1_Project43_Twitter

April 23, 2022

Twitter Mining Project Course: CISD 43 Professor: Sohair Zaki Student: Jack Chen Purpose: - Text mining via twitter api, implement natural language processing (NLP), cleaning text data, visualization, Name Entity Recognition - Implement Deep Learning model, compare with TextBlob Tasks: - Pre-Setup - Twitter API - Load, Clean, Visualize Numeric Data - NLP – Clean Data – Visualize Data – Name Entity Recognition - Deep Learning

Conclusion: 2022-03-27 Before Will Smith slapped Chris Rock, there was barely any tweets. About 2 hours later after Oscars, the tweets started exploding. Tweets lasted about 1 week and starts falling off. 2022-04-08 Announcement of Will get banned for 10 years, the tweets started exploding again. After about 1 weeks, they tweets started falling off again.

- In order to promote on tweets, seems like only 1 week the trend/hype will scale off. So best to act within 1 week.
- From previous students' projects, there was minority percent of android users. Mostly iPhone, iPad, or Apple products. Now the tweet source from Androids has almost have same share of iPhone. Website takes 3rd place. The growth of Android is huge.

Pre-Setup: Loading Data, Functions, etc

[ ]:
```
# Importing Libraries
# import webbrowser
# import time
import tweepy
from tweepy import Stream
from tweepy import OAuthHandler
import os
import pandas as pd
import re
import seaborn as sns
import matplotlib.pyplot as plt
# import files into variable
import glob
import nltk
nltk.download('stopwords')
nltk.download('words')
words = set(nltk.corpus.words.words())
from nltk.probability import FreqDist
from wordcloud import WordCloud, STOPWORDS
import spacy
```

```
from spacy import displacy
from nltk.corpus import stopwords
import string
# import langid to detect language
import langid
from textblob import TextBlob
import collections
from tensorflow.keras.preprocessing.sequence import pad_sequences
from keras.models import load_model
import pickle
# load model
lstm = load_model('data3/LSTM.h5') # max length 15

# load tokenizer
with open('data3/token_mdl1.pickle', 'rb') as handle:
    token = pickle.load(handle)



# load keys into keys
#[apiKey,apiKeySecret,bearerTokem,accessToken,accessTokenSecret]
# Consumer Keys: apiKey, apiKeySecret
# Access Keys: accessToken, accessTokenSecret
# for window
# path =  r'C:\Users\Gumo\Desktop\Git\selfBooks\tweepy.txt'
# for mac
path = 'tweepy.txt'
keys = []
with open(path, mode='r') as w:
    for line in w:
        keys.append(line.split(': ')[1].strip())
access_token = keys[3]
access_secret = keys[4]
consumer_key = keys[0]
consumer_secret = keys[1]
bearer_token = keys[2]

###### my id/name #####
myUserId = 1309643764172947456
myUsername = 'stockjanitor'
```

```
[nltk_data] Downloading package stopwords to /Users/Gumo/nltk_data…
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Downloading package words to /Users/Gumo/nltk_data…
[nltk_data]   Package words is already up-to-date!
```

[ ]:
```
###### FUNCTIONS ######
def tweetPost(text):
    try:
        twitterApi.update_status(text)
        print("bling bling~~")
    except:
        print("boom boom")
def tweetMedia(text, img):
    try:
        media = twitterApi.media_upload(img)
        twitterApi.update_status(text,media_ids=[media.media_id_string])
        print("bling bling~~")
    except:
        print("boom boom")
def tweetFriend(name):
    try:
        twitterApi.create_friendship(screen_name=name)
        print("bling bling~~")
    except:
        print("boom boom")
def tweetUnfriend(name):
    try:
        twitterApi.destroy_friendship(screen_name=name)
        print("bling bling~~")
    except:
        print("boom boom")

# Regex Remove functions
# remove url
def remove_url(txt):
    return " ".join(re.sub("([^0-9A-Za-z \t])|(\w+:\/\/\S+)", "", txt).split())
#remove hashtag #
def remove_hashtag(txt):
    return " ".join(re.sub("([# ]+)([0-9A-Z_]*[A-Z_]+[a-z0-9_üÀ-ÖØ-öø-ÿ]*)",␣
 ↪"", txt).split())
# remove mention @
def remove_at(txt):
    return " ".join(re.sub("(\@[a-zA-Z0-9_%]*)", "", txt).split())

    # remove stopwords and puncturations
def get_text_processing(text):
    stpword = stopwords.words('english')
    stpword.remove('not')
    no_punctuation = [char for char in text if char not in string.punctuation]
    no_punctuation = ''.join(no_punctuation)
    return ' '.join([word for word in no_punctuation.split() if word.lower()␣
 ↪not in stpword])
```

```
# remove url, hashtag, at, stop words, punctuation
def remove3(a):
    x = remove_at(a)
    x = remove_hashtag(x)
    x = remove_url(x)
    x = get_text_processing(x.lower())
    return x

# found empty text rows, remove them by replacing with none
def fillNa(x):
    if x == '':
        return 'none'

# detect language - Note: may not be most accurate
def lanDetectFunc(x):
    a = langid.classify(x)
    return a[0]

# convert to english only words
def engOnly(x):
    a = " ".join(w for w in nltk.wordpunct_tokenize(x) if w.lower() in words )␣
 ↪#or not w.isalpha()
    return a

# determine text sentiment using TextBlob
def blobSent(x):
    a = TextBlob(x)
    if a.sentiment.polarity > 0:
        return 'Positive'
    elif a.sentiment.polarity == 0:
        return 'Neutral'
    else:
        return 'Negative'

# Remove names from text
def removeName(x):
    names = ['will', 'jada', 'smith', 'chris', 'rock']
    new_text = []
    for a in x:
        if a not in names:
            new_text.append(a)
    return new_text

# Predict Sentiment with made model
def predictFunc(x):
    sentiment_classes = ['Negative', 'Neutral', 'Positive']
```

```
    try:
        # since x is cleaned, we tokenize right away
        a = token.texts_to_sequences(x)

        # apply padding
        a_pad = pad_sequences(a, maxlen = 15, padding='post')

        # predict
        y = lstm.predict(a_pad).argmax(axis=1)
        a = sentiment_classes[y[0]]
    except:
        a = 'NoWork'
    return a
```

Twitter API to pull data

[ ]:
```
# Twitter API v1 - auth keys (Cursor)
auth = tweepy.OAuthHandler(consumer_key, consumer_secret)
auth.set_access_token(access_token,access_secret)

# create instance
twitterApi = tweepy.API(auth, wait_on_rate_limit=True)
# wait on rate limit, not to get errors on timing out

# verify credential
try:
    # see if credential works
    twitterApi.verify_credentials()
    print("twitterApi works")
except:
    print("Please fix me")

# Twitter API v2 - auth keys (Client)
# for user access, tweeting etc
client = tweepy.
 ↪Client(consumer_key=consumer_key,consumer_secret=consumer_secret,access_token=access_token,

# for query access, search tweets etc
clientBearer = tweepy.Client(bearer_token=bearer_token)
```

```
twitterApi works
```

Client - v2

[ ]:
```
# # store responses of query1 in response1
# response1 = clientBearer.search_all_tweets(query=query1, max_results=10,␣
 ↪start_time= "2022-03-28T12:12:01Z", end_time='2022-03-27T13:12:
 ↪01Z',tweet_fields=['id','text', 'created_at','geo','source',␣
 ↪'public_metrics'])
```

```
# # convert response into list1
# list1 = [[tweet.id,tweet.text,tweet.created_at,tweet.geo,tweet.source,tweet.
 ↪public_metrics]for tweet in response1.data]

# # load to df
# # df = original df
# df = pd.
 ↪DataFrame(data=list1,columns=['userid','text','time','location','source','metrics'])

# # show df
# df.head(3)
```

[ ]:
```
# # assign new df for editing
# df1 = df

# # extract public metrics into respective columns
# df1['retweet_count'] = df.metrics.apply(lambda x: list(x.items())[0][1])
# df1['reply_count'] = df.metrics.apply(lambda x: list(x.items())[1][1])
# df1['like_count']= df.metrics.apply(lambda x: list(x.items())[2][1])
# df1['quote_count']= df.metrics.apply(lambda x: list(x.items())[3][1])

# # drop the metrics since we have extracted it
# df1 = df1.drop(columns='metrics')

# #show df
# df1.head(3)
```

Cursor v1

[ ]:
```
# set query1
query1 = "jadasmith"
hour = '08'

date = '20220415'
time =hour+'00'
time2=hour+'59'
fromdate =date+time
todate=date+time2

######################### Search 30 Day Queries ##########################
# store search in tweets
queryResponse1 = twitterApi.
 ↪search_30_day(label='30Days',query=query1,fromDate=fromdate,toDate=todate,maxResults=100)
# save tweets to list1
```

```
list1 = [[tweet.user.screen_name,tweet.text,tweet.created_at,tweet.user.
 ↪location,tweet.source,tweet.favorite_count,tweet.quote_count,tweet.
 ↪reply_count,tweet.retweet_count]for tweet in queryResponse1]
# convert tweet list into dataframe
df = pd.
 ↪DataFrame(data=list1,columns=['user','text','time','location','source','like_count','quote_
# save to dataframe
df.to_csv('data/'+date+time+time2+query1+'.csv')
df.shape



######################### Search Recent queries #########################
# sincedate=''
# queryResponse1 = twitterApi.search_tweets(q=query1,until=sincedate,count=100)
# # items = 5, retrieve 5 tweets
# list1 = [[tweet.user.screen_name,tweet.text,tweet.created_at,tweet.user.
 ↪location,tweet.source,tweet.favorite_count,tweet.retweet_count]for tweet in␣
 ↪queryResponse1]
# # convert tweet list into dataframe
# df = pd.
 ↪DataFrame(data=list1,columns=['user','text','time','location','source','like_count','retwee
# # save to dataframe
# df.to_csv('data/'+sincedate+query1+'.csv')
# df.shape
```

[ ]: (0, 9)

Load, Clean, and Visualize Numeric Data

Clean Data

[ ]:
```
pathOfData = 'data/'
# saves path all file name to variable all_files
all_files = glob.glob(os.path.join(pathOfData , "*.csv"))
#initiate a list
merged_list1 = []

# loop all files to append each file to list
for a in all_files:
    df = pd.read_csv(a, index_col=None, header=0)
    merged_list1.append(df)

# concat all files
merged_df1 = pd.concat(merged_list1, axis=0, ignore_index=True)
merged_df1.shape
```

[ ]: (5867, 10)

[ ]:
```
pathOfData = 'data2/'
# saves path all file name to variable all_files
all_files2 = glob.glob(os.path.join(pathOfData , "*.csv"))
#initiate a list
merged_list2 = []

# loop all files to append each file to list
for b in all_files2:
    df = pd.read_csv(b, index_col=None, header=0)
    merged_list2.append(df)

# concat all files
merged_df2 = pd.concat(merged_list2, axis=0, ignore_index=True)
merged_df2.shape
```

[ ]:
```
(297, 8)
```

[ ]:
```
merged_df2.head(3)
```

[ ]:
```
  Unnamed: 0           user  \
0          0  larepublica_pe
1          1      AdetoroMph
2          2    Melisa_Porte

                                                text  \
0  RT @LRTendencias:    Primero #Netflix y ahora…
1  #ChrisRock: Where was #WillSmith when #MeekMil…
2                    @chrisrock Who's bored her too?

                       time       location              source like_count  \
0  2022-04-22 18:24:18+00:00     Lima, Perú     Twitter Web App          0
1  2022-04-22 18:22:40+00:00  Princeton, NJ  Twitter for iPhone          0
2  2022-04-22 18:21:49+00:00            NaN     Twitter Web App          0

  retweet_count
0             1
1             0
2             0
```

[ ]:
```
merged_df1.head(3)
```

[ ]:
```
  Unnamed: 0          user                                                text  \
0          0     damnratez  @KevinHart4real @chrisrock deer infomous https…
1          1     djBESWOLF  #wolfliveapp #wolflive #wolflovers #music #liv…
2          2  _Dani_Danis_  RT @hotvickkrishna: The Oscars Meeting about W…

                       time                    location  \
```

```
0  2022-04-10 21:57:54+00:00  Sailacross It's Firebizar
1  2022-04-10 21:57:53+00:00              London, England
2  2022-04-10 21:56:46+00:00                      Schweiz

                source like_count quote_count reply_count retweet_count
0  Twitter for Android          0           0           0             0
1   Twitter for iPhone          0           0           0             0
2     Tweetbot for iOS          0           0           0             0
```

[ ]:
```
# add missing columns - due to v1 recent twitter pull missing those data
merged_df2['quote_count'] = 'NaN'
merged_df2['reply_count'] = 'NaN'
merged_df2.head(3)
```

[ ]:
```
  Unnamed: 0           user  \
0          0  larepublica_pe
1          1      AdetoroMph
2          2    Melisa_Porte

                                              text  \
0  RT @LRTendencias:    Primero #Netflix y ahora…
1  #ChrisRock: Where was #WillSmith when #MeekMil…
2                   @chrisrock Who's bored her too?

                       time       location              source like_count  \
0  2022-04-22 18:24:18+00:00     Lima, Perú     Twitter Web App          0
1  2022-04-22 18:22:40+00:00  Princeton, NJ  Twitter for iPhone          0
2  2022-04-22 18:21:49+00:00            NaN     Twitter Web App          0

  retweet_count quote_count reply_count
0             1         NaN         NaN
1             0         NaN         NaN
2             0         NaN         NaN
```

[ ]:
```
# obtain columns names, so we can rearrange it into same column order and append
mdf2col = merged_df2.columns.tolist()
print(mdf2col)
```

```
['Unnamed: 0', 'user', 'text', 'time', 'location', 'source', 'like_count',
'retweet_count', 'quote_count', 'reply_count']
```

[ ]:
```
# rearrange df1, append, show shape
merged_df1 = merged_df1[['Unnamed: 0', 'user', 'text', 'time', 'location',␣
 ↪'source', 'like_count', 'retweet_count', 'quote_count', 'reply_count']]
master_df = pd.concat([merged_df1,merged_df2])
master_df.shape
```

[ ]:
```
(6164, 10)
```

[ ]:
```
# drop the named:0 column
master_df=master_df.iloc[:,1:]
# reset index and drop old index
master_df = master_df.reset_index(drop=True)
master_df.shape
```

[ ]:
```
(6164, 9)
```

[ ]:
```
master_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6164 entries, 0 to 6163
Data columns (total 9 columns):
 #   Column         Non-Null Count  Dtype 
---  ------         --------------  ----- 
 0   user           6164 non-null   object
 1   text           6164 non-null   object
 2   time           6164 non-null   object
 3   location       3779 non-null   object
 4   source         6164 non-null   object
 5   like_count     6164 non-null   object
 6   retweet_count  6164 non-null   object
 7   quote_count    6164 non-null   object
 8   reply_count    6164 non-null   object
dtypes: object(9)
memory usage: 433.5+ KB
```

[ ]:
```
# function detect bot
def botDetect(x):
    if 'bot' in x:
        return True
# convert to string
master_df['bot'] = master_df['source'].apply(lambda x: botDetect(x.lower()))
master_df.head()
```

[ ]:
```
             user                                               text  \
0       damnratez  @KevinHart4real @chrisrock deer infomous https…
1       djBESWOLF  #wolfliveapp #wolflive #wolflovers #music #liv…
2    _Dani_Danis_  RT @hotvickkrishna: The Oscars Meeting about W…
3  MsAnalytical15   New Podcast! "Janet Hubert 'Original Aunt Vi…
4   okuleygodfryd  Let's be honest, before @chrisrock got slapped…

                        time                     location  \
0  2022-04-10 21:57:54+00:00  Sailacross It's Firebizar    
1  2022-04-10 21:57:53+00:00              London, England
2  2022-04-10 21:56:46+00:00                      Schweiz
3  2022-04-10 21:56:43+00:00                          NaN
4  2022-04-10 21:56:35+00:00                Accra, Ghana
```

```
                source like_count retweet_count quote_count reply_count   bot
0  Twitter for Android          0             0           0           0  None
1   Twitter for iPhone          0             0           0           0  None
2     Tweetbot for iOS          0             0           0           0  True
3            Spreaker          1             0           0           0  None
4   Twitter for iPhone          0             0           0           0  None
```

[ ]:
```
# count num of bots
master_df.bot.value_counts()
```

[ ]:
```
True    31
Name: bot, dtype: int64
```

[ ]:
```
# save to df, drop bot, drop bot column, reset index
master_df1 = master_df[master_df['bot'] != True].iloc[:,0:-1].
 ↪reset_index(drop=True)
master_df1.columns
```

[ ]:
```
Index(['user', 'text', 'time', 'location', 'source', 'like_count',
       'retweet_count', 'quote_count', 'reply_count'],
      dtype='object')
```

[ ]:
```
master_df1.sort_values(by="retweet_count",ascending=False).head(1)
```

[ ]:
```
          user                                               text  \
5932  76393mk2  RT @PeteFighter: OK……. This one wins!!\n#WillS…

                           time           location           source  \
5932  2022-04-22 14:43:47+00:00  SW-8451-6194-1526  Twitter Web App

     like_count retweet_count quote_count reply_count
5932          0          6349         NaN         NaN
```

[ ]:
```
# drop duplicate text, reset index
# master_df1.drop_duplicates(subset='text',keep='last',inplace=True)
# master_df1.reset_index(drop=True)
# master_df1.tail()
# master_df1.sort_values(by="retweet_count",ascending=False)


# Notes: cannot drop duplicates because many are retweets, and it will mess up␣
 ↪the retweet count,
# also in the sentiment analysis, more retweets should have more weight
```

[ ]:
```
# function detect will
def willDetect(x):
```

```
    if 'will' in x:
        a = 1
    else:
        a = 0
    return a
# function detect jada
def jadaDetect(x):
    if 'jada' in x:
        a = 1
    else:
        a = 0
    return a
# function detect chris
def chrisDetect(x):
    if 'chris' in x:
        a = 1
    else:
        a = 0
    return a
# convert to string
master_df1['willsmith'] = master_df1['text'].apply(lambda x: willDetect(x.
 ↪lower()))
master_df1['chrisrock'] = master_df1['text'].apply(lambda x: chrisDetect(x.
 ↪lower()))
master_df1['jadasmith'] = master_df1['text'].apply(lambda x: jadaDetect(x.
 ↪lower()))
# master df1 done ready for next step
# its like cleaned raw df
master_df1.tail(3)
```

[ ]:

```
                user                                                text  \
6130  Taurus89514630  RT @mid_day: #ICYMI Top 10 #EntertainmentNews …
6131       LSwagata  RT @mid_day: #ICYMI Top 10 #EntertainmentNews …
6132     ChangeMyJg  RT @GabyMeza8: CONFIRMADO: #Netflix cancela su…

                          time location               source like_count  \
6130  2022-04-22 17:18:03+00:00      NaN  Twitter for Android          0
6131  2022-04-22 17:17:25+00:00      NaN  Twitter for Android          0
6132  2022-04-22 17:16:55+00:00   México  Twitter for Android          0

     retweet_count quote_count reply_count  willsmith  chrisrock  jadasmith
6130           352         NaN         NaN          1          0          0
6131           352         NaN         NaN          1          0          0
6132            39         NaN         NaN          0          0          0
```

[ ]:

```
# assign new df
master_df2 = master_df1
```

```
# only get dates
def convTime(x):
    x = x[:10]
    return x

# df2 has time converted convert time
master_df2['time'] = master_df2['time'].apply(lambda x: convTime(x))
```

[ ]:
```
# group by dates, so we can peak at tweet count trend
tweetTrend_df = master_df2[['time','willsmith','chrisrock','jadasmith','like_count','retweet_count']].groupby('time').sum().reset_index()
likeRetweetCount = master_df2[['time','like_count','retweet_count']].groupby('time').sum().reset_index()
# merge them
mergeGroupby_df = tweetTrend_df.merge(likeRetweetCount, how = 'inner', on = 'time')
mergeGroupby_df.sort_values(by='retweet_count',ascending=False).head(3)
```

[ ]:

	time	willsmith	chrisrock	jadasmith	like_count	retweet_count
15	2022-04-22	116	86	39	78	47638
13	2022-04-20	9	0	10	12	2122
12	2022-04-19	5	2	6	10	1800

[ ]:
```
master_df2.source.value_counts()
```

[ ]:
```
Twitter for iPhone                2156
Twitter for Android               2122
Twitter Web App                   1450
Twitter for iPad                   125
TweetDeck                           54
                                   …
Twitterrific for iOS                 1
Erin Sakura                          1
The Catford Social Network, LDN      1
Twitter DAO                          1
Missinglettr                         1
Name: source, Length: 89, dtype: int64
```

[ ]:
```
# converting source to prepare piechart
sourceCount_df = pd.DataFrame(master_df2.source.value_counts()).reset_index()
sourceCount_df.rename(columns={"index": "sourcename"}, inplace=True)

# store sourcename
sourcelist= list(sourceCount_df.sourcename.head(6))
```

```
# convert source names
def sourceConv(x):
    if x in sourcelist:
        return str(x)
    else:
        return 'Others'

sourceCount_df["sourcename2"] = sourceCount_df['sourcename'].apply(lambda x:␣
↪sourceConv(x))

#groupby new srouce name, reset index
sourceCount_df = sourceCount_df.groupby('sourcename2').sum().reset_index()
# calculate percent
sourceCount_df["percent"] = sourceCount_df['source'].apply(lambda x: x/
↪sourceCount_df['source'].sum())
sourceCount_df = sourceCount_df.sort_values(by=['source'])
sourceCount_df
```

[ ]:

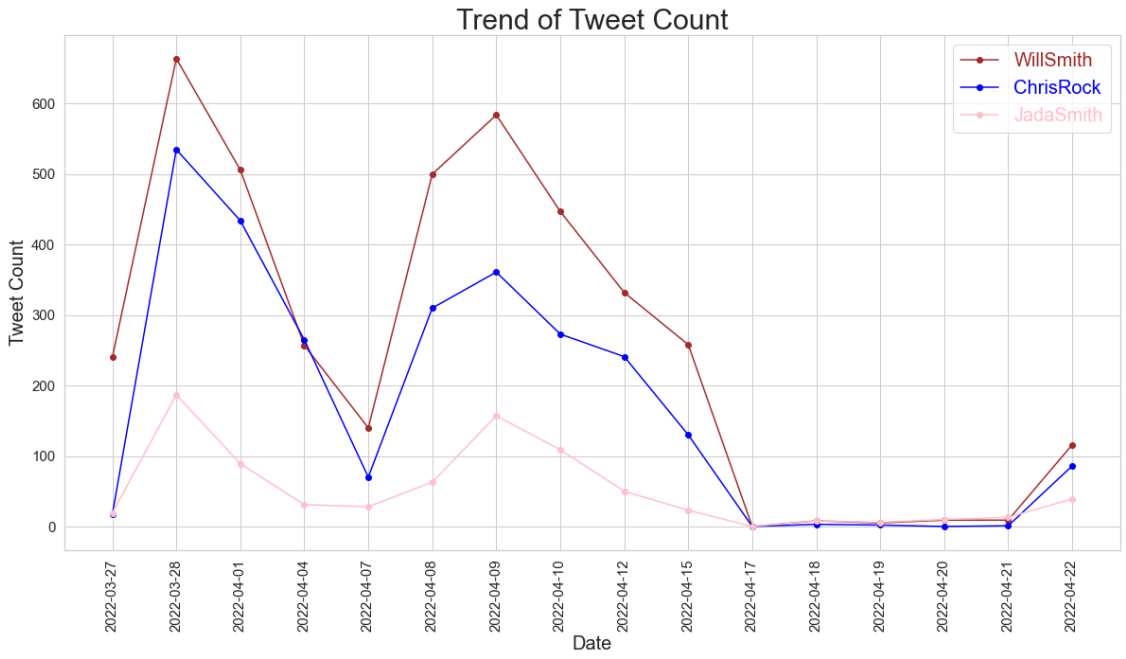
	sourcename2	source	percent
0	Instagram	25	0.004076
2	TweetDeck	54	0.008805
5	Twitter for iPad	125	0.020382
1	Others	201	0.032774
3	Twitter Web App	1450	0.236426
4	Twitter for Android	2122	0.345997
6	Twitter for iPhone	2156	0.351541

Visualization

[ ]:
```
sns.set_theme(style="whitegrid") # all charts will have a light grid
plt.figure(figsize=(20,10))
plt.plot(mergeGroupby_df.time, mergeGroupby_df.willsmith, 'o-',␣
↪label="WillSmith", color='brown')
plt.plot(mergeGroupby_df.time, mergeGroupby_df.chrisrock, 'o-',␣
↪label="ChrisRock", color='blue')
plt.plot(mergeGroupby_df.time, mergeGroupby_df.jadasmith, 'o-',␣
↪label="JadaSmith", color='pink')

plt.xlabel('Date', fontsize=20)
plt.ylabel('Tweet Count', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Trend of Tweet Count', fontsize=30)
plt.
↪legend(labels=['WillSmith','ChrisRock','JadaSmith'],labelcolor=['brown','blue','pink'],loc=
↪right", prop={'size': 20})
```

