Week8_3_NLP_text_vectorizer_model

May 31, 2021

NLP: Text Classification

Importing relevant libraries

[1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import re
import nltk
import tensorflow as tf
from nltk.corpus import stopwords
nltk.download('stopwords')
from tensorflow import keras
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.layers import LSTM
from tensorflow.keras.layers import Dropout
from tensorflow.keras.wrappers.scikit_learn import KerasClassifier
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.layers import Embedding, Flatten, GlobalMaxPool1D, Conv1D
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.model_selection import train_test_split
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
# from tensorflow.keras.optimizers import Adam
# from sklearn.feature_extraction.text import TfidfVectorizer
from wordcloud import WordCloud
# from sklearn.model_selection import RandomizedSearchCV
from nltk.stem import WordNetLemmatizer
nltk.download('wordnet')

import warnings
warnings.filterwarnings("ignore")
```

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

```
[nltk_data]     /Users/preethamvignesh/nltk_data…
[nltk_data]   Package wordnet is already up-to-date!
```

Load Train and Test data

[2]:
```
train = pd.read_csv('/Users/preethamvignesh/Desktop/Work/ML_EIT/Data/
 ↪corona_nlpdata/Corona_NLP_train.csv',encoding='latin')
test = pd.read_csv('/Users/preethamvignesh/Desktop/Work/ML_EIT/Data/
 ↪corona_nlpdata/Corona_NLP_test.csv', encoding ='latin')

# train = pd.read_csv('/home/jayanthikishore/Desktop/Analysis/Work/ML_EIT/Data/
 ↪corona_nlpdata/Corona_NLP_train.csv',encoding='latin')
# test = pd.read_csv('/home/jayanthikishore/Desktop/Analysis/Work/ML_EIT/Data/
 ↪corona_nlpdata/Corona_NLP_test.csv', encoding ='latin')
```

Data Exploration

[3]:
```
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 41157 entries, 0 to 41156
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   UserName       41157 non-null  int64
 1   ScreenName     41157 non-null  int64
 2   Location       32567 non-null  object
 3   TweetAt        41157 non-null  object
 4   OriginalTweet  41157 non-null  object
 5   Sentiment      41157 non-null  object
dtypes: int64(2), object(4)
memory usage: 1.9+ MB
```

[4]:
```
train
```

[4]:

	UserName	ScreenName	Location	TweetAt	\
0	3799	48751	London	16-03-2020	
1	3800	48752	UK	16-03-2020	
2	3801	48753	Vagabonds	16-03-2020	
3	3802	48754	NaN	16-03-2020	
4	3803	48755	NaN	16-03-2020	
…	…	…	…	…	
41152	44951	89903	Wellington City, New Zealand	14-04-2020	
41153	44952	89904	NaN	14-04-2020	
41154	44953	89905	NaN	14-04-2020	
41155	44954	89906	NaN	14-04-2020	
41156	44955	89907	i love you so much || he/him	14-04-2020	

```
                                                 OriginalTweet           Sentiment
0      @MeNyrbie @Phil_Gahan @Chrisitv https://t.co/i…              Neutral
1      advice Talk to your neighbours family to excha…             Positive
2      Coronavirus Australia: Woolworths to give elde…             Positive
3      My food stock is not the only one which is emp…             Positive
4      Me, ready to go at supermarket during the #COV…  Extremely Negative
…                                                    …                 …
41152  Airline pilots offering to stock supermarket s…              Neutral
41153  Response to complaint not provided citing COVI…  Extremely Negative
41154  You know itÂ s getting tough when @KameronWild…             Positive
41155  Is it wrong that the smell of hand sanitizer i…              Neutral
41156  @TartiiCat Well new/used Rift S are going for …              Negative

