In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

In [3]:

```
from scipy.stats import pearsonr
import sklearn.ensemble
from nltk.corpus import stopwords
from textblob import TextBlob
from nltk.stem import PorterStemmer
from textblob import Word
```

In [154]:

```
df = pd.read_csv('train.csv')
df1 = pd.read_csv('test.csv')# use / not this \

# df = pd.merge(
#              df,
#              df1,
#              how='outer',
#              on='tweet_id',
#              indicator=True
# )
```

In [155]:

```
df.head(10)
```

Out[155]:

	tweet_id	tweet	sentiment
0	1701	#sxswnui #sxsw #apple defining language of tou...	1
1	1851	Learning ab Google doodles! All doodles should...	1
2	2689	one of the most in-your-face ex. of stealing t...	2
3	4525	This iPhone #SXSW app would b pretty awesome i...	0
4	3604	Line outside the Apple store in Austin waiting...	1
5	966	#technews One lone dude awaits iPad 2 at Apple...	1
6	1395	SXSW Tips, Prince, NPR Videos, Toy Shopping Wi...	1
7	8182	NU user RT @mention New #UberSocial for #iPhon...	1
8	8835	Free #SXSW sampler on iTunes {link} #FreeMusic	2
9	883	I think I might go all weekend without seeing ...	2

In [156]:

```
df1.head()
```

Out[156]:

	tweet_id	tweet
0	7506	Audience Q: What prototyping tools do you use?...
1	7992	At SXSW? Send Your Best Photos & Videos to...
2	247	@mention and here's a pic of you winning your...
3	7688	Google Marissa Mayer: mobile phone as a cursor...

	tweet_id	tweet
4	3294	#SXSW Google maps is even cooler than I thought

In [157]:

```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1819 entries, 0 to 1818
Data columns (total 2 columns):
tweet_id    1819 non-null int64
tweet       1819 non-null object
dtypes: int64(1), object(1)
memory usage: 28.5+ KB
```

Analyzing The Data

In [158]:

```
df.info()
```

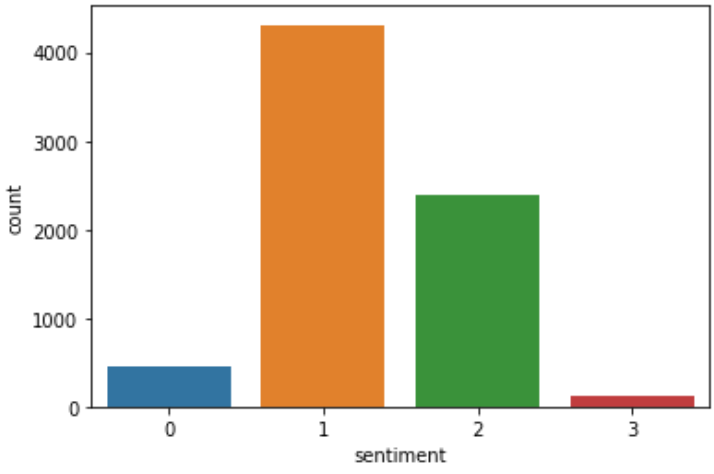
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7274 entries, 0 to 7273
Data columns (total 3 columns):
tweet_id     7274 non-null int64
tweet        7273 non-null object
sentiment    7274 non-null int64
dtypes: int64(2), object(1)
memory usage: 170.6+ KB
```

In [159]:

```
sns.countplot(x="sentiment",data=df)
#0: Negative, 1: Neutral, 2: Positive, 3: Can't Tell
```

Out[159]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1a5a7cda0>
```



Data Wrangling

In [160]:

```
df.isnull().sum()
```

Out[160]:

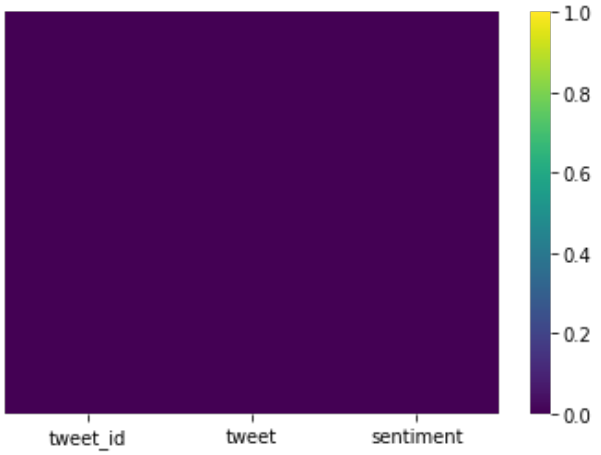
```
tweet_id     0
tweet        1
sentiment    0
dtype: int64
```

In [161]:

```
sns.heatmap(df.isnull(),yticklabels=False,cmap="viridis")
#1 Missing Value
```

Out[161]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1a5a7d4e0>
```



In [162]:

```
df.drop("tweet_id",axis=1,inplace=True)
```

In [163]:

