Data 620 _ Final_Project 2

May 22, 2020

1 DATA620 Final Project

Sentiment Analysis Krishna Rajan

2 Video Presentation

3 Twitter Sentiment Analysis about the COVID19 Crisis

The COVID19 has struck fear into the heart of the world, Every country in the world has had to endure this pandemic and has brought life to a stand still. Millions of people have been bitten by the COVID bug and 100's of thousands of people have been killed by the bug while bringing economies of developed countries to its knees causing economic hardship to millions of people worldwide, the world will never be the same again.This project is dedicated to all thoses who have been directly and indirectly effected by this pandemic.This project tries to analyse the sentiments around the COVID pandemic

PATH = "/Users/rajans/Desktop/CUNY/Data620/FInal Project/" Image(filename = PATH + "COVID.jpg", width=100, height=100)

4 Twitter Data Pull

Process file for Twitter data pull: https://github.com/rajank17/Data620/blob/master/Final%20Project/Data%20
The COVID 19 started to become a Pandemic around first week of March 2020 The Twitter data pull notebook linked above has the code to retrieve data from Twitter since 03/1/2019 with the hashtags #COVID-19 OR #COVID19. The data retrieval specified 1000 tweets; Twitter returned 1000 rows. The returned tweets were saved on a CSV file named "COVID19_Tweets_Raw.csv". This is the input file used for sentiment analysis.

5 Sentiment Analysis

This project is going to perform sentiment analysis on approximately 1000 tweets that have the hashtag #COVID-19 OR #COVID19. The sentiment analysis is going to classify the text as positive, neutral, or negative. For each sentiment class, we're going to analyze associated hashtags and location. TextBlob is the package used to do the sentiment analysis: https://textblob.readthedocs.io/en/dev/

6 Load Libraries

[175]:
```
import pandas as pd
from textblob import TextBlob
import re
import matplotlib.pyplot as plt; plt.rcdefaults()
import numpy as np
import matplotlib.pyplot as plt
```

7 Load Tweets

These are the links to the saved Twitter data pull in CSV format. The adjusted CSV file contains standardize location. The raw location values in the data pull were manually typed in by Twitter users, and they can enter whatever they want as their location. Most provided valid locations that either refer to a state in the United States or refer to a country that is not United States. If more than one location is present, the first location was selected. Because the data set is small (about 560 rows), the standardization was done by manually going through each location value in Excel and converting it to a standard format. When possible, US states were captured. More specific areas in other countries were not standardized. Raw output from Twitter data pull: https://github.com/rajank17/Data620/blob/master/Final%20Project/COVID19_Tweets_Raw.csv
Adjusted CSV file (cleaned location): https://github.com/rajank17/Data620/blob/master/Final%20Project/COV

[179]:
```
tweets_df = pd.read_csv("/Users/rajans/Desktop/CUNY/Data 602/Data620/Final␣
 ↪Project/COVID19_Tweets_Clean.csv")
```

[181]:
```
tweets_df.shape
```

[181]:
```
(1000, 8)
```

[182]:
```
tweets_df.head(10)
```

[182]:
```
   row_id              tweet_id     created_at             user  \
0  0       '1263613281924595712  5/21/20 23:30  ToplessVegas
1  1       '1263613280381263872  5/21/20 23:30  Adwoaadubianews
2  2       '1263613280242683904  5/21/20 23:30  roselarosillo
3  3       '1263613270574989312  5/21/20 23:30  GreenCleanLV
4  4       '1263613269086011393  5/21/20 23:30  RajaNomanjamwal
5  5       '1263613268066734093  5/21/20 23:30  BreatheAgain777
6  6       '1263613267865415682  5/21/20 23:30  SonKing
7  7       '1263613267773198336  5/21/20 23:30  newsfilterio
```

```
8  8       '1263613267106136064  5/21/20 23:30  katgjovik
9  9       '1263613266229555200  5/21/20 23:30  MurraySchwann

                      location location_clean      location_type  \
0  Las Vegas                   Nevada         USA
1  Ghana                       Ghana          Rest Of the World
2  Baja California, México     Mexico         Rest Of the World
3  Las Vegas, Nevada           Nevada         USA
4  Jammu, Jammu And Kashmir    India          Rest Of the World
5  Texas, USA                  Texas          USA
6  Tampa Bay                   Florida        USA
7  New York, NY                New Mexico     USA
8  Bainbridge Island, WA  USA  Washington     USA
9  Biggar,Saskatchewan, Canada  Canada         Rest Of the World

                                                           text
0  @chrislhayes Cuomo, Murphy, Walz, Whitmer, and Newsom are de facto
euthanizing grandparents by requiring unprepared… https://t.co/K54Q2FRYFs
1  Meet the 95-year-old veteran walking 14 miles to raise US$600,000 for
COVID-19 charities https://t.co/63ssLbcLBm
2  #COVID19 da mucha sed https://t.co/C3ogGuBG1L
3  https://t.co/18dsvdpAZf Architects design COVID-19 mobile testing labs for
underserved communities #GreenClean
4  We are the only generation in human history to fight 3 pandemics together :
TikTok, Covid 19 and stupidity.
5  Well the blue states have more Adrenochrome addicts and child traffickers. Of
course they are still locked down…… https://t.co/rwfI8N6cxz
6  @SteveRustad1 Over 600 Doctors Road to Trump and asked him to end the
COVID-19 lockdown. We don't believe your fake… https://t.co/QlXPxQsubb
7  UPDATE 1-Brazil retail tycoon Diniz says local supermarkets were fast to
adjust to COVID-19 $BRFS #coronavirus… https://t.co/AwD1zSvE2P
8  This promises to be a lively conversation - @dkorten w/ @SandraWaddock aka
@IntellectShaman re how economic and man… https://t.co/PYZ9Qfnx3P
9  Gary Kohls MD: An Alternative Medical View on COVID-19
```

8 Utility Functions

Below are functions for cleaning tweets (remove links and special characters) and for getting sentiment output for a tweet. Source: https://www.geeksforgeeks.org/twitter-sentiment-analysis-using-python/

[183]:
```
def clean_tweet(tweet_text):
        return ' '.join(re.sub("(@[A-Za-z0-9]+)|([^0-9A-Za-z \t]) |(\w+:\/\/
 ↪\S+)", " ", tweet_text).split())
```

```python
#classify sentiment of passed tweet using textblob's sentiment method
def get_tweet_sentiment(tweet_text):
        analysis = TextBlob(tweet_text)
        if analysis.sentiment.polarity > 0:
            return 'positive'
        elif analysis.sentiment.polarity == 0:
            return 'neutral'
        else:
            return 'negative'

def get_tweet_sentiment_polarity(tweet_text):
         analysis = TextBlob(tweet_text)
         return analysis.polarity

#for plotting horizontal bar plots
def plot_location(data):
    ax = data.plot(kind='barh', x='location', y='count', alpha=0.8,␣
 ↪figsize=(10, 12),
                                   color='#86bf91', zorder=2, width=0.6,␣
 ↪legend=0)
    #Source: https://mode.com/example-gallery/python_horizontal_bar/
    # Despine
    ax.spines['right'].set_visible(False)
    ax.spines['top'].set_visible(False)
    ax.spines['left'].set_visible(False)
    ax.spines['bottom'].set_visible(False)
    # Switch off ticks
    ax.tick_params(axis="both", which="both", bottom=0, top=0, labelbottom=1,␣
 ↪left=0, right=0, labelleft=1)

    #clear axis labels
    plt.xlabel('')
    plt.ylabel('')
```

9 Sentiment Analysis of Cleaned Tweets

TextBlob is the package used to perform the sentiment analysis. TextBlob is a Python (2 and 3) library for processing textual data. It provides a consistent API for diving into common natural language processing (NLP) tasks such as part-of-speech tagging, noun phrase extraction, sentiment analysis, and more. The function call TextBlob(tweet_text) returns a sentiment polarity score. Sentiment polarity score > 0 evaluates to a positive sentiment Sentiment polarity score = 0 evaluates to a neutral sentiment Sentiment polarity score < 0 evalutes to a negative sentiment Source: https://textblob.readthedocs.io/en/dev/_modules/textblob/blob.html

[184]:

```
tweets_df['clean_text'] = tweets_df['text'].apply(clean_tweet)
tweets_df['sentiment'] = tweets_df['clean_text'].apply(get_tweet_sentiment)
tweets_df['sentiment_polarity'] = tweets_df['clean_text'].
 ↪apply(get_tweet_sentiment_polarity)
```

[185]:

```
tweets_by_type = tweets_df.groupby(['sentiment'])['tweet_id'].count()
```

[186]:

```
tweets_by_type
```

[186]:

```
sentiment
negative    174
neutral     437
positive    389
Name: tweet_id, dtype: int64
```

10 Sentiment Result

As anticipated, most of the tweets are positive or neutral. Only 6% of the tweets are negative. Positive: 39% Neutral: 44% Negative: 17%

[187]:

```
positive_count = tweets_by_type['positive']
negative_count = tweets_by_type['negative']
neutral_count = tweets_by_type['neutral']
size = len(tweets_df.index)
```

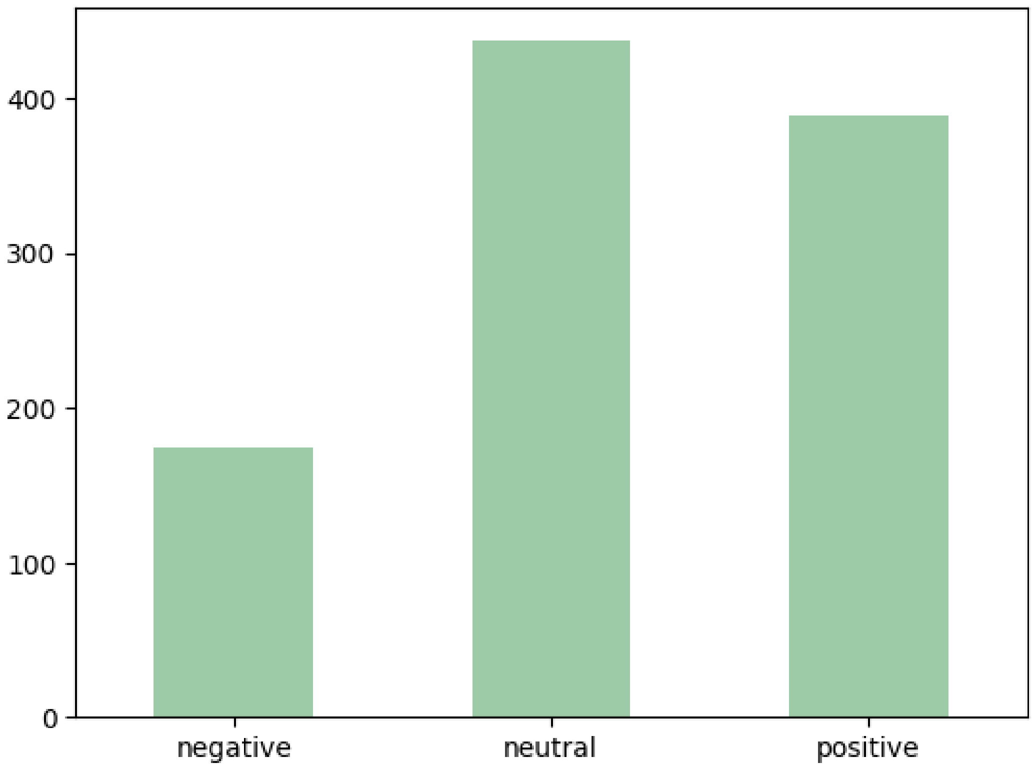
[188]:

```
print("Positive: " + "{0:.0f}%".format(positive_count/size * 100))
print("Neutral: " + "{0:.0f}%".format(neutral_count/size * 100))
print("Negative: " + "{0:.0f}%".format(negative_count/size * 100))
```

```
Positive: 39%
Neutral: 44%
Negative: 17%
```

[189]:

```
tweets_by_type.plot(kind='bar', alpha=0.8, rot=0, color='#86bf91')
plt.xlabel('')
plt.show()
```



```
[190]: negative_tweets = tweets_df.loc[tweets_df['sentiment'] ==␣
        ↪'negative']['clean_text']
       pd.set_option('display.max_colwidth', -1)
       negative_tweets.sample(10).reset_index(drop=True)
```

```
/Users/rajans/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:2:
FutureWarning: Passing a negative integer is deprecated in version 1.0 and will
not be supported in future version. Instead, use None to not limit the column
width.
```

```
[190]: 0    Trump endorsing hydroxychloroquine to ward off COVID-19 offers a stark
       lesson in how science social media politi
       1    Looks like the military is just now starting to test our soldiers over in
       Poland for covid19.
       2    You need MFA to log into Facebook yet Washington state loses hundreds of
       millions of dollars in fake unemployment c
       3    Fuck Covid-19 My allergies have been beating my ass for the past 3 days
       4    How incredibly selfish and idiotic can you be causing worry and financial
       distress for your neighbors A 67 year old
       5    An odd feature for scmp to print Their crew is usually looking for stories
       to drag CN.
```

```
6    "A prudent person foresees danger and takes precautions The simpleton goes
blindly on and suffers
7    Too little too late In my town the flags have been at half mast for at
least a month in memory of
8    Stupid people and stupid public reserve to get covid19 You have no care for
9    No 3 counties with a lot of dead people from COVID 19 elected them.
Name: clean_text, dtype: object
```

```
[191]: positive_tweets = tweets_df.loc[tweets_df['sentiment'] ==␣
        ↪'positive']['clean_text']
       positive_tweets.sample(10).reset_index(drop=True)
```

```
[191]: 0    Quite excited to present this to the world thank you for your support and
dedication to amplify
1    Island Records One Love COVID-19 Relief Auction raised £179,755 today
thanks in part to Bono's autographed handw
2    Join _Ideas for a special panel discussion on #geopolitics in a #post-
pandemic world on 2 June register now
3    Evolution of number of cases for Djibouti with a total confirmed of 1,828
4    All I need to do is carry a mask What a relief Thanks ! #Covid_19 #COVID
5    Canton City Public Health is now monitoring outbreaks of COVID-19 at meat
processors Case Farms and Fresh Mark whi
6    Agus and her husband Wiki are two creatives that moved to Santa Cruz last
year Like many people ..
7    "Right now we started spiking again this week We’re at our highest level
since the pandemic began.
8    Please see today's #COVID19ON update You can always find the most up to
date information by visiting
9    Better if he looks like the virus is going away Covid-19 is stronger than
Trump more people is testing positive t
Name: clean_text, dtype: object
```

```
[192]: neutral_tweets = tweets_df.loc[tweets_df['sentiment'] ==␣
        ↪'neutral']['clean_text']
       neutral_tweets.sample(10)
```

```
[192]: 597    Why Some Minnesota Events Can't Cancel Despite COVID-19-and What We Can
Do about It
993    If your going to open dentist offices why can’t you open beauty salons
You get the virus through breathing not you
528    when you find out China has a virology lab in Wuhan where the COVID-19
outbreak began
903    Minks may have infected humans novel coronavirus Dutch government… |
#Mink #Netherlands #Dutch #Coronavirus
668    Japan Cambodia,Thailand,covid19 final episode on way
261    Here we go… #ItIs1984 #RayBradbury #Orwellian
906    March 2020 Dr Anthony Fauci talks with Dr Jon LaPook about Covid-19 via
```

```
17      Dummy in a mask…
899     Libertarian presidential contender Jo Jorgensen sees government COVID-19
restrictions as "the biggest assault on ou
481     Overnight boss Robert Elstone said in a message to fans the UK-based
competition is aiming to restart
Name: clean_text, dtype: object
```

11 Reviewing the Tweets

Because the nature of the subject , I anticipated that most of the tweets would be Negative or netural. So when the results came in, we were very interested in looking at the tweets with positive sentiments. Some of the results sound more neutral and some may contain some negative keywords but the meaning is not necessarily negative. Positive tweets 39% of the tweets resulted in a Positive sentiment. Below you will see a random sample of 10 tweets with positive sentiments. Did you miss our last webinar Here are our top 3 tips for building a new norm Are you struggling to create a post
1 I know Dr Nelson by reputation because one of his successful early heart surgeries saved the life of my grand-unke 2 _Trump20 88 Significant risk for COVID-19.
3 Just watched the interview with Professor Sunetra Gupta at Highly recommended #covid19
4 Odigo clients have been able to harness our #cloud #ccaas during #COVID19 to support #remoteworking Odigo teams ar 5 Feel Good Friday….If you need a pick me up read this beautiful letter To see more heart warming letters visit th 6 Trump 'I Tested Very Positively for COVID-19 via
7 Sweet surprise for Maggie today when her Cherokee County Special Olympics Track Coaches came by to visit from a dis 8 New charter co-locations are a public health threat to students and families Co-locations will cause overcrowding, 9 I donated to the a rapid response fund to support Greater #Philadelphia #nonprofits at the frontli
Name: clean_text, dtype: object

12 Tweets by Location

Twitter API allows us to pull user location of the tweets. These are location typed in by the users themselves. Because the data set is small, we were able to manage to clean up the location into a standardized format. We also classified the location as United States or Other. United States: 44% Rest Of the World: 23% Unknown: 33%

[193]:
```
tweets_by_location = tweets_df.groupby(['location_type'])['tweet_id'].count()
```

[194]:
```
tweets_by_location.sort_values()
```

[194]:
```
location_type
Rest Of the World    231
Unknown              332
USA                  437
```

```
Name: tweet_id, dtype: int64
```

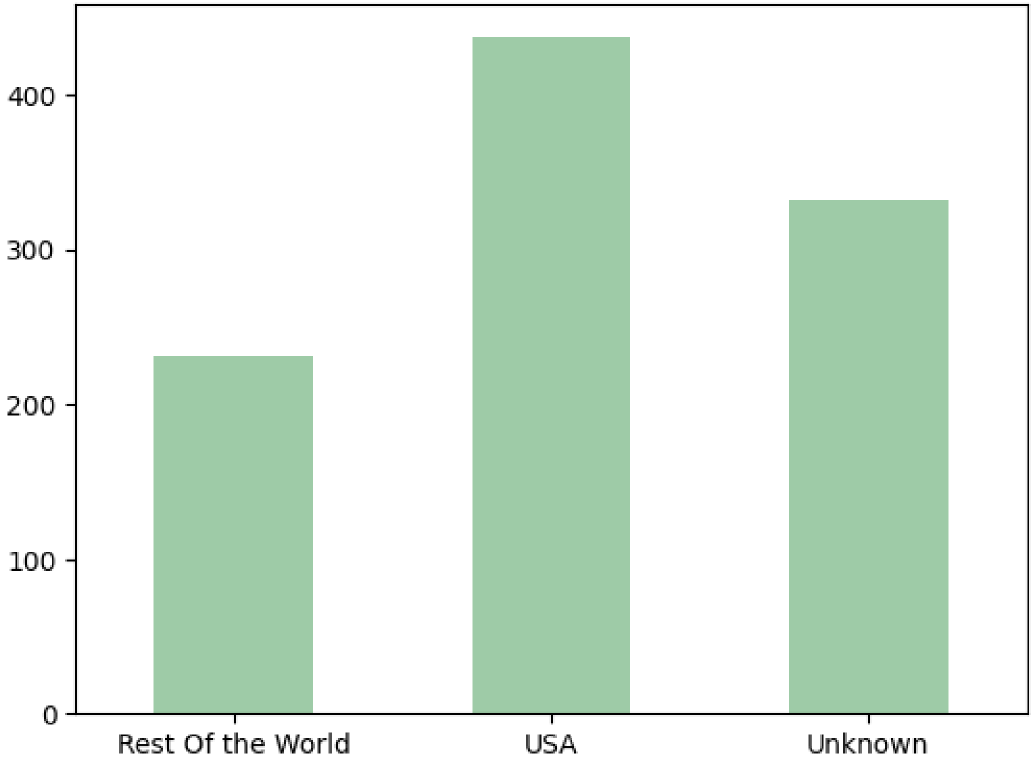
[195]:
```
other_count = tweets_by_location['Rest Of the World']
unknown_count = tweets_by_location['Unknown']
unitedStates_count = tweets_by_location['USA']

print("United States: " + "{0:.0f}%".format(unitedStates_count/size * 100))
print("Rest Of the World: " + "{0:.0f}%".format(other_count/size * 100))
print("Unknown: " + "{0:.0f}%".format(unknown_count/size * 100))
```

```
United States: 44%
Rest Of the World: 23%
Unknown: 33%
```

13 Tweets by United States and Other Countries

Majority of the tweets are from United States.

[196]:
```
tweets_by_location.plot(kind='bar', alpha=0.8, rot=0, color='#86bf91')
plt.xlabel('')
plt.show()
```



[197]:

```
# The code below creates two data frames. One for tweets with United States as␣
↪their user location, and another for tweets with user location from other␣
↪countries. Unkown locations are excluded.
```

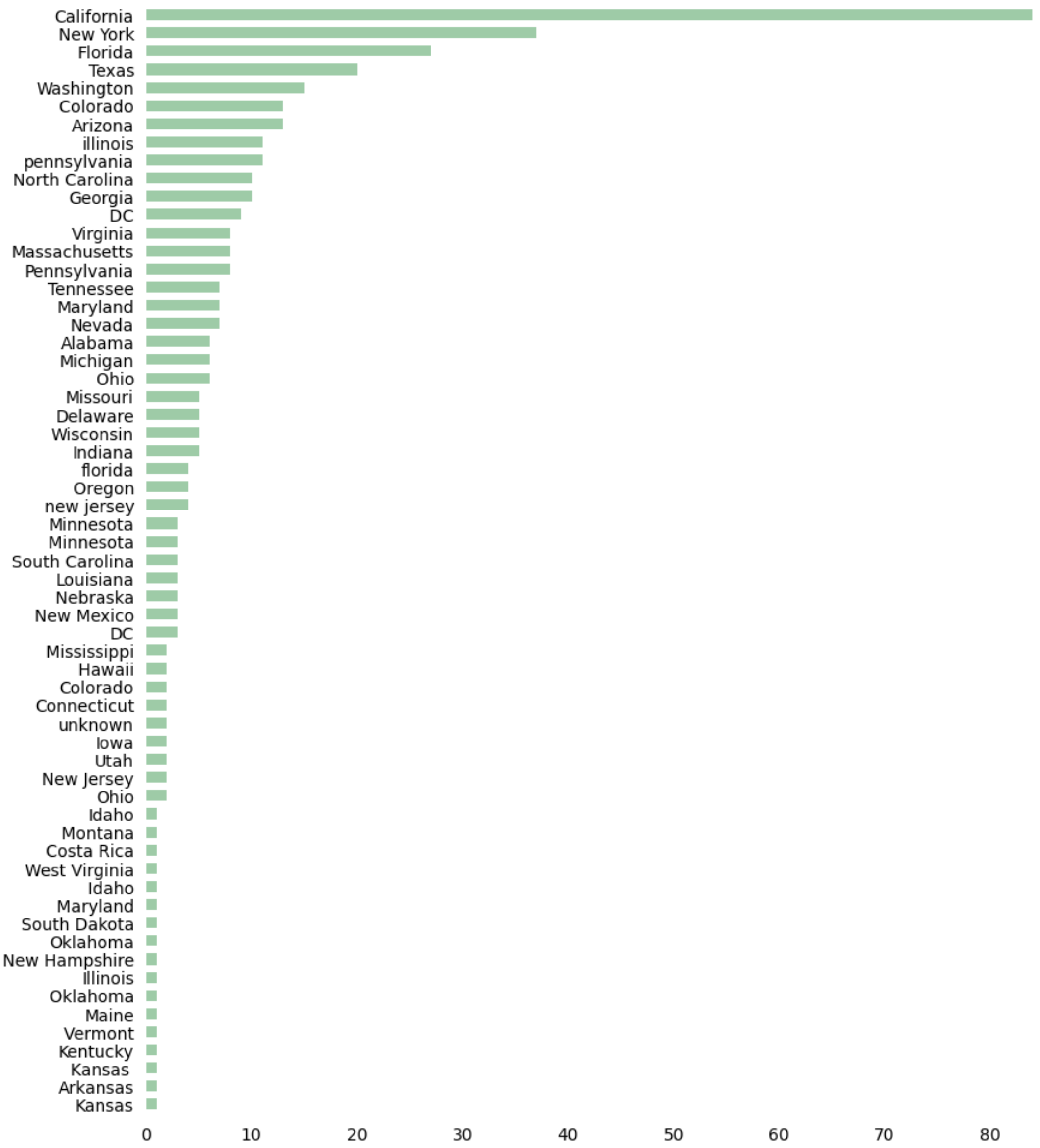
[198]:

```
tweets_USA = tweets_df[tweets_df['location_type'] == 'USA']
tweets_Other = tweets_df[tweets_df['location_type'] == 'Rest Of the World']

tweets_USA = tweets_USA.groupby(['location_clean'])['tweet_id'].count().
↪to_frame()
tweets_USA = tweets_USA.reset_index(drop=False)
tweets_USA.columns = ['location', 'count']
tweets_USA = tweets_USA[tweets_USA['location'] != 'Unknown']
tweets_USA = tweets_USA.sort_values(by="count", ascending=True)
tweets_USA = tweets_USA.reset_index(drop=True)

tweets_Other = tweets_Other.groupby(['location_clean'])['tweet_id'].count().
↪to_frame()
tweets_Other = tweets_Other.reset_index(drop=False)
tweets_Other.columns = ['location', 'count']
tweets_Other = tweets_Other[tweets_Other['location'] != 'Unknown']
tweets_Other = tweets_Other.sort_values(by="count", ascending=True)
tweets_Other = tweets_Other.reset_index(drop=True)
```

Tweets from United States It's not a suprise that most of the tweets from the United States are from California (!80 tweets). We somewhat expected for New York to be on the top three; Kansas and Arkansas round up the states with lowest tweets

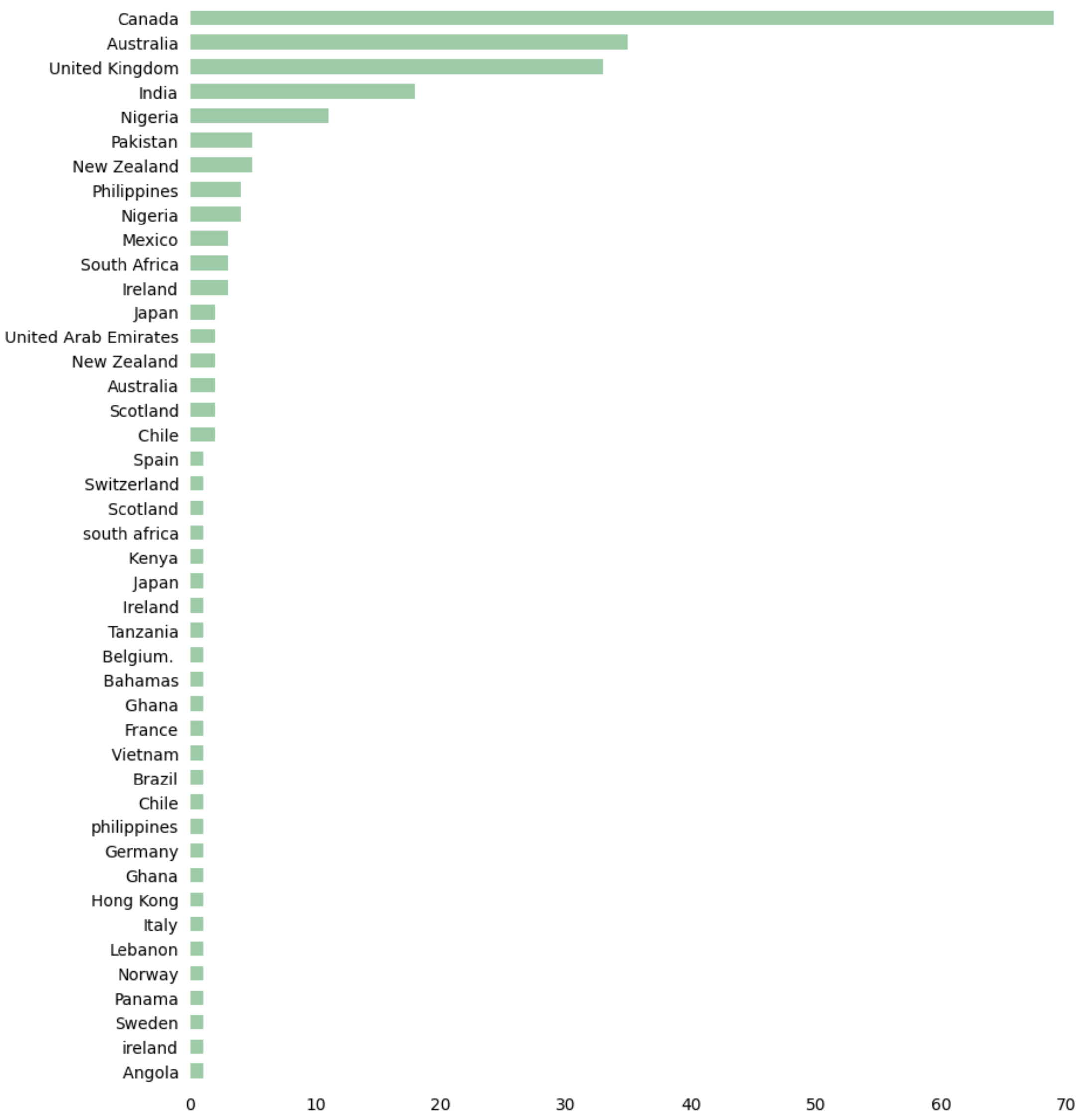
[199]:

```
plot_location(tweets_USA)
```



Tweets from Other Countries The number one spot goes to Canada with 70 tweets. Australia & UK take up the other 2 spots in the top 3.

[200]:
```
plot_location(tweets_Other)
```



Tweet Sentiment by Location Below is a plot of of each sentiment broken down by United States and Other Countries. As expected, majority of the tweets in each sentiment category are from United States.

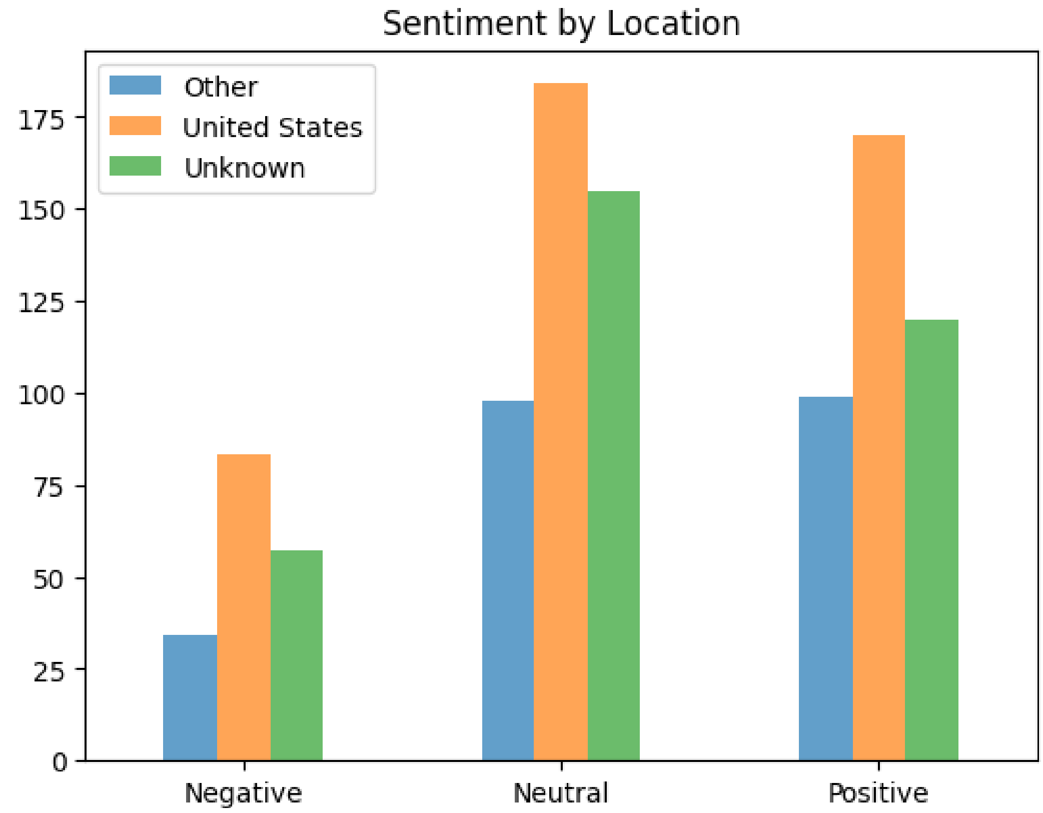
[201]:
```
tweets_by_location_sentiment = tweets_df.groupby(['sentiment',␣
 ↪'location_type'])['tweet_id'].count()
tweets_by_location_sentiment
```

[201]:
```
sentiment  location_type
negative   Rest Of the World    34
           USA                  83
           Unknown              57
neutral    Rest Of the World    98
```

```
           USA                  184
           Unknown              155
positive   Rest Of the World     99
           USA                  170
           Unknown              120
Name: tweet_id, dtype: int64
```

[202]:

```
#https://stackoverflow.com/questions/47796264/
 ↪function-to-create-grouped-bar-plot
df = pd.DataFrame([['Positive','United States',170],['Positive','Other',␣
 ↪99],['Positive','Unknown',120],
                   ['Neutral','United␣
 ↪States',184],['Neutral','Other',98],['Neutral','Unknown',155],
                   ['Negative','United␣
 ↪States',83],['Negative','Other',34],['Negative','Unknown',57]
                  ],
                  columns=['group','column','val'])
ax = df.pivot("group", "column", "val").plot(kind='bar', title="Sentiment by␣
 ↪Location", rot=0, alpha=0.7)
plt.legend()
plt.xlabel('')
plt.show()
```



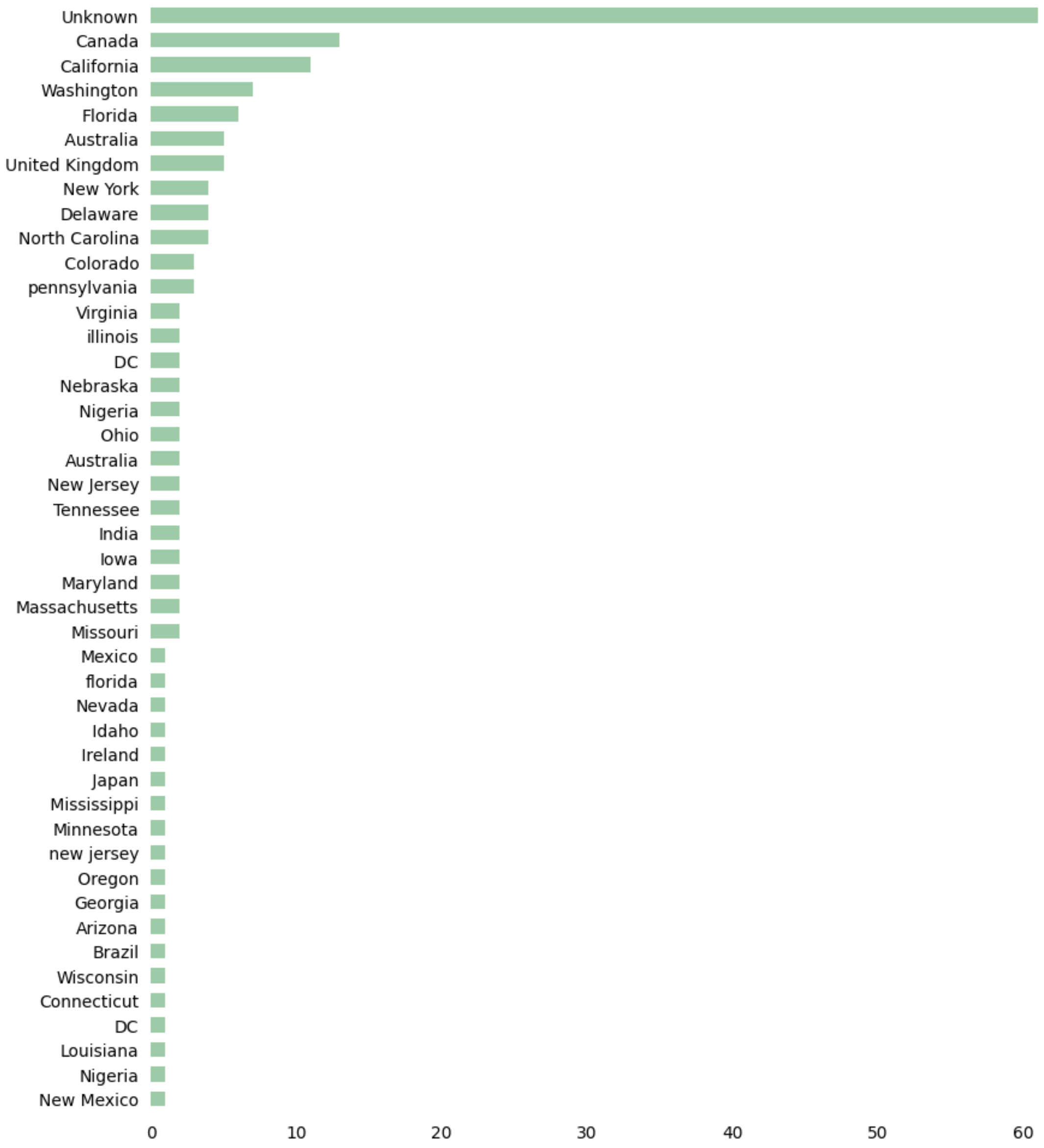
Location of Tweets with Positive Sentiment Below is a closer look at user locations of tweets with positive sentiments.Ignoring Unknown It's not surprising that Canada takes the lead on this. States in the United States with at most positive tweet are California, Washington & Florida. Other countries with at good list of positive tweets are Australia & United Kingdom

[204]:

```
tweets_positive = tweets_df[tweets_df['sentiment'] == 'positive']
tweets_positive = tweets_positive.groupby(['location_clean'])['tweet_id'].
 ↪count().to_frame()
tweets_positive = tweets_positive.reset_index(drop=False)
tweets_positive.columns = ['location', 'count']
tweets_positive = tweets_positive[tweets_positive['location'] != 'unknown']
tweets_positive = tweets_positive.sort_values(by="count", ascending=True)
tweets_positive = tweets_positive.reset_index(drop=True)
```

[169]:

```
plot_location(tweets_positive)
```



I set out on this project thinking i will find whole lot of negative and neutral tweets comapred to positive tweets regarding the COVID virus, but it turns out that the tweets have been more postive than negative, tells us tha tpeople are more well equipped to deal with this pandemic compared to prevous pandemics.