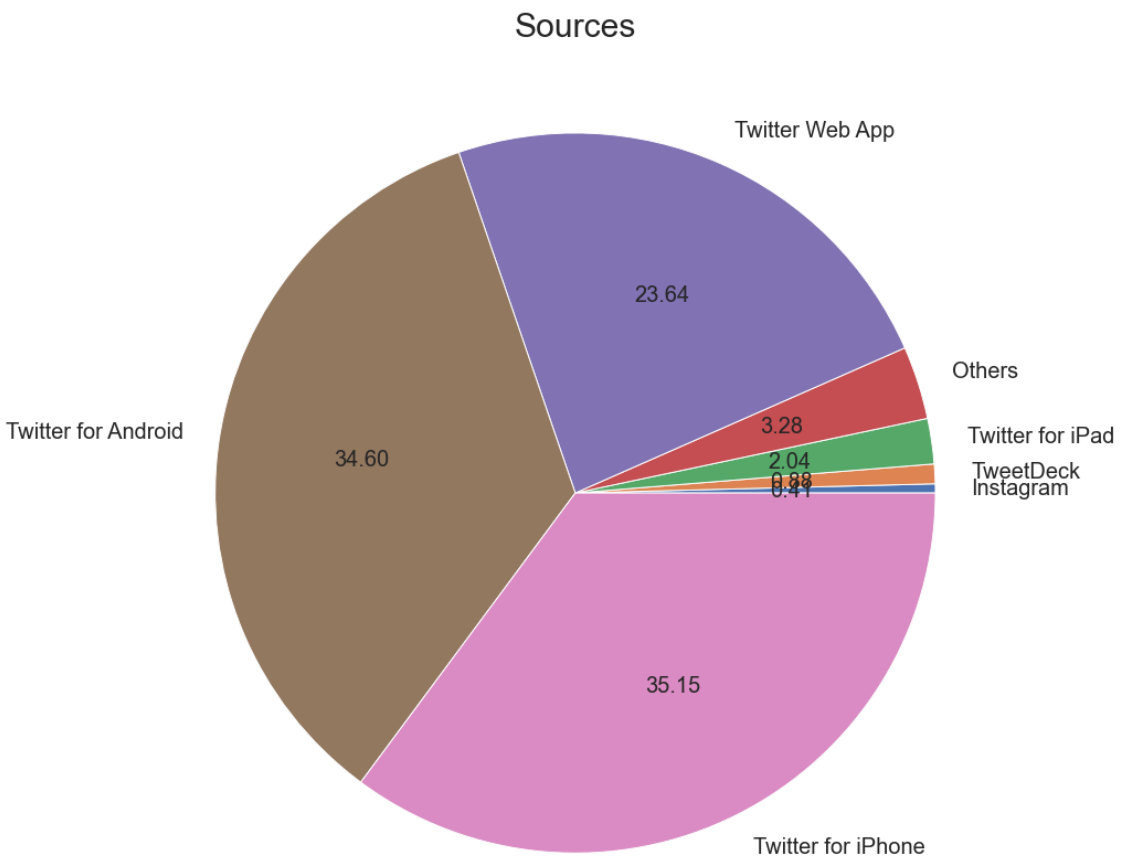
[ ]:
```
<matplotlib.legend.Legend at 0x7ff915e7daf0>
```



There are barely tweets about Jada on twitter. The hype seems to fall off within a week of event occurring.

[ ]:
```
import matplotlib as mpl
mpl.rcParams['font.size'] = 25
# plot chart
plt.figure(figsize=(15,15))
# realize dont need percent, pie chat calculates for you
plt.pie(sourceCount_df.source, labels=sourceCount_df.sourcename2, autopct='%.
 ↪2f',textprops= {"fontsize":20})
plt.title('Sources', fontsize=30)
```

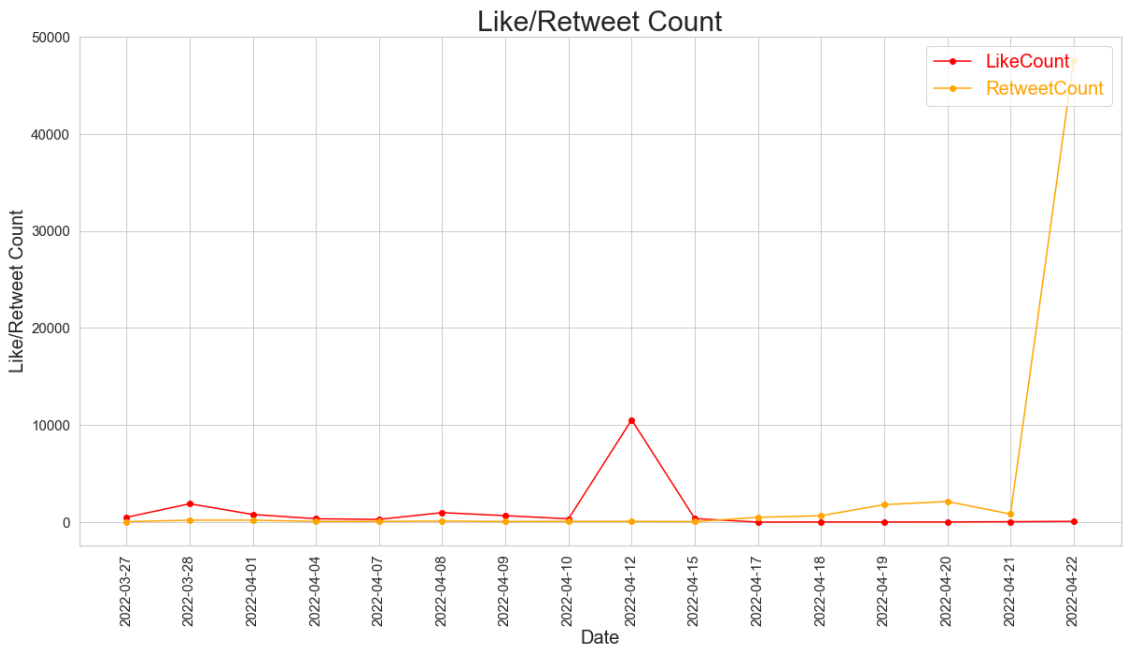
[ ]:
```
Text(0.5, 1.0, 'Sources')
```



From the data, Android market is almost equal to iPhone. Google has performed well!

[ ]:
```
plt.figure(figsize=(20,10))
plt.plot(mergeGroupby_df.time, mergeGroupby_df.like_count, 'o-',␣
 ↪label="LikeCount", color='red')
plt.plot(mergeGroupby_df.time, mergeGroupby_df.retweet_count, 'o-',␣
 ↪label="RetweetCount", color='orange')
plt.xlabel('Date', fontsize=20)
plt.ylabel('Like/Retweet Count', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Like/Retweet Count', fontsize=30)
plt.
 ↪legend(labels=['LikeCount','RetweetCount'],labelcolor=['red','orange'],loc="upper␣
 ↪right", prop={'size': 20})
```

[ ]:
```
<matplotlib.legend.Legend at 0x7ff916b59370>
```



Top Retweet & Like

[ ]:
```
# recently had huge retweet, i wanted to see what the message was
df3 = master_df2.sort_values(by='retweet_count',ascending=False)
df3.iloc[0,1]

# 1 retweet media file - https://t.co/3d3xn8MlUe

# 2 retweet
# by twitter screen name - TheRealMelissaE
# If Hollywood is going to go to such great lengths to cancel a Black man,
# who had a moment- one single slap, out in the open,
# then it needs to go to those same lengths to cancel a white woman,
# who repeatedly committed violence behind closed doors. #WillSmith #AmberHeard␣
↪#JohnnyDepp
```

[ ]:
```
'RT @PeteFighter: OK……. This one wins!!\n#WillSmith #Oscars2022 #ChrisRock
#StreetFighter \n\nBy bruscopa (tiktok) https://t.co/3d3xn8MlUe'
```

[ ]:
```
df4 = master_df2.sort_values(by='like_count',ascending=False)
df4.head()

# 1 like - disturbing child soilder violence
#this inhuman act by separatist group is now 'common' thing in west papua and␣
↪it
# just sad that no one from so called human rights activist condemn and even␣
↪talk about this..
```

```
# https://t.co/tfQlnbm2Db

# 2 like - photo of will slapping chris
# Cette photo mérite d'être une cover d'un morceau comme NWTS  de Drake
# This photo deserves to be a cover of a track like Drake's NWTS
```

[ ]:
```
                user                                                text  \
2931       srojeupark  this inhuman act by separatist group is now 'c…
5079       srojeupark  this inhuman act by separatist group is now 'c…
3419  jaidchosesadire  Cette photo mérite d'être une cover d'un morce…
443         willsmith  Wordle 293 3/6*\n\n   \n   \n   \n\n100 …
1599   tandemperfecte  Un niño de siete años zurdo obligado a tocar e…

            time           location              source like_count  \
2931  2022-04-12       Planet Earth     Twitter Web App       4862
5079  2022-04-12       Planet Earth     Twitter Web App       4851
3419  2022-03-28    Liège, Belgique  Twitter for iPhone        796
443   2022-04-08  San Francisco, CA  Twitter for iPhone        346
1599  2022-04-07          Barcelona  Twitter for iPhone        159

     retweet_count quote_count reply_count  willsmith  chrisrock  jadasmith
2931             0           0          13          0          0          0
5079             0           0          13          0          0          0
3419            84          10           1          1          1          1
443              6           4          55          0          0          0
1599            38           3          12          0          0          0
```

