A company has launched the product, people are using it and giving comments. Company want to know the sentiment status of comments/review about Positive , Negative or Neutral.

In [1]:
```
import pandas as pd
import numpy as np
import nltk # natual language toolkit
```

In [2]:
```
#vader it is pretrained for sentiment analysis
```

In [3]:
```
import nltk
```

In [4]:
```
from nltk.sentiment.vader import SentimentIntensityAnalyzer
sent=SentimentIntensityAnalyzer() #object
```

In [6]:
```
#compund would from-1 to  +1
#  where - indicates -ve sentiment and + ve indicates +ve sentiment
```

In [ ]:
```

```

In [7]:
```
ta= pd.read_csv(r"F:\Imaticus\Data set\AmazonFoodReviews.csv")
```

In [8]:
```
ta.shape
```

Out[8]:
```
(568454, 10)
```

In [9]:
```
ta.head()
```

Out[9]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Sc
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	

In [10]:
```
ta.columns
```

Out[10]:
```
Index(['Id', 'ProductId', 'UserId', 'ProfileName', 'HelpfulnessNumerator',
       'HelpfulnessDenominator', 'Score', 'Time', 'Summary', 'Text'],
      dtype='object')
```

In [11]:
```
ta = ta.loc[:, ['Text']]
```

In [12]:
```
ta.head()
```

Out[12]:

	Text
0	I have bought several of the Vitality canned d...
1	Product arrived labeled as Jumbo Salted Peanut...
2	This is a confection that has been around a fe...
3	If you are looking for the secret ingredient i...
4	Great taffy at a great price. There was a wid...

Sentiment Analysis

In [13]:
```
sentiment=[] #empty list
for comment in ta['Text']:
    var1=sent.polarity_scores(comment)  #storing in var1
    sentiment.append(var1['compound'])
```

In [14]:
```
ta['sentiment']=sentiment
```

In [ ]:
```

```

In [15]:
```
ta.shape
```

Out[15]:
```
(568454, 2)
```

In [16]:
```
len(sentiment)
```

Out[16]:
```
568454
```

In [17]:
```
ta.head()
```

Out[17]:

	Text	sentiment
0	I have bought several of the Vitality canned d...	0.9441
1	Product arrived labeled as Jumbo Salted Peanut...	-0.5664
2	This is a confection that has been around a fe...	0.8265
3	If you are looking for the secret ingredient i...	0.0000
4	Great taffy at a great price. There was a wid...	0.9468

In [18]:
```
ta.sentiment.describe()
```

Out[18]:
```
count    568454.000000
mean          0.647316
std           0.466244
min          -0.999400
25%           0.576400
50%           0.854600
75%           0.942100
max           0.999900
Name: sentiment, dtype: float64
```

In [19]:
```
ta.sentiment.describe(percentiles=[.1,.2,.3,.4,.5,.6,.7,.8,.9,1])
```

Out[19]:
```
count    568454.000000
mean          0.647316
std           0.466244
min          -0.999400
10%          -0.101000
20%           0.440400
30%           0.669600
40%           0.788400
50%           0.854600
60%           0.897900
70%           0.928700
80%           0.953800
90%           0.974800
100%          0.999900
max           0.999900
Name: sentiment, dtype: float64
```

In [20]:
```
ta[ta.sentiment<0].shape
```

Out[20]:
```
(61404, 2)
```

In [21]:
```
ta[ta.sentiment>0].shape
```

Out[21]:
```
(499075, 2)
```

In [ ]:
```

```

In [22]:
```
analysis = [] # make a new empty list
i=0
for i in range(len(ta.sentiment)):
    if ta['sentiment'][i] < 0:
        analysis.append('Negative')
    elif ta['sentiment'][i] > 0:
        analysis.append('Positive')

    else:
        analysis.append('Neuteral')

ta['SentimentAnalysis'] = analysis
```

In [ ]:
```

```

In [24]:
```
ta = ta.loc[:, ['Text','SentimentAnalysis']]
```

In [25]:
```
ta.head()
```

Out[25]:

	Text	SentimentAnalysis
0	I have bought several of the Vitality canned d...	Positive
1	Product arrived labeled as Jumbo Salted Peanut...	Negative
2	This is a confection that has been around a fe...	Positive
3	If you are looking for the secret ingredient i...	Neuteral
4	Great taffy at a great price. There was a wid...	Positive

In [26]:
```
ta['SentimentAnalysis'].value_counts()
```

Out[26]:
```
Positive    499075
Negative     61404
Neuteral      7975
Name: SentimentAnalysis, dtype: int64
```

In [27]:
```
ta['SentimentAnalysis'].replace({'Positive':2 , 'Negative':1 , 'Neuteral':0} , inplace= True)
```

In [ ]:
```

```

In [28]:
```
from nltk.corpus import stopwords
abcd = stopwords.words('english')
```

In [29]:
```
import string
```

In [30]:
```
xyz=string.punctuation
```

In [31]:
```
def text_process(mess):            ### creating a function
    """                                                    ## a docstring
    1. remove the punctuation
    2. remove the stopwords
    3. return the list of clean textwords

    """
    nopunc = [char for char in mess if char not in xyz]
    nopunc = "".join(nopunc)

    return [ word for word in nopunc.split() if word not in abcd]
```

In [32]:
```
ta.Text=ta.Text.str.lower()
```

In [33]:
```
from sklearn.feature_extraction.text import CountVectorizer

# TDM - I need count of each & every word
# CountVectorizer used to get count of each unique word
# count is needed after removing punctuation & stopwords
```

In [34]:
```
import time

start = time.time() # Get the current time

bow_transformer =    CountVectorizer(analyzer = text_process   ).fit(ta.Text)

end = time.time() # get the current time
print(end - start)
```

```
400.6111686229706
```

In [35]:
```
len(bow_transformer.vocabulary_)
```

Out[35]: 240626

In [36]:
```
tdm = bow_transformer.transform(ta["Text"])
```

In [37]:
```
tdm.shape
```

Out[37]: (568454, 240626)

In [38]:
```
type(tdm) # SPARSE matrix
```

Out[38]: scipy.sparse.csr.csr_matrix

In [39]:
```
tdm1=tdm.copy()
```

In [ ]:
```

```

In [87]:
```
tdm=tdm1
```

Sampling

In [88]:
```
from sklearn.model_selection import train_test_split
```

In [89]:
```
x_train, x_test, y_train, y_test = train_test_split( tdm,ta['SentimentAnalysis'] ,test_size=.2)
```

In [93]:
```
print(x_train.shape)
print(y_train.shape)
print("----")
print(x_test.shape)
print(y_test.shape)
```

```
(454763, 240626)
(454763,)
----
(113691, 240626)
(113691,)
```

Naive Bayes

In [46]:
```
from sklearn.naive_bayes import MultinomialNB
```

In [47]:
```
nb_model = MultinomialNB()
```

In [48]:
```
nb_model.fit(x_train, y_train)
```

Out[48]:
```
MultinomialNB()
```

In [49]:
```
pred = nb_model.predict(x_test)
```

In [50]:
```
from sklearn.metrics import confusion_matrix
```

In [51]:
```
tab =  confusion_matrix(y_test , pred)
```

In [52]:
```
tab
```

Out[52]:
```
array([[   61,   322,  1233],
       [    6,  5829,  6480],
       [   26,  4658, 95076]], dtype=int64)
```

In [53]:
```
tab.diagonal().sum() * 100 / tab.sum()
```

Out[53]:
```
88.80738141101759
```

In [54]:
```
from sklearn.metrics import classification_report
```

In [55]:
```
print(classification_report(y_test,pred))
```

```
              precision    recall  f1-score   support

           0       0.66      0.04      0.07      1616
           1       0.54      0.47      0.50     12315
           2       0.92      0.95      0.94     99760

    accuracy                           0.89    113691
   macro avg       0.71      0.49      0.50    113691
weighted avg       0.88      0.89      0.88    113691
```

In [ ]:
```
#Model is Not performaning well for class 1 , so checking for class imbalance problem.
```