[41157 rows x 6 columns]
```

Shape of the Dataset

[5]:
```
train.shape
```

[5]:
```
(41157, 6)
```

Replace sentiments

[6]:
```
#Replace Extremely Positive & Negative with Positive and Negative
train.loc[train.Sentiment == 'Extremely Negative','Sentiment'] = 'Negative'
train.loc[train.Sentiment == 'Extremely Positive', 'Sentiment'] = 'Positive'

test.loc[test.Sentiment == 'Extremely Negative', 'Sentiment'] = 'Negative'
test.loc[test.Sentiment == 'Extremely Positive', 'Sentiment'] = 'Positive'

train
```

[6]:
```
       UserName  ScreenName                      Location     TweetAt  \
0          3799       48751                        London  16-03-2020
1          3800       48752                            UK  16-03-2020
2          3801       48753                     Vagabonds  16-03-2020
3          3802       48754                           NaN  16-03-2020
4          3803       48755                           NaN  16-03-2020
…           …          …                              …          …
41152     44951       89903  Wellington City, New Zealand  14-04-2020
41153     44952       89904                           NaN  14-04-2020
41154     44953       89905                           NaN  14-04-2020
41155     44954       89906                           NaN  14-04-2020
41156     44955       89907  i love you so much || he/him  14-04-2020

                                          OriginalTweet Sentiment
0      @MeNyrbie @Phil_Gahan @Chrisitv https://t.co/i…   Neutral
1      advice Talk to your neighbours family to excha…  Positive
```

```
2      Coronavirus Australia: Woolworths to give elde…  Positive
3      My food stock is not the only one which is emp…  Positive
4      Me, ready to go at supermarket during the #COV…  Negative
…                                                    …         …
41152  Airline pilots offering to stock supermarket s…   Neutral
41153  Response to complaint not provided citing COVI…  Negative
41154  You know itÃ s getting tough when @KameronWild…  Positive
41155  Is it wrong that the smell of hand sanitizer i…   Neutral
41156  @TartiiCat Well new/used Rift S are going for …  Negative

[41157 rows x 6 columns]
```

Counting Sentiments

[7]:
```
from collections import Counter
test_cnt = Counter(test.Sentiment)
train_cnt = Counter(train['Sentiment'])
print(test_cnt)
print(train_cnt)
```

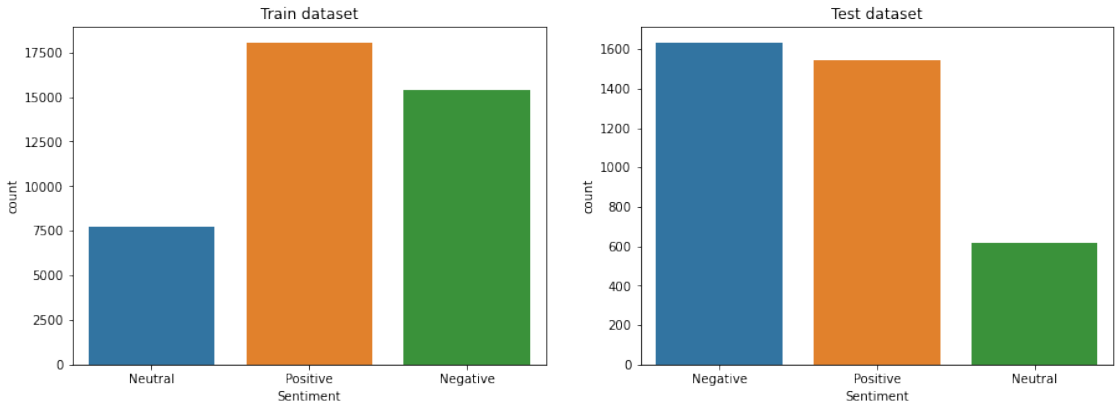
```
Counter({'Negative': 1633, 'Positive': 1546, 'Neutral': 619})
Counter({'Positive': 18046, 'Negative': 15398, 'Neutral': 7713})
```

[8]:
```
f, axes = plt.subplots(ncols=2, figsize=(15, 5))

sns.countplot(train.Sentiment,ax=axes[0])
axes[0].set_title('Train dataset')

