the number of tweets. That is, we count the number of tweets/second for the first 30 seconds in our timeframe, then for the first 60 seconds, then the first 90 and so on till we reach 1 hour. We plot a graph with the x-axis containing the number of tweets/second for #SB49 and the y-axis contains the number of tweets/second for #brandbowl. The plot has 120 points as there are 120 time slots of 30 seconds each in an hour. Our choice of 30 was not random. We tried a few different values ranging from 3 seconds to 1 minute and this seemed to give the most "informative" graph. The resulting graph gives us a good indication of how closely the two hashtags are correlated.



6) Each line of the 'tweets.txt' file is parsed by using the json.loads() function. The tweet's post date, text, number of retweets, and the user posting it are printed out in the 'Output - Q6.txt' file attached along with this report.