Class Imbalance

In [56]:
```
print("Before OverSampling, counts of label 'Positive': {}".format(sum(y_train == 2)))
print("Before OverSampling, counts of label 'Negative': {} \n".format(sum(y_train  == 1)))
print("Before OverSampling, counts of label 'Neuteral': {} \n".format(sum(y_train  == 0)))
```

```
Before OverSampling, counts of label 'Positive': 399315
Before OverSampling, counts of label 'Negative': 49089

Before OverSampling, counts of label 'Neuteral': 6359
```

In [ ]:
```
#class imbalance problem exists.
```

In [ ]:
```

```

Oversampling using Smote

In [52]:
```
#pip install imblearn
```

In [ ]:
```

```

In [ ]:
```
# import SMOTE module from imblearn library
# pip install imblearn (if you don't have imblearn in your system)
```

In [97]:
```
from imblearn.over_sampling import SMOTE
sm = SMOTE(k_neighbors=1)
```

In [98]:
```
x_train_res, y_train_res = sm.fit_resample(x_train, y_train)
```

In [99]:
```
print("After OverSampling, counts of label 'Positive': {}".format(sum(y_train_res == 2)))
print("After OverSampling, counts of label 'Negative': {} \n".format(sum(y_train_res == 1)))
print("After OverSampling, counts of label 'Neuteral': {} \n".format(sum(y_train_res == 0)))
```

```
After OverSampling, counts of label 'Positive': 399249
After OverSampling, counts of label 'Negative': 399249

After OverSampling, counts of label 'Neuteral': 399249
```

In [ ]:
```
#using smote class is balanced now.
```

In [ ]:
```

```

Naive Bayes after Smote

In [100…
```
nb_model.fit(x_train_res, y_train_res)
```

Out[100…
```
MultinomialNB()
```

In [101…
```
predn = nb_model.predict(x_test)
```

In [102…
```
from sklearn.metrics import confusion_matrix
```

In [103…
```
tab1 =  confusion_matrix(y_test , predn)
```

In [104…
```
tab1
```

Out[104…
```
array([[  684,   321,   578],
       [  119,  8143,  4020],
       [  605, 10170, 89051]], dtype=int64)
```

In [105…
```
tab1.diagonal().sum() * 100 / tab1.sum()
```

Out[105…
```
86.09124732828457
```

In [106…
```
from sklearn.metrics import classification_report
```

In [107…
```
print(classification_report(y_test,predn))
```

```
              precision    recall  f1-score   support

           0       0.49      0.43      0.46      1583
           1       0.44      0.66      0.53     12282
           2       0.95      0.89      0.92     99826

    accuracy                           0.86    113691
   macro avg       0.62      0.66      0.63    113691
weighted avg       0.89      0.86      0.87    113691
```

In [ ]:
```

```

In [ ]:
```

```

Model with smote giving good result

In [ ]:
```

```

plot a word cloud

In [102…
```
#  plot a word cloud
# word cloud is pictorial representaion of the most frequent words
# based on those words we can get the idea on which topic the document was
```

In [103…
```
from wordcloud import WordCloud #required import
```

In [104…
```
import matplotlib.pyplot as plt
```

In [105…
```
ta['SentimentAnalysis'].value_counts()
```

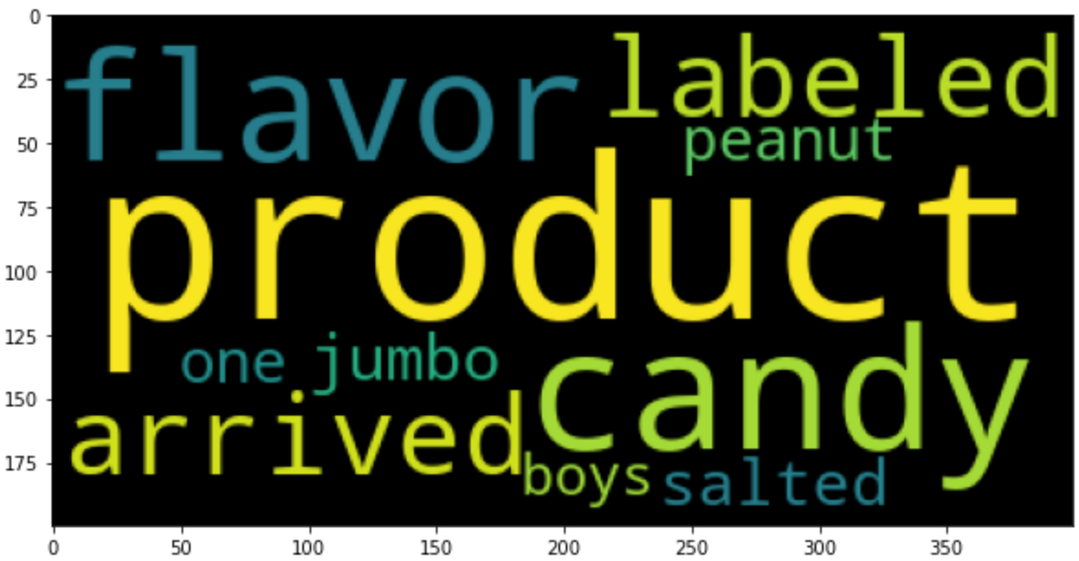
Out[105…
```
2    499075
1     61404
0      7975
Name: SentimentAnalysis, dtype: int64
```

In [107…
```
Negative_sentiment=ta[ta.SentimentAnalysis==1]
Positive_sentiment=ta[ta.SentimentAnalysis==2]
```

Negative Sentiment word representation using cloud word

In [110…
```
cloud  = WordCloud(stopwords = stopwords.words("english"), max_words= 10).generate(str(Negative_
plt.figure(figsize=(10 , 10))
plt.imshow(cloud)
```

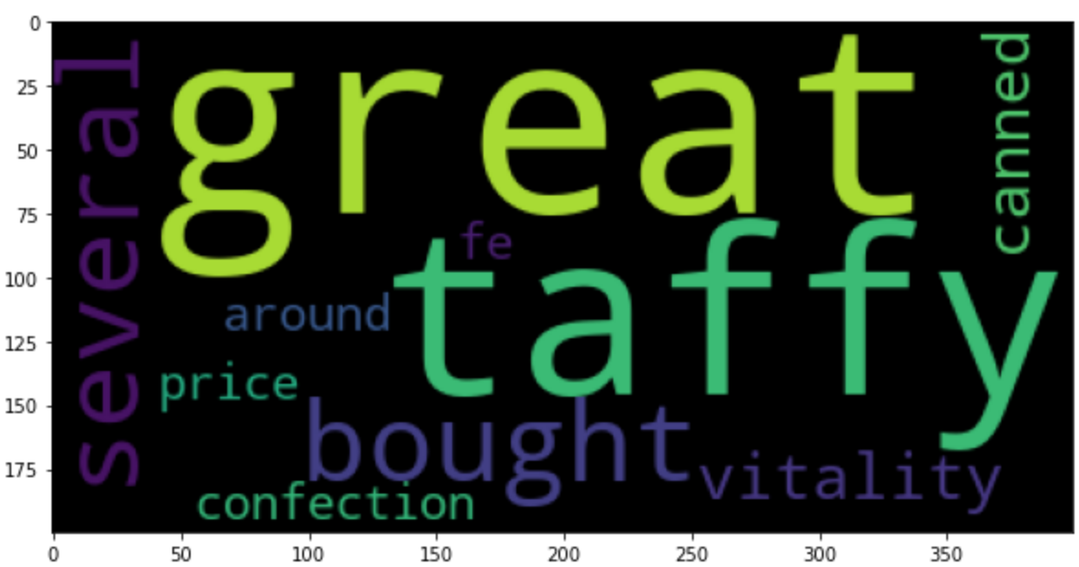
Out[110…
```
<matplotlib.image.AxesImage at 0x299347175e0>
```



Positive Sentiment word representation using cloud word

In [111…
```
cloud  = WordCloud(stopwords = stopwords.words("english"), max_words= 10).generate(str(Positive_
plt.figure(figsize=(10 , 10))
plt.imshow(cloud)
```

Out[111…
```
<matplotlib.image.AxesImage at 0x29934791160>
```



In [ ]: