

Assignment 2

CS 532: Introduction to Web Science

Spring 2018

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Question

1. Write a Python program that extracts 1000 unique links from Twitter. You might want to take a look at:

<http://adilmoujahid.com/posts/2014/07/twitter-analytics/>

see also:

<http://docs.tweepy.org/en/v3.5.0/index.html>

<https://github.com/bear/python-twitter>

<https://dev.twitter.com/rest/public>

But there are many other similar resources available on the web. Note that only Twitter API 1.1 is currently available; version 1 code will no longer work.

Also note that you need to verify that the final target URI (i.e., the one that responds with a 200) is unique. You could have many different shortened URIs for www.cnn.com (t.co, bit.ly, goo.gl, etc.). For example:

```
$ curl -IL --silent https://t.co/Dp0767Md1v | egrep -i "(HTTP/1.1|^location:)"
HTTP/1.1 301 Moved Permanently
location: https://goo.gl/40yQo2
HTTP/1.1 301 Moved Permanently
Location: https://soundcloud.com/roanoketimes
/ep-95-talking-hokies-recruiting-one-week-before-signing-day
HTTP/1.1 200 OK
```

You might want to use the search feature to find URIs, or you can pull them from the feed of someone famous (e.g., Tim O'Reilly). If you find something inappropriate for any reason you see fit, just discard it and get some more links. We just want 1000 links that were shared via Twitter.

Hold on to this collection and upload it to github -- we'll use it later throughout the semester.

Answer

To solve the above problem, I first went through the two resources [1] and [2] as mentioned on the assignment page as well as from the discussion in the class, I got to know that in order to access the twitter API and fetch URIs I need to get keys and tokens by creating a developer account on twitter. Also, the program needed to install and import tweepy library which allows the developer to stream tweets based on keywords. The following dependencies were used:

- from tweepy.streaming import StreamListener
- from tweepy import OAuthHandler
- from tweepy import Stream
- import json
- import requests
- import urllib
- import tldextract
- from urllib.parse import urlparse, urljoin
- import sys

For this assignment I reused the code which was developed for assignment 2 which made implementation much easier and quicker. The program shown in Listing 1 was written in Python 3.5 for fetching 1000 unique links, omitting links from twitter domain. The following command was used to run and save the output in **1000ulinks.txt**.

```
python tweet_crawl.py > 1000ulinks.txt
```

```
1 #Import the necessary methods from tweepy library
2 from tweepy.streaming import StreamListener
3 from tweepy import OAuthHandler
4 from tweepy import Stream
5 import json
6 import requests
7 import urllib
8 import tldextract
9 from urllib.parse import urlparse, urljoin
10 import sys
```

```

11
12 #get keys from: https://apps.twitter.com/
13 #consumer key, consumer secret, access token, access secret.
14 ckey = 'bSeaweiw68Hma0VLyeEd9se9u'
15 csecret = 'jch6kXwJociEynIHD0C8OunYLSYeRDCCjkaz0EUf3CSHzrNpSd'
16 atoken = '958819771000205312-w7L1GrIudQbONzjpfMRbwD33ITfWxnB'
17 asecret = 'MKE2Au1XVZDg1xV1F4USZsuIETm7WxgEuLACbDiQooxHG'
18 #created two blank lists for comparison
19 links1 = []
20 links2 = []
21
22 #listen to the stream of data from twitter streaming API
23 class listener(StreamListener):
24
25     def on_data(self, data):
26
27         #data in JSON format is extracted
28         tweetJson = json.loads(data)
29
30
31         #get links from tweets
32         links = tweetJson['entities']['urls']
33
34         #constraints set
35         if( len(links) != 0 and tweetJson['truncated']
           == False ):
36
37         #links passed as dictionary
38             self.getLinksFromTweet(links)
39
40             return True
41
42         def getLinksFromTweet(self, linksDict):
43
44             for uri in linksDict:
45                 #establish http connection for head and get request
46                 urllib.request.urlopen(uri['expanded_url'])
47                 req = requests.get(uri['expanded_url'])
48                 resp = requests.head(uri['expanded_url'])
49
50
51
52                 if req.status_code == 200 and resp.
                   headers.get('content-type') is not None
                   :
53         #check if expanded_url has any redirections or short links
54             if req.history:

```

```

55 | final2 = req.url
56 | #extract domain name using tldextract
57 |
58 | extracted2 = tldextract.extract(final2)
59 | if extracted2.domain != 'twitter':
60 |     o = urlparse(final2)
61 |     final3 = urljoin(final2, o.path)
62 |     finalresp = requests.head(final3)
63 | #make comparison and then append
64 | if final3 not in links1:
65 |     links1.append(final3)
66 |     links2.append(final2)
67 |     print(final2)
68 | #similar steps for expanded_url
69 | else:
70 |     extracted3 = tldextract.extract(uri['expanded_url'])
71 |     if extracted3.domain != 'twitter':
72 |         o = urlparse(uri['expanded_url'])
73 |         urilink = urljoin(uri['expanded_url'], o.path)
74 |         if urilink not in links1:
75 |             links1.append(urilink)
76 |             links2.append(uri['expanded_url'])

```

```

77         '] )
           print(
           uri[ '
           expanded_url
           '])

78
79         if req.history:
80             final = req.url
81             extracted = tldextract.extract(
82                 final)
83             if extracted.domain != 'twitter':
84                 ol = urlparse(final)
85                 final4 = urljoin(final,
86                                     ol.path)
87                 finalresp = requests.
88                     head(final4)
89
90                 if final4 not in links1:
91                     links1.append(
92                         final4)
93                     links2.append(
94                         final)
95                     print(final)
96
97     return True
98
99     def on_error(self, status):
100         print( status )
101
102         if status_code == 420:
103             #returning False in on_data disconnects the stream
104             return False
105         return True
106
107
108     auth = OAuthHandler(ckey, csecret)
109     auth.set_access_token(accessToken, asecret)
110
111     #for getting just 1000 links
112     while len(links2) < 1001:
113         try:
114             twitterStream = Stream(auth, listener())
115             #multiple keywords used

```

```

116         twitterStream.filter(track=['trump', 'football',
117                                     'olympics', 'jenner', 'kardashian', 'politics
118                                     '])
119
120     except KeyboardInterrupt:
121         print()
122         sys.exit(1)
123
124     except:
125         pass

```

Listing 1: Python script for twitter streaming

For my keywords I chose the ones which were currently trending on twitter. It first starts by listening to the stream of data from twitters streaming API, from which data is received in JSON format. The data was parsed using entities and urls object of a tweet and also filtered them for lengths and maximum characters [3]. These links one by one were sent to getLinksFromTweet for further filtration. In the next step, HTTP head and get requests [8] were made for each of the links fetched from the previous step and checked if expandedUrl entity had any redirects or were shortened for status 200 as well as status 301. Next I used the tldextract [4] library for extracting the domain name as twitter since it had to be excluded. For checking the links to be unique I maintained two lists where in List 1, I stored all the URIs by formatting the query and parameters in links and List 2 where new links after comparing with List 1, the links were again formed as original URIs. For this I used the urlparse and urljoin libraries [7].

Here is the output with first 6 unique links extracted:

```

https://shareblue.com/intel-experts-trumps-fixation-on-twitter-
and-fox-threatens-national-security/#.Wn5bN9f2.Rp.twitter
http://myNBC15.com/news/nation-world/team-usa-arrives-at-winter-
olympics-opening-ceremony?utm_content=bufferb5e59&utm_medium=
social&utm_source=twitter.com&utm_campaign=buffer
https://www.cnn.com/2018/02/09/politics/david-sorensen-white-
house-resign-domestic-abuse-allegation/index.html
https://www.billboard.com/articles/columns/pop/8098906/winter-
olympics-2018-opening-ceremony-psy-bts-skating-oasis-ed-
sheeran?utm_source=twitter
https://www.reuters.com/article/us-usa-budget-wall/trump-budget-
to-include-3-billion-for-border-wall-official-idUSKBN1FT09M
https://www.gq.com/story/adam-ripon-olympics-skater-pence-and-
roasts

```

2

Question

2. Download the TimeMaps for each of the target URIs. We'll use the ODU Memento Aggregator, so for example:

URI-R = <http://www.cs.odu.edu/>

URI-T = <http://memgator.cs.odu.edu/timemap/link/http://www.cs.odu.edu/>

or:

URI-T = <http://memgator.cs.odu.edu/timemap/json/http://www.cs.odu.edu/>
(depending on which format you'd prefer to parse)

Create a histogram* of URIs vs. number of Mementos (as computed from the TimeMaps). For example, 100 URIs with 0 Mementos, 300 URIs with 1 Memento, 400 URIs with 2 Mementos, etc. The x-axis will have the number of mementos, and the y-axis will have the frequency of occurrence.

* = <https://en.wikipedia.org/wiki/Histogram>

What's a TimeMap?

See: <http://www.mementoweb.org/guide/quick-intro/>

And the week 4 lecture.

Answer

To solve the above problem, <http://memgator.cs.odu.edu/> was used as mentioned in the question for getting the time maps for each of the 1000 URIs. I chose the JSON format to parse the data. The following dependencies were used:

- import requests
- import json
- import os
- import csv

First I checked the response code for first few URIs. From that I came to know about the links which had zero or no mementos, returned a response code of 404. So I made HTTP get and head requests to get the json data of timemaps and saved in .json file for URIs which returned 200 response using json.dump [5] function and in .txt file as No-Mementos for those which returned a 404 response. Secondly to store the number of mementos and no of URIs in a csv file [6] named **timemaps.csv**, I used a dictionary to arrange them with respect to Key as MementoCount and URICount as value. The following program was written to implement the above problem in Python 3.5:

```
1 import requests
2 import json
3 import os
4 import csv
5
6 #directory for storing timemaps for each uri
7 os.mkdir("timemaps")
8 count = 1
9
10 #dictionary for sorting
11 dict={}
12 with open('1000ulinks.txt') as fp:
13     for line in fp:
14         #get request made to memgatorin as json
15         url = 'http://memgator.cs.odu.edu/timemap/json/'
16             + line.strip()
17
18         try:
19             req = requests.get(url, stream=True,
20                               headers={'User-Agent': 'Mozilla/5.0'})
```

```

20         resp = requests.head(url, stream=True,
21                               headers={'User-Agent': 'Mozilla/5.0'})
22
23
24         if req.status_code == 200 :
25
26             #dumping json data into respective timemap files for URI
27             with open('timemaps/%s.json' %
28                       count, 'w+') as outfile:
29                 json.dump(req.json(),
30                           outfile, sort_keys =
31                             True, indent = 4,
32                             ensure_ascii = False)
33
34             #getting mementocount
35             mementocount = resp.
36               headers.get('X-
37                 Memento-Count')
38             #dictionary for sorting the number of mementos with URIs
39             if mementocount in dict:
40                 dict[
41                     mementocount]
42                     += 1
43
44             else:
45                 dict[
46                     mementocount]
47                     = 1
48
49             #if 404 storing no mementos in for respective URI
50             else :
51                 with open('timemaps/%s.txt' %
52                           count, 'w+') as outfile1:
53                     outfile1.write('No
54                       Momentos')
55                     mementocount = 0
56                     if mementocount in dict:
57                         dict[
58                             mementocount]
59                             += 1
60
61                     else:
62                         dict[
63                             mementocount]
64                             = 1
65
66             count = count + 1
67
68     except:

```

```

52         pass
53
54
55 #Dumping data into csv file in Memento-Count and URI count
    columns
56 with open('timemaps.csv', 'w', newline='') as csvfile:
57     fieldnames = ['Memento_Count', 'URI_Count']
58     writer = csv.DictWriter(csvfile, fieldnames=fieldnames)
59     writer.writeheader()
60
61     for key, value in dict.items():
62         writer.writerow({'Memento_Count': key, '
            URI_Count': value})
63     csvfile.close()

```

Listing 2: Python Script for downloading Timemaps

There were few errors while plotting the histogram, for which I had to write a small piece of code shown below, for converting the **timemaps.csv** file into a single column file named **counts.csv**.

```

1 import csv
2
3 with open('counts.csv', 'a+', newline='') as csvfile:
4     spamwriter = csv.writer(csvfile, delimiter=' ',
5         quotechar='|', quoting=csv.QUOTE_MINIMAL)
6     spamwriter.writerow('Memento_Count')
7     csvfile.close()
8 #reading rows from csv file
9 with open('names.csv', newline='') as csvfile:
10     field = ['Memento_Count', 'URI_Count']
11     reader = csv.DictReader(csvfile, fieldnames=field)
12     for row in reader:
13         if row['URI_Count'] == "URI_Count":
14             continue
15         count = row['URI_Count']
16         count = int(count)
17 #storing all the mementos in single column based on their counts
18     for row1 in range(0, count):
19
20         with open('counts.csv', 'a+', newline
21             = '') as csvfile:
22             spamwriter = csv.writer(csvfile,
23                 delimiter=' ', quotechar
24                 = '|', quoting=csv.
25                 QUOTE_MINIMAL)
26             spamwriter.writerow(row[ '
27                 Memento_Count '])
28             csvfile.close()

```

Listing 3: Conversion

I then created a simple histogram , using R [9] shown in Listing 4, of URIs vs. Number of Mementos as shown in Figure 1. From the histogram observation we come to know that majority of URIs had zero or low counts of mementos.

```
1 setwd(getwd())
2 # csv dataframe of URI, number of mementos
3 numMementos <- read.table(header = TRUE, sep = ",", 'counting.csv'
4                               ')
5 # histogram
6 hgram <- hist(numMementos$Memento.Count, col = "gray", breaks =
7               20, main="URIs vs. Number of Mementos", xlab = "Number of
8               Mementos", ylab = "Number of URIs")
9 # add count labels
10 text(hgram$mids, hgram$counts, adj=c(0.5, -0.5), labels=
11       hgram$counts)
```

Listing 4: R script for creating Histogram

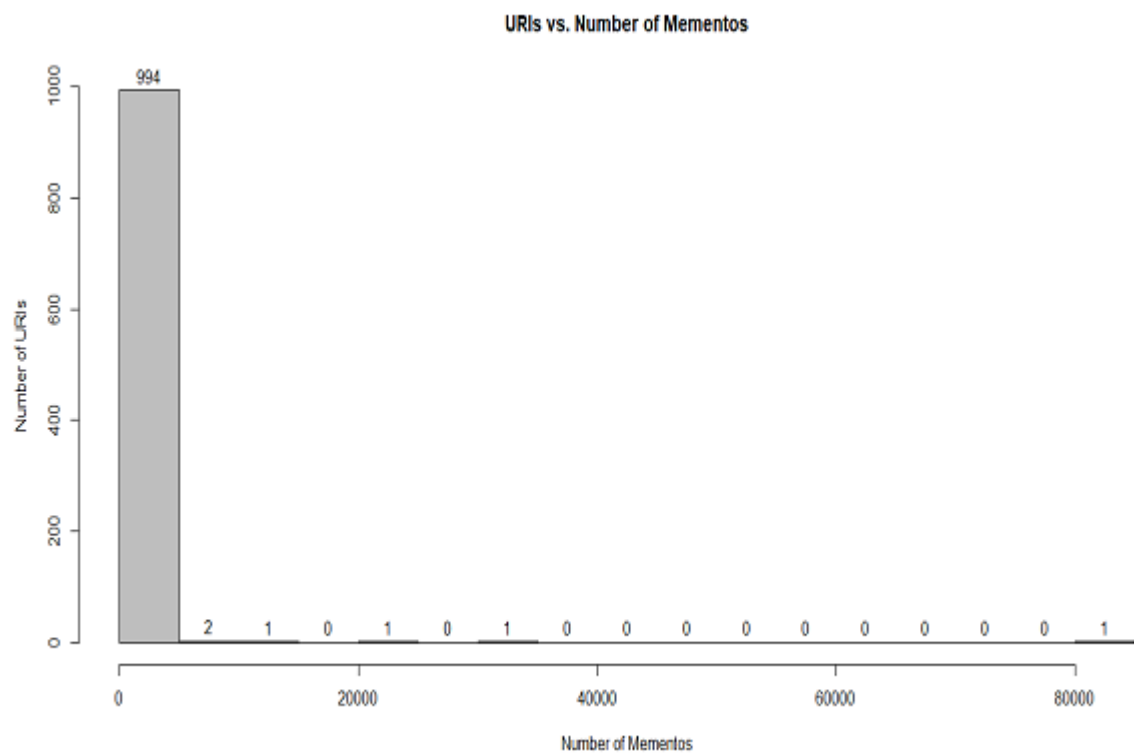


Figure 1: Histogram of Number of URIs vs. Number of Mementos

3

Question

3. Estimate the age of each of the 1000 URIs using the "Carbon Date" tool:

<http://ws-dl.blogspot.com/2016/09/2016-09-20-carbon-dating-web-version-30.html>

Note: you should use "docker" and install it locally. You can do it like this:

<http://cd.cs.odu.edu/cd?url=http://www.cs.odu.edu/>

But it will inevitably crash when everyone tries to use it at the last minute.

For URIs that have > 0 Mementos and an estimated creation date, create a graph with age (in days) on the x-axis and number of mementos on the y-axis.

Not all URIs will have Mementos, and not all URIs will have an estimated creation date. Show how many fall into either categories.

For example,

total URIs: 1000

no mementos: 137

no date estimate: 212

Answer

To solve the above problem, used the carbon dating tool [11] provided in the question to retrieve the estimated creation dates and memgator to fetch the number of memtos for each of the URIs from the saved **1000ulinks.txt** file. I first checked first few links and came to know that links with zero mementos either no creation date or had a creation date whereas URIs that had no date estimates didn't contain any mementos. The following dependencies were used:

- import requests
- import json
- from datetime import datetime
- import csv

The program shown in Listing 5 was written in Python 3.5 and the output was saved in **dates.csv** while with column names as Age and MementoCount.

```
1 import requests
2 import json
3 from datetime import datetime
4 import csv
5
6
7 #counts initialized
8
9 count = 1
10 count_nocd = 0
11 count_nomem = 0
12
13 #write first row as headers in csv file
14 with open('dates.csv', 'a+', newline='') as csvfile:
15     spamwriter = csv.writer(csvfile, delimiter=',',
16                             quotechar='|')
17     spamwriter.writerow(['Age', 'Memento-Count'])
18     csvfile.close()
19
20 with open('1000ulinks.txt') as fp:
21     for line in fp:
22         try:
23             #requests made to memgator as well as carbon date url
24             urlmem = 'http://memgator.cs.odu.edu/
25                     timemap/json/' + line.strip()
```

```

24         urlcd = 'http://cd.cs.odu.edu/cd/' +
25             line.strip()
26         reqmem = requests.head(urlmem, stream=
27             True, headers={'User-Agent': 'Mozilla
28             /5.0'})
29
30         #if no mementos
31         if reqmem.status_code == 404:
32             reqcd = requests.get(urlcd,
33                 stream=True, headers={'User-
34                 Agent': 'Mozilla/5.0'})
35             data = reqcd.json()
36             #get the count for no date estimates if any
37             if data['estimated-creation-date
38                 '] == "":
39                 count_nocd = count_nocd
40                 + 1
41                 count_nomem =
42                 count_nomem +1
43
44             else:
45                 count_nomem =
46                 count_nomem +1
47
48         else:
49             reqcd = requests.get(urlcd,
50                 stream=True, headers={'User-
51                 Agent': 'Mozilla/5.0'})
52             data = reqcd.json()
53             #check if any uri having memento count has no estimate date
54             creation
55             if data['estimated-creation-date
56                 '] == "":
57                 count_nocd = count_nocd
58                 + 1
59
60         #else get the age in days using datetime
61         else:
62             memento.count = reqmem.
63                 headers.get('X-
64                 Memento-Count')
65             birthday = data['
66                 estimated-creation-
67                 date']
68             birthday = datetime.
69                 strptime(birthday, '%
70                 Y-%m-%dT%X')

```



```

52         age = datetime.now() -
53             birthday
54     #dump data into csv file
55     with open('dates.csv', '
56         a+', newline='') as
57         csvfile:
58         spamwriter = csv
59             .writer(
60                 csvfile,
61                 delimiter
62                 =',',
63                 quotechar
64                 ='|')
65         spamwriter.
66             writerow([age
67                 .days,
68                 memento_count
69                 ])
69         csvfile.close()

59 #the other data required dumped in calc.csv file
60     with open('calc.csv', 'w', newline='')
61         as csvfile:
62         spamwriter = csv.writer(csvfile,
63             delimiter=',', quotechar
64             ='|')
65         spamwriter.writerow(['Total URIs
66             ', 'No Mementos', 'No Date
67             Estimate '])
68         spamwriter.writerow(['1000',
69             count_nomem, count_nocd])
69         csvfile.close()

67     except:
68         pass

```

Listing 5: Python script for finding the carbon date

Also the program in Listing 5, calculated the following values and saved in **calc.csv** file.

- total URIs: 1000
- no mementos: 533
- no date estimate: 82

The following R [10] program was used to create the scatterplot for Age in Days vs number of Mementos, shown in Figure 2

```
1 setwd(getwd())
2 # Merged Dataset with memento count and days
3 mementoDays <- read.table(header = TRUE, sep = ",", 'thirdq.csv')
4 # filtered set w/ atleast 1 memento
5 #withMementos <- subset(mementoDays, mementoDays$V2 > 0)
6 #emptyDate <- subset(mementoDays, is.na(mementoDays$V3))
7 plot(mementoDays$Age, mementoDays$Memento_Count, xlab="Age in Days",
      ylab="Number of Mementos", main="Scatter Plot for Days vs.
      Mementos")
```

Listing 6: R Script to create scatterplot

Looking at the graph I noticed that the URIs with very few number of mementos are new whereas the URIs having more mementos are old. Also very few URIs are archived regularly.

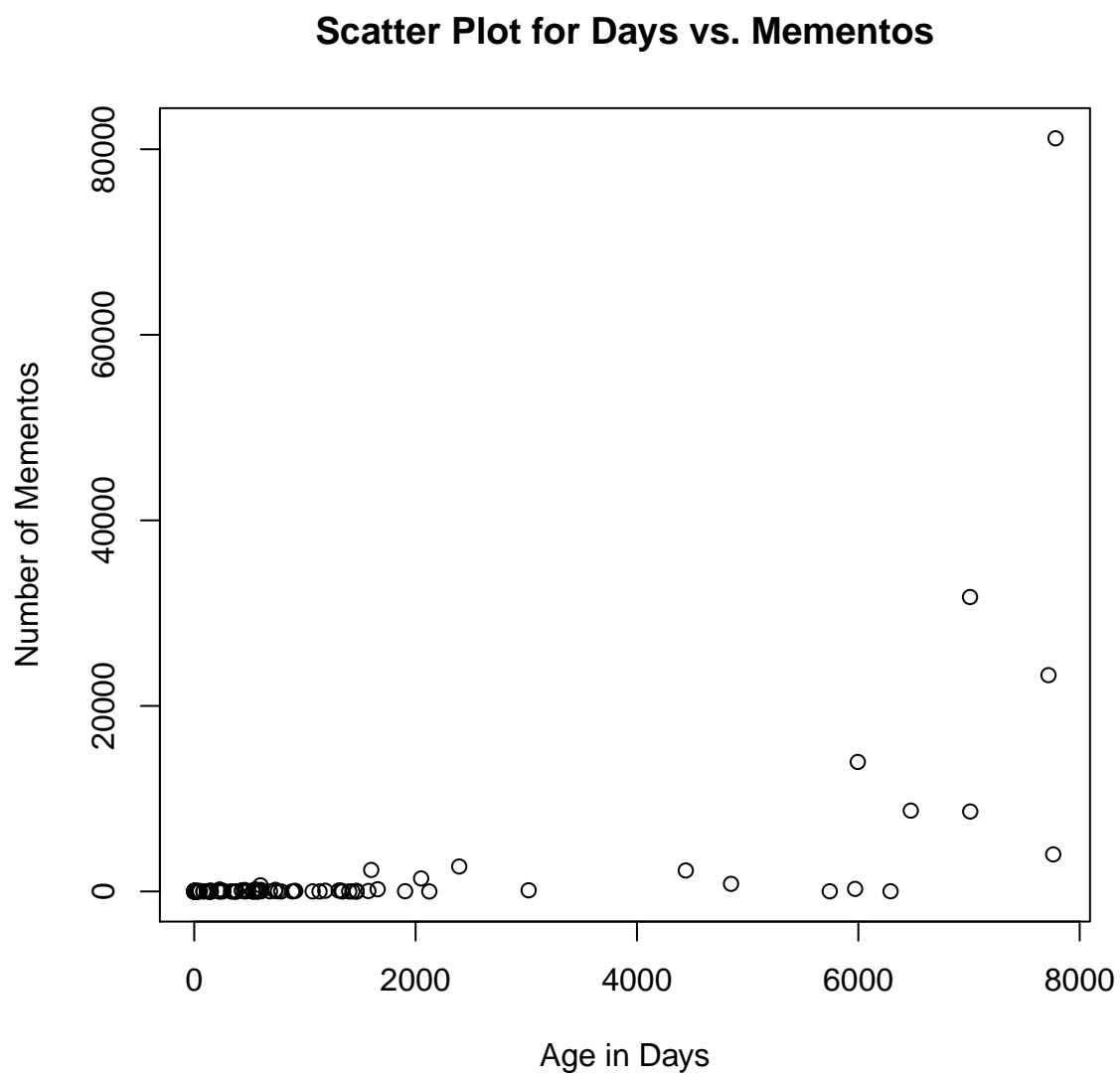


Figure 2: Scatter plot of age in days and number of mementos

References

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- [3] Tweepy Documentation. “Tweepy Documentation - tweepy 3.5.0 .” N.p., 13 Feb. 2018. <http://docs.tweepy.org/en/v3.5.0/index.html>
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- [11] Zetan, Li. “2016-09-20: Carbon Dating the Web, Version 3.0.” 2016-09-20: Carbon Dating the Web, Version 3.0. N.p., 20 Sept. 2016. Web. 08 Feb. 2017. <http://ws-dl.blogspot.com/2016/09/2016-09-20-carbon-dating-web-version-30.html>