Natural Language Processing (NLP)

Cleaning - Text

[ ]:
```
# assign new df
master_df3 = master_df2
# apply remove3 function
master_df3.text = master_df3.text.apply(remove3)
master_df3.head(10)
```

[ ]:
```
             user                                                text  \
0       damnratez                                        deer infomous
1       djBESWOLF  wolfliveapp wolflive wolflovers music livemusi…
2  MsAnalytical15  new podcast janet hubert original aunt viv sta…
3   okuleygodfryd  lets honest got slappedhad anyone asked knew a…
4  BonadonnaMarco  rt smith bandito per 10 anni dagli per lo schi…
5    glohtraveler  rt never mind jadashe helps cause continuously…
6   Jonti44291277          human made mistake dies one said wasnt li
7    glohtraveler  rt whao chris hero example world right walk wa…
8     lionofgold1     rt good evil exist lord almighty says not agai
9    TheColdIron1           say dont stand anything people say nword
```

```
         time                      location               source like_count  \
0  2022-04-10  Sailacross It's Firebizar   Twitter for Android          0
1  2022-04-10              London, England   Twitter for iPhone          0
2  2022-04-10                          NaN             Spreaker          1
3  2022-04-10                 Accra, Ghana   Twitter for iPhone          0
4  2022-04-10                         Rome  Twitter for Android          0
5  2022-04-10               Manhattan, NYC   Twitter for iPhone          0
6  2022-04-10                          NaN   Twitter for iPhone          1
7  2022-04-10               Manhattan, NYC   Twitter for iPhone          0
8  2022-04-10                          NaN  Twitter for Android          0
9  2022-04-10                          NaN  Twitter for Android          0

  retweet_count quote_count reply_count  willsmith  chrisrock  jadasmith
0             0           0           0          0          1          0
1             0           0           0          0          0          0
2             0           0           0          1          0          0
3             0           0           0          0          1          0
4             0           0           0          1          1          0
5             0           0           0          0          1          1
6             0           0           2          1          1          0
7             0           0           0          0          1          0
8             0           0           0          0          1          0
9             0           0           1          0          1          0
```

[ ]:
```
master_df3.shape
```

[ ]:
```
(6133, 12)
```

[ ]:
```
# there are text with no content, obtain their index
b = list(master_df3.text)
na = []
for a in range(len(b)):
    if b[a] == '':
        na.append(a)
len(na)
```

[ ]:
```
163
```

[ ]:
```
# drop rows with no text content
masterdf4 = master_df3.drop(index=na)
masterdf4.head(10)
```

[ ]:
```
             user                                                text  \
0       damnratez                                  deer infomous
1       djBESWOLF  wolfliveapp wolflive wolflovers music livemusi…
2  MsAnalytical15  new podcast janet hubert original aunt viv sta…
```

```
3   okuleygodfryd  lets honest got slappedhad anyone asked knew a…
4  BonadonnaMarco  rt smith bandito per 10 anni dagli per lo schi…
5    glohtraveler  rt never mind jadashe helps cause continuously…
6   Jonti44291277          human made mistake dies one said wasnt li
7    glohtraveler  rt whao chris hero example world right walk wa…
8     lionofgold1     rt good evil exist lord almighty says not agai
9    TheColdIron1           say dont stand anything people say nword

         time                      location               source like_count  \
0  2022-04-10  Sailacross It's Firebizar   Twitter for Android          0
1  2022-04-10              London, England   Twitter for iPhone          0
2  2022-04-10                          NaN             Spreaker          1
3  2022-04-10                Accra, Ghana   Twitter for iPhone          0
4  2022-04-10                         Rome  Twitter for Android          0
5  2022-04-10               Manhattan, NYC   Twitter for iPhone          0
6  2022-04-10                          NaN   Twitter for iPhone          1
7  2022-04-10               Manhattan, NYC   Twitter for iPhone          0
8  2022-04-10                          NaN  Twitter for Android          0
9  2022-04-10                          NaN  Twitter for Android          0

  retweet_count quote_count reply_count  willsmith  chrisrock  jadasmith
0             0           0           0          0          1          0
1             0           0           0          0          0          0
2             0           0           0          1          0          0
3             0           0           0          0          1          0
4             0           0           0          1          1          0
5             0           0           0          0          1          1
6             0           0           2          1          1          0
7             0           0           0          0          1          0
8             0           0           0          0          1          0
9             0           0           1          0          1          0
```

[ ]:
```
masterdf4.shape
```

[ ]:
```
(5970, 12)
```

[ ]:
```
# detect language
masterdf4['lang'] = masterdf4.text.apply(lambda x :lanDetectFunc(x))

# master_df3['translateText'] = master_df3['text'].apply(translator1.translate,␣
↪dest='en').apply(getattr, args=('text',))
```

[ ]:
```
masterdf4.lang.value_counts()
```

[ ]:
```
en    4222
es     717
fr     263
```

```
it     180
de     113
id      86
pt      72
nl      64
no      50
da      17
sv      16
ms      15
ca      13
pl      13
tr      13
tl      12
mt      10
sw       9
et       8
af       8
cy       7
eu       7
eo       6
rw       6
ro       5
hr       5
sl       4
br       4
nn       2
an       2
oc       2
gl       2
fi       2
la       2
ga       2
lb       2
xh       2
lt       1
lv       1
mg       1
bs       1
sq       1
az       1
hu       1
Name: lang, dtype: int64
```

[ ]:
```
# reset index again
masterdf4.reset_index(drop=True)

# backup to csv
```

```
# masterdf4.to_csv('datadf/cleanedDf.csv')
```

[ ]:
```
                user                                                text  \
0          damnratez                                       deer infomous
1          djBESWOLF  wolfliveapp wolflive wolflovers music livemusi…
2     MsAnalytical15  new podcast janet hubert original aunt viv sta…
3      okuleygodfryd  lets honest got slappedhad anyone asked knew a…
4     BonadonnaMarco  rt smith bandito per 10 anni dagli per lo schi…
…                …                                                 …
5965      SpeakMeow6  rt confirmado cancela sus planes sobre una sec…
5966         VanElyo  rt confirmado cancela sus planes sobre una sec…
5967  Taurus89514630  rt top 10 news week smith gill respond trolls …
5968        LSwagata  rt top 10 news week smith gill respond trolls …
5969      ChangeMyJg  rt confirmado cancela sus planes sobre una sec…

            time                     location              source like_count  \
0     2022-04-10  Sailacross It's Firebizar   Twitter for Android          0
1     2022-04-10             London, England   Twitter for iPhone          0
2     2022-04-10                         NaN            Spreaker          1
3     2022-04-10                Accra, Ghana   Twitter for iPhone          0
4     2022-04-10                        Rome  Twitter for Android          0
…          …                           …                   …        …
5965  2022-04-22                         NaN   Twitter for iPhone          0
5966  2022-04-22                   La Laguna  Twitter for Android          0
5967  2022-04-22                         NaN  Twitter for Android          0
5968  2022-04-22                         NaN  Twitter for Android          0
5969  2022-04-22                      México  Twitter for Android          0

     retweet_count quote_count reply_count  willsmith  chrisrock  jadasmith  \
0                0           0           0          0          1          0
1                0           0           0          0          0          0
2                0           0           0          1          0          0
3                0           0           0          0          1          0
4                0           0           0          1          1          0
…              …         …         …        …         …        …
5965            39         NaN         NaN          0          0          0
5966            39         NaN         NaN          0          0          0
5967           352         NaN         NaN          1          0          0
5968           352         NaN         NaN          1          0          0
5969            39         NaN         NaN          0          0          0

     lang
0      nl
1      en
2      en
3      en
4      it
```

```
…   …
5965   es
5966   es
5967   en
5968   en
5969   es

[5970 rows x 13 columns]
```

[ ]:
```
masterdf4.shape
```

[ ]:
```
(5970, 13)
```

[ ]:
```
# make new df, select only en
masterdf5 = masterdf4[masterdf4.lang =='en']

# none eng words
masterdf5['text2'] = masterdf5.text.apply(engOnly)

# assign sentimentscore
masterdf5['blobscore'] = masterdf5.text2.apply(lambda x : TextBlob(x).sentiment.
 ↪polarity)

masterdf5.shape
```

```
/var/folders/fy/_jcf8bdn3hbccf_yk638qvkw0000gn/T/ipykernel_852/1953886280.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  masterdf5['text2'] = masterdf5.text.apply(engOnly)
/var/folders/fy/_jcf8bdn3hbccf_yk638qvkw0000gn/T/ipykernel_852/1953886280.py:8:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  masterdf5['blobscore'] = masterdf5.text2.apply(lambda x :
TextBlob(x).sentiment.polarity)
```