sns.countplot(test.Sentiment,ax=axes[1])
axes[1].set_title('Test dataset')
```

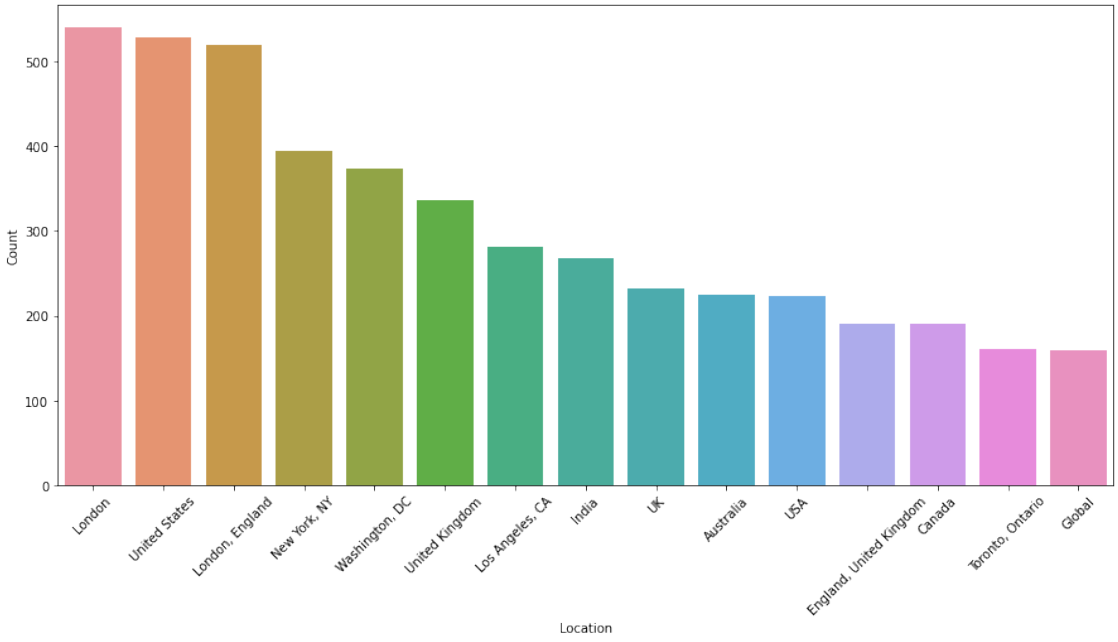
[8]:
```
Text(0.5, 1.0, 'Test dataset')
```



Count Locationwise

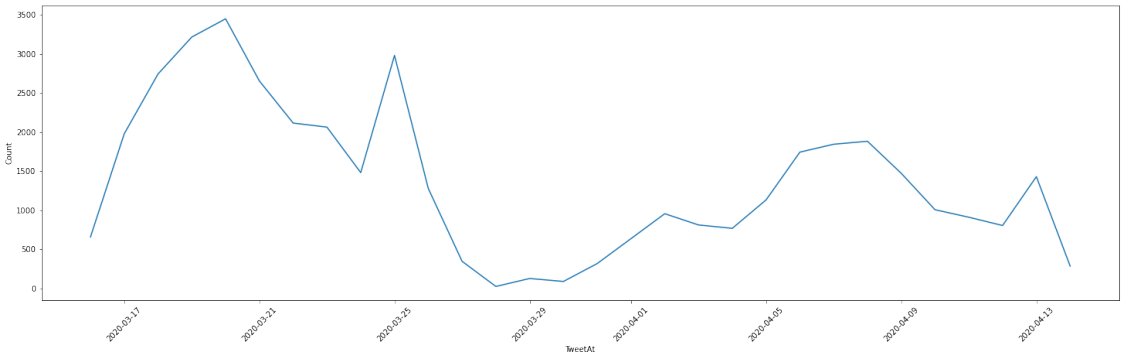
[9]:
```
location = train.Location
location = pd.DataFrame(location)
location['Count'] = 1
location = location.groupby('Location').sum().sort_values(by = 'Count',␣
 ↪ascending = False).nlargest(15,['Count'])
location = location.reset_index()
plt.figure(figsize=(15,7))
sns.barplot(x = 'Location',y = 'Count', data = location)
plt.xticks(rotation=45)