```
df.head(10)
```

Out[163]:

	tweet	sentiment
0	#sxswnui #sxsw #apple defining language of tou...	1
1	Learning ab Google doodles! All doodles should...	1
2	one of the most in-your-face ex. of stealing t...	2
3	This iPhone #SXSW app would b pretty awesome i...	0
4	Line outside the Apple store in Austin waiting...	1
5	#technews One lone dude awaits iPad 2 at Apple...	1
6	SXSW Tips, Prince, NPR Videos, Toy Shopping Wi...	1
7	NU user RT @mention New #UberSocial for #iPhon...	1
8	Free #SXSW sampler on iTunes {link} #FreeMusic	2
9	I think I might go all weekend without seeing ...	2

In [164]:

```
df.dropna(inplace=True)
#Dropping The Column
```

In [165]:

```
df.isnull().sum()
```

Out[165]:

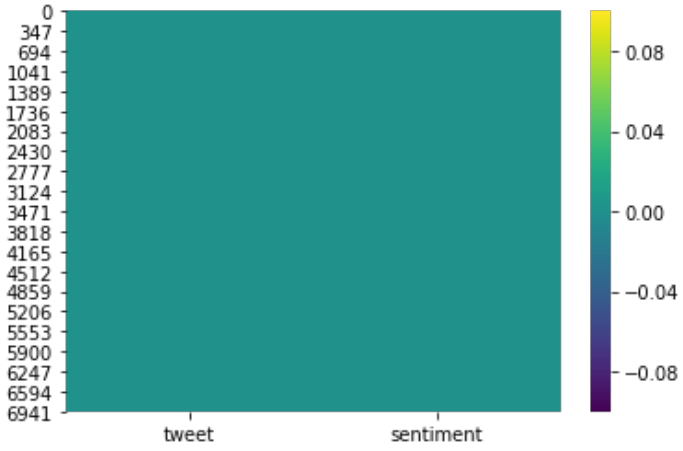
```
tweet        0
sentiment    0
dtype: int64
```

In [166]:

```
sns.heatmap(df.isnull(), linecolor="red",cmap="viridis")
# Perfectly Clean Data
```

Out[166]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1a6e867b8>
```



In [167]:

```
df.head(5)
```

Out[167]:

	tweet	sentiment
0	#sxswnui #sxsw #apple defining language of tou...	1
1	Learning ab Google doodles! All doodles should...	1
2	one of the most in-your-face ex. of stealing t...	2
3	This iPhone #SXSW app would b pretty awesome i...	0
4	Line outside the Apple store in Austin waiting...	1

Exploratory Data Analysis

In [168]:

```
df['word_count'] = df['tweet'].apply(lambda x: len(str(x).split(" ")))
df[['tweet','word_count']].head()
```

Out[168]:

	tweet	word_count
0	#sxswnui #sxsw #apple defining language of tou...	12
1	Learning ab Google doodles! All doodles should...	19
2	one of the most in-your-face ex. of stealing t...	23
3	This iPhone #SXSW app would b pretty awesome i...	19
4	Line outside the Apple store in Austin waiting...	15

In [169]:

```
df['char_count'] = df['tweet'].str.len() ## this also includes spaces
df[['tweet','char_count']].head()
```

Out[169]:

	tweet	char_count
0	#sxswnui #sxsw #apple defining language of tou...	89
1	Learning ab Google doodles! All doodles should...	143

	tweet	char_count
2	one of the most in-your-face ex. of stealing t...	132
3	This iPhone #SXSW app would b pretty awesome i...	125
4	Line outside the Apple store in Austin waiting...	77

In [170]:

```
def avg_word(sentence):
  words = sentence.split()
  return (sum(len(word) for word in words)/len(words))

df['avg_word'] = df['tweet'].apply(lambda x: avg_word(x))
df[['tweet','avg_word']].head()
```

Out[170]:

	tweet	avg_word
0	#sxswnui #sxsw #apple defining language of tou...	6.500000
1	Learning ab Google doodles! All doodles should...	6.578947
2	one of the most in-your-face ex. of stealing t...	5.000000
3	This iPhone #SXSW app would b pretty awesome i...	5.631579
4	Line outside the Apple store in Austin waiting...	4.500000

In [171]:

```
stop = stopwords.words('english')
df['stopwords'] = df['tweet'].apply(lambda x: len([x for x in x.split() if x in stop]))
df[['tweet','stopwords']].head()
```

Out[171]:

	tweet	stopwords
0	#sxswnui #sxsw #apple defining language of tou...	2
1	Learning ab Google doodles! All doodles should...	4
2	one of the most in-your-face ex. of stealing t...	7
3	This iPhone #SXSW app would b pretty awesome i...	4
4	Line outside the Apple store in Austin waiting...	4

In [172]:

```
print(stop)
```

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're", "you've",
"you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he', 'him', 'his', 'himsel
f', 'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its', 'itself', 'they', 'the
m', 'their', 'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this', 'that', "tha
t'll", 'these', 'those', 'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have',
'has', 'had', 'having', 'do', 'does', 'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if
', 'or', 'because', 'as', 'until', 'while', 'of', 'at', 'by', 'for', 'with', 'about', 'ag
ainst', 'between', 'into', 'through', 'during', 'before', 'after', 'above', 'below', 'to'
, 'from', 'up', 'down', 'in', 'out', 'on', 'off', 'over', 'under', 'again', 'further', 't
hen', 'once', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'any', 'both', 'each
', 'few', 'more', 'most', 'other', 'some', 'such', 'no', 'nor', 'not', 'only', 'own', 'sa
me', 'so', 'than', 'too', 'very', 's', 't', 'can', 'will', 'just', 'don', "don't", 'shoul
d', "should've", 'now', 'd', 'll', 'm', 'o', 're', 've', 'y', 'ain', 'aren', "aren't", 'c
ouldn', "couldn't", 'didn', "didn't", 'doesn', "doesn't", 'hadn', "hadn't", 'hasn', "hasn
't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "mightn't", 'mustn', "mustn't",
'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'wasn', "wasn't", 'weren',
"weren't", 'won', "won't", 'wouldn', "wouldn't"]
```

In [173]:

```
df['hastags'] = df['tweet'].apply(lambda x: len([x for x in x.split() if x.startswith('#
')]))
df[['tweet','hastags']].head()
```

Out[173]:

	tweet	hastags
0	#sxswnui #sxsw #apple defining language of tou...	3
1	Learning ab Google doodles! All doodles should...	2
2	one of the most in-your-face ex. of stealing t...	1
3	This iPhone #SXSW app would b pretty awesome i...	3
4	Line outside the Apple store in Austin waiting...	1

In [174]:

```
df.head(5)
```

Out[174]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags
0	#sxswnui #sxsw #apple defining language of tou...	1	12	89	6.500000	2	3
1	Learning ab Google doodles! All doodles should...	1	19	143	6.578947	4	2
2	one of the most in-your-face ex. of stealing t...	2	23	132	5.000000	7	1
3	This iPhone #SXSW app would b pretty awesome i...	0	19	125	5.631579	4	3
4	Line outside the Apple store in Austin waiting...	1	15	77	4.500000	4	1

In [175]:

```
df['numerics'] = df['tweet'].apply(lambda x: len([x for x in x.split() if x.isdigit()]))
df[['tweet','numerics']].head()
#Total Number Present
```

Out[175]:

	tweet	numerics
0	#sxswnui #sxsw #apple defining language of tou...	0
1	Learning ab Google doodles! All doodles should...	0
2	one of the most in-your-face ex. of stealing t...	0
3	This iPhone #SXSW app would b pretty awesome i...	0
4	Line outside the Apple store in Austin waiting...	0

In [176]:

```
df['upper'] = df['tweet'].apply(lambda x: len([x for x in x.split() if x.isupper()]))
df[['tweet','upper']].head()
#Upper Case Characters Presnt in Datset
```

Out[176]:

	tweet	upper
0	#sxswnui #sxsw #apple defining language of tou...	0
1	Learning ab Google doodles! All doodles should...	0
2	one of the most in-your-face ex. of stealing t...	2

3	This iPhone #SXSW app would b pretty awesome i...	tweet	upper 1
4	Line outside the Apple store in Austin waiting...		1

In [177]:

```
df.tail(5)
```

Out[177]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
7269	@mention Google plze Tammi. I'm in middle of ...	1	16	93	5.200000	4	1	0	1
7270	RT @mention ÷¼ Are you all set? ÷_ {link} ÷...	1	15	91	5.133333	2	5	0	1
7271	RT @mention Aha! Found proof of lactation room...	1	22	140	5.409091	5	1	0	2
7272	We just launched our iPad app at #SXSW! Get al...	1	18	92	4.166667	6	1	0	2
7273	The next fin serv battle is vs Apple, GOOG, Mo...	1	23	137	5.000000	4	2	0	2

Data Preprocessing And Cleaning

In [178]:

```
df['tweet'] = df['tweet'].apply(lambda x: " ".join(x.lower() for x in x.split()))
df['tweet'].head()
#Making Everything in LowerCase No Repeatations
```

Out[178]:

```
0    #sxswnui #sxsw #apple defining language of tou...
1    learning ab google doodles! all doodles should...
2    one of the most in-your-face ex. of stealing t...
3    this iphone #sxsw app would b pretty awesome i...
4    line outside the apple store in austin waiting...
Name: tweet, dtype: object
```

In [179]:

```
df['tweet'] = df['tweet'].str.replace('[^\w\s]','')
df['tweet'].head()
#REMOVING THE PUNCTUCATION
```

Out[179]:

```
0    sxswnui sxsw apple defining language of touch ...
1    learning ab google doodles all doodles should ...
2    one of the most inyourface ex of stealing the ...
3    this iphone sxsw app would b pretty awesome if...
4    line outside the apple store in austin waiting...
Name: tweet, dtype: object
```

In [180]:

