Final_Project_7

March 10, 2023

Student Loan Forgiveness

[1]:
```
import sys
print(sys.version)
```

```
3.8.15 | packaged by conda-forge | (default, Nov 22 2022, 08:46:39)
[GCC 10.4.0]
```

[29]:
```
import pandas as pd
import numpy as np
pd.set_option('display.max_colwidth', None)
pd.reset_option('display.max_rows')
from itertools import compress
from pyspark.sql.functions import *
from pyspark.sql.types import *
import seaborn as sns
import matplotlib.pyplot as plt
warnings.filterwarnings(action='ignore')
```

[30]:
```
from pyspark.sql import SparkSession
from pyspark import SparkContext
from pyspark.sql import SQLContext
from pyspark.sql import Row
from pyspark.sql.functions import col
```

[4]:
```
spark.conf.set("spark.sql.repl.eagerEval.enabled",True)
```

[5]:
```
%%time
twitter = spark.read.parquet('gs://chen26-bdp/original_data')
```

```
CPU times: user 3.89 ms, sys: 4.59 ms, total: 8.47 ms
Wall time: 8.78 s
```

```
23/03/08 19:24:56 WARN org.apache.spark.sql.catalyst.util.package: Truncated the
string representation of a plan since it was too large. This behavior can be
adjusted by setting 'spark.sql.debug.maxToStringFields'.
```

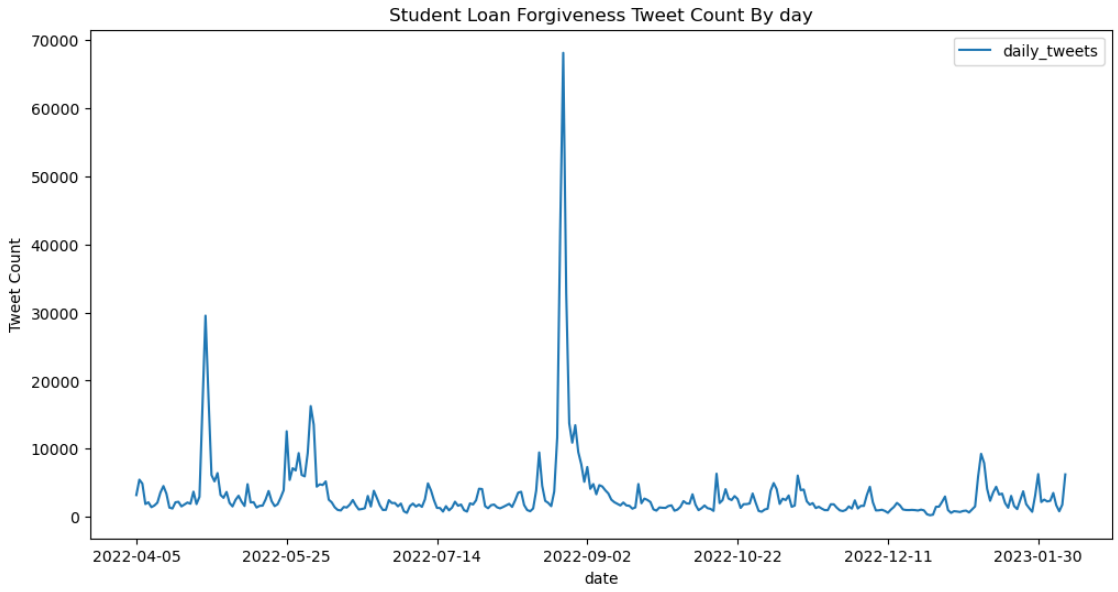
[6]:
```
keywords = ['loan','biden','forgiveness']
#filter out rows that do not contain words in keywords
twitter = twitter.withColumn('lower', lower(col('text')))
filter_twitter = twitter.filter(col('lower').rlike('|'.join(keywords)))

twitter_eng = filter_twitter.filter(col('lang') == 'en')
from pyspark.sql import functions as F
from pyspark.sql import types as t
from pyspark.sql.types import ArrayType, IntegerType, BooleanType

eng_ord=F.udf(lambda x: [ord(a) for a in x],t.ArrayType(IntegerType()))

def english_filter(x):
    for index in range(len(x)):
        if x[index] > 128:
            return False
        else:
            return True

filter_udf = F.udf(english_filter, BooleanType())
loan_tweets = twitter_eng.filter(filter_udf(eng_ord('text')) == True)
```

