

CS5540: Principles to Big Data - SP2017

Project 1 - Team 2

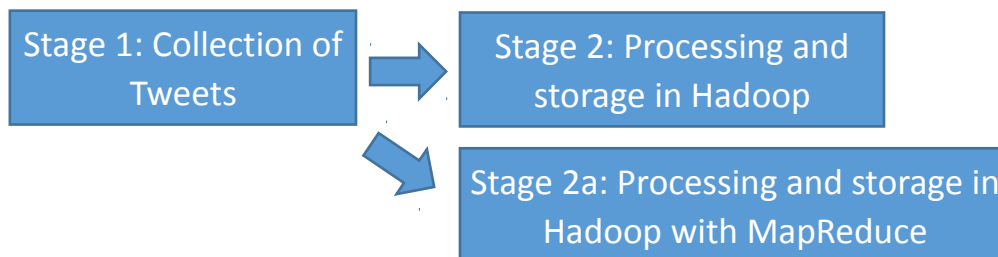
Project Overview:

The objective of the project is to collect 100,000 tweets from Twitter and identify the top 10 hashtags using the Hadoop file system. This report is split into 5 sections, as follows:

1. Collection of tweets from twitter with Twitter API
2. Processing of tweets to categorize by hashtags and identify top 10
3. Screenshots of Hadoop File System
4. Count Keywords (Extra Requirement)
5. Appendix: References, Source Code, Etc

The sections will include text, diagrams and source code where applicable to illustrate the methods and results of this project.

From a high level perspective, the algorithm flows as follows:



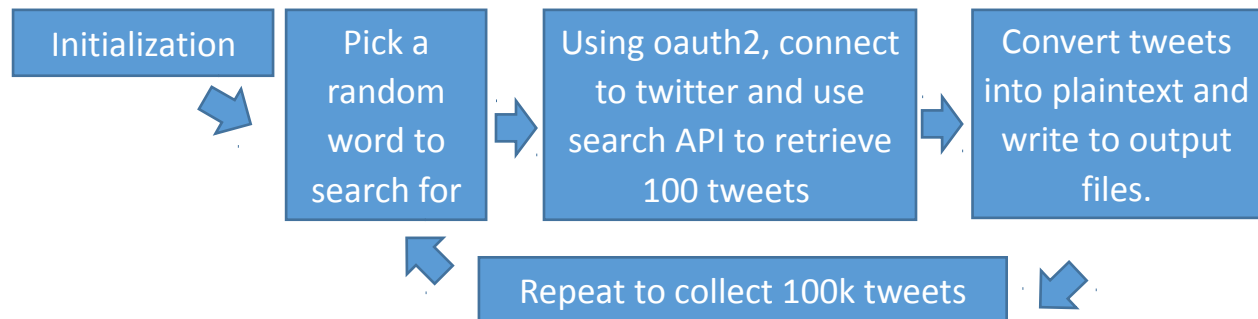
Section 1.

As dictated by the project requirements, 100K (100,000) tweets needed to be collected. To accomplish this Stage 1, this project uses the twitter API. By creating a twitter account and setting up an application, tweets can be collected via the Search API. For example, take this query:

<https://api.twitter.com/1.1/search/tweets.json?q=the&count=100>

This example would return 100 tweets containing the word “the”. The tweets will be returned in a JSON format and will need to be processed into t for stage 2.

From a high level perspective, the flow diagram looks like so:



During initialization several libraries are imported, one of which is oauth2. In order to use certain twitter API queries, authentication must first be established. For this project, oauth2 was used; a function, `oauth_req`, is query twitter. The function will be explained later on.

```

def oauth_req(url1, key, secret, http_method="GET", http_headers=None):
    consumer = oauth2.Consumer(key=CONSUMER_KEY, secret=CONSUMER_SECRET)
    token = oauth2.Token(key=key, secret=secret)
    client = oauth2.Client(consumer, token)
    resp, content = client.request( url1, headers=http_headers)
    return content
  
```

Output files are created and prepared to be written to and a dictionary is opened and stored in a list to facilitate the picking of a random word. In addition, the consumer key and consumer secret are set.

A while loop is started, based on increment variable `i`. `i` will increment each time a tweet is written to an output file. A random word is chosen from the list of words that were initialized earlier.

```
# Loop to collect 100k tweets if possible (typically rate limited)
while i < 100000:
    randword = random.choice(word) # random word used to search twitter for tweets
    print str(i)
    print randword
```

With the random word chosen, the program will now query Twitter.

```
home_timeline = oauth_req('https://api.twitter.com/1.1/search/tweets.json?q='+ randword + '&count=100',
                           [REDACTED],
                           [REDACTED])
tweets = json.loads(home_timeline) # load tweets into json parser
```

The function will return the tweets to home_timeline. Three arguments are passed into the oauth_req function.

The first is a string concatenated from three parts:

`'https://api.twitter.com/1.1/search/tweets.json?q='+ randword + '&count=100'`

If for example randword was chosen to be “bye”, the concatenated string would be:

`'https://api.twitter.com/1.1/search/tweets.json?q=bye&count=100'`

The twitter API will understand this to be a request for 100 tweets containing the text “bye”. The other two arguments, blacked out, are the token key and token secret. This program is meant to work with a Twitter App, and requires the key and secret for authentication. The earlier defined consumer secret and consumer token are also used for authentication.

home_timeline is then loaded into a JSON parser and stored in tweets. The tweets are converted to string type and then written to output files, one tweet per line. This process, random word, query and write, are repeated until 100,000 tweets are collected.

Write code snippet:

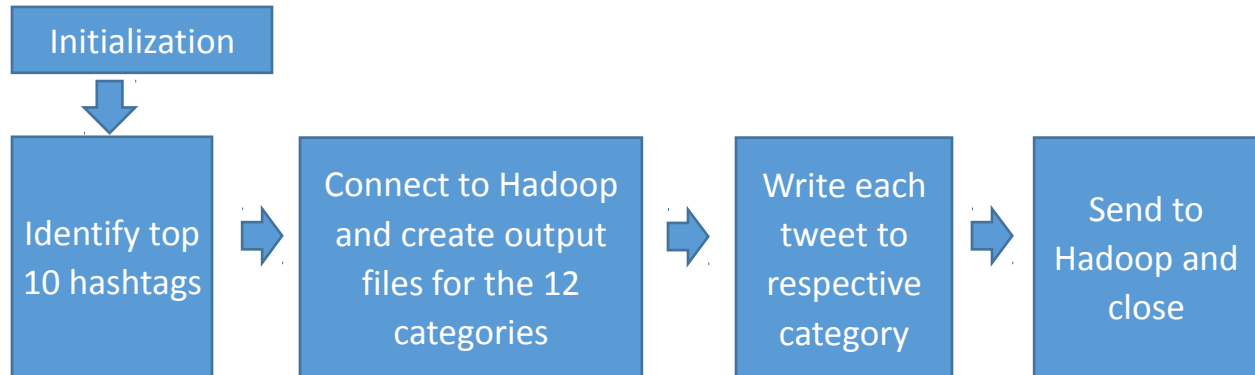
```
tweets = json.loads(home_timeline) # load tweets into json parser

# Iterate through tweets and output each tweet to a file, 1 tweet per line
# Split output among 4 files to avoid one giant file
for t in tweets["statuses"]:
    tweet = str(t) + "\n"
    if i % 4 == 0:
        out1.write(tweet)
    elif i % 4 == 1:
        out2.write(tweet)
    elif i % 4 == 2:
        out3.write(tweet)
    elif i % 4 == 3:
        out4.write(tweet)
    i += 1
```

Section 2.

With the tweets collected, they must now be processed and sorted. Based on the top 10 most common hashtags, 10 categories will be created in the HDFS: one for each hashtag. Two additional categories will also be created to store tweets that either have no hashtags or have a less common hashtag.

From a high level perspective, the flow diagram looks like so:



Initialization will import relevant libraries, such as `hdfs` which is needed to interface with Hadoop.

```
import ast
import os
import hdfs
import operator
```

```
# Helper function to identify which hashtag category a tweet belongs to
```

```
def tagCategory(hashtags, word):
    for tup in hashtags:
        tag = tup[0]
        if tag == word:
            return word
    return "OTHER"
```

```
# Open tweet input file
```

```
fin = open("allout.txt", "r")
tweets = fin.readlines()
```

```
hashtagdict = {}
```

The function tagCategory will be explained later. The file containing the tweets is opened and stored in a list. Finally a dictionary is initialized. This dictionary, hashtagdict, will store a count of hashtag occurrences to identify the top 10.

Using a for-loop, each tweet's 'hashtags' property is stored in ht. Since a tweet can have multiple hashtags, a for-loop is used to check each one. If the hashtag is already in the dictionary, simply increment the value. If there is no entry for that hashtag, then set it to one.

After going through every hashtag, in every tweet, the dictionary's items are then sorted so that the entries with the most occurrences are placed at the front. Store those first ten into a list called topten.

```
i = 0
for line in tweets:
    # t = json.loads(ast.literal_eval(line))
    tweet = ast.literal_eval(line)["text"]
    ht = ast.literal_eval(line)["entities"]['hashtags']
    print (str(i) + " : " + tweet)
    if (ht != []):
        h = 1
        for tag in ht:
            print ("hashtag #" + str(h) + " " + tag["text"])
            if (hashtagdict.has_key(tag["text"])):
                hashtagdict[tag["text"]] += 1
            else:
                hashtagdict[tag["text"]] = 1
            h += 1
        i += 1

hashtagsort = sorted(hashtagdict.items(), key=operator.itemgetter(1), reverse=True)
topten = hashtagsort[:10]
```

With a list of the top ten hashtags, the tweets must now be placed into the Hadoop File system. This is accomplished using the hdfs library.

First a connection is established to the HDFS server, which is run locally. Using the topten list, ten directories are created in the HDFS system; a map from the tags to the directories are also created. Two additional directories are set to complete the

12 categories. Output files are then set to store the tweets. For categories of “OTHER” and “NONE”, the tags are set directly to the text file.

```
# Create connection to hadoop and create map from tags to their respective directory in hadoop
tagToHadoopDir = {}
client = hdfs.InsecureClient("http://localhost:50070", user="hduser")
for tup in topten:
    path = "/user/hduser/" + tup[0]
    client.mkdirs(path)
    tagToHadoopDir[tup[0]] = path
client.mkdirs("/user/hduser/Others")
client.mkdirs("/user/hduser/None")

# Create a directory for convince to store category files
if not os.path.exists("tweetfiles"):
    os.makedirs("tweetfiles")

# Create output files for each tweet category
tagToOutFile = {}
for tup in topten:
    strg = "tweetfiles/"+tup[0]+"-tweets.txt"
    tagToOutFile[tup[0]] = open(strg, "w")
tagToOutFile["OTHER"] = open("tweetfiles/Other-tweets.txt", "w")
tagToOutFile["NONE"] = open("tweetfiles/None-tweets.txt", "w")
```

The program now begins writing tweets to the appropriate categories. Similar to before, the tweet’s hashtags are stored in ht. If ht is null (no hashtag) then write to the file tagged as NONE. This is accomplished using the tagToOutFile function. Otherwise, check each hashtag and write to the appropriate file.

```
# Write each tweet to their respective tweet category
# options are one of the top ten, other, or none
for line in tweets:
    ht = ast.literal_eval(line)["entities"]["hashtags"]
    if ht == []:
        tagToOutFile["NONE"].write(line)
    for tag in ht:
        tagcat = tagCategory(topten, tag["text"])
        tagToOutFile[tagcat].write(line)
```

A key function is the tagCategory function, which was defined earlier. If the tweet's hashtag is among the top ten, it will be returned to be used as a tag. If the tweet's hashtag is not among the top ten, "OTHER" will be returned to be used as a tag.

```
# Helper function to identify which hashtag category a tweet belongs to
def tagCategory(hashtags, word):
    for tup in hashtags:
        tag = tup[0]
        if tag == word:
            return word
    return "OTHER"
```

After all tweets have been written to the appropriate files, the program will tell Hadoop to close the files and finish up.

```
# Send to hadoop and close each file
for tag, file in tagToOutFile.iteritems():
    if tag == "OTHER":
        hdir = "/user/hduser/Others"
    elif tag == "NONE":
        hdir = "/user/hduser/None"
    else:
        hdir = tagToHadoopDir[tag]
    client.upload(hdir, file.name)
    file.close()

print (client.list("/user/hduser/"))
fin.close() # close tweets input file
```

With the program complete, the project's main requirement has been fulfilled.

Section 3.

Screenshots of the HDFS after main program completion.

```

x - □ hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1Tr
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs 81x46
hduser@brendan-Q500A:/home/brendan/PycharmProjects/PBDMProject1TrendingHTs$ hadoo
p fs -ls
17/02/15 19:23:42 WARN util.NativeCodeLoader: Unable to load native-hadoop librar
y for your platform... using builtin-java classes where applicable
Found 12 items
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 Hiring
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:03 KCAPinoyStar
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 NadineLustre
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 None
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 NowPlaying
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 Others
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 art
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 job
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 nonsense
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:03 nonsenseengine
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 nowplaying
drwxr-xr-x - hduser supergroup 0 2017-02-15 15:02 sanremo2017
hduser@brendan-Q500A:/home/brendan/PycharmProjects/PBDMProject1TrendingHTs$ hadoo
p fs -ls Hiring
17/02/15 19:23:57 WARN util.NativeCodeLoader: Unable to load native-hadoop librar
y for your platform... using builtin-java classes where applicable
Found 1 items
-rwxr-xr-x 1 hduser supergroup 495616 2017-02-15 15:02 Hiring/Hiring-tweets
.txt
hduser@brendan-Q500A:/home/brendan/PycharmProjects/PBDMProject1TrendingHTs$ █

```

Tweets with no hashtags:

```

x - hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1Tr
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs 81x46
, u'statuses_count': 666028, u'description': u"ICE-T and COCO interview the TWIN
TOWERS on FOX-5 / PIX-11 in that link below. Congrat's to us.", u'friends_count':
899, u'location': u'Anywhere! ', u'profile_link_color': u'1DA1F2', u'profile_ima
ge_url': u'http://pbs.twimg.com/profile_images/829923904256897024/yIaxBjl3_normal
.jpg', u'following': False, u'geo_enabled': True, u'profile_banner_url': u'https:
//pbs.twimg.com/profile_banners/101075559/1453444873', u'profile_background_image
_url': u'http://abs.twimg.com/images/themes/theme1/bg.png', u'screen_name': u'Fil
thyBrotherz', u'lang': u'en', u'profile_background_tile': False, u'favourites_cou
nt': 729, u'name': u'THE TWIN TOWERS.', u'notifications': False, u'url': u'https:
//t.co/nbE7A50IfU', u'created_at': u'Fri Jan 01 22:43:13 +0000 2010', u'contribut
ors_enabled': False, u'time_zone': u'Quito', u'protected': False, u'default_profi
le': True, u'is_translator': False}, u'geo': None, u'in_reply_to_user_id_str': No
ne, u'lang': u'en', u'created_at': u'Sat Feb 11 20:40:32 +0000 2017', u'in_reply
_to_status_id_str': None, u'place': None, u'metadata': {u'iso_language_code': u'en
', u'result_type': u'recent'}}
{u'contributors': None, u'truncated': False, u'text': u'RT @weblackblack: AFRICAN
AMERICAN, NATIVE AMERICAN, MEXICAN AND CREOLE https://t.co/VIjZoDK6Jz', u'is_quo
te_status': False, u'in_reply_to_status_id': None, u'id': 830516681919303680, u'f
avorite_count': 0, u'entities': {u'symbols': [], u'user_mentions': [{u'id': 36210
59476, u'indices': [3, 16], u'id_str': u'3621059476', u'screen_name': u'weblackbl
ack', u'name': u'blackasf'}]}, u'hashtags': [], u'urls': [], u'media': [{u'source
_user_id': 3621059476, u'source_status_id_str': u'784719994294853637', u'expanded
_url': u'https://twitter.com/weblackblack/status/784719994294853637/photo/1', u'di
splay_url': u'pic.twitter.com/VIjZoDK6Jz', u'url': u'https://t.co/VIjZoDK6Jz', u'
media_url_https': u'https://pbs.twimg.com/media/CuPih_kWAAEijja.jpg', u'source_us
er_id_str': u'3621059476', u'source_status_id': 784719994294853637, u'id_str': u'
784719833720029185', u'sizes': {u'large': {u'h': 639, u'resize': u'fit', u'w': 63
9}, u'small': {u'h': 639, u'resize': u'fit', u'w': 639}, u'medium': {u'h': 639, u
'resize': u'fit', u'w': 639}, u'thumb': {u'h': 150, u'resize': u'crop', u'w': 150
}}, u'indices': [72, 95], u'type': u'photo', u'id': 784719833720029185, u'media_u
rl': u'http://pbs.twimg.com/media/CuPih_kWAAEijja.jpg'}]}, u'retweeted': False, u
'coordinates': None, u'source': u'<a href="http://twitter.com/download/iphone" rel="
nofollow">Twitter for iPhone</a>', u'in_reply_to_screen_name': None, u'in_repl
y_to_user_id': None, u'retweet_count': 108, u'id_str': u'830516681919303680', u'f
avorited': False, u'retweeted_status': {u'contributors': None, u'truncated': Fals
e, u'text': u'AFRICAN AMERICAN, NATIVE AMERICAN, MEXICAN AND CREOLE https://t.co/
VIjZoDK6Jz', u'is_quote_status': False, u'in_reply_to_status_id': 784291052282798
080, u'id': 784719994294853637, u'favorite_count': 113, u'entities': {u'symbols':
[], u'user_mentions': [], u'hashtags': [], u'urls': [], u'media': [{u'expanded_u
rl': u'https://twitter.com/weblackblack/status/784719994294853637/photo/1', u'dis
play_url': u'pic.twitter.com/VIjZoDK6Jz', u'url': u'https://t.co/VIjZoDK6Jz', u'm
edia_url_https': u'https://pbs.twimg.com/media/CuPih_kWAAEijja.jpg', u'id_str': u
'784719833720029185', u'sizes': {u'large': {u'h': 639, u'resize': u'fit', u'w': 6
39}, u'small': {u'h': 639, u'resize': u'fit', u'w': 639}, u'medium': {u'h': 639,
u'resize': u'fit', u'w': 639}, u'thumb': {u'h': 150, u'resize': u'crop', u'w': 15
0}}, u'indices': [54, 77], u'type': u'photo', u'id': 784719833720029185, u'media_

```

Tweets from “OTHER” category:

```

x - hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1Tr
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs 81x46
u'metadatas': {u'iso_language_code': u'en', u'result_type': u'recent'}}
{u'contributors': None, u'truncated': False, u'text': u"Have you heard \u2018D@Z'
S HOUSE PARTY MIX 2017\u2019 by @RC@NE on #SoundCloud? #np https://t.co/wqsytQKz
0l", u'is_quote_status': False, u'in_reply_to_status_id': None, u'id': 8305175435
29959428, u'favorite_count': 0, u'entities': {u'symbols': [], u'user_mentions': [
], u'hashtags': [{u'indices': [58, 69], u'text': u'SoundCloud'}, {u'indices': [71
, 74], u'text': u'np'}]}, u'urls': [{u'url': u'https://t.co/wqsytQKz0l', u'indices
': [75, 98], u'expanded_url': u'https://soundcloud.com/daz-jones-4/dzs-house-part
y-mix-2017?utm_source=soundcloud&utm_campaign=share&utm_medium=twitter', u'displa
y_url': u'soundcloud.com/daz-jones-4/dz\u2026'}]}, u'retweeted': False, u'coordin
ates': None, u'source': u'<a href="http://twitter.com" rel="nofollow">Twitter Web
Client</a>', u'in_reply_to_screen_name': None, u'in_reply_to_user_id': None, u'r
etweet_count': 0, u'id_str': u'830517543529959428', u'favorited': False, u'user':
{u'follow_request_sent': False, u'has_extended_profile': False, u'profile_use_ba
ckground_image': False, u'default_profile_image': False, u'id': 2879430897, u'pro
file_background_image_url_https': u'https://abs.twimg.com/images/themes/themel/bg
.png', u'verified': False, u'translator_type': u'none', u'profile_text_color': u'
000000', u'profile_image_url_https': u'https://pbs.twimg.com/profile_images/78979
6112219643905/Aw0VPJt6_normal.jpg', u'profile_sidebar_fill_color': u'000000', u'e
ntities': {u'description': {u'urls': []}}, u'followers_count': 212, u'profile_sid
ebar_border_color': u'000000', u'id_str': u'2879430897', u'profile_background_col
or': u'000000', u'listed_count': 4, u'is_translation_enabled': False, u'utc_offse
t': 0, u'statuses_count': 1416, u'description': u'Bit of a chancer, an a shit dan
cer, bedroom dj, trainee wizard, lurker and all round fuck-up. ROCK DANCE INDIE \
u270c Y.N.W.A.', u'friends_count': 284, u'location': u'scouser in wigan', u'
profile_link_color': u'FA743E', u'profile_image_url': u'http://pbs.twimg.com/prof
ile_images/789796112219643905/Aw0VPJt6_normal.jpg', u'following': False, u'geo_en
abled': True, u'profile_banner_url': u'https://pbs.twimg.com/profile_banners/2879
430897/1477137023', u'profile_background_image_url': u'http://abs.twimg.com/image
s/themes/themel/bg.png', u'screen_name': u'JonzeeD', u'lang': u'en', u'profile_ba
ckground_tile': False, u'favourites_count': 1104, u'name': u'D@Z-J-', u'notificat
ions': False, u'url': None, u'created_at': u'Sun Nov 16 11:58:48 +0000 2014', u'c
ontributors_enabled': False, u'time_zone': u'Dublin', u'protected': False, u'defa
ult_profile': False, u'is_translator': False}, u'geo': None, u'in_reply_to_user_i
d_str': None, u'possibly_sensitive': False, u'lang': u'en', u'created_at': u'Sat
Feb 11 20:43:07 +0000 2017', u'in_reply_to_status_id_str': None, u'place': None,
u'metadatas': {u'iso_language_code': u'en', u'result_type': u'recent'}}
{u'contributors': None, u'truncated': False, u'text': u"#NP on air Spargo - you
and me - listen https://t.co/4DN2fNSIjl - #dance80 #entertainment #webradio #Sp
argo #SaveTheVinyl #Hit's #over", u'is_quote_status': False, u'in_reply_to_status
_id': None, u'id': 830516858071695360, u'favorite_count': 0, u'entities': {u'symb
ols': [], u'user_mentions': [], u'hashtags': [{u'indices': [0, 3], u'text': u'NP'
}, {u'indices': [69, 77], u'text': u'dance80'}, {u'indices': [78, 92], u'text': u
'entertainment'}, {u'indices': [93, 102], u'text': u'webradio'}, {u'indices': [10
3, 110], u'text': u'Spargo'}, {u'indices': [111, 124], u'text': u'SaveTheVinyl'},
{u'indices': [125, 129], u'text': u'Hit'}, {u'indices': [132, 137], u'text': u'o

```


Section 4.

An extra requirement of the project is to implement a program that counts the number of times a keyword appears in either the tweet's text or hashtag. For this project, a MapReduce algorithm was used.

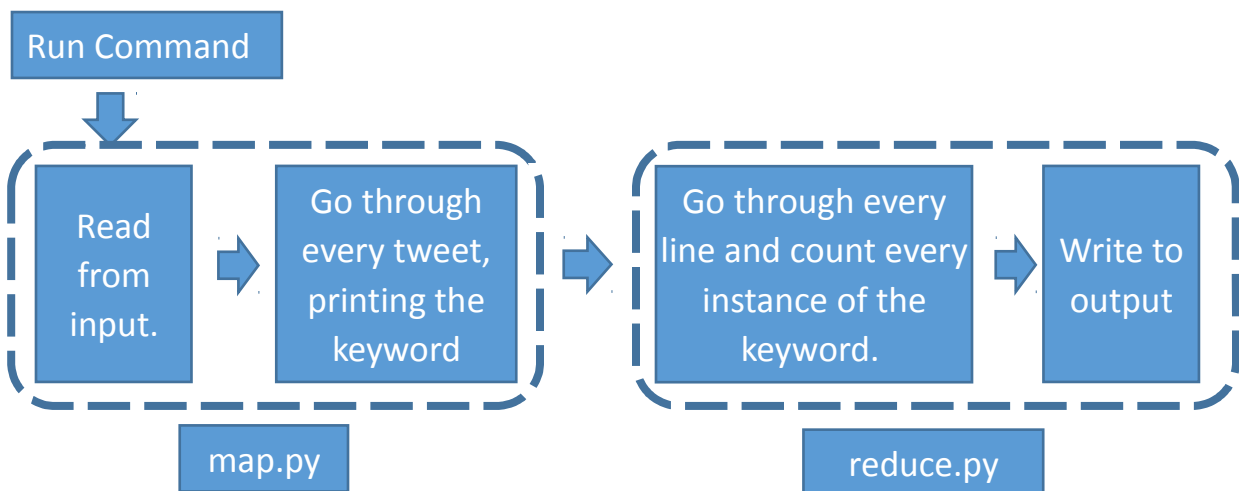
```

x - □ hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1Tr
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs 81x46
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs$ hadoo
p jar hadoop-streaming-2.7.3.jar -mapper map.py -reducer reduce.py -input /user/h
duser/* -output Output

```

The MapReduce code is split across two files: one for the mapper and the other for the reducer. The input will pull from the 12 directories created earlier. For this project, the keyword “Amazon” was used.

From a high level perspective, the flow diagram looks like so:



For the mapper, it uses a for-loop is used to read in the tweets from the input directories.

```

import sys, ast

keyword = "Amazon"
attribute = "hashtags"

for line in sys.stdin:

```

For each line, two attributes are checked – “text” and “hashtags”. Both are checked for the keyword. Both text and hashtag portions are split by word and checked against the keyword. If the word matches, it is printed.

```

if attribute == "text":
    try:
        newline = ast.literal_eval(line)["text"]
        newline = newline.strip()
        words = newline.split()
        for word in words:
            if word == keyword:
                print '%s\t%s' % (word, 1)
    except:
        continue

elif attribute == "hashtags":
    try:
        hts = ast.literal_eval(line)["entities"]["hashtags"]
        if not hts == []:
            for ht in hts:
                if ht["text"] == keyword:
                    print '%s\t%s' % (ht["text"], 1)
    except:
        continue

```

For the reducer, it uses a for-loop to read from the prints made by the mapper.

<pre> current_word = None current_count = 0 word = None </pre>	<p>Three variables are set: current_word and current_count will hold the final count, and will be printed to output.</p> <pre> for line in sys.stdin: </pre>
--	--

For each line, it is processed so that the word (“Amazon”) and count (“1”) are placed into variables. count is also converted into an int.

```
line = line.strip()

word, count = line.split('\t', 1)

try:
    count = int(count)
except ValueError:
    continue
```

In brief, the counting portion is taken care of by an if/else. Since current_word is initially set to none, the else conditional will trigger. This will set the current_count and current_word to the inputted line. From there, future iterations should trigger the if conditional, updating the current_count. Once all lines have been read in, a final print will be made. The program is complete and has counted every keyword appearance in the tweet’s text and hashtag.

```
if current_word == word:
    current_count += count
else:
    if current_word:
        print '%s\t%s' % (current_word, current_count)
    current_count = count
    current_word = word

if current_word == word:
    print '%s\t%s' % (current_word, current_count)
```

Below are two screenshots of the console after the command was executed. At the bottom of the second screenshot, the final result can be seen; it is indicated by a blue arrow.

First Screenshot

```

x - □ hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1Tr
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs 81x46
17/02/15 19:39:02 INFO mapreduce.Job: map 100% reduce 100%
17/02/15 19:39:02 INFO mapreduce.Job: Job job_local989523038_0001 completed succe
ssfully
17/02/15 19:39:02 INFO mapreduce.Job: Counters: 35
  File System Counters
    FILE: Number of bytes read=2262396
    FILE: Number of bytes written=6700024
    FILE: Number of read operations=0
    FILE: Number of large read operations=0
    FILE: Number of write operations=0
    HDFS: Number of bytes read=9127596032
    HDFS: Number of bytes written=11
    HDFS: Number of read operations=497
    HDFS: Number of large read operations=0
    HDFS: Number of write operations=18
  Map-Reduce Framework
    Map input records=133291
    Map output records=100
    Map output bytes=900
    Map output materialized bytes=1190
    Input split bytes=1709
    Combine input records=0
    Combine output records=0
    Reduce input groups=1
    Reduce shuffle bytes=1190
    Reduce input records=100
    Reduce output records=1
    Spilled Records=200
    Shuffled Maps =15
    Failed Shuffles=0
    Merged Map outputs=15
    GC time elapsed (ms)=96
    Total committed heap usage (bytes)=7905738752
  Shuffle Errors
    BAD_ID=0
    CONNECTION=0
    IO_ERROR=0
    WRONG_LENGTH=0
    WRONG_MAP=0
    WRONG_REDUCE=0
  File Input Format Counters
    Bytes Read=652390400
  File Output Format Counters
    Bytes Written=11
17/02/15 19:39:02 INFO streaming.StreamJob: Output directory: Output
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs$