```
stop = stopwords.words('english')
df['tweet'] = df['tweet'].apply(lambda x: " ".join(x for x in x.split() if x not in stop
))
df['tweet'].head()
# Removing Stopwords
```

Out[180]:

```
0    sxswnui sxsw apple defining language touch dif...
1    learning ab google doodles doodles light funny...
2    one inyourface ex stealing show urs rt mention
```

```
2    one inyourface ex stealing show yrs rt mention...
3    iphone sxsw app would b pretty awesome didnt c...
4    line outside apple store austin waiting new ip...
Name: tweet, dtype: object
```

In [181]:

```
freq = pd.Series(' '.join(df['tweet']).split()).value_counts()[:10]
#Commonly Used Words And Thier Count
```

In [182]:

```
freq
```

Out[182]:

```
sxsw        7540
mention     5512
link        3427
rt          2344
ipad        1912
google      1862
apple       1729
iphone      1215
store       1188
new          862
dtype: int64
```

In [183]:

```
freq = list(freq.index)
df['tweet'] = df['tweet'].apply(lambda x: " ".join(x for x in x.split() if x not in freq
))
df['tweet'].head()
#Removing the Common Words
```

Out[183]:

```
0    sxswnui defining language touch different dial...
1    learning ab doodles doodles light funny amp in...
2    one inyourface ex stealing show yrs quotat sch...
3    app would b pretty awesome didnt crash every 1...
4                          line outside austin waiting
Name: tweet, dtype: object
```

In [184]:

```
freq1 = pd.Series(' '.join(df['tweet']).split()).value_counts()[-10:]
# Rare Words From Dataset
```

In [185]:

```
freq1
```

Out[185]:

```
voluntary          1
activations        1
socialgood         1
cloudcomputing     1
stations           1
nonot              1
empowering         1
ummm               1
threequarters      1
syd                1
dtype: int64
```

In [186]:

```
freq1 = list(freq1.index)
df['tweet'] = df['tweet'].apply(lambda x: " ".join(x for x in x.split() if x not in freq
```

```
1))
df['tweet'].head()
#Removing Rare Words From Dataset
```

Out[186]:

```
0    sxswnui defining language touch different dial...
1    learning ab doodles doodles light funny amp in...
2    one inyourface ex stealing show yrs quotat sch...
3    app would b pretty awesome didnt crash every 1...
4                           line outside austin waiting
Name: tweet, dtype: object
```

In [187]:

```
df['tweet'][:5].apply(lambda x: str(TextBlob(x).correct()))
#Words Correction analytics and analtycs
```

Out[187]:

```
0    sxswnui defining language touch different dial...
1    learning ab doubles doubles light funny amp in...
2    one inyourface ex stealing show yes quotas sch...
3    pp would b pretty awesome didn crash every 10m...
4                           line outside austin waiting
Name: tweet, dtype: object
```

In [188]:

```
TextBlob(df['tweet'][1]).words
```

Out[188]:

```
WordList(['learning', 'ab', 'doodles', 'doodles', 'light', 'funny', 'amp', 'innovative',
'exceptions', 'significant', 'occasions', 'googledoodle'])
```

In [189]:

```
st = PorterStemmer()
df['tweet'][:5].apply(lambda x: " ".join([st.stem(word) for word in x.split()]))
#removal of suffices, like "ing", "ly", "s", etc.
```

Out[189]:

```
0    sxswnui defin languag touch differ dialect bec...
1    learn ab doodl doodl light funni amp innov exc...
2    one inyourfac ex steal show yr quotat school m...
3    app would b pretti awesom didnt crash everi 10...
4                             line outsid austin wait
Name: tweet, dtype: object
```

In [190]:

```
df.head(5)
```

Out[190]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	**sxswnui defining language touch different dial...**	**1**	**12**	**89**	**6.500000**	**2**	**3**	**0**	**0**
1	**learning ab doodles doodles light funny amp in...**	**1**	**19**	**143**	**6.578947**	**4**	**2**	**0**	**0**
2	**one inyourface ex stealing show yrs quotat sch...**	**2**	**23**	**132**	**5.000000**	**7**	**1**	**0**	**2**
3	**app would b pretty awesome didnt crash every 1...**	**0**	**19**	**125**	**5.631579**	**4**	**3**	**0**	**1**
4	**line outside austin waiting**	**1**	**15**	**77**	**4.500000**	**4**	**1**	**0**	**1**

Advanced Text Processing

Advanced Text Processing

In [191]:

```
TextBlob(df['tweet'][0]).ngrams(2)
#N-grams are the combination of multiple words used together.
```

Out[191]:

```
[WordList(['sxswnui', 'defining']),
 WordList(['defining', 'language']),
 WordList(['language', 'touch']),
 WordList(['touch', 'different']),
 WordList(['different', 'dialects']),
 WordList(['dialects', 'becoming']),
 WordList(['becoming', 'smaller'])]
```

In [192]:

```
tf1 = (df['tweet'][1:2]).apply(lambda x: pd.value_counts(x.split(" "))).sum(axis = 0).re
set_index()
tf1.columns = ['words','tf']
tf1
#Term frequency is simply the ratio of the count of a word present in a sentence, to the
length of the sentence.
```

Out[192]:

	words	tf
0	doodles	2
1	googledoodle	1
2	ab	1
3	significant	1
4	innovative	1
5	funny	1
6	light	1
7	learning	1
8	exceptions	1
9	amp	1
10	occasions	1

In [193]:

```
for i,word in enumerate(tf1['words']):
  tf1.loc[i, 'idf'] = np.log(df.shape[0]/(len(df[df['tweet'].str.contains(word)])))
tf1
#The intuition behind inverse document frequency (IDF) is that a word is not of much use
to us if it's appearing
#in all the documents.
```

Out[193]:

	words	tf	idf
0	doodles	2	5.800882
1	googledoodle	1	6.183874
2	ab	1	2.787131
3	significant	1	8.891924
4	innovative	1	7.793312
5	funny	1	5.896192
6	light	1	4.687232

	words	tf	idf
7	learning	1	6.326975
8	exceptions	1	8.891924
9	amp	1	2.349452
10	occasions	1	8.891924

In [194]:

```
tf1['tfidf'] = tf1['tf'] * tf1['idf']
tf1
#TF-IDF is the multiplication of the TF and IDF which we calculated above.
```

Out[194]:

	words	tf	idf	tfidf
0	doodles	2	5.800882	11.601763
1	googledoodle	1	6.183874	6.183874
2	ab	1	2.787131	2.787131
3	significant	1	8.891924	8.891924
4	innovative	1	7.793312	7.793312
5	funny	1	5.896192	5.896192
6	light	1	4.687232	4.687232
7	learning	1	6.326975	6.326975
8	exceptions	1	8.891924	8.891924
9	amp	1	2.349452	2.349452
10	occasions	1	8.891924	8.891924

In [195]:

```
df_copy=df
```

In [196]:

```
df_copy.head()
```

Out[196]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	sxswnui defining language touch different dial...	1	12	89	6.500000	2	3	0	0
1	learning ab doodles doodles light funny amp in...	1	19	143	6.578947	4	2	0	0
2	one inyourface ex stealing show yrs quotat sch...	2	23	132	5.000000	7	1	0	2
3	app would b pretty awesome didnt crash every 1...	0	19	125	5.631579	4	3	0	1
4	line outside austin waiting	1	15	77	4.500000	4	1	0	1

In [53]:

```
# df.drop(["word_count","char_count","avg_word","hastags","numerics","upper","stopwords"]
,inplace=True,axis=1)
```

In [54]:

```
df.head(5)
```

Out[54]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	sxswnui defining language touch different dial...	1	12	89	6.500000	2	3	0	0
1	learning ab doodles doodles light funny amp in...	1	19	143	6.578947	4	2	0	0
2	one inyourface ex stealing show yrs quotat sch...	2	23	132	5.000000	7	1	0	2
3	app would b pretty awesome didnt crash every 1...	0	19	125	5.631579	4	3	0	1
4	line outside austin waiting	1	15	77	4.500000	4	1	0	1

In [55]:

```
df.to_csv('newtwitter.csv')
```

In [56]:

```
!pip install WordCloud
```

```
Requirement already satisfied: WordCloud in c:\users\shaikh\anaconda3\lib\site-packages (
1.5.0)
Requirement already satisfied: pillow in c:\users\shaikh\anaconda3\lib\site-packages (fro
m WordCloud) (6.2.1)
Requirement already satisfied: numpy>=1.6.1 in c:\users\shaikh\anaconda3\lib\site-package
s (from WordCloud) (1.17.4)
```

```
WARNING: You are using pip version 19.3.1; however, version 20.0.2 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.
```

In [57]:

```
from wordcloud import WordCloud
from PIL import Image
import requests
```

In [58]:

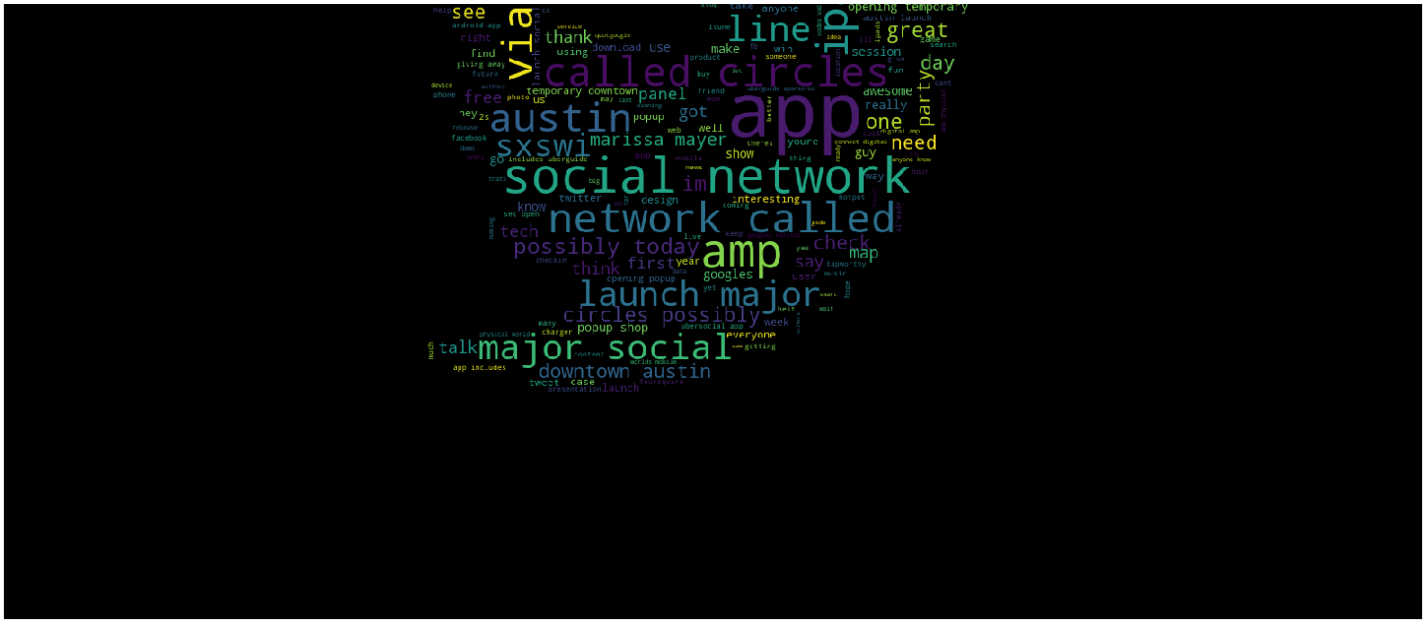
```
all_words = ' '.join([text for text in df['tweet']])
```

In [59]:

```
mask = np.array(Image.open(requests.get('https://lofrev.net/wp-content/photos/2016/07/twi
tter_logo.jpg', stream=True).raw))
```

In [249]:

```
def generate_wordcloud(all_words, mask):
    word_cloud = WordCloud(width = 900, height = 600, background_color='black', mask=mas
k).generate(all_words)
    plt.figure(figsize=(20,18),facecolor = 'white', edgecolor='blue')
    plt.figure
    plt.imshow(word_cloud)
    plt.axis('off')
    plt.tight_layout(pad=0)
    plt.show()
generate_wordcloud(all_words,mask)
```



In [ ]:

```
```

Model I

In [61]:

```
df_copy.head()
```

Out[61]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	sxswnui defining language touch different dial...	1	12	89	6.500000	2	3	0	0
1	learning ab doodles doodles light funny amp in...	1	19	143	6.578947	4	2	0	0
2	one inyourface ex stealing show yrs quotat sch...	2	23	132	5.000000	7	1	0	2
3	app would b pretty awesome didnt crash every 1...	0	19	125	5.631579	4	3	0	1
4	line outside austin waiting	1	15	77	4.500000	4	1	0	1

In [62]:

```
import numpy as np
from sklearn.model_selection import train_test_split
```

In [64]:

```
X_train, X_test, y_train, y_test = train_test_split(df_copy.drop(['sentiment'], axis = 1
), df_copy['sentiment'], test_size=0.33, random_state=42)
```

In [76]:

```
from sklearn.feature_extraction.text import TfidfVectorizer

tfidf = TfidfVectorizer(max_features=1000, lowercase=True, analyzer='word',
stop_words= 'english',ngram_range=(1,1))
train_vect = tfidf.fit_transform(df_copy['tweet'])

train_vect
```

Out[76]:

```
<7273x1000 sparse matrix of type '<class 'numpy.float64'>'
 with 36486 stored elements in Compressed Sparse Row format>
```

In [77]:

```
from sklearn.feature_extraction.text import CountVectorizer
bow = CountVectorizer(max_features=1000, lowercase=True, ngram_range=(1,1),analyzer = "word")
train_bow = bow.fit_transform(df_copy['tweet'])
train_bow
#Bag of Words
```

Out[77]:

```
<7273x1000 sparse matrix of type '<class 'numpy.int64'>'
 with 40110 stored elements in Compressed Sparse Row format>
```

In [78]:

```
df_copy['tweet'][:5].apply(lambda x: TextBlob(x).sentiment)
```

Out[78]:

```
0           (0.15, 0.65)
1     (0.38125, 0.89375)
2              (0.0, 0.0)
3           (0.625, 1.0)
4             (0.0, 0.05)
Name: tweet, dtype: object
```

In [79]:

```
df_copy.head()
```

Out[79]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	sxswnui defining language touch different dial...	1	12	89	6.500000	2	3	0	0
1	learning ab doodles doodles light funny amp in...	1	19	143	6.578947	4	2	0	0
2	one inyourface ex stealing show yrs quotat sch...	2	23	132	5.000000	7	1	0	2
3	app would b pretty awesome didnt crash every 1...	0	19	125	5.631579	4	3	0	1
4	line outside austin waiting	1	15	77	4.500000	4	1	0	1

In [90]:

```
df.head()
```

Out[90]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	sxswnui defining language touch different dial...	0.15000	12	89	6.500000	2	3	0	0
1	learning ab doodles doodles light funny amp in...	0.38125	19	143	6.578947	4	2	0	0
2	one inyourface ex stealing show yrs quotat sch...	0.00000	23	132	5.000000	7	1	0	2
3	app would b pretty awesome didnt crash every 1...	0.62500	19	125	5.631579	4	3	0	1
4	line outside austin waiting	0.00000	15	77	4.500000	4	1	0	1

In [80]:

```
df_copy['sentiment'] = df['tweet'].apply(lambda x: TextBlob(x).sentiment[0] )
df_copy[['tweet','sentiment']].head()
```

Out[80]:

	tweet	sentiment
0	sxswnui defining language touch different dial...	0.15000
1	learning ab doodles doodles light funny amp in...	0.38125
2	one inyourface ex stealing show yrs quotat sch...	0.00000
3	app would b pretty awesome didnt crash every 1...	0.62500
4	line outside austin waiting	0.00000

In [146]:

```
df_copy.sentiment.value_counts()
```

Out[146]:

```
 0.000000    3442
 0.500000     270
 0.400000     232
 0.200000     190
 0.250000     165
             ...
 0.378788       1
 0.471429       1
 0.621429       1
-0.088889       1
-0.111111       1
Name: sentiment, Length: 446, dtype: int64
```

In [81]:

```
df_copy['sentiment']
```

Out[81]:

```
0        0.15000
1        0.38125
2        0.00000
3        0.62500
4        0.00000
          ...
7269     0.05000
7270     0.00000
7271    -0.02500
7272     0.32500
7273     0.00000
Name: sentiment, Length: 7273, dtype: float64
```

Testing

In [132]:

```
from sklearn.metrics import classification_report
y_true = df['sentiment']
y_pred = df_copy['sentiment']
#0: Negative, 1: Neutral, 2: Positive, 3: Can't Tell
target_names = ['0', '1', '2','3']
# print(classification_report(y_true, y_pred, target_names=target_names)
```

In [133]:

```
df_copy.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 7273 entries, 0 to 7273
Data columns (total 9 columns):
tweet          7273 non-null object
sentiment      7273 non-null float64
word_count     7273 non-null int64
char_count     7273 non-null int64
avg_word       7273 non-null float64
stopwords      7273 non-null int64
hastags        7273 non-null int64
numerics       7273 non-null int64
upper          7273 non-null int64
dtypes: float64(2), int64(6), object(1)
memory usage: 888.2+ KB
```

In [134]:

```
y_true.head(20)
```

Out[134]:

```
0     1
1     1
2     2
3     0
4     1
5     1
6     1
7     1
8     2
9     2
10    3
11    2
12    2
13    1
14    1
15    1
16    1
17    2
18    1
19    1
Name: sentiment, dtype: int64
```

In [136]:

```

```

Out[136]:

```
0       0.0
1       0.0
2       0.0
3       1.0
4       0.0
       ...
7269    0.0
7270    0.0
7271   -0.0
7272    0.0
7273    0.0
Name: sentiment, Length: 7273, dtype: float64
```

In [137]:

```
y_pred = y_pred.abs()
```

In [139]:

```
y_pred = y_pred.round(decimals=0)
```

In [140]:

```
y_pred
```

Out[140]:

```
0       0.0
1       0.0
2       0.0
3       1.0
4       0.0
       ...
7269    0.0
7270    0.0
7271    0.0
7272    0.0
7273    0.0
Name: sentiment, Length: 7273, dtype: float64
```

In [141]:

```
print(classification_report(y_true, y_pred, target_names=target_names))
```

```
              precision    recall  f1-score   support

           0       0.06      0.88      0.11       456
           1       0.38      0.06      0.10      4310
           2       0.00      0.00      0.00      2382
           3       0.00      0.00      0.00       125

    accuracy                           0.09      7273
   macro avg       0.11      0.23      0.05      7273
weighted avg       0.23      0.09      0.07      7273
```

```
C:\Users\Shaikh\Anaconda3\lib\site-packages\sklearn\metrics\classification.py:1437: Undef
inedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels w
ith no predicted samples.
  'precision', 'predicted', average, warn_for)
```

Model II - SVM

In [149]:

```
df_copy.head()
```

Out[149]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	**sxswnui defining language touch different dial...**	**0.15000**	**12**	**89**	**6.500000**	**2**	**3**	**0**	**0**
1	**learning ab doodles doodles light funny amp in...**	**0.38125**	**19**	**143**	**6.578947**	**4**	**2**	**0**	**0**
2	**one inyourface ex stealing show yrs quotat sch...**	**0.00000**	**23**	**132**	**5.000000**	**7**	**1**	**0**	**2**
3	**app would b pretty awesome didnt crash every 1...**	**0.62500**	**19**	**125**	**5.631579**	**4**	**3**	**0**	**1**
4	**line outside austin waiting**	**0.00000**	**15**	**77**	**4.500000**	**4**	**1**	**0**	**1**

In [150]:

```
from sklearn.feature_extraction.text import TfidfVectorizer
# Create feature vectors
vectorizer = TfidfVectorizer(
                             min_df = 5,
                             max_df = 0.8,
                             sublinear_tf = True,
```

```
                                use_idf = True
                               )
train_vectors = vectorizer.fit_transform(df_copy['tweet'])
test_vectors = vectorizer.transform(df_copy['tweet'])
```

In [151]:

```
train_vectors
```

Out[151]:

```
<7273x2018 sparse matrix of type '<class 'numpy.float64'>'
 with 46863 stored elements in Compressed Sparse Row format>
```

In [197]:

```
df_copy
```

Out[197]:

	tweet	sentiment	word_count	char_count	avg_word	stopwords	hastags	numerics	upper
0	sxswnui defining language touch different dial...	1	12	89	6.500000	2	3	0	0
1	learning ab doodles doodles light funny amp in...	1	19	143	6.578947	4	2	0	0
2	one inyourface ex stealing show yrs quotat sch...	2	23	132	5.000000	7	1	0	2
3	app would b pretty awesome didnt crash every 1...	0	19	125	5.631579	4	3	0	1
4	line outside austin waiting	1	15	77	4.500000	4	1	0	1
...	...	...	...	...	...	...	...	...	...
7269	plze tammi im middle craziness everything sooo...	1	16	93	5.200000	4	1	0	1
7270	¼ set _ _ edchat musedchat sxswi newtwitter	1	15	91	5.133333	2	5	0	1
7271	aha found proof lactation room excuse quotmoth...	1	22	140	5.409091	5	1	0	2
7272	launched app get details first edition free	1	18	92	4.166667	6	1	0	2
7273	next fin serv battle vs goog mobile operators ...	1	23	137	5.000000	4	2	0	2

7273 rows × 9 columns

In [199]:

```
import time
from sklearn import svm
from sklearn.metrics import classification_report
# Perform classification with SVM, kernel=linear
classifier_linear = svm.SVC(kernel='linear')
t0 = time.time()
classifier_linear.fit(train_vectors, df_copy['sentiment'])
t1 = time.time()
y_pred = classifier_linear.predict(test_vectors)
t2 = time.time()
time_linear_train = t1-t0
time_linear_predict = t2-t1
```

In [202]:

```
import warnings
warnings.filterwarnings('always')
```

In [203]:

In [205]:

```
# results
print("Training time: %fs; Prediction time: %fs" % (time_linear_train, time_linear_predi
ct))
report = classification_report(df_copy['sentiment'], y_pred, output_dict=True)
```

```
Training time: 4.363214s; Prediction time: 2.779313s
```

```
C:\Users\Shaikh\Anaconda3\lib\site-packages\sklearn\metrics\classification.py:1437: Undef
inedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels w
ith no predicted samples.
  'precision', 'predicted', average, warn_for)
C:\Users\Shaikh\Anaconda3\lib\site-packages\sklearn\metrics\classification.py:1437: Undef
inedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels w
ith no predicted samples.
  'precision', 'predicted', average, warn_for)
C:\Users\Shaikh\Anaconda3\lib\site-packages\sklearn\metrics\classification.py:1437: Undef
inedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in labels w
ith no predicted samples.
  'precision', 'predicted', average, warn_for)
```

In [220]:

```
#Since Classification Report could not be generated due ti MetricWarning we use sklearn.m
etrics to calculate performance measure of our model

from sklearn.metrics import f1_score, precision_recall_fscore_support, accuracy_score
precision,recall,_,_ = precision_recall_fscore_support(
                                                        df_copy['sentiment'],
                                                        y_pred,
                                                        average='weighted',
                                                        warn_for=tuple()
                                                    )

print("F1 Score: ",f1_score(df_copy['sentiment'], y_pred, average='weighted', labels=np.
unique(y_pred)),
      "\nPrecision:",precision,"\nRecall:",recall, "\nAccuracy Score:", accuracy_score(d
f_copy['sentiment'], y_pred)

     )
```

```
F1 Score:  0.7468037529033524
Precision: 0.755092924873162
Recall: 0.7578715798157569
Accuracy Score: 0.7578715798157569
```

In [241]:

```
Ser = pd.Series(y_pred).append(pd.Series([3]))
Ser.value_counts()
```

Out[241]:

```
1    5399
2    1742
0     132
3       1
dtype: int64
```

In [248]:

```
df_copy['sentiment'].value_counts()
```

Out[248]:

```
1    4310
2    2382
0     456
3     125
Name: sentiment, dtype: int64
```

In [247]:

Out[247]:

```
(array([2., 0., 0., 0., 0., 1., 0., 0., 0., 1.]),
 array([ 125. ,  543.5,  962. , 1380.5, 1799. , 2217.5, 2636. , 3054.5,
        3473. , 3891.5, 4310. ]),
 <a list of 10 Patch objects>)
```