[7]:
```
loan_tweets.count()
```

[7]:
```
1031389
```

[8]:
```
from pyspark.sql.functions import from_unixtime, date_format
spark.sql("set spark.sql.legacy.timeParserPolicy=LEGACY")
tweets_day = loan_tweets.select('id', 'created_at')
tweets_day = tweets_day.withColumn("timestamp_unix",␣
 ↪from_unixtime(unix_timestamp("created_at", "EEE MMM dd HH:mm:ss Z yyyy")))
tweets_day = tweets_day.withColumn("date", date_format("timestamp_unix",␣
 ↪"yyyy-MM-dd"))
tweets_by_day = tweets_day.drop('created_at', 'timestamp_unix')
total_by_day = tweets_by_day.groupby('date').agg(count('*').
 ↪alias('daily_tweets'))
day_total = total_by_day.orderBy('date', ascending = True)
day = day_total.toPandas()
```

[12]:
```
day.plot(kind="line",x= 'date', y="daily_tweets", figsize=(12, 6))
plt.ylabel("Tweet Count")
plt.title('Student Loan Forgiveness Tweet Count By day')
plt.show()
```



[10]:
```
month_total = day_total.withColumn('month', month(col('date')))
month_total_t = month_total.groupby('month').agg(sum('daily_tweets').
 ↪alias('monthly_tweets'))
month = month_total_t.toPandas()
```

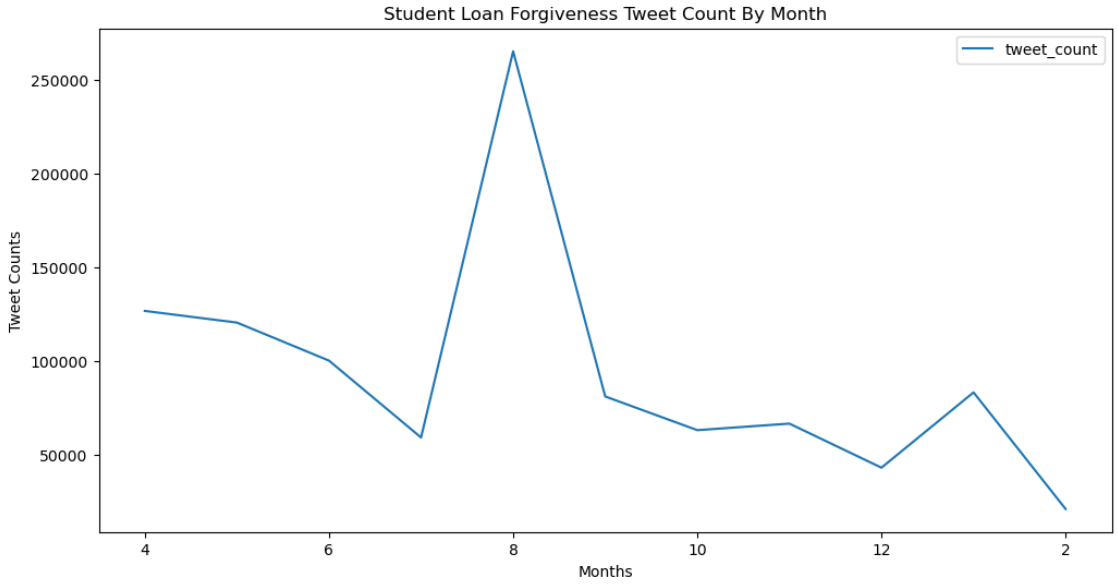
[13]:
```
month
```

[13]:

	month	monthly_tweets
0	12	43327
1	1	83409
2	6	100325
3	5	120567
4	9	81236
5	4	126768
6	8	264982
7	7	59386
8	10	63295
9	11	66786
10	2	21308

[17]:
```
months = ['4','5','6','7','8','9','10','11','12','1','2']
count = [126768, 120567,100325, 59386, 264982, 81236, 63295, 66786, 43327,␣
 ↪83409, 21308]

tweet_month = pd.DataFrame({'Months': months, 'tweet_count': count})
```

[18]:
```
tweet_month.plot(kind="line",x= 'Months', y="tweet_count", figsize=(12, 6))
plt.ylabel("Tweet Counts")
plt.xlabel('Months')
plt.title('Student Loan Forgiveness Tweet Count By Month')
plt.show()
```



[23]:
```
dt = loan_tweets.select([loan_tweets.created_at,
                         loan_tweets.id_str.alias('tweet_id'),
                         loan_tweets.user['id'].alias('user_id'),
                         loan_tweets.user['screen_name'].alias('user_name'),
                         loan_tweets.user['verified'].alias('verified'),
                         loan_tweets.user['followers_count'].
 ↪alias('followers_count'),
                         loan_tweets.user['description'].alias('user_description'),
                         loan_tweets.user['location'].alias('user_location'),
                         loan_tweets.text,
                         loan_tweets.retweeted_status.retweet_count.
 ↪alias('rt_count'),
                         loan_tweets.retweeted_status.favorite_count.alias('rt_fav'),
                         loan_tweets.retweeted_status.quote_count.alias('rt_quo'),
                         loan_tweets.retweeted_status.retweeted.alias('retweet'),
                         loan_tweets.retweeted_status.user['name'].
 ↪alias('rt_user_name')])
```

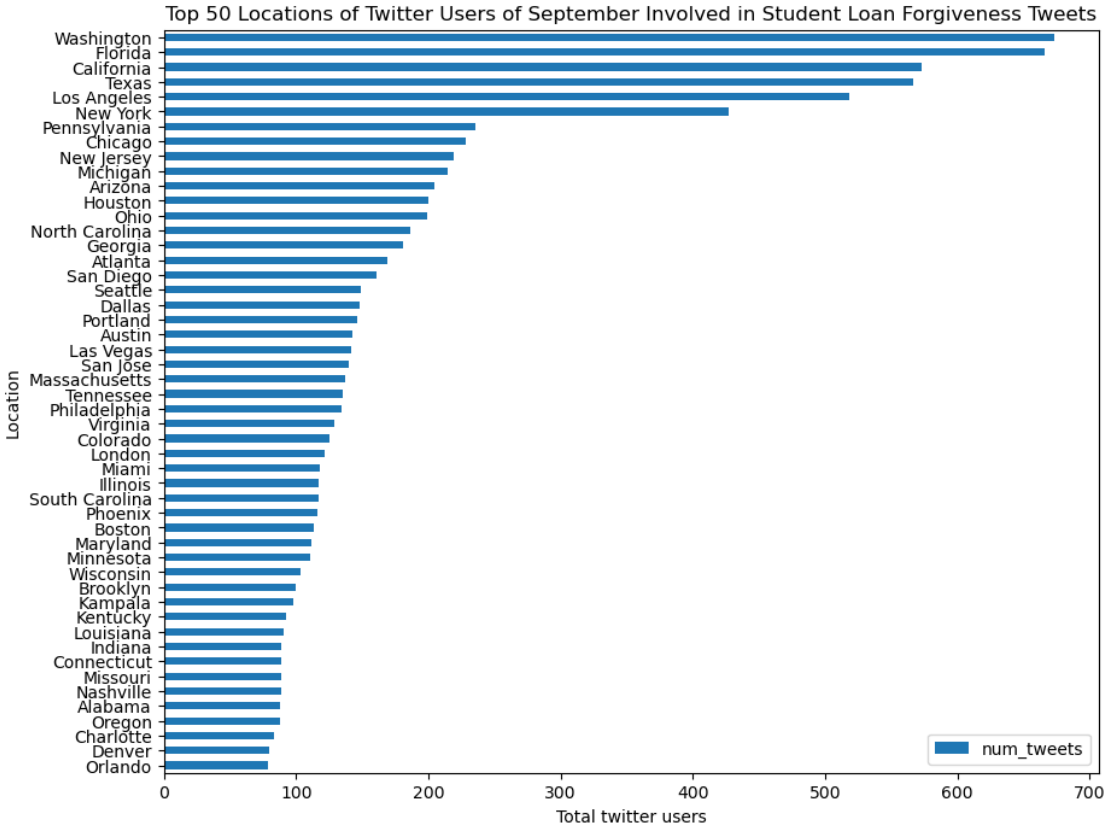
[31]:
```
from pyspark.sql.functions import month
dt_loc = dt.filter(col('user_location').isNotNull())
dt_loc = dt_loc.select('tweet_id', 'created_at', 'user_location')
```

```
dt_loc = dt_loc.withColumn("timestamp_unix",␣
 ↪from_unixtime(unix_timestamp("created_at", "EEE MMM dd HH:mm:ss Z yyyy")))
dt_loc = dt_loc.withColumn("date", date_format("timestamp_unix", "yyyy-MM-dd"))
dt_loc = dt_loc.drop('created_at', 'timestamp_unix')
dt_loc = dt_loc.withColumn('month', month('date'))
dt9 = dt_loc.filter(col('month')==9)
dt9 = dt9.withColumn('loc', split(dt9.user_location, ", ").getItem(0))
dt9 = dt9.filter(col("user_location").like("%,%"))
dt9_count = dt9.groupby('loc').agg(count('*').alias('num_tweets'))
dt9_desc = dt9_count.orderBy(col('num_tweets').desc()).limit(50)
```