```

Second screenshot – see blue arrow for final result

```

x - □ hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1Tr
hduser@brendan-Q500A: /home/brendan/PycharmProjects/PBDMProject1TrendingHTs 81x46
HDFS: Number of read operations=497
HDFS: Number of large read operations=0
HDFS: Number of write operations=18
Map-Reduce Framework
  Map input records=133291
  Map output records=100
  Map output bytes=900
  Map output materialized bytes=1190
  Input split bytes=1709
  Combine input records=0
  Combine output records=0
  Reduce input groups=1
  Reduce shuffle bytes=1190
  Reduce input records=100
  Reduce output records=1
  Spilled Records=200
  Shuffled Maps =15
  Failed Shuffles=0
  Merged Map outputs=15
  GC time elapsed (ms)=96
  Total committed heap usage (bytes)=7905738752
Shuffle Errors
  BAD_ID=0
  CONNECTION=0
  IO_ERROR=0
  WRONG_LENGTH=0
  WRONG_MAP=0
  WRONG_REDUCE=0
File Input Format Counters
  Bytes Read=652390400
File Output Format Counters
  Bytes Written=11
17/02/15 19:39:02 INFO streaming.StreamJob: Output directory: Output
hduser@brendan-Q500A:/home/brendan/PycharmProjects/PBDMProject1TrendingHTs$ hadoo
p fs -ls Output
17/02/15 19:41:16 WARN util.NativeCodeLoader: Unable to load native-hadoop librar
y for your platform... using builtin-java classes where applicable
Found 2 items
-rw-r--r--  1 hduser supergroup          0 2017-02-15 19:39 Output/_SUCCESS
-rw-r--r--  1 hduser supergroup        11 2017-02-15 19:39 Output/part-00000
hduser@brendan-Q500A:/home/brendan/PycharmProjects/PBDMProject1TrendingHTs$ hadoo
p fs -cat Output/part-00000
17/02/15 19:41:33 WARN util.NativeCodeLoader: Unable to load native-hadoop librar
y for your platform... using builtin-java classes where applicable
Amazon 100
hduser@brendan-Q500A:/home/brendan/PycharmProjects/PBDMProject1TrendingHTs$

```



Section 5.

References:

- Twitter API:
 - <https://dev.twitter.com/docs>
- Twitter Search API:
 - <https://dev.twitter.com/rest/public/search>
- Twitter Authentication API:
 - <https://dev.twitter.com/oauth/application-only>
- OAuth2 Python Library:
 - <https://github.com/joestump/python-oauth2>
- OAuth example:
 - <https://dev.twitter.com/oauth/overview/single-user>
- HDFS Install:
 - http://www.bogotobogo.com/Hadoop/BigData_hadoop_Install_on_ubuntu_single_node_cluster.php
- HDFS Quickstart:
 - <https://hdfscli.readthedocs.io/en/latest/quickstart.html#configuration>
- Check if Directory Exists:
 - <http://stackoverflow.com/questions/273192/how-to-check-if-a-directory-exists-and-create-it-if-necessary>
- Sorting Dictionary:
 - <http://stackoverflow.com/questions/613183/sort-a-python-dictionary-by-value>
- Hadoop MapReduce
 - <https://hadoop.apache.org/docs/r2.6.0/hadoop-mapreduce-client/hadoop-mapreduce-client-core/HadoopStreaming.html>
- Python/Hadoop MapReduce
 - <http://www.michael-noll.com/tutorials/writing-an-hadoop-mapreduce-program-in-python/>

Source Code: gettweets.py, gettophts.py, map.py, reduce.py

gettweets.py:

import oauth2

import json

import random

Twitter provided access key and secret

CONSUMER_KEY = "[REMOVED]"

CONSUMER_SECRET = "[REMOVED]"

Twitter provided function to submit authenticated requests for data

def oauth_req(url, key, secret, http_method="GET", http_headers=None):

 consumer = oauth2.Consumer(key=CONSUMER_KEY, secret=CONSUMER_SECRET)

 token = oauth2.Token(key=key, secret=secret)

 client = oauth2.Client(consumer, token)

 resp, content = client.request(url, headers=http_headers)

 return content

out1 = open("output1.txt", "a") #output files

out2 = open("output2.txt", "a")

out3 = open("output3.txt", "a")

out4 = open("output4.txt", "a")

words = open("/usr/share/dict/words", "r") #dict of words to random search for

word = words.readlines()

i = 0

Loop to collect 100k tweets if possible (typically rate limited)

while i < 100000:

 randword = random.choice(word) # random word used to search twitter for tweets

 print str(i)

 print randword

 home_timeline = oauth_req('https://api.twitter.com/1.1/search/tweets.json?q='+ randword
+ '&count=100',

 '[REMOVED]',

 '[REMOVED]')

 tweets = json.loads(home_timeline) # load tweets into json parser

Iterate through tweets and output each tweet to a file, 1 tweet per line

Split output among 4 files to avoid one giant file

```

for t in tweets["statuses"]:
    tweet = str(t) + "\n"
    if i % 4 == 0:
        out1.write(tweet)
    elif i % 4 == 1:
        out2.write(tweet)
    elif i % 4 == 2:
        out3.write(tweet)
    elif i % 4 == 3:
        out4.write(tweet)
    i += 1

```

```

out1.close()
out2.close()
out3.close()
out4.close()
words.close()

```

gettophits.py:

```

import ast
import os
import hdfs
import operator

```

Helper function to identify which hashtag category a tweet belongs to

```

def tagCategory(hashtags, word):
    for tup in hashtags:
        tag = tup[0]
        if tag == word:
            return word
    return "OTHER"

```

Open tweet input file

```

fin = open("allout.txt", "r")
tweets = fin.readlines()

```

```

hashtagdict = {}

```

```

i = 0

```

```

for line in tweets:

```

```

    # t = json.loads(ast.literal_eval(line))
    tweet = ast.literal_eval(line)["text"]
    ht = ast.literal_eval(line)["entities"]["hashtags"]

```

```

print (str(i) + " : " + tweet)
if (ht != []):
    h = 1
    for tag in ht:
        print ("hashtag #" + str(h) + " " + tag["text"])
        if (hashtagdict.has_key(tag["text"])):
            hashtagdict[tag["text"]] += 1
        else:
            hashtagdict[tag["text"]] = 1
        h += 1
    i += 1

hashtagsort = sorted(hashtagdict.items(), key=operator.itemgetter(1), reverse=True)
topten = hashtagsort[:10]

# topten = [(u'nonsenseengine', 530), (u'nonsense', 530), (u'KCAPinoyStar', 280),
#          (u'NadineLustre', 219), (u'job', 217), (u'art', 154), (u'NowPlaying', 136),
#          (u'Hiring', 129), (u'sanremo2017', 126), (u'nowplaying', 120)]

# Create connection to hadoop and create map from tags to their respective directory in hadoop
tagToHadoopDir = {}
client = hdfs.InsecureClient("http://localhost:50070", user="hduser")
for tup in topten:
    path = "/user/hduser/" + tup[0]
    client.makedirs(path)
    tagToHadoopDir[tup[0]] = path
client.makedirs("/user/hduser/Others")
client.makedirs("/user/hduser/None")

# Create a directory for convince to store category files
if not os.path.exists("tweetfiles"):
    os.makedirs("tweetfiles")

# Create output files for each tweet category
tagToOutFile = {}
for tup in topten:
    strg = "tweetfiles/"+tup[0]+"-tweets.txt"
    tagToOutFile[tup[0]] = open(strg,"w")
tagToOutFile["OTHER"] = open("tweetfiles/Other-tweets.txt", "w")
tagToOutFile["NONE"] = open("tweetfiles/None-tweets.txt", "w")

# Write each tweet to their respective tweet category
# options are one of the top ten, other, or none
for line in tweets:

```

```

ht = ast.literal_eval(line)["entities"]["hashtags"]
if ht == []:
    tagToOutFile["NONE"].write(line)
for tag in ht:
    tagcat = tagCategory(topten,tag["text"])
    tagToOutFile[tagcat].write(line)

# Send to hadoop and close each file
for tag, file in tagToOutFile.iteritems():
    if tag == "OTHER":
        hdir = "/user/hduser/Others"
    elif tag == "NONE":
        hdir = "/user/hduser/None"
    else:
        hdir = tagToHadoopDir[tag]
    client.upload(hdir, file.name)
    file.close()

print (client.list("/user/hduser/"))
fin.close() # close tweets input file

```

map.py:

```

#!/usr/bin/python
import sys, ast

keyword = "Amazon"
attribute = "hashtags"

for line in sys.stdin:
    if line == "":
        continue

    if attribute == "text":
        try:
            newline = ast.literal_eval(line)["text"]
            newline = newline.strip()
            words = newline.split()
            for word in words:
                if word == keyword:
                    print '%s\t%s' % (word, 1)
        except:
            continue

```

```

elif attribute == "hashtags":
    try:
        hts = ast.literal_eval(line)["entities"]["hashtags"]
        if not hts == []:
            for ht in hts:
                if ht["text"] == keyword:
                    print '%s\t%s' % (ht["text"], 1)
    except:
        continue

```

reduce.py:

```

#!/usr/bin/python
from operator import itemgetter
import sys

current_word = None
current_count = 0
word = None

for line in sys.stdin:
    line = line.strip()

    word, count = line.split('\t', 1)

    try:
        count = int(count)
    except ValueError:
        continue

    if current_word == word:
        current_count += count
    else:
        if current_word:
            print '%s\t%s' % (current_word, current_count)
            current_count = count
            current_word = word

if current_word == word:
    print '%s\t%s' % (current_word, current_count)

```