plt.show()
```



Time wise total tweets

[10]:
```
time = train.TweetAt
time = pd.DataFrame(time)
time['Count'] = 1
time = time.groupby('TweetAt').sum()
time = time.reset_index()
time = time.iloc[1:,:]
time['TweetAt'] = pd.to_datetime(time['TweetAt'], format = '%d-%m-%Y')
plt.figure(figsize=(25,7))
sns.lineplot(x = 'TweetAt', y = 'Count', data = time)
plt.xticks(rotation=45)
plt.show()
```



Data Cleaning and drop some variables

[11]:
```
train = train.drop(['UserName','ScreenName'], axis = 1)
test = test.drop(['UserName','ScreenName'], axis = 1)
```

[12]:
```
train
```

[12]:

	Location	TweetAt	OriginalTweet	Sentiment
0	London	16-03-2020	@MeNyrbie @Phil_Gahan @Chrisitv https://t.co/i…	Neutral
1	UK	16-03-2020	advice Talk to your neighbours family to excha…	Positive
2	Vagabonds	16-03-2020	Coronavirus Australia: Woolworths to give elde…	Positive
3	NaN	16-03-2020	My food stock is not the only one which is emp…	Positive
4	NaN	16-03-2020	Me, ready to go at supermarket during the #COV…	Negative
…	…	…	…	…
41152	Wellington City, New Zealand	14-04-2020	Airline pilots offering to stock supermarket s…	Neutral
41153	NaN	14-04-2020	Response to complaint not provided citing COVI…	Negative
41154	NaN	14-04-2020	You know itÂ s getting tough when @KameronWild…	Positive
41155	NaN	14-04-2020	Is it wrong that the smell of hand sanitizer i…	Neutral
41156	i love you so much || he/him	14-04-2020	@TartiiCat Well new/used Rift S are going for …	Negative

[41157 rows x 4 columns]

Transform into datetime column

[13]:
```
#Transform it into a datetime column
train['TweetAt'] = pd.to_datetime(train['TweetAt'], format = '%d-%m-%Y')
test['TweetAt'] = pd.to_datetime(test['TweetAt'], format = '%d-%m-%Y')
```

Tweets cleaning

[14]:
```
train.rename(columns={'OriginalTweet': 'Tweet'}, inplace=True)
test.rename(columns={'OriginalTweet': 'Tweet'}, inplace=True)
```

[15]:
```
train.Tweet.head(10)
```

[15]:
```
0    @MeNyrbie @Phil_Gahan @Chrisitv https://t.co/i…
1    advice Talk to your neighbours family to excha…
2    Coronavirus Australia: Woolworths to give elde…
3    My food stock is not the only one which is emp…
4    Me, ready to go at supermarket during the #COV…
5    As news of the regionÂ s first confirmed COVID…
6    Cashier at grocery store was sharing his insig…
7    Was at the supermarket today. Didn't buy toile…
8    Due to COVID-19 our retail store and classroom…
9    For corona prevention,we should stop to buy th…
Name: Tweet, dtype: object
```

[16]:
```
#Remove urls:
train.Tweet = train.Tweet.str.replace('http\S+|www.\S+', '', case=False)
test.Tweet = test.Tweet.str.replace('http\S+|www.\S+', '', case=False)
```

[17]:
```
#Remove hashtag character
train.Tweet = train.Tweet.str.replace('#', '', case=False)
test.Tweet = test.Tweet.str.replace('#', '', case=False)
```

[18]:
```
# Remove punctuation, special characters & mentions:
train.Tweet = train.Tweet.str.replace(r'[^\w\s]', '', case=False)
test.Tweet = test.Tweet.str.replace(r'[^\w\s]', '', case=False)
```

[19]:
```
# #Remove stopwords:
stop_words = set(stopwords.words('english'))
train.Tweet = train.Tweet.apply(lambda x: ' '.join([word for word in x.split()␣
 ↪if word not in (stop_words)]))
test.Tweet = test.Tweet.apply(lambda x: ' '.join([word for word in x.split() if␣
 ↪word not in (stop_words)]))
```

[20]:
```
#Remove non alphabetic words:
train.Tweet = train.Tweet.apply(lambda x: ' '.join([word for word in x.split()␣
 ↪if word.isalpha()]))
```