[33]:
```
df9 = dt9_desc.toPandas()
```

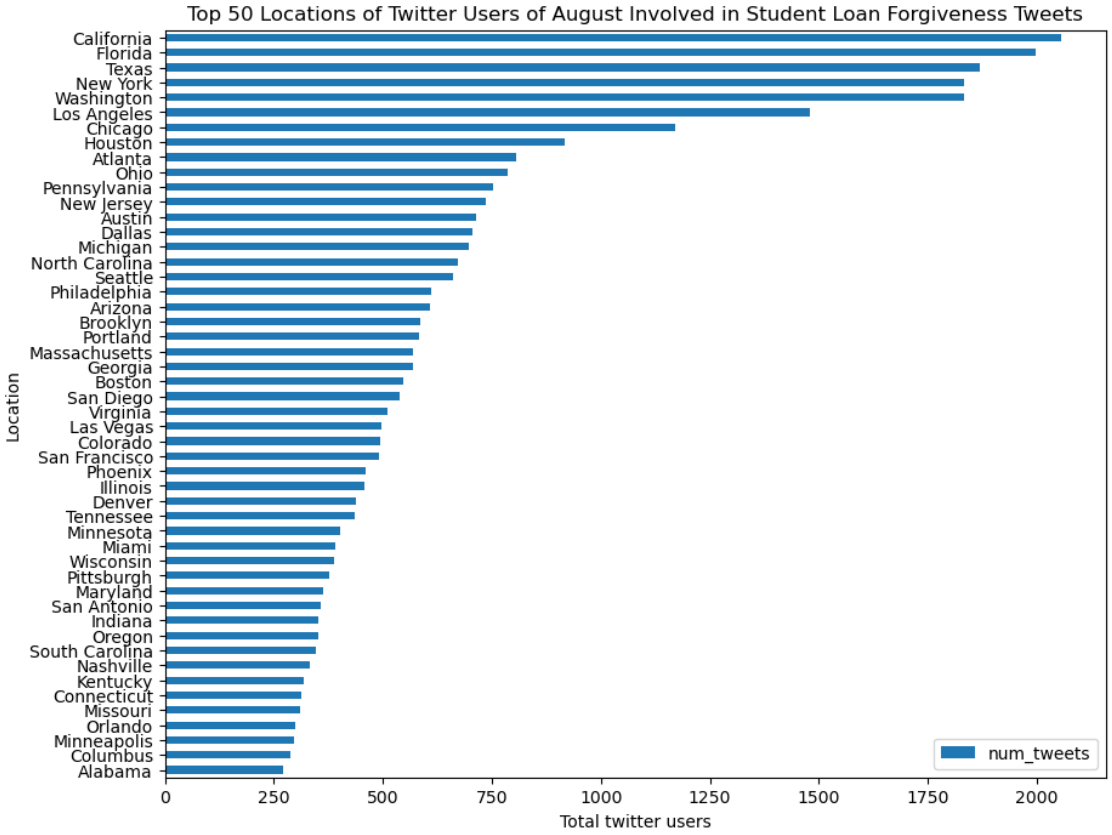
```
Exception in thread "serve-DataFrame" java.net.SocketTimeoutException: Accept
timed out
        at java.net.PlainSocketImpl.socketAccept(Native Method)
        at
java.net.AbstractPlainSocketImpl.accept(AbstractPlainSocketImpl.java:409)
        at java.net.ServerSocket.implAccept(ServerSocket.java:560)
        at java.net.ServerSocket.accept(ServerSocket.java:528)
        at org.apache.spark.security.SocketAuthServer$$anon$1.run(SocketAuthServ
er.scala:64)
```