[ ]:
```
(4222, 15)
```

[ ]:
```
# add sent using text 2
masterdf5['blobsent'] = masterdf5.text2.apply(blobSent)
masterdf5.shape
```

```
/var/folders/fy/_jcf8bdn3hbccf_yk638qvkw0000gn/T/ipykernel_852/327221747.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  masterdf5['blobsent'] = masterdf5.text2.apply(blobSent)
```

[ ]:
```
(4222, 16)
```

[ ]:
```
# obtain unique tweets
masterdf6 = masterdf5.drop_duplicates(subset='text2',keep='last')
masterdf6.shape
# list # obtain word pool of unique tweets
wordpool = list(masterdf6.text2)
# string - joiin each sentence
wordpool3 = ' '.join(wordpool)
# list of words - split into words
wordpool2 = wordpool3.split(' ')
len(wordpool2)
```

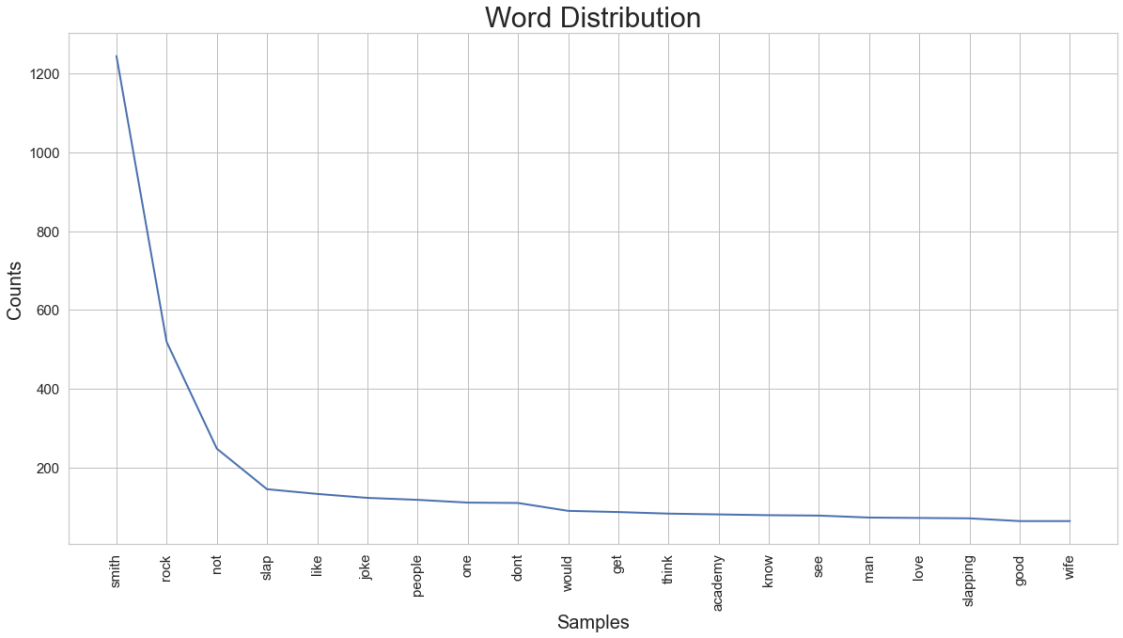
[ ]:
```
15822
```

[ ]:
```
# count
wordcountset = FreqDist(wordpool2)
wordcountset.most_common(20)
```

[ ]:
```
[('smith', 1245),
 ('rock', 519),
 ('not', 248),
 ('slap', 145),
 ('like', 133),
 ('joke', 123),
 ('people', 118),
 ('one', 111),
 ('dont', 110),
 ('would', 90),
 ('get', 87),
 ('think', 83),
 ('academy', 81),
 ('know', 79),
 ('see', 78),
 ('man', 73),
 ('love', 72),
 ('slapping', 71),
 ('good', 64),
 ('wife', 64)]
```

Visualization - Text

[ ]:
```
plt.figure(figsize=(20,10))
# Annotation
plt.xlabel('Words', fontsize=20)
plt.ylabel('Counts', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Word Distribution', fontsize=30)
wordcountset.plot(20)
```



[ ]:
```
<AxesSubplot:title={'center':'Word Distribution'}, xlabel='Samples',
ylabel='Counts'>
```

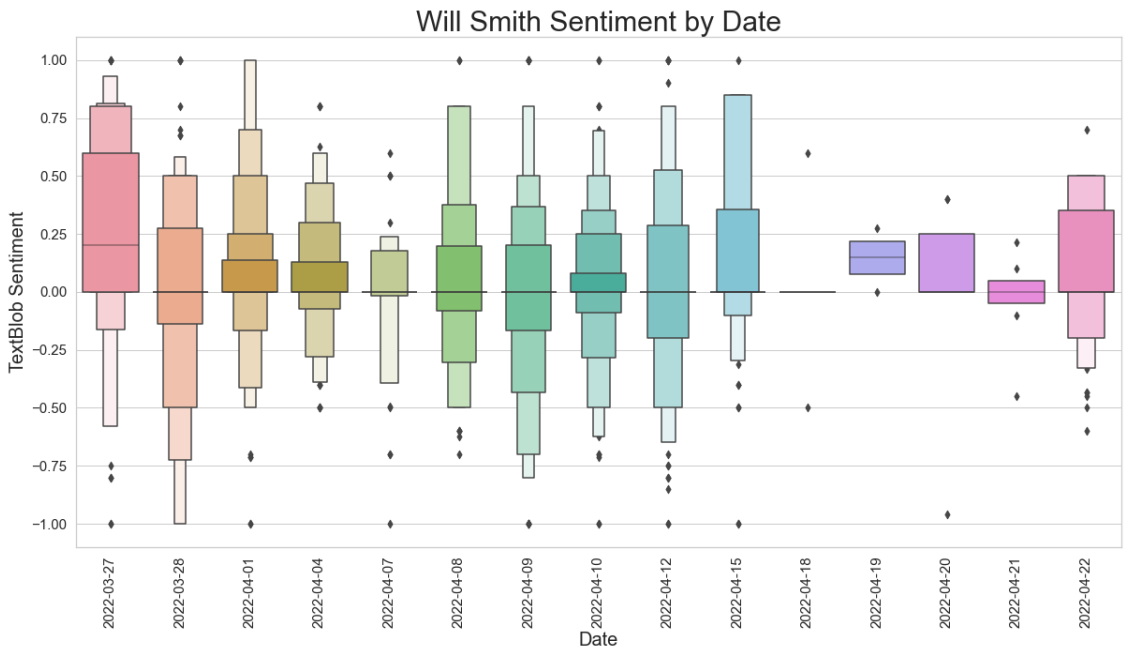
[ ]:
```
wc = WordCloud(background_color='white', max_words=100, stopwords = STOPWORDS)

# Generate and plot wordcloud
plt.figure(figsize=(20,10))
plt.imshow(wc.generate(wordpool3))
plt.axis('off')
plt.show()
```

[ ]:
```
# we use 5 because we dont want unique tweets, every retweet should add weight␣
↪on sentiment
willsentdf = masterdf5[masterdf5.willsmith == 1]
jadasentdf = masterdf5[masterdf5.jadasmith == 1]
chrissentdf = masterdf5[masterdf5.chrisrock == 1]
```

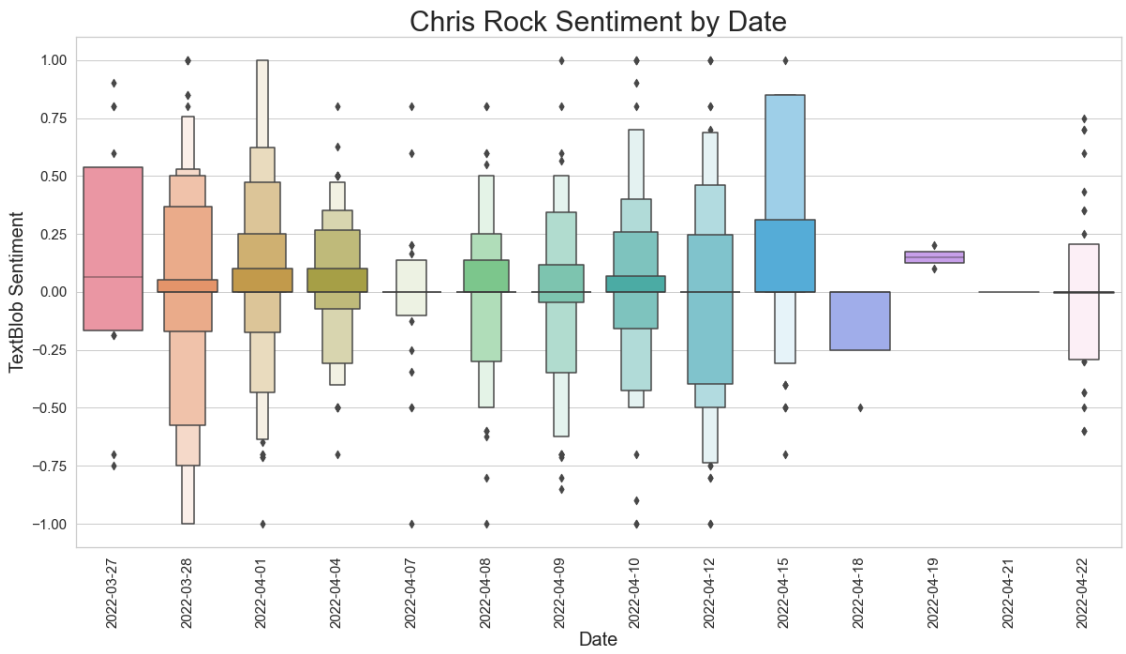
[ ]:
```
plt.figure(figsize=(20,10))
sns.boxenplot(y="blobscore", x="time", scale='linear',data=willsentdf.
↪sort_values(by='time'))
# Annotation
plt.xlabel('Date', fontsize=20)
plt.ylabel('TextBlob Sentiment', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Will Smith Sentiment by Date', fontsize=30)
```

[ ]:
```
Text(0.5, 1.0, 'Will Smith Sentiment by Date')
```



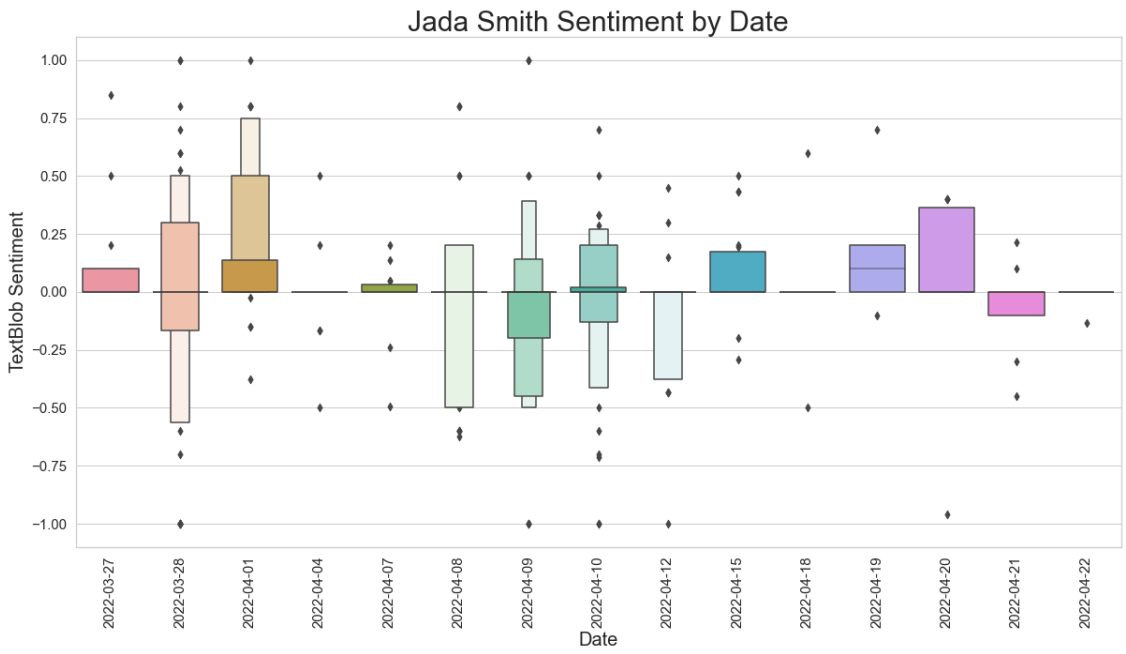
[ ]:
```
plt.figure(figsize=(20,10))
sns.boxenplot(y="blobscore", x="time", scale='linear',data=chrissentdf.
 ↪sort_values(by='time'))
# Annotation
plt.xlabel('Date', fontsize=20)
plt.ylabel('TextBlob Sentiment', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Chris Rock Sentiment by Date', fontsize=30)
```

[ ]:
```
Text(0.5, 1.0, 'Chris Rock Sentiment by Date')
```



[ ]:
```
plt.figure(figsize=(20,10))
sns.boxenplot(y="blobscore", x="time", scale='linear',data=jadasentdf.
 ↪sort_values(by='time'))
# Annotation
plt.xlabel('Date', fontsize=20)
plt.ylabel('TextBlob Sentiment', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Jada Smith Sentiment by Date', fontsize=30)
```

[ ]:
```
Text(0.5, 1.0, 'Jada Smith Sentiment by Date')
```



Seems like tweets may be sympathetic towards Jada at the beginning. When Will got banned, tweets are negative towards her.

Named Entity Recognition

[ ]:
```
nlp = spacy.load('en_core_web_lg')

# list # obtain word pool of unique tweets
nerpool = list(masterdf6.text)
# string - joiin each sentence
nerpool2 = ';'.join(nerpool)

doc_q = nlp(nerpool2)

displacy.render(doc_q, style='ent', jupyter=True)
```

```
<IPython.core.display.HTML object>
```

Deep Learning

[ ]:
```
masterdf6 = masterdf5.reset_index(drop=True)
masterdf6.head(1)
```

[ ]:
```
        user                                                text        time  \
0  djBESWOLF  wolfliveapp wolflive wolflovers music livemusi…  2022-04-10

          location              source like_count retweet_count quote_count  \
0  London, England  Twitter for iPhone          0             0           0
```

```
  reply_count  willsmith  chrisrock  jadasmith lang  text2  blobscore blobsent
0           0          0          0          0   en  music        0.0  Neutral
```

[ ]:
```
masterdf6['text_noname'] = masterdf6.text2.apply(lambda x : removeName(x.
 ↪split()))
masterdf6.head(1)
```

[ ]:
```
        user                                                text        time  \
0  djBESWOLF  wolfliveapp wolflive wolflovers music livemusi…  2022-04-10

          location              source like_count retweet_count quote_count  \
0  London, England  Twitter for iPhone          0             0           0

  reply_count  willsmith  chrisrock  jadasmith lang  text2  blobscore  \
0           0          0          0          0   en  music        0.0

  blobsent text_noname
0  Neutral     [music]
```

[ ]:
```
# load model
model = load_model('data3/LSTM.h5') # max length 15

# load tokenizer
with open('data3/token_mdl1.pickle', 'rb') as handle:
    token = pickle.load(handle)
```

[ ]:
```
masterdf6['predict_sent'] = masterdf6.text_noname.apply(lambda x:␣
 ↪predictFunc(x))
masterdf6 = masterdf6[masterdf6.predict_sent!='NoWork']
```

[ ]:
```
masterdf6['predict_score'] = masterdf6['predict_sent'].map({'Negative': -1,␣
 ↪'Neutral': 0, 'Positive':1})
```

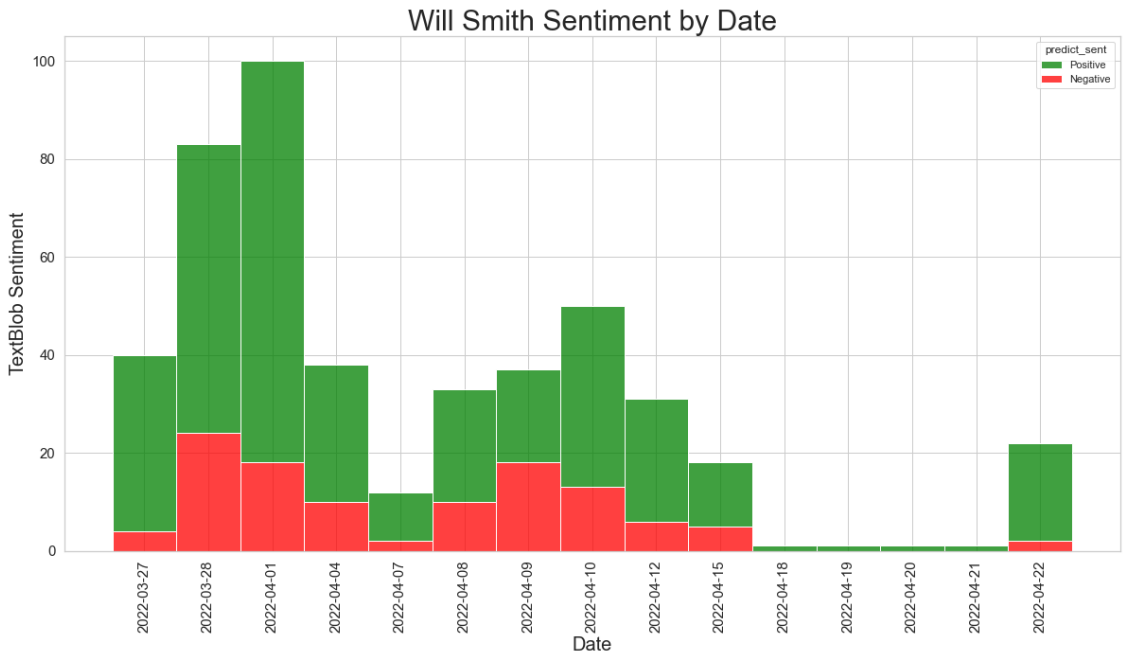
[ ]:
```
# we use 5 because we dont want unique tweets, every retweet should add weight␣
 ↪on sentiment
masterdf7 = masterdf6[masterdf6.predict_sent!='Neutral']
willsentdf2 = masterdf7[masterdf6.willsmith == 1]
jadasentdf2 = masterdf7[masterdf6.jadasmith == 1]
chrissentdf2 = masterdf7[masterdf6.chrisrock == 1]
```

```
/var/folders/fy/_jcf8bdn3hbccf_yk638qvkw0000gn/T/ipykernel_852/3833716636.py:3:
UserWarning: Boolean Series key will be reindexed to match DataFrame index.
  willsentdf2 = masterdf7[masterdf6.willsmith == 1]
/var/folders/fy/_jcf8bdn3hbccf_yk638qvkw0000gn/T/ipykernel_852/3833716636.py:4:
UserWarning: Boolean Series key will be reindexed to match DataFrame index.
  jadasentdf2 = masterdf7[masterdf6.jadasmith == 1]
/var/folders/fy/_jcf8bdn3hbccf_yk638qvkw0000gn/T/ipykernel_852/3833716636.py:5:
```

```
UserWarning: Boolean Series key will be reindexed to match DataFrame index.
  chrissentdf2 = masterdf7[masterdf6.chrisrock == 1]
```

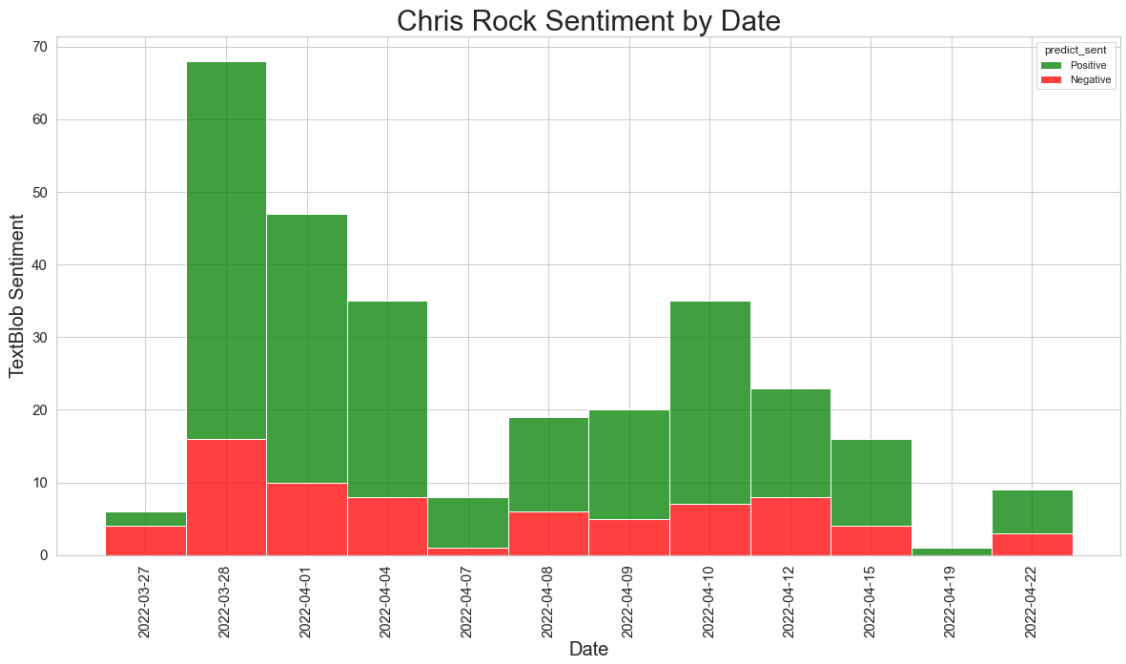
[ ]:
```
# Histplot stacked by type
plt.figure(figsize=(20,10))
sns.histplot(data=willsentdf2.
 ↪sort_values(by='time'),x='time',hue='predict_sent',multiple='stack',edgecolor='white',hue_o
# Annotation
plt.xlabel('Date', fontsize=20)
plt.ylabel('TextBlob Sentiment', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Will Smith Sentiment by Date', fontsize=30)
```

[ ]:
```
Text(0.5, 1.0, 'Will Smith Sentiment by Date')
```



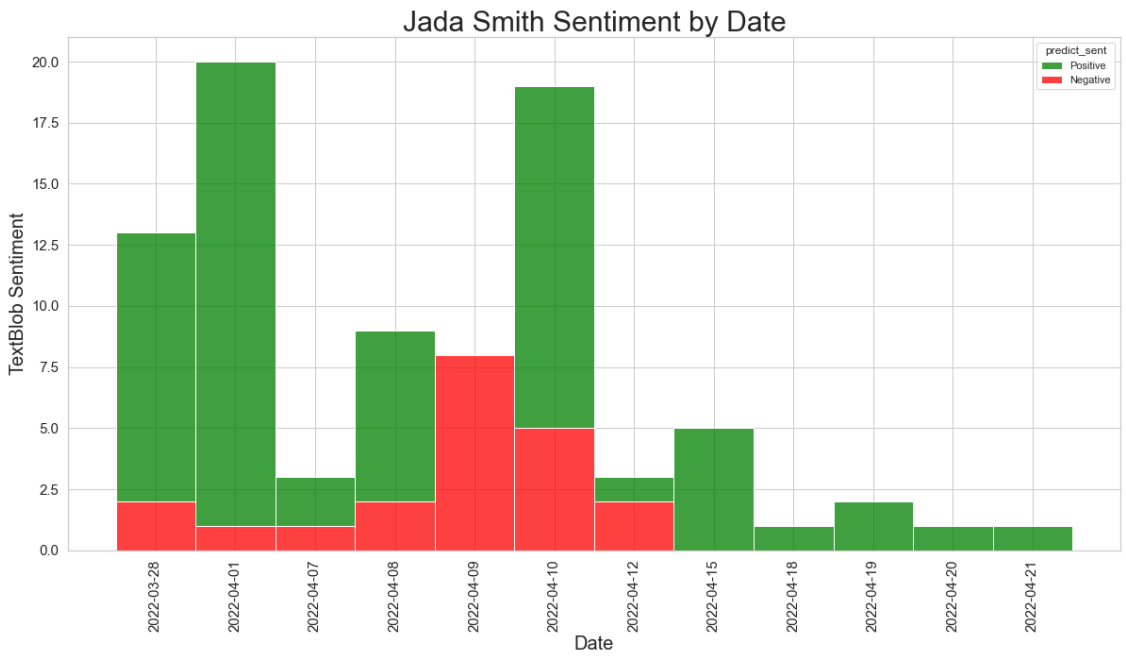
[ ]:
```
plt.figure(figsize=(20,10))
sns.histplot(data=chrissentdf2.
 ↪sort_values(by='time'),x='time',hue='predict_sent',multiple='stack',edgecolor='white',hue_o
# Annotation
plt.xlabel('Date', fontsize=20)
plt.ylabel('TextBlob Sentiment', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Chris Rock Sentiment by Date', fontsize=30)
```

[ ]: Text(0.5, 1.0, 'Chris Rock Sentiment by Date')



[ ]:
```
plt.figure(figsize=(20,10))
sns.histplot(data=jadasentdf2.
 ↪sort_values(by='time'),x='time',hue='predict_sent',multiple='stack',edgecolor='white',hue_o
# Annotation
plt.xlabel('Date', fontsize=20)
plt.ylabel('TextBlob Sentiment', fontsize = 20)
plt.yticks(fontsize=15)
plt.xticks(fontsize=15,rotation=90)
plt.title('Jada Smith Sentiment by Date', fontsize=30)
```

[ ]: Text(0.5, 1.0, 'Jada Smith Sentiment by Date')


Jada Smith Sentiment by Date
predict_sent
Positive
Negative
TextBlob Sentiment
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
2022-03-28
2022-04-01
2022-04-07
2022-04-08
2022-04-09
2022-04-10
2022-04-12
2022-04-15
2022-04-18
2022-04-19
2022-04-20
2022-04-21
Date

[ ]: