sentiment-analysis-of-pfizer-vaccine-via-tweets

January 17, 2021

[1]:
```
# This Python 3 environment comes with many helpful analytics libraries␣
 ↪installed
# It is defined by the kaggle/python Docker image: https://github.com/kaggle/
 ↪docker-python
# For example, here's several helpful packages to load

 # linear algebra
# data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/" directory
# For example, running this (by clicking run or pressing Shift+Enter) will list␣
 ↪all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/) that␣
 ↪gets preserved as output when you create a version using "Save & Run All"
# You can also write temporary files to /kaggle/temp/, but they won't be saved␣
 ↪outside of the current session
```

```
/kaggle/input/monkeylearn-pfizer-sentiment-analysis-images/Positive.png
/kaggle/input/monkeylearn-pfizer-sentiment-analysis-images/Overall.png
/kaggle/input/monkeylearn-pfizer-sentiment-analysis-images/Negative.png
/kaggle/input/monkeylearn-pfizer-sentiment-analysis-images/Neutral.png
/kaggle/input/pfizer-vaccine-tweets/vaccination_tweets.csv
/kaggle/input/monkeylearn-pfizer-vaccine-300-tweets/processed_batch 300
tweets.csv
```

1 A Sentiment Analysis of Pfizer Vaccine via Tweets

1. Introduction
2. Data analysis;
3. Method for sentiment analysis;
4. Results;
5. Comments and conclusions.

2 1. Introduction

Here we will perform a sentiment analysis on the Pfizer vaccine tweets.

[2]:
```
import pandas as pd
import numpy as np
import seaborn as sb
import matplotlib.pyplot as plt
%matplotlib inline
from IPython.display import Image
import os
!ls ../input/monkeylearn-pfizer-sentiment-analysis-images
```

```
Negative.png  Neutral.png  Overall.png  Positive.png
```

[3]:
```
pfizerTweets_df = pd.read_csv('/kaggle/input/pfizer-vaccine-tweets/
↪vaccination_tweets.csv')
```

[4]:
```
pfizerTweets_df.head()
```

[4]:

	id	user_name	user_location	user_description	user_created	user_followers	user_friends	user_favourites	user_verified	date	text
0	1340539111971516416	Rachel Roh	La Crescenta-Montrose, CA	Aggregator of Asian American news; scanning di…	2009-04-08 17:52:46	405	1692	3247	False	2020-12-20 06:06:44	Same folks said daikon paste could treat a cyt…
1	1338158543359250433	Albert Fong	San Francisco, CA	Marketing dude, tech geek, heavy metal & '80s …	2009-09-21 15:27:30	834	666	178	False	2020-12-13 16:27:13	While the world has been on the wrong side of …
2	1337858199140118533	eli	Your Bed	heil, hydra	2020-06-25 23:30:28	10	88	155	False	2020-12-12 20:33:45	#coronavirus #SputnikV #AstraZeneca #PfizerBio…
3	1337855739918835717	Charles Adler	Vancouver, BC - Canada	Hosting "CharlesAdlerTonight" Global News Radi…	2008-09-10 11:28:53	49165	3933	21853	True	2020-12-12 20:23:59	Facts are immutable, Senator, even when you're…
4	1337854064604966912	Citizen News Channel	NaN	Citizen News Channel bringing you an alternati…	2020-04-23 17:58:42	152	580	1473	False	2020-12-12 20:17:19	Explain to me again why we need a vaccine @Bor…

```
                                                hashtags               source  \
0                                ['PfizerBioNTech']  Twitter for Android
1                                                NaN      Twitter Web App
2  ['coronavirus', 'SputnikV', 'AstraZeneca', 'Pf…  Twitter for Android
3                                                NaN      Twitter Web App
4     ['whereareallthesickpeople', 'PfizerBioNTech']   Twitter for iPhone

   retweets  favorites  is_retweet
0         0          0       False
1         1          1       False
2         0          0       False
3       446       2129       False
4         0          0       False
```

[5]:
```
pfizerTweets_df['is_retweet'].value_counts()
```

[5]:
```
False    3683
Name: is_retweet, dtype: int64
```

[6]:
```
There are no retweets.
```

```
  File "<ipython-input-6-eb9c686cc983>", line 1
    There are no retweets.
              ^
SyntaxError: invalid syntax
```

[7]:
```
pfizerTweets_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3683 entries, 0 to 3682
Data columns (total 16 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   id                3683 non-null   int64
 1   user_name         3683 non-null   object
 2   user_location     2911 non-null   object
 3   user_description  3458 non-null   object
 4   user_created      3683 non-null   object
 5   user_followers    3683 non-null   int64
 6   user_friends      3683 non-null   int64
 7   user_favourites   3683 non-null   int64
 8   user_verified     3683 non-null   bool
 9   date              3683 non-null   object
 10  text              3683 non-null   object
 11  hashtags          2726 non-null   object
 12  source            3682 non-null   object
```

```
 13  retweets          3683 non-null   int64
 14  favorites         3683 non-null   int64
 15  is_retweet        3683 non-null   bool
dtypes: bool(2), int64(6), object(8)
memory usage: 410.1+ KB
```

I will remove columns that I don't need for the sentiment analysis such as: 1. user_description 2. user_created 3. user_followers 4. user_friends 5. user_favourites 6. user_verified 7. hashtags 8. retweets 9. favorites 10. is_retweet

[8]:
```
pfizerTweets_df = pfizerTweets_df.drop(['user_name',
 'user_description',
 'user_created',
 'user_followers',
 'user_friends',
 'user_favourites',
 'user_verified',
 'hashtags',
 'retweets',
 'favorites',
 'is_retweet'],1)
```

[9]:
```
list(pfizerTweets_df)
```

[9]:
```
['id', 'user_location', 'date', 'text', 'source']
```

Check for duplicate tweets

[10]:
```
sum(pfizerTweets_df['id'].duplicated())
```

[10]:
```
0
```

[11]:
```
sum(pfizerTweets_df['text'].duplicated())
```

[11]:
```
2
```

Change the column text and source to text format

[12]:
```
pfizerTweets_df["source"] = pfizerTweets_df["source"].str.replace(r'<(?:
 ↪a\b[^>]*>|/a>)', '')
pfizerTweets_df["text"] = pfizerTweets_df["text"].str.replace(r'<(?:a\b[^>]*>|/
 ↪a>)', '')
```

[13]:
```
pfizerTweets_df['date'].dtypes
```

[13]:
```
dtype('O')
```

[14]:
```
pfizerTweets_df['date'] = pd.to_datetime(pfizerTweets_df['date'])
```

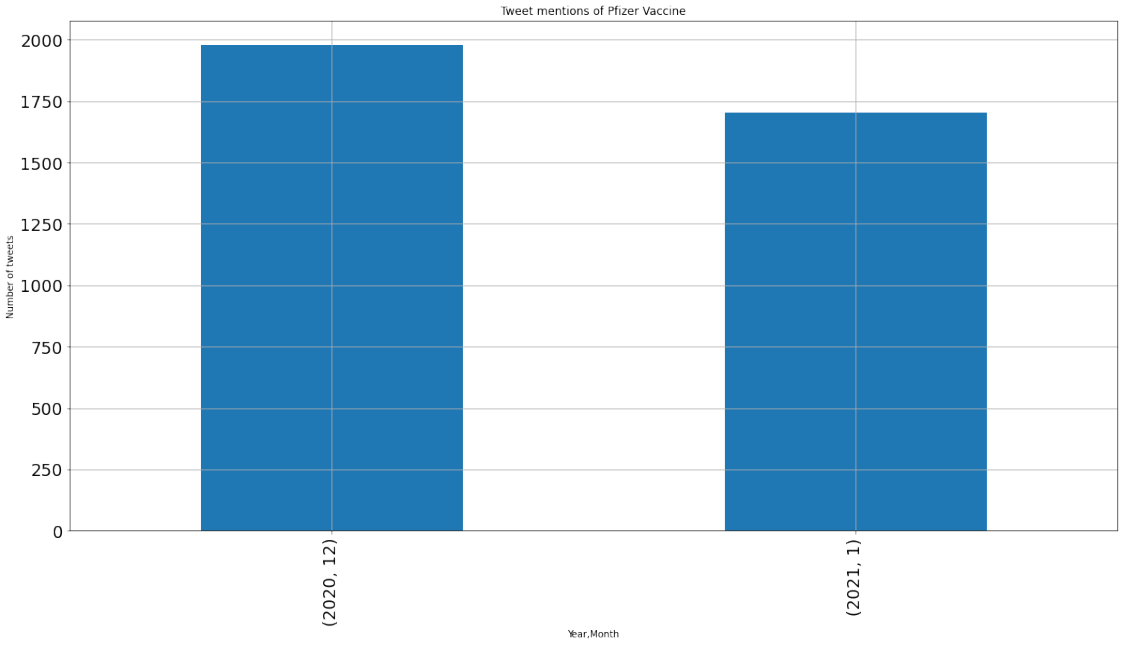
[15]:
```
pfizerTweets_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3683 entries, 0 to 3682
Data columns (total 5 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   id             3683 non-null   int64
 1   user_location  2911 non-null   object
 2   date           3683 non-null   datetime64[ns]
 3   text           3683 non-null   object
 4   source         3682 non-null   object
dtypes: datetime64[ns](1), int64(1), object(3)
memory usage: 144.0+ KB
```

The date column was converted to datetime64 format instead of an object

3 2. Data analysis;

[16]:
```
da_df = pfizerTweets_df.id.groupby([pfizerTweets_df["date"].rename('Year').dt.
 ↪year, pfizerTweets_df["date"].rename('Month').dt.month]).count()
da_df.plot(kind = 'bar', figsize=(20,10), grid = True, fontsize = 18 , x =␣
 ↪'date', title = 'Tweet mentions of Pfizer Vaccine').set_ylabel('Number of␣
 ↪tweets')
ax = plt.gca()
plt.show();
```



From this graph we can see that the data contains tweets from December 2020 and January 2021.

4 3. Method for sentiment analysis;

For the sentiment analysis I used MonkeyLearn. https://monkeylearn.com/

now we will export this dataframe.

[17]:
```
pfizerTweets_df.to_csv('cleaned_pfizer_vaccine_tweets.csv', index = False,␣
↪encoding = 'utf-8')
```

4.1 The Sentiment analysis was done using MonkeyLearn.

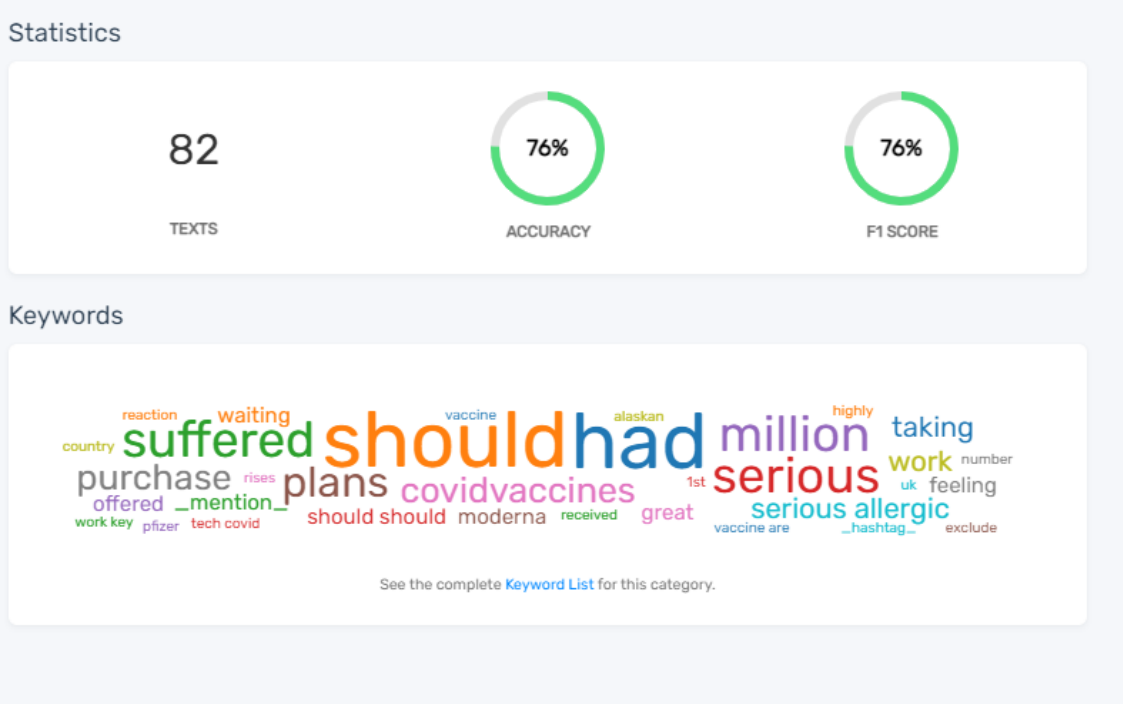
82 texts have been used to train the model.

The result can be found in the ../input/monkeylearn-pfizer-vaccine-300-tweets/processed_batch 300 tweets.csv

This is the overall Confidence level of the model.

[18]:
```
Image("../input/monkeylearn-pfizer-sentiment-analysis-images/Overall.png")
```

[18]:

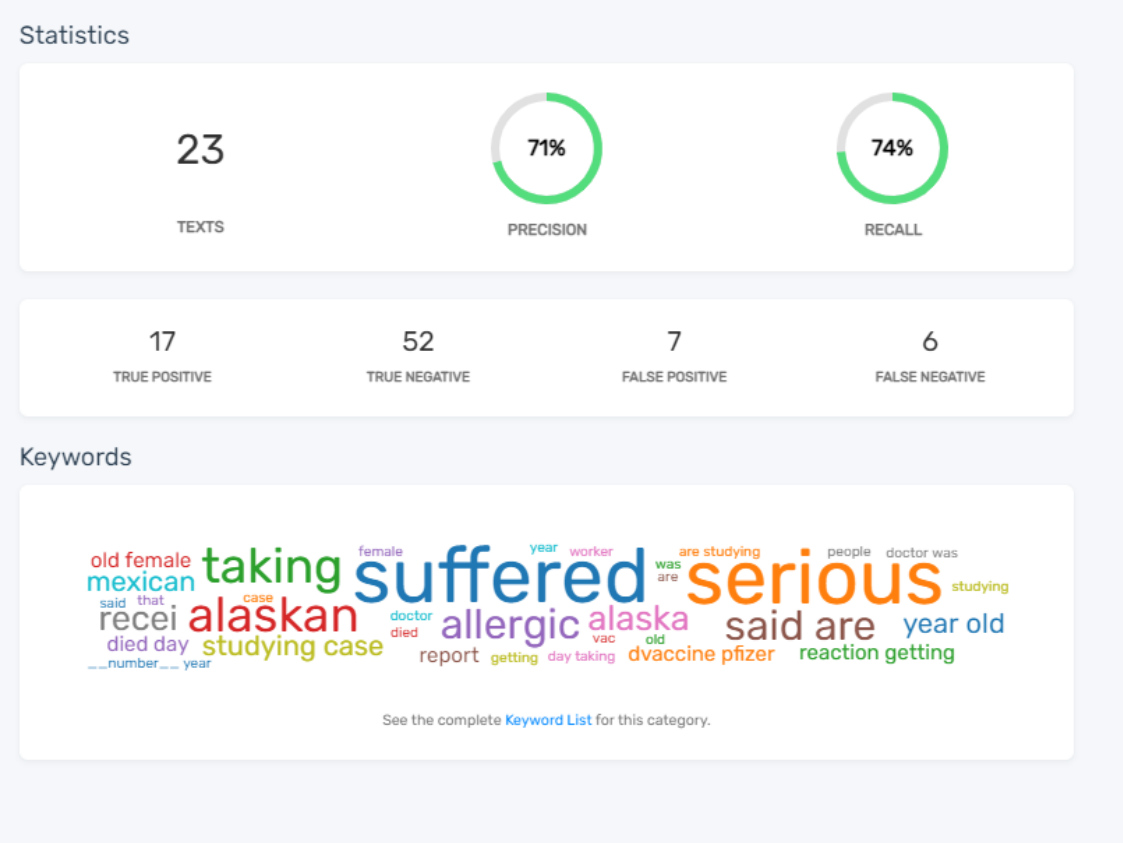


monkeylearn-pfizer-sentiment-analysis-images

This is the Negative Confidence level of the model.

[19]:
```
Image("../input/monkeylearn-pfizer-sentiment-analysis-images/Negative.png")
```

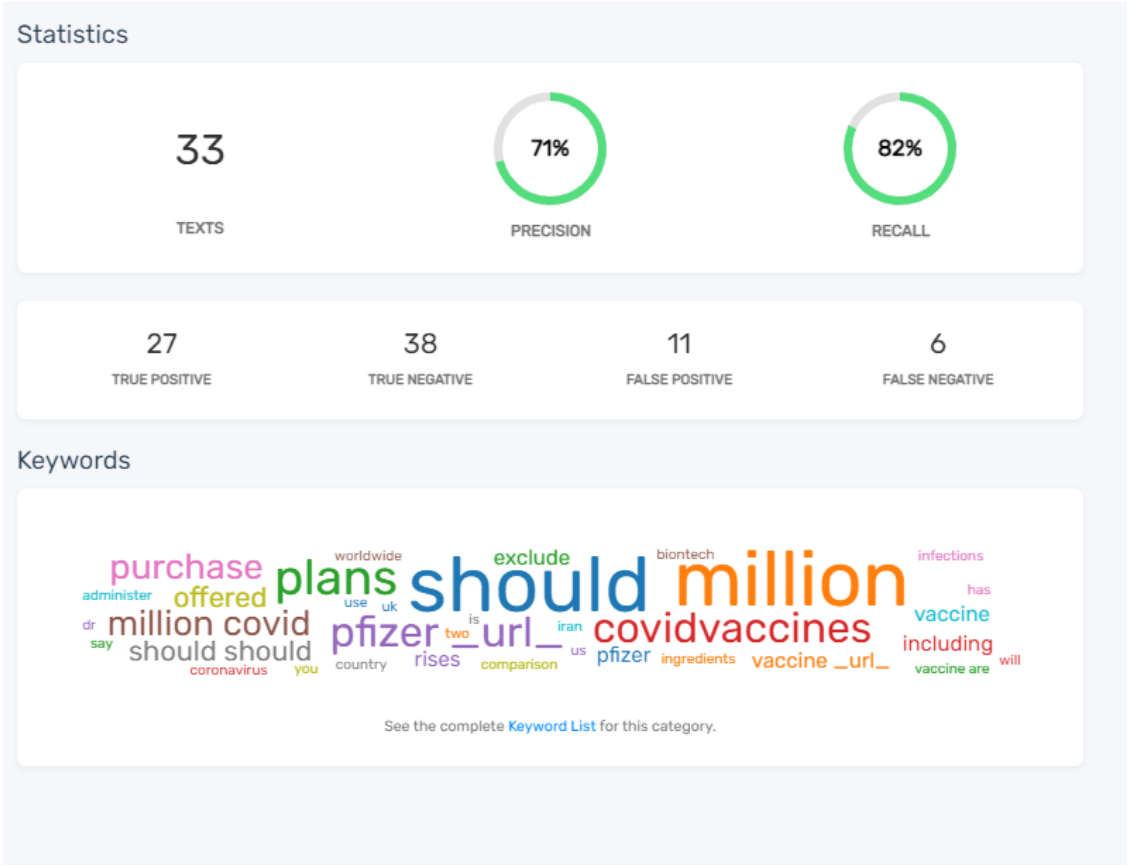
[19]:



This is the Neutral Confidence level of the model.

[20]:
```
Image("../input/monkeylearn-pfizer-sentiment-analysis-images/Neutral.png")
```

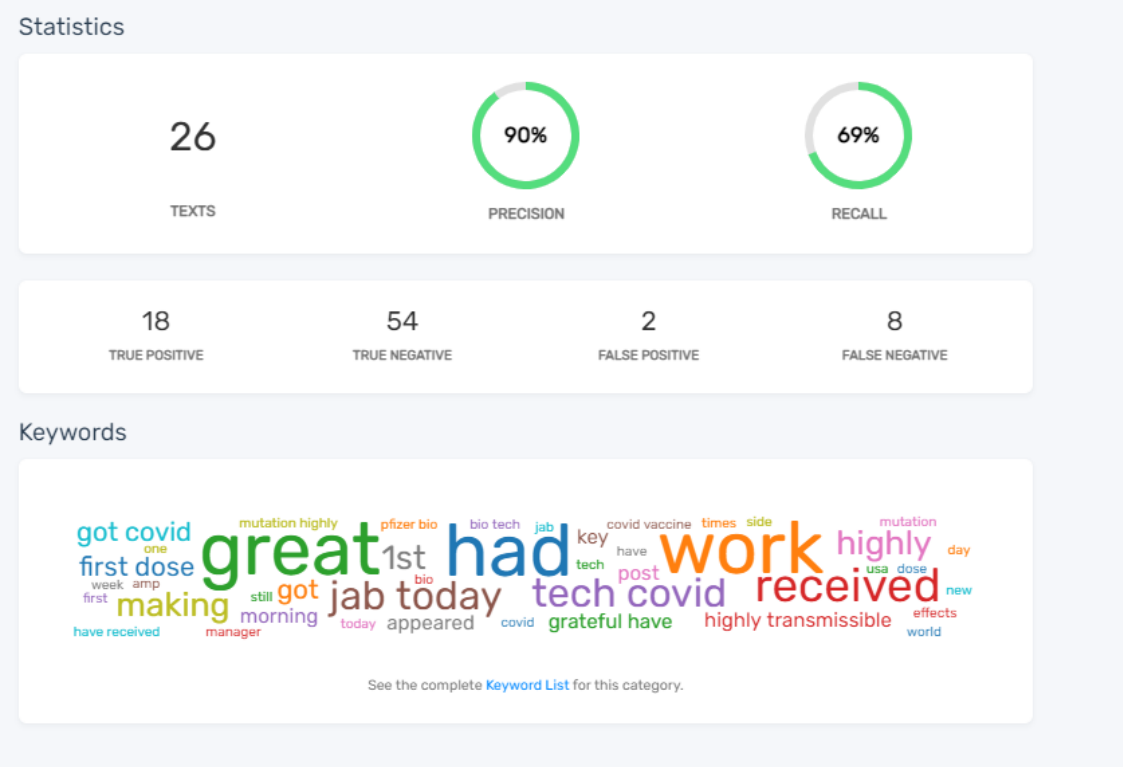
[20]:



This is the Positive Confidence level of the model.

[21]:
```
Image("../input/monkeylearn-pfizer-sentiment-analysis-images/Positive.png")
```

[21]:



5 4. Results;

These are the results.

[22]:
```
sentiment_df = pd.read_csv('../input/monkeylearn-pfizer-vaccine-300-tweets/
↪processed_batch 300 tweets.csv')
```

[23]:
```
no_tweets =  len(sentiment_df.query('Classification == "Negative"')) +␣
↪len(sentiment_df.query('Classification == "Neutral"')) + len(sentiment_df.
↪query('Classification == "Positive"'))
no_tweets
```

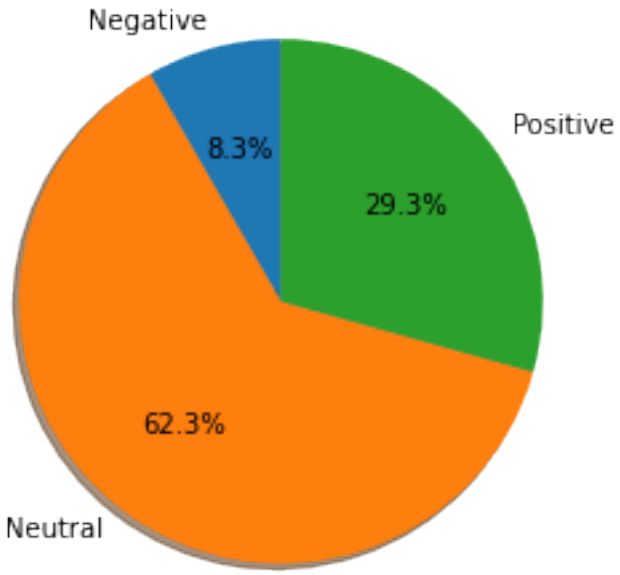
[23]: 300

[24]:
```
labels = 'Negative', 'Neutral','Positive'
sizes = [(len(sentiment_df.query('Classification == "Negative"'))/
↪no_tweets),(len(sentiment_df.query('Classification == "Neutral"'))/
↪no_tweets),(len(sentiment_df.query('Classification == "Positive"'))/
↪no_tweets)]
plt.suptitle('Percentage of tweets', fontsize=24)
explode = (0, 0, 0)
```

```
fig1, ax1 = plt.subplots()
ax1.pie(sizes, explode=explode, labels=labels, autopct='%1.1f%%',
        shadow=True, startangle=90)
ax1.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a circle.

plt.show()
```

```
<Figure size 432x288 with 0 Axes>
```



As shown from the pie chart most of the tweets were neutral at 62.3%. Positive at 29.3% and Negative at 8.3%

[25]:
```
sentiment_df.user_location = sentiment_df.user_location.str.
 ↪replace('^[a-z]+','None')
sentiment_df ['user_location'] = sentiment_df ['user_location'].astype(str)
sentiment_relation["user_location"] = sentiment_relation["user_location"].str.
 ↪replace(r'<(?:a\b[^>]*>|/a>)', '')
sentiment_df.info()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-25-1d901fb9d0ff> in <module>
      1 sentiment_df.user_location = sentiment_df.user_location.str.
 ↪replace('^[a-z]+','None')
      2 sentiment_df ['user_location'] = sentiment_df ['user_location'].
 ↪astype(str)
```

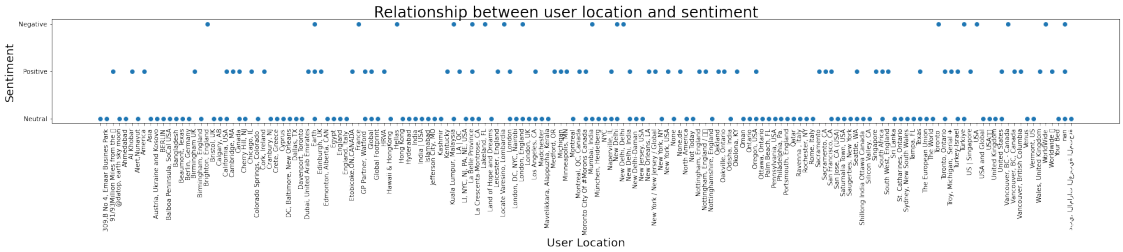
```
----> 3 sentiment_relation["user_location"] =␣
 ↪sentiment_relation["user_location"].str.replace(r'<(?:a\b[^>]*>|/a>)', '')
      4 sentiment_df.info()

NameError: name 'sentiment_relation' is not defined
```

[26]:
```
sentiment_relation = sentiment_df.groupby(['user_location', 'Classification'],␣
 ↪as_index=False).count()
sentiment_relation = sentiment_relation[['user_location', 'Classification']]
plt.figure(figsize=[30,3])
plt.suptitle('Relationship between user location and sentiment ', fontsize=24)
plt.xlabel('User Location', fontsize=18)
plt.xticks(rotation=90)
plt.ylabel('Sentiment', fontsize=18)
plt.scatter(sentiment_relation.user_location, sentiment_relation.
 ↪Classification);
```

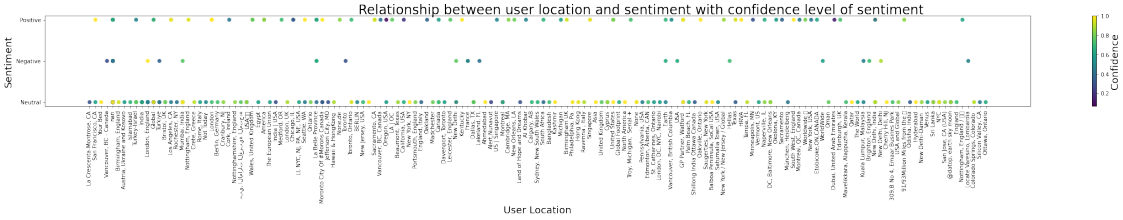
```
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:214:
RuntimeWarning: Glyph 127774 missing from current font.
  font.set_text(s, 0.0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:214:
RuntimeWarning: Glyph 127477 missing from current font.
  font.set_text(s, 0.0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:214:
RuntimeWarning: Glyph 127469 missing from current font.
  font.set_text(s, 0.0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:214:
RuntimeWarning: Glyph 127482 missing from current font.
  font.set_text(s, 0.0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:214:
RuntimeWarning: Glyph 127480 missing from current font.
  font.set_text(s, 0.0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:214:
RuntimeWarning: Glyph 127759 missing from current font.
  font.set_text(s, 0.0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:183:
RuntimeWarning: Glyph 127774 missing from current font.
  font.set_text(s, 0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:183:
RuntimeWarning: Glyph 127477 missing from current font.
  font.set_text(s, 0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:183:
RuntimeWarning: Glyph 127469 missing from current font.
  font.set_text(s, 0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:183:
RuntimeWarning: Glyph 127482 missing from current font.
  font.set_text(s, 0, flags=flags)
```

```
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:183:
RuntimeWarning: Glyph 127480 missing from current font.
  font.set_text(s, 0, flags=flags)
/opt/conda/lib/python3.7/site-packages/matplotlib/backends/backend_agg.py:183:
RuntimeWarning: Glyph 127759 missing from current font.
  font.set_text(s, 0, flags=flags)
```



Here the relationship between the user location and sentiment is displayed.

[27]:
```
def sentiment_confidence(x):
    confidence_max, confidence_min = 1, 0
    if(x>confidence_max):
        x=confidence_max
    elif(x<confidence_min):
        x=confidence_min
    return x
sentiment_df.Confidence = sentiment_df.Confidence.apply(sentiment_confidence)
plt.figure(figsize=[40,3])
plt.suptitle('Relationship between user location and sentiment with confidence␣
 ↪level of sentiment', fontsize=24)
plt.xlabel('User Location', fontsize=18)
plt.xticks(rotation=90)
plt.ylabel('Sentiment', fontsize=18)
plt.scatter(x=sentiment_df.user_location, y=sentiment_df.Classification, alpha=.
 ↪9, c=sentiment_df.Confidence)
colorBar = plt.colorbar();
colorBar.set_label("Confidence",fontsize=18, labelpad=+2)
plt.show()
```



This graph shows the sentiment of the tweets including the confidence level of each sentiment.

6 5. Comments and conclusions.

Most of the tweets analyzed were neutral as they were reporting facts and have neither a positive or negative sentiment. The sentiment analysis was done for only 300 tweets as it is a limit by my acount at MonkeyLearn.