[35]:
```
ax = df9.plot(x ='loc',y='num_tweets', kind='barh', figsize = (10, 8))

ax.set_ylabel('Location')
ax.set_xlabel('Total twitter users')
ax.set_title('Top 50 Locations of Twitter Users of September Involved in␣
 ↪Student Loan Forgiveness Tweets')
ax.invert_yaxis()

# show the plot
plt.show()
```



[36]:
```
dt8 = dt_loc.filter(col('month')==8)
dt8 = dt8.withColumn('loc', split(dt8.user_location, ", ").getItem(0))
dt8 = dt8.filter(col("user_location").like("%,%"))
dt8_count = dt8.groupby('loc').agg(count('*').alias('num_tweets'))
dt8_desc = dt8_count.orderBy(col('num_tweets').desc()).limit(50)
df8 = dt8_desc.toPandas()
```

[38]:
```
ax = df8.plot(x ='loc',y='num_tweets', kind='barh', figsize = (10, 8))

ax.set_ylabel('Location')
ax.set_xlabel('Total twitter users')
ax.set_title('Top 50 Locations of Twitter Users of August Involved in Student␣
 ↪Loan Forgiveness Tweets')
ax.invert_yaxis()

# show the plot
plt.show()
```

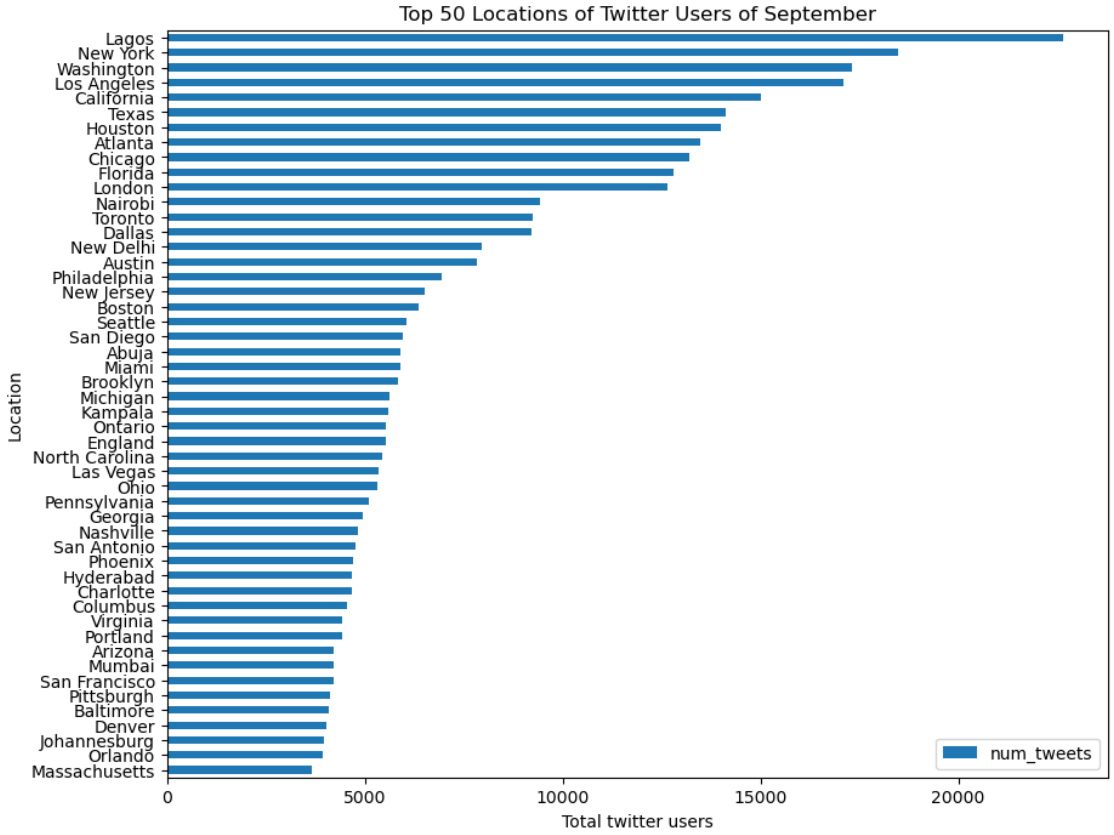


[41]:
```
keywords = ['college', 'high', 'university', 'students'
            , 'public', 'private', 'secondary', 'primary', 'education',␣
 ↪'undergraduate','graduate']
#filter out rows that do not contain words in keywords
twitter = twitter.withColumn('lower', lower(col('text')))
filter_twitter = twitter.filter(col('lower').rlike('|'.join(keywords)))

twitter_eng = filter_twitter.filter(col('lang') == 'en')
from pyspark.sql import functions as F
from pyspark.sql import types as t
from pyspark.sql.types import ArrayType, IntegerType, BooleanType

eng_ord=F.udf(lambda x: [ord(a) for a in x],t.ArrayType(IntegerType()))

def english_filter(x):
    for index in range(len(x)):
        if x[index] > 128:
            return False
        else:
            return True
```

```
filter_udf = F.udf(english_filter, BooleanType())
tweets = twitter_eng.filter(filter_udf(eng_ord('text')) == True)

t = tweets.select([tweets.created_at,
                   tweets.id_str.alias('tweet_id'),
                   tweets.user['id'].alias('user_id'),
                   tweets.user['screen_name'].alias('user_name'),
                   tweets.user['verified'].alias('verified'),
                   tweets.user['followers_count'].alias('followers_count'),
                   tweets.user['description'].alias('user_description'),
                   tweets.user['location'].alias('user_location'),
                   tweets.text,
                   tweets.retweeted_status.retweet_count.alias('rt_count'),
                   tweets.retweeted_status.favorite_count.alias('rt_fav'),
                   tweets.retweeted_status.quote_count.alias('rt_quo'),
                   tweets.retweeted_status.retweeted.alias('retweet'),
                   tweets.retweeted_status.user['name'].alias('rt_user_name')])
```