```
test.Tweet = test.Tweet.apply(lambda x: ' '.join([word for word in x.split() if␣
↪word.isalpha()]))
```

[21]:
```
#Remove emptys rows:
train = train[train.Tweet != '']
test = test[test.Tweet != '']
```

[22]:
```
#Initiate a lemmatizer and lemmatize each word in the data
lemmatizer = WordNetLemmatizer()
train.Tweet = train.Tweet.apply(lambda x: ' '.join([lemmatizer.lemmatize(word)␣
↪for word in x.split()]))
test.Tweet = test.Tweet.apply(lambda x: ' '.join([lemmatizer.lemmatize(word)␣
↪for word in x.split()]))
```

check the tweets are cleaned are not

[23]:
```
for i in range(0,5):
    print(i,':',train.Tweet[i])
    print(i,':',test.Tweet[i])
```

```
0 : MeNyrbie Chrisitv
0 : TRENDING New Yorkers encounter empty supermarket shelf pictured Wegmans
Brooklyn soldout online grocer FoodKick MaxDelivery coronavirusfearing shopper
stock
1 : advice Talk neighbour family exchange phone number create contact list phone
number neighbour school employer chemist GP set online shopping account po
adequate supply regular med order
1 : When I couldnt find hand sanitizer Fred Meyer I turned Amazon But pack
PurellCheck coronavirus concern driving price
2 : Coronavirus Australia Woolworths give elderly disabled dedicated shopping
hour amid outbreak
2 : Find protect loved one coronavirus
3 : My food stock one empty PLEASE dont panic THERE WILL BE ENOUGH FOOD FOR
EVERYONE take need Stay calm stay safe coronavirus confinement Confinementotal
ConfinementGeneral
3 : Panic buying hit NewYork City anxious shopper stock foodampmedical supply
healthcare worker becomes BigApple confirmed coronavirus patient OR Bloomberg
staged event QAnon CDC
4 : Me ready go supermarket outbreak Not Im paranoid food stock litteraly empty
The coronavirus serious thing please dont panic It cause shortage
CoronavirusFrance restezchezvous StayAtHome confinement
4 : toiletpaper dunnypaper coronavirus coronavirusaustralia CoronaVirusUpdate
dunnypapergate Costco One week everyone buying baby milk powder next everyone
buying toilet paper
```

[24]:
```
train.head()
```

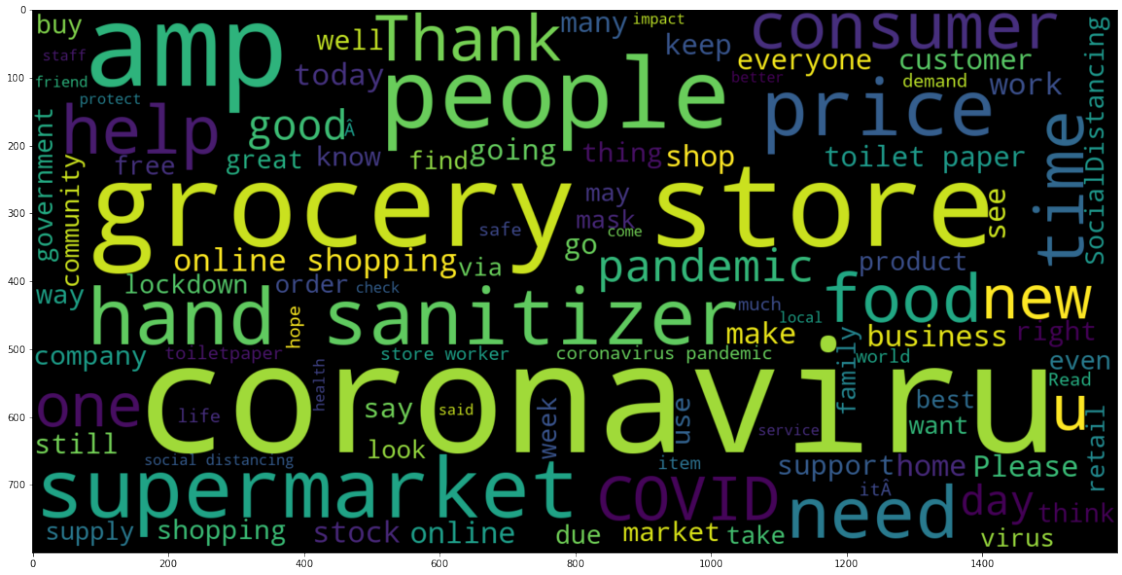
[24]:
```
     Location    TweetAt                                                Tweet  \
0      London 2020-03-16                                    MeNyrbie Chrisitv
1          UK 2020-03-16  advice Talk neighbour family exchange phone nu…
2  Vagabonds 2020-03-16  Coronavirus Australia Woolworths give elderly …
3         NaN 2020-03-16  My food stock one empty PLEASE dont panic THER…
4         NaN 2020-03-16  Me ready go supermarket outbreak Not Im parano…

  Sentiment
0   Neutral
1  Positive
2  Positive
3  Positive
4  Negative
```

Word Cloud for positive tweets

[25]:
```
# Top 100 words for positive tweets:
plt.figure(figsize = (20,20)) # Text that is Fake
wc = WordCloud(max_words = 100 , width = 1600 , height = 800).generate(" ".
 ↪join(train[(train.Sentiment == 'Positive') | (train.Sentiment == 'Extremely␣
 ↪Positive')].Tweet))
plt.imshow(wc , interpolation = 'bilinear')
```

[25]:
```
<matplotlib.image.AxesImage at 0x139723be0>
```

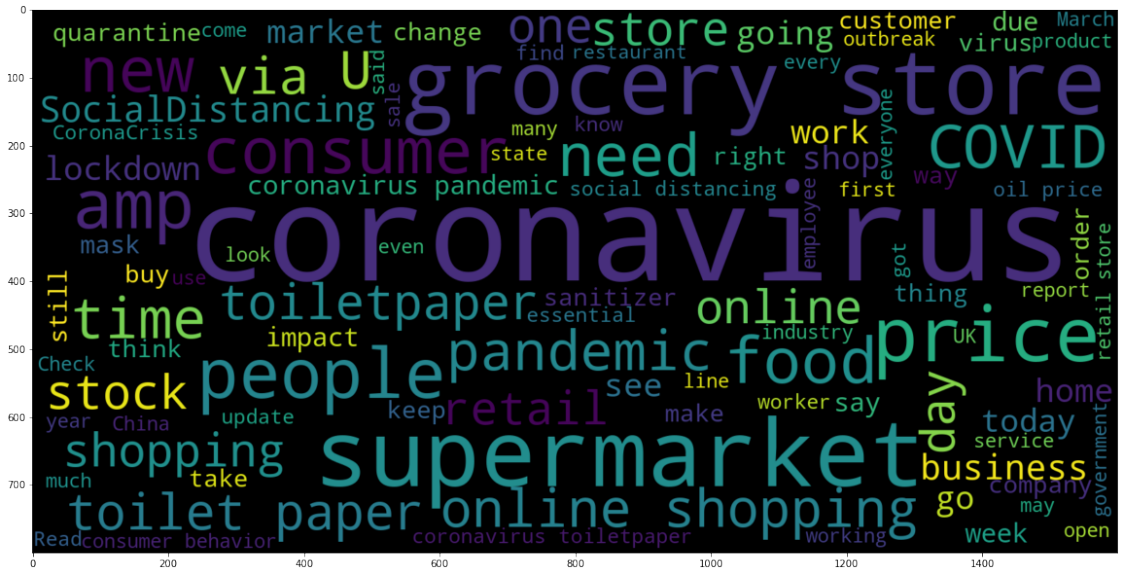


Word Cloud for neutral tweets

[26]:
```
#Top 100 words for neutral tweets:
plt.figure(figsize = (20,20)) # Text that is Fake
```

```
wc = WordCloud(max_words = 100 , width = 1600 , height = 800).generate(" ".
 ↪join(train[train.Sentiment == 'Neutral'].Tweet))
plt.imshow(wc , interpolation = 'bilinear')
```

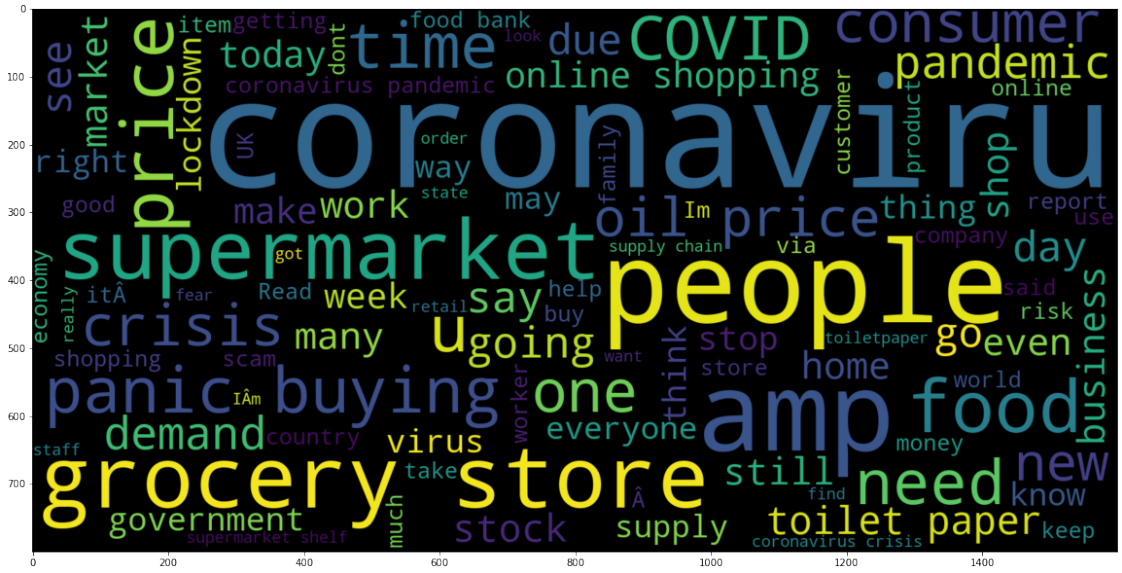
[26]: <matplotlib.image.AxesImage at 0x138745fa0>



Word Cloud for negative tweets

[27]:
```
#Top 100 words for negative tweets:
plt.figure(figsize = (20,20)) # Text that is Fake
wc = WordCloud(max_words = 100 , width = 1600 , height = 800).generate(" ".
 ↪join(train[(train.Sentiment == 'Negative') | (train.Sentiment == 'Extremely␣
 ↪Negative')].Tweet))
plt.imshow(wc , interpolation = 'bilinear')
```

[27]: <matplotlib.image.AxesImage at 0x138779940>



save the train and test cleaned tweets into local hard disk

[28]:
```
#Save the data cleaned to be an input for our streamlit app
train.to_csv('/Users/preethamvignesh/Downloads/train_cleaned.csv', index=False)
test.to_csv('/Users/preethamvignesh/Downloads/test_cleaned.csv', index=False)
```

[29]:
```
#Encode the target:
y_train = pd.get_dummies(train.Sentiment).values
y_test = pd.get_dummies(test.Sentiment).values
y_train
```

[29]:
```
array([[0, 1, 0],
       [0, 0, 1],
       [0, 0, 1],
       …,
       [0, 0, 1],
       [0, 1, 0],
       [1, 0, 0]], dtype=uint8)
```

Count Vectorized Model

[30]:
```
vectorizer = CountVectorizer()
vectorizer.fit(train.Tweet.values)

X_train = vectorizer.transform(train.Tweet.values)
X_test = vectorizer.transform(test.Tweet.values)

X_train = X_train.toarray()
X_test = X_test.toarray()
```

Simple Model (One layer)

[31]:
```
opti = Adam(lr = 0.01)

vectorizer_onelayer_count = Sequential()
vectorizer_onelayer_count.add(Dense(16, input_dim = X_train.shape[1],␣
↪activation = 'relu'))
vectorizer_onelayer_count.add(Dense(3, activation = 'softmax'))
```

[32]:
```
vectorizer_onelayer_count.compile(loss = 'categorical_crossentropy', optimizer␣
↪= opti, metrics = ['accuracy'])
vectorizer_onelayer_count.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 16)                872864
_________________________________________________________________
dense_1 (Dense)              (None, 3)                 51
=================================================================
Total params: 872,915
Trainable params: 872,915
Non-trainable params: 0
_________________________________________________________________
```

[33]:
```
history_vectorizer_onelayer = vectorizer_onelayer_count.fit(X_train, y_train,
                    epochs=2,
                    verbose=True,
                    validation_data=(X_test, y_test),
                    batch_size=16)
```

```
Epoch 1/2
2572/2572 [==============================] - 30s 12ms/step - loss: 0.7482 -
accuracy: 0.6814 - val_loss: 0.5983 - val_accuracy: 0.7788
Epoch 2/2
2572/2572 [==============================] - 31s 12ms/step - loss: 0.2773 -
accuracy: 0.9032 - val_loss: 0.6736 - val_accuracy: 0.7659
```

save model and history

[34]:
```
#Save models and history
vectorizer_onelayer_count.save('/Users/preethamvignesh/Downloads/
↪vectorizer_onelayer_Count.h5')
np.save('/Users/preethamvignesh/Downloads/history_vectorizer_onelayer.
↪npy',history_vectorizer_onelayer.history)
```

Simple Model (multi layer)

[35]:
```
opti = Adam(lr = 0.01)

model_multi_count = Sequential()
model_multi_count.add(Dense(64, input_dim = X_train.shape[1], activation =␣
↪'relu'))
model_multi_count.add(Dense(32, activation = 'relu'))
model_multi_count.add(Dense(16, activation = 'relu'))
model_multi_count.add(Dense(3, activation = 'softmax'))
```

[36]:
```
model_multi_count.compile(loss = 'categorical_crossentropy', optimizer = opti,␣
↪metrics = ['accuracy'])
model_multi_count.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_2 (Dense)              (None, 64)                3491456
_________________________________________________________________
dense_3 (Dense)              (None, 32)                2080
_________________________________________________________________
dense_4 (Dense)              (None, 16)                528
_________________________________________________________________
dense_5 (Dense)              (None, 3)                 51
=================================================================
Total params: 3,494,115
Trainable params: 3,494,115
Non-trainable params: 0
_________________________________________________________________
```

[37]:
```
history_multi_count = model_multi_count.fit(X_train, y_train,
                    epochs=2,
                    verbose=True,
                    validation_data=(X_test, y_test),
                    batch_size=16)
```

```
Epoch 1/2
2572/2572 [==============================] - 59s 23ms/step - loss: 0.7640 -
accuracy: 0.6662 - val_loss: 0.6191 - val_accuracy: 0.7462
Epoch 2/2
2572/2572 [==============================] - 60s 23ms/step - loss: 0.3180 -
accuracy: 0.8887 - val_loss: 0.6366 - val_accuracy: 0.7701
```

[ ]:

[ ]:

[38]:
```
# Covid_text_classification_Keras
```