

PriceWeave

31st May, 2016



BY DATAWEAVE

Social media can be defined as virtual communities and networks, where social interaction takes place among people and a wide variety of content is shared including ideas, opinions, information, pictures, videos and much more. Due to the massive growth of social media in the last decade, it has become a rage among data enthusiasts to tap into the vast pool of social data and gather interesting insights like trending items, reception of newly released products by society, popularity measures to name a few.

As you are aware, we are constantly evolving **PriceWeave**, which has the most extensive set of offerings when it comes to providing actionable insights to retail stores and brands. As part of the product development, we look at social data from a variety of channels to mine things like: trending products/brands; social engagement of stores/brands; what content “works” and what doesn’t on social media, and so forth.

We do a number of experiments with Twitter data, and this series of blog posts is one of the outputs from those efforts.

In some of our recent blog posts, we have seen **how to look at current trends and gather insights from YouTube** the popular video sharing website. We have also talked about how to create a quick bare-bones web application to **perform sentiment analysis of tweets from Twitter**. Today I will be talking about mining data from Twitter and doing much more with it than just sentiment analysis. We will be analyzing Twitter data in depth and then we will try to get some interesting insights from it.

To get data from twitter, first we need to create a new Twitter application to get OAuth credentials and access to their APIs. For doing this, head over to the [Twitter Application Management page](#) and sign in with your Twitter credentials. Once you are logged in, click on the Create New App button as you can see in the snapshot below. Once you create the application, you will be able to view it in your dashboard just like the application I created, named DataScienceApp1_DS shows up in my dashboard depicted below.

 Application Management 

Twitter Apps

Create New App



DataScienceApp1_DS

Test Application for the data science course

On clicking the application, it will take you to your application management dashboard. Here, you will find the necessary keys you need in the Keys and Access Tokens section. The main tokens you need are highlighted in the snapshot below.



DataScienceApp1_DS

[Test OAuth](#)[Details](#) [Settings](#) [Keys and Access Tokens](#) [Permissions](#)

Application Settings

Keep the "Consumer Secret" a secret. This key should never be human-readable in your application.

Consumer Key (API Key)	<YOUR API KEY>
Consumer Secret (API Secret)	<YOUR API SECRET>
Access Level	Read-only (modify app permissions)
Owner	[REDACTED]
Owner ID	[REDACTED]

Application Actions

[Regenerate Consumer Key and Secret](#)[Change App Permissions](#)

Your Access Token

This access token can be used to make API requests on your own account's behalf. Do not share your access token secret with anyone.

Access Token	<YOUR ACCESS TOKEN>
Access Token Secret	<YOUR ACCESS TOKEN SECRET>
Access Level	Read-only
Owner	[REDACTED]
Owner ID	[REDACTED]

I will be doing most of my analysis using the [Python](#) programming language. To be more specific, I will be using the IPython shell, but you are most welcome to use the language of your choice, provided you get the relevant API wrappers and necessary libraries.

Installing necessary packages

After obtaining the necessary tokens, we will be installing some necessary libraries and packages, namely [twitter](#), [prettytable](#) and [matplotlib](#). Fire up your terminal or command prompt and use the following commands to install the libraries if you don't have them already.

```
[root@dip]# pip install twitter [root@dip]# pip install pretty
table [root@dip]# pip install matplotlib
```

Creating a Twitter API Connection

Once the packages are installed, you can start writing some code. For this, open up the IDE or text editor of your choice and use the following code segment to create an authenticated connection to [Twitter's API](#). The way the following code snippet works, is by using your OAuth credentials to create an object called `auth` that represents your OAuth authorization. This is then passed to a class called `Twitter` belonging to the `twitter` library and we create a resource object named `twitter_api` that is capable of issuing queries to Twitter's API.

```
import twitter
CONSUMER_KEY = 'REPLACE WITH YOUR KEY'

CONSUMER_SECRET = 'REPLACE WITH YOUR SECRET'

OAUTH_TOKEN = 'REPLACE WITH YOUR TOKEN'

OAUTH_TOKEN_SECRET = 'REPLACE WITH YOUR TOKEN SECRET'

auth = twitter.oauth.OAuth(OAUTH_TOKEN, OAUTH_TOKEN_SECRET,
CONSUMER_KEY, CONSUMER_SECRET)
twitter_api = twitter.Twitter
(auth=auth)
print twitter_api
```

If you do a `print twitter_api` and all your tokens are correct, you should be getting something similar to the snapshot below. This indicates that we've successfully used OAuth credentials to gain authorization to query Twitter's API.

```
In [9]: print twitter_api
<twitter.api.Twitter object at 0x00000000AE4D048>
```

Exploring Trending Topics

Now that we have a working Twitter resource object, we can start issuing requests to Twitter. Here, we will be looking at the topics which are currently trending worldwide using some specific API calls. The API can also be parameterized to constrain the topics to more specific locales and regions. Each query uses a unique identifier which follows the Yahoo! [GeoPlanet's Where On Earth \(WOE\)](#) ID system, which is an API itself that aims to provide a way to map a unique identifier to any named place on Earth. The following code segment retrieves trending topics in the world, the US and in India.

```

import json WORLD_WOE_ID = 1 US_WOE_ID = 23424977

IND_WOE_ID = 23424848 world_trends = twitter_api.trends.place

(_id=WORLD_WOE_ID) us_trends = twitter_api.trends.place

(_id=US_WOE_ID) india_trends = twitter_api.trends.place

(_id=IND_WOE_ID) print world_trends print us_trends print

india_trends

```

Once you print the responses, you will see a bunch of outputs which look like JSON data. To view the output in a pretty format, use the following commands and you will get the output as a pretty printed JSON shown in the snapshot below.

```

In [38]: import json

In [39]: print json.dumps(india_trends, indent=2)
[
  {
    "created_at": "2014-11-23T10:55:25Z",
    "trends": [
      {
        "url": "http://twitter.com/search?q=%23MufflerMan",
        "query": "%23MufflerMan",
        "name": "#MufflerMan",
        "promoted_content": null
      },
      {
        "url": "http://twitter.com/search?q=%23MTVStars",
        "query": "%23MTVStars",
        "name": "#MTVStars",
        "promoted_content": null
      },
      {
        "url": "http://twitter.com/search?q=%23YennaiArindhaalForPongal2015",
        "query": "%23YennaiArindhaalForPongal2015",
        "name": "#YennaiArindhaalForPongal2015",
        "promoted_content": null
      },
      {
        "url": "http://twitter.com/search?q=%23ModiSirRemoveUnfairPOCSOlaw",
        "query": "%23ModiSirRemoveUnfairPOCSOlaw",

```

To view all the trending topics in a convenient way, we will be using list comprehensions to slice the data we need and print it using prettytable as shown below.

```
from prettytable import PrettyTable world_trends = [trend
['name'] for trend in world_trends[0]['trends']] us_trends =
[trend['name'] for trend in us_trends[0]['trends']]
india_trends = [trend['name'] for trend in india_trends[0]
['trends']] pt = PrettyTable(field_names=['World Trends',
'US Trends', 'India Trends']) for world_trend, us_trend,
india_trend in zip(world_trends, us_trends, india_trends):
pt.add_row([world_trend, us_trend, india_trend]) print pt
```

On printing the result, you will get a neatly tabulated list of current trends which keep changing with time.

```
In [49]: print pt
```

World Trends	US Trends	India Trends
#1YearOf1DDAY	#MTVStars	#MufflerMan
#HappyBirthdayMiley	#1YearOf1DDAY	#MTVStars
#AskMaris	Marion Barry	#YennaiArindhaalForPongal2015
#votetroyesivan	#HappyBirthdayMiley	#ModiSirRemoveUnfairPOCSOlaw
Puppy Ko Si Papi Third Episode	Don't Do Drugs	#ARSMUN
#BSWNET_Minyak	#iHeartFiesta	Waiting For BABY Trailer
Amri	Algieri	Sanskrit
JOSHANE aBANGan Sa NKNKK	#votetroyesivan	Booker T
MilyonlarPeşinde BEŞİKTAŞımBuGece	Mocking Jay	Vatican
Gasquet	Pacquiao	Wilshere

Now, we will try to analyze and see if some of these trends are common. For that we use Python's set data structure and compute intersections to get common trends as shown in the snapshot below.

```
In [54]: set(world_trends).intersection(set(us_trends))
Out[54]: {u'#1YearOf1DDAY', u'#HappyBirthdayMiley', u'#votetroyesivan'}

In [55]: set(us_trends).intersection(set(india_trends))
Out[55]: {u'#MTVStars'}
```

Interestingly, some of the trending topics at this moment in the US are common with some of the trending topics in the world. The same holds good for US and India.

Mining for Tweets

In this section, we will be looking at ways to mine Twitter for retrieving tweets based on specific queries and extracting useful information from the query results. For this we will be using Twitter API's [GET search/tweets](#) resource. Since the Google Nexus 6 phone was launched recently, I will be using that as my query string. You can use the following code segment to make a robust API request to Twitter to get a size-able number of tweets.

```
query = 'Nexus6' count = 100 search_results = twitter
_api.search.tweets(q=query, count=count) statuses = search_results['statuses']
# Iterate through 5 more batches of results by following the cursor for _ in
range(5): print "Length of status list", len(statuses)
    try: next_results = search_results['search_metadata']
        ['next_results'] except KeyError, e: break # create a
        dictionary of parameters to be passed to the search

method kwargs = dict([kv.split('=') for kv in

next_results[1:].split('&')]) search_results = twitter_api.search.tweets(**kwargs) sta
tuses += search_results['statuses'] # Print one sample tweet by slicing the list print
json.dumps(statuses[0],

indent=2)
```

The code snippet above, makes repeated requests to the Twitter Search API. Search results contain a special `search_metadata` node that embeds a `next_results` field with a query string that provides the basis of making a subsequent query. If we weren't using a library like `twitter` to make the HTTP requests for us, this preconstructed query string would just be appended to the Search API URL, and we'd update it with additional parameters for handling OAuth. However, since we are not making our HTTP requests directly, we must parse the query string into its constituent key/value pairs and provide them as keyword arguments to the `search/tweets` API endpoint. I have provided a snapshot below, showing how this dictionary of key/value pairs are constructed which are passed as `kwargs` to the `Twitter.search.tweets(..)` method.

```

In [18]: search_results['search_metadata']['next_results'][1:].split('&')
Out[18]:
[u'max_id=536541787595083775',
 u'q=Nexus6',
 u'count=100',
 u'include_entities=1']

In [19]: [kv.split('=') for kv in search_results['search_metadata']['next_results'][1:].split('&')]
Out[19]:
[[u'max_id', u'536541787595083775'],
 [u'q', u'Nexus6'],
 [u'count', u'100'],
 [u'include_entities', u'1']]

In [20]: dict([kv.split('=') for kv in search_results['search_metadata']['next_results'][1:].split('&')])
Out[20]:
{'count': u'100',
 'include_entities': u'1',
 'max_id': u'536541787595083775',
 'q': u'Nexus6'}

```

Analyzing the structure of a Tweet

In this section we will see what are the main features of a tweet and what insights can be obtained from them. For this we will be taking a sample tweet from our list of tweets and examining it closely. To get a detailed overview of tweets, you can refer to [this excellent resource](#) created by Twitter. I have extracted a sample tweet into the variable `sample_tweet` for ease of use. `sample_tweet.keys()` returns the top-level fields for the tweet.

Typically, a tweet has some of the following data points which are of great interest.

- The identifier of the tweet can be accessed through `sample_tweet['id']`
- The human-readable text of a tweet is available through `sample_tweet['text']`
- The entities in the text of a tweet are conveniently processed and available through `sample_tweet['entities']`
- The “interestingness” of a tweet is available through `sample_tweet['favorite_count']` and `sample_tweet['retweet_count']`, which return the number of times it’s been bookmarked or retweeted, respectively
- An important thing to note, is that, the `retweet_count` reflects the total number of times the original tweet has been retweeted and should reflect the same value in both the original tweet and all subsequent retweets. In other words, retweets aren’t retweeted
- The user details can be accessed through `sample_tweet['user']` which contains details like `screen_name`, `friends_count`, `followers_count`, `name`, `location` and so on

Some of the above datapoints are depicted in the snapshot below for the `sample_tweet`. Note, that the names have been changed to protect the

identity of the entity that created the status.

```
In [117]: print sample_tweet['id']
5365475218046

In [118]: print sample_tweet['text']
That's a lot of available RAM #Nexus6 http://t.co/Gi5fsIHJIp

In [119]: print 'favorite count:', sample_tweet['favorite_count'],\
...: '\nretweet count:', sample_tweet['retweet_count']
favorite count: 6
retweet count: 3

In [120]: print 'screen name:', sample_tweet['user']['screen_name'],\
...: '\nfriends:', sample_tweet['user']['friends_count'],\
...: '\nfollowers:', sample_tweet['user']['followers_count'],\
...: '\nlocation:', sample_tweet['user']['location'],\
...: '\nname:', sample_tweet['user']['name'],\
...: '\ntotal statuses:', sample_tweet['user']['statuses_count']
screen name: JohnDoe
friends: 303
followers: 7233
location: Philadelphia, PA
name: John Doe
total statuses: 9853
```

Before we move on to the next section, my advice is that you should play around with the sample tweet and consult the documentation to clarify all your doubts. A good working knowledge of a tweet's anatomy is critical to effectively mining Twitter data.

Extracting Tweet Entities

In this section, we will be filtering out the text statuses of tweets and different entities of tweets like hashtags. For this, we will be using list comprehensions which are faster than normal looping constructs and yield substantial performance gains. Use the following code snippet to extract the texts, screen names and hashtags from the tweets. I have also displayed the first five samples from each list just for clarity.

```
status_texts = [ status['text'] for status in statuses ]
screen_names = [ user_mention['screen_name'] for status

in statuses for user_mention in status['entities']
['user_mentions'] ]
hashtags = [ hashtag['text']

for status in statuses for hashtag in status['entities']
['hashtags'] ] # get samples of first five entities
```

```
texts = status_texts[0:5] scr_names = list(set(screen_names))[0:5] hash_tags = hashtag
s[0:5] tweet_words = words[0:5] # display the results as a table pt = PrettyTable() p
t.add_column('Tweets', texts) pt.add_column('Screen Names',scr_names) pt.add_column('H
ashTags', hash_tags)pt.add_column('Words', tweet_words)
```

Once you print the table, you should be getting a table of the sample data which should look something like the table below but with different content ofcourse!

Tweets	Screen Names	HashTags	Words
Best #android #nexus6 #HTConeM8 #SamsungS5 XperiaULTRAかNexus6か Nexus6のパフォーマンスゴミのか...?	babelnedd expresso_6 BrandonMiniman	android today nexus6	Which is the best
Win A #Google #Nexus6 & from Fremo Nexus6はでけわ	Repli_nexus6 caschy	HTConeM8 SamsungS5	#android

Frequency Analysis of Tweet and Tweet Entities

Once we have all the required data in relevant data structures, we will do some analysis on it. The most common analysis would be a frequency analysis where we find out the most common terms occurring in different entities of the tweets. For this we will be making use of the [collection](#) module. The following code snippet ranks the top ten most occurring tweet entities and prints them as a table.

```
from collections import Counter # get top ten entities
```

```
top_words = [item[0] for item in Counter
(words).most_common()[:10]] top_words_freq = [item[1] for item in Counter(words).most_
common()[:10]]

top_screen_names = [item[0] for item in Counter
(screen_names).most_common()[:10]] top_screen_names_freq = [item[1] for item in Counte
r(screen_names)

.most_common()[:10]] top_hashtags = [item[0] for item in Counter(hashtags).most_common
()[:10]]

top_hashtags_freq = [item[1] for item in Counter(hashtags).most_common()[:10]]
# print the results as a table pt = PrettyTable()
pt.add_column('Words',top_words)
pt.add_column('Frequency',top_words_freq)
pt.add_column('Screen Names',top_screen_names)
pt.add_column('Frequency',top_screen_names_freq)
```

```
pt.add_column('Hashtags',top_hashtags)
pt.add_column('Frequency',top_hashtags_freq) print pt
```

The output I obtained is shown in the snapshot below. As you can see, there is a lot of noise in the tweets because of which several meaningless terms and symbols have crept into the top ten list. For this, we can use some pre-processing and data cleaning techniques.

```
In [71]: print pt
```

Words	Frequency	Screen Names	Frequency	Hashtags	Frequency
the	963	smartphone_mato	11	Nexus6	534
#Nexus6	529	BrandonMiniman	3	Android	470
Nexus	502	Repli_nexus6	3	Nexus5	442
6	497	Motorola	3	Google	40
and	480	Emonium	3	Nexus6Sleeve	37
-	479	skyblue_1985jp	2	Nexus6Cover	37
Android	476	TMobile	2	GoogleNexus6	33
new	475	babelnedd	1	Nexus6Leather	15
#Android	470	espresso_6	1	nexus6	14
about	445	caschy	1	Organic	13

Analyzing the Lexical Diversity of Tweets

A slightly more advanced measurement that involves calculating simple frequencies and can be applied to unstructured text is a metric called lexical diversity. Mathematically, lexical diversity can be defined as an expression of the number of unique tokens in the text divided by the total number of tokens in the text. Let us take an example to understand this better. Suppose you are listening to someone who repeatedly says “and stuff” to broadly generalize information as opposed to providing specific examples to reinforce points with more detail or clarity. Now, contrast that speaker to someone else who seldom uses the word “stuff” to generalize and instead reinforces points with concrete examples. The speaker who repeatedly says “and stuff” would have a lower lexical diversity than the speaker who uses a more diverse vocabulary.

The following code snippet, computes the lexical diversity for status texts, screen names, and hashtags for our data set. We also measure the average number of words per tweet.

```
# A function for computing lexical diversity
```

```
def lexical_diversity(tokens): return 1.0*len(set(tokens))/len(tokens)
#A function for computing the average number of words per tweet
def average_words(statuses):
    total_words = sum([len(s.split()) for s in statuses ])
    return
```

```
1.0*total_words/len(statuses)
print lexical_diversity(words)
print lexical_diversity(screen_names)
print lexical_diversity(hashtags)
print average_words(status_texts)
```

The output which I obtained is depicted in the snapshot below.

```
In [74]: print lexical_diversity(words)
0.0974507322365

In [75]: print lexical_diversity(screen_names)
0.591836734694

In [76]: print lexical_diversity(hashtags)
0.0299295774648

In [77]: print average_words(status_texts)
18.4366666667
```

Now, I am sure you must be thinking, what on earth do the above numbers indicate? We can analyze the above results as follows.

- The lexical diversity of the words in the text of the tweets is around 0.097. This can be interpreted as, each status update carries around 9.7% unique information. The reason for this is because, most of the tweets would contain terms like Android, Nexus 6, Google
- The lexical diversity of the screen names, however, is even higher, with a value of 0.59 or 59%, which means that about 29 out of 49 screen names mentioned are unique. This is obviously higher because in the data set, different people will be posting about Nexus 6
- The lexical diversity of the hashtags is extremely low at a value of around 0.029 or 2.9%, implying that very few values other than the #Nexus6 hashtag appear multiple times in the results. This is relevant because tweets about Nexus 6 should contain this hashtag
- The average number of words per tweet is around 18 words

This gives us some interesting insights like people mostly talk about Nexus 6 when queried for that search keyword. Also, if we look at the top hashtags, we see that Nexus 5 co-occurs a lot with Nexus 6. This might be an indication that people are comparing these phones when they are tweeting.

Examining Patterns in Retweets

In this section, we will analyze our data to determine if there were any particular tweets that were highly retweeted. The approach we'll take to find

the most popular retweets, is to simply iterate over each status update and store out the retweet count, the originator of the retweet, and status text of the retweet, if the status update is a retweet. We will be using a list comprehension and sort by the retweet count to display the top few results in the following code snippet.

```
retweets = [ # Store out a tuple of following three values (status['retweet_count'], status['retweeted_status']['user']['screen_name'], status['text'])

# for each status for status in statuses
# as long as the status has been retweeted if status.has_key('retweeted_status') ]
# Display the top 5 retweets with necessary fields

pt = PrettyTable(field_names=
['Count', 'Screen Name', 'Text'])
[ pt.add_row(row) for row in sorted
(retweets, reverse=True)[:5] ] pt.max_width
['Text'] = 50 print pt
```

The output I obtained is depicted in the following snapshot.

In [89]: print pt

Count	Screen Name	Text
201	googlenexus	RT @googlenexus: 6 hours of use on a 15 minute charge? We call that a win. We also call it a #Nexus6. http://t.co/0wP1HLLacb
23	hak5darren	RT @hak5darren: I don't know what everyone's talking about - the #Nexus6 is the perfect size phone. http://t.co/n0en5iVQTK
13	smartphone_mato	RT @smartphone_mato: 『Nexus6が出るけどあえてNexus5をオススメする理由』 http://t.co/1kC17SieoY -NAVERまとめ (スマートフォン)
13	smartphone_mato	RT @smartphone_mato: 『Nexus6が出るけどあえてNexus5をオススメする理由』 http://t.co/1kC17SieoY -NAVERまとめ (スマートフォン)
13	smartphone_mato	RT @smartphone_mato: 『Nexus6が出るけどあえてNexus5をオススメする理由』 http://t.co/1kC17SieoY -NAVERまとめ (スマートフォン)

From the results, we see that the top most retweet is from the official [googlenexus](#) channel on Twitter and the tweet speaks about the phone being used non-stop for 6 hours on only a 15 minute charge. Thus, you can see that this has definitely been received positively by the users based on its retweet count. You can detect similar interesting patterns in retweets based on the topics of your choice.

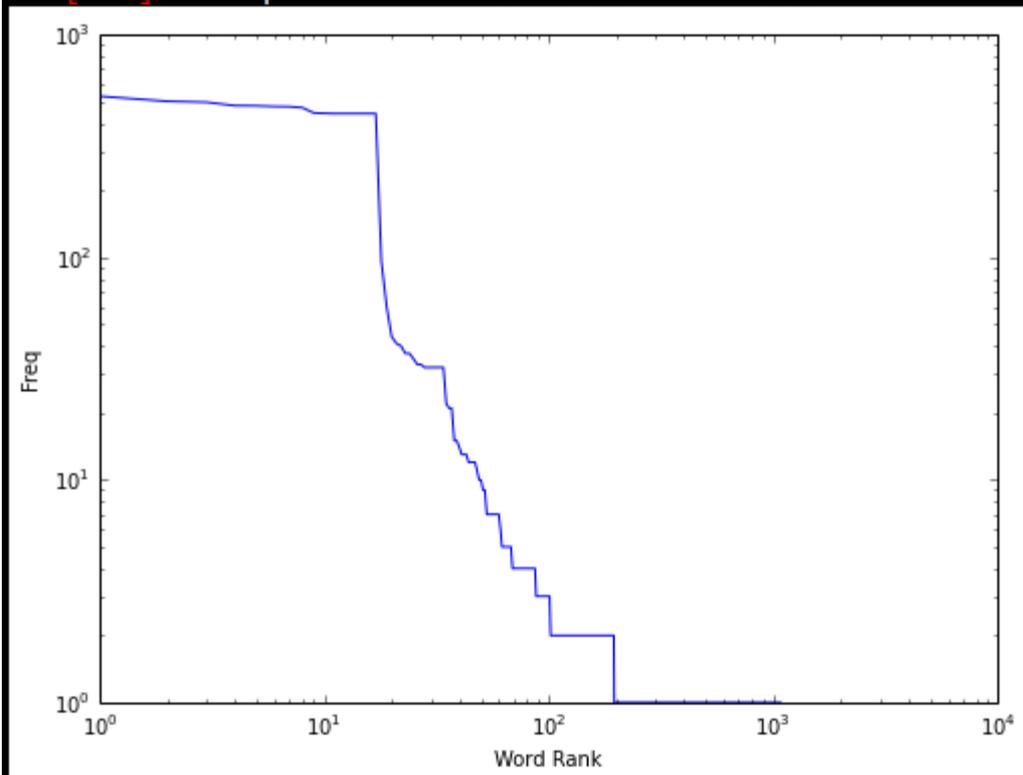
Visualizing Frequency Data

In this section, we will be creating some interesting visualizations from our data set. For plotting we will be using matplotlib, a popular Python plotting library which comes inbuilt with IPython. If you don't have matplotlib loaded by default use the command `import matplotlib.pyplot as plt` in your code.

Visualizing word frequencies

In our first plot, we will be displaying the results from the words variable which contains different words from the tweet status texts. Using Counter from the collections package, we generate a sorted list of tuples, where each tuple is a (word, frequency) pair. The x-axis value will correspond to the index of the tuple, and the y-axis will correspond to the frequency for the word in that tuple. We transform both axes into a logarithmic scale because of the vast number of data points.

```
In [105]: word_counts = sorted(Counter(words).values(), reverse=True)
...: plt.loglog(word_counts)
...: plt.ylabel("Freq")
...: plt.xlabel("Word Rank")
...:
Out[105]: <matplotlib.text.Text at 0xcdc17b8>
```

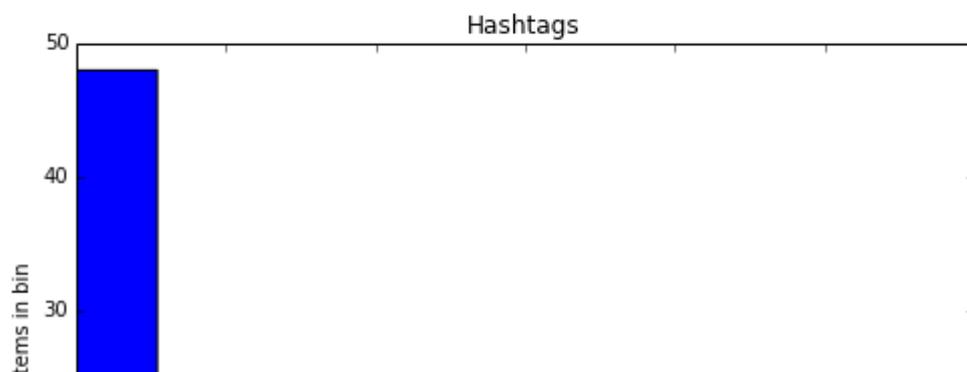
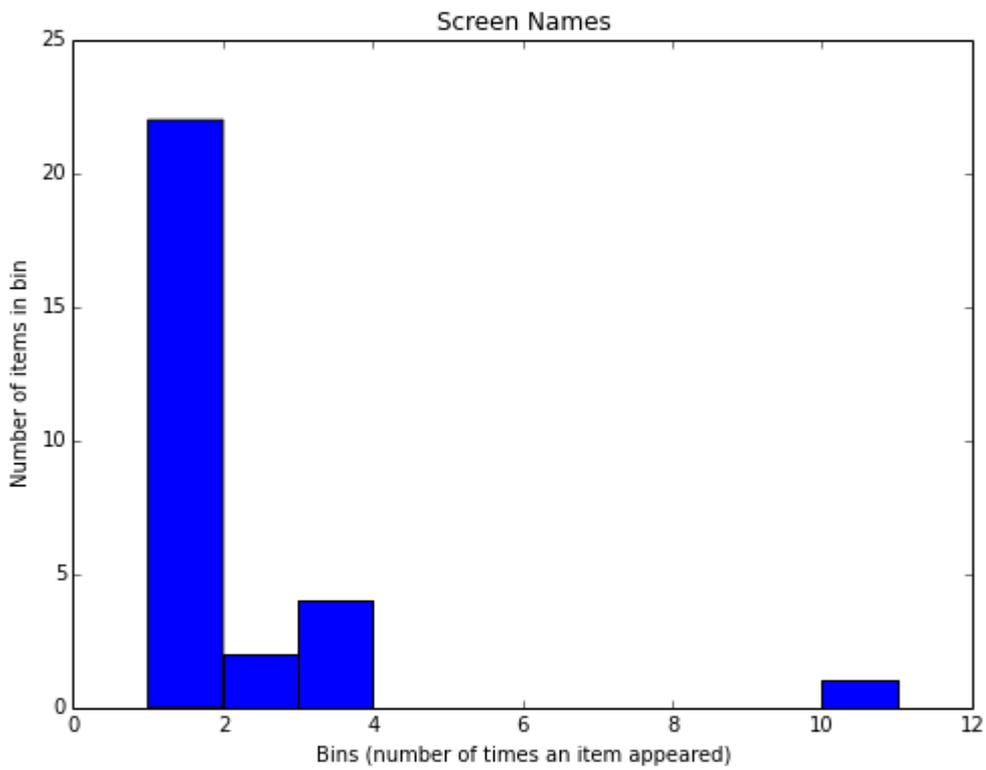
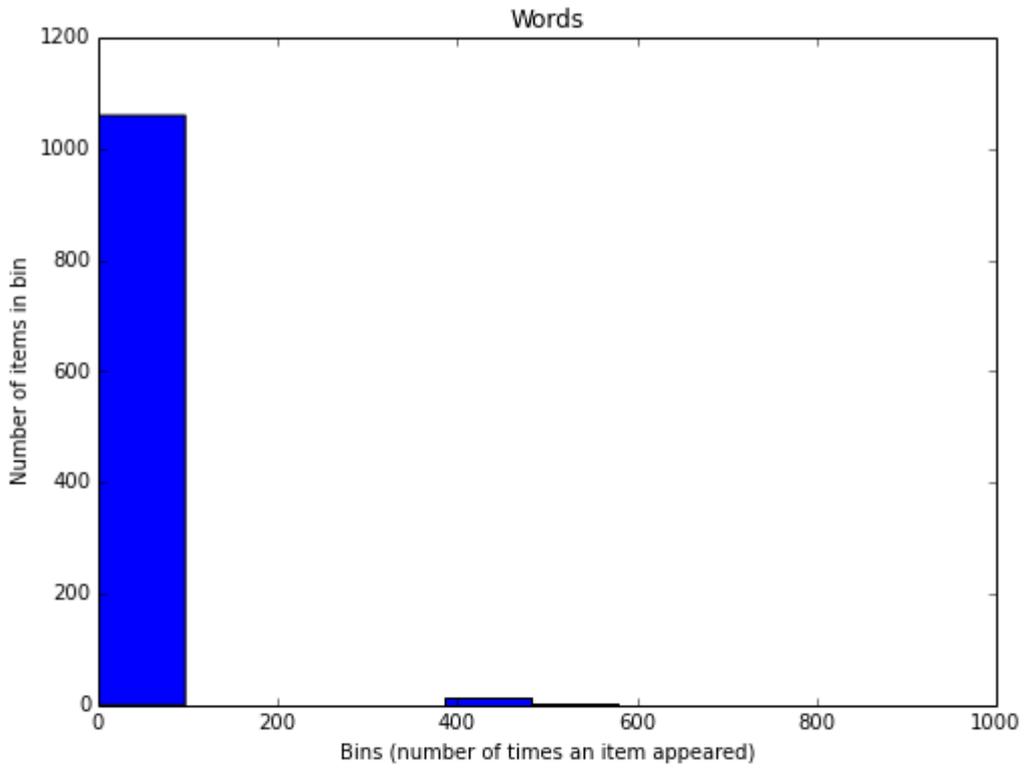


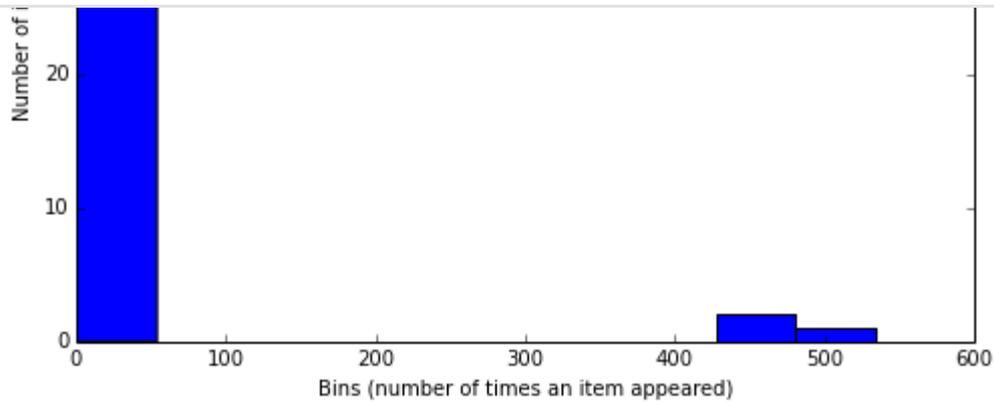
Visualizing words, screen names, and hashtags

A line chart of frequency values is decent enough. But what if we want to find out the number of words having a frequency between 1-5, 5-10, 10-15... and so on. For this purpose we will be using a histogram to depict the frequencies. The following code snippet achieves the same.

```
for label, data in (('Words', words), ('Screen Names', screen_names), ('Hashtags', hashtags)): # Build a frequency map for each set of data and plot the values c = Counter(data) plt.hist(c.values()) # Add a title labels plt.title(label) plt.ylabel("Number of items in a bin") plt.xlabel("Bins (number of times an item appeared)") # Display as a new figure plt.figure()
```

What this essentially does is, it takes all the frequencies and groups them together and creates bins or ranges and plots the number of entities which fall in that bin or range. The plots I obtained are shown below.





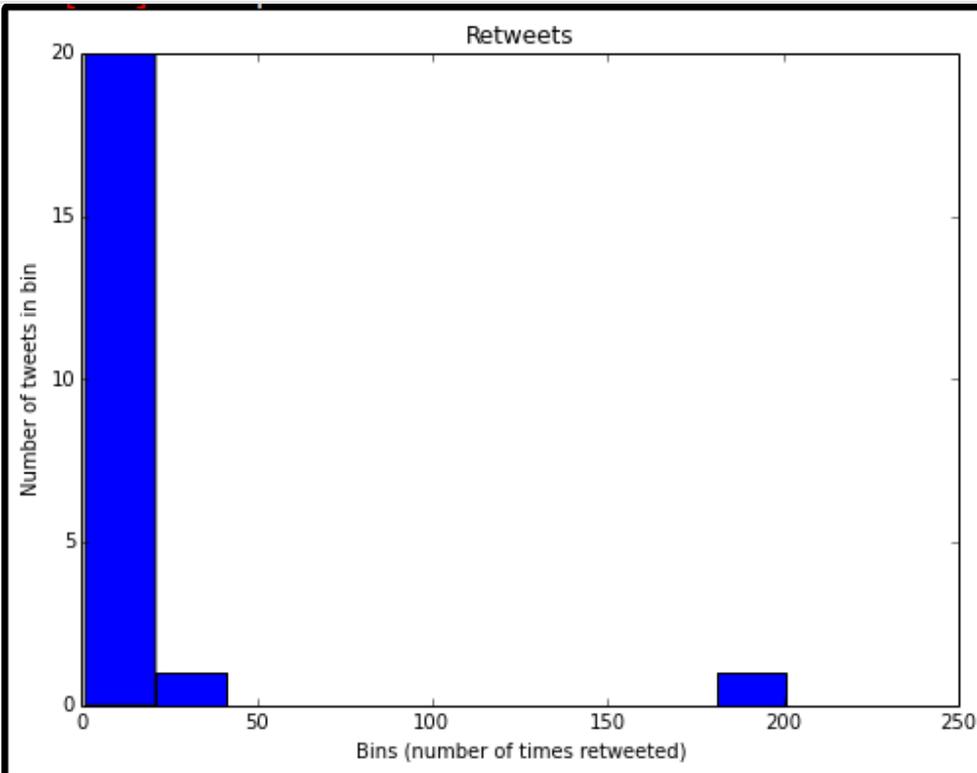
From the above plots, we can observe that, all the three plots follow the “Pareto Principle” i.e, almost 80% of the words, screen names and hashtags have a frequency of only 20% in the whole data set and only 20% of the words, screen names and hashtags have a frequency of more than 80% in the data set. In short, if we consider hashtags, a lot of hashtags occur maybe only once or twice in the whole data set and very few hashtags like #Nexus6 occur in almost all the tweets in the data set leading to its high frequency value.

Visualizing retweets

In this visualization, we will be using a histogram to visualize retweet counts using the following code snippet.

```
# Using underscores while unpacking values in a tuple is idiomatic for discarding them
counts = [count for count, _, _ in retweets] plt.hist(counts) plt.title("Retweets") pl
t.xlabel('Bins (number of times retweeted)') plt.ylabel('Number of tweets in bin') pri
nt counts
```

The plot which I obtained is shown below.



```
In [114]: print counts  
[201, 13, 13, 13, 13, 13, 13, 13, 13, 13, 13, 13, 13, 3, 6, 1, 6, 3, 3, 1, 23, 1, 1]
```

Looking at the frequency counts, it is clear that very few retweets have a large count.

I hope you have seen by now, how powerful Twitter APIs are and using simple Python libraries and modules, it is really easy to generate very powerful and interesting insights. That's all for now folks! I will be talking more about Twitter Mining in another post sometime in the future. A ton of thanks goes out to **Matthew A. Russell** and his excellent book [Mining the Social Web](#), without which this post would never have been possible.

- [DataWeave Marketing](#)

31st May, 2016

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