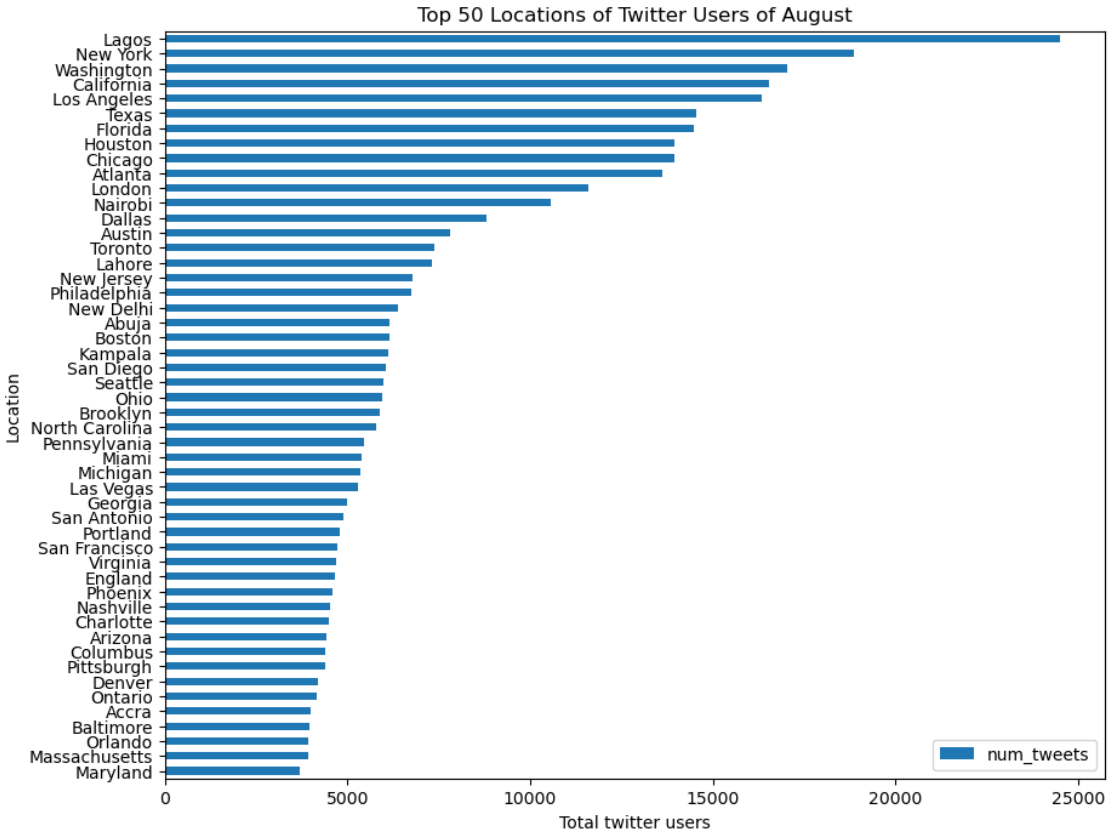
[ ]:
```
spark.sql("set spark.sql.legacy.timeParserPolicy=LEGACY")
tdt = t.filter(col('user_location').isNotNull())
tdt = tdt.select('tweet_id', 'created_at', 'user_location')
tdt = tdt.withColumn("timestamp_unix",␣
 ↪from_unixtime(unix_timestamp("created_at", "EEE MMM dd HH:mm:ss Z yyyy")))
tdt = tdt.withColumn("date", date_format("timestamp_unix", "yyyy-MM-dd"))
tdt = tdt.withColumn('month', month('date'))
tdt9 = tdt.filter(col('month')==9)
tdt9 = tdt9.withColumn('loc', split(tdt9.user_location, ", ").getItem(0))
tdt9 = tdt9.filter(col("user_location").like("%,%"))
tdt_count = tdt9.groupby('loc').agg(count('*').alias('num_tweets'))
tdt_desc = tdt_count.orderBy(col('num_tweets').desc()).limit(50)
tdt_df = tdt_desc.toPandas()
```

[43]:
```
ax = tdt_df.plot(x ='loc',y='num_tweets', kind='barh', figsize = (10, 8))

ax.set_ylabel('Location')
ax.set_xlabel('Total twitter users')
ax.set_title('Top 50 Locations of Twitter Users of September')
ax.invert_yaxis()

# show the plot
plt.show()
```



[44]:
```
tdt8 = tdt.filter(col('month')== 8)
tdt8 = tdt8.withColumn('loc', split(tdt8.user_location, ", ").getItem(0))
tdt8 = tdt8.filter(col("user_location").like("%,%"))
tdt_count = tdt8.groupby('loc').agg(count('*').alias('num_tweets'))
tdt_desc = tdt_count.orderBy(col('num_tweets').desc()).limit(50)
tdt_df8 = tdt_desc.toPandas()
```

[46]:
```
ax = tdt_df8.plot(x ='loc',y='num_tweets', kind='barh', figsize = (10, 8))

ax.set_ylabel('Location')
ax.set_xlabel('Total twitter users')
ax.set_title('Top 50 Locations of Twitter Users of August')
ax.invert_yaxis()

# show the plot
plt.show()
```


Top 50 Locations of Twitter Users of August
Lagos
New York
Washington
California
Los Angeles
Texas
Florida
Houston
Chicago
Atlanta
London
Nairobi
Dallas
Austin
Toronto
Lahore
New Jersey
Philadelphia
New Delhi
Abuja
Boston
Kampala
San Diego
Seattle
Ohio
Brooklyn
North Carolina
Pennsylvania
Miami
Michigan
Las Vegas
Georgia
San Antonio
Portland
San Francisco
Virginia
England
Phoenix
Nashville
Charlotte
Arizona
Columbus
Pittsburgh
Denver
Ontario
Accra
Baltimore
Orlando
Massachusetts
Maryland
Location
0
5000
10000
15000
20000
25000
Total twitter users
num_tweets

[ ]: