In [121]:

```
# Importing the required packages for Sentiment Analysis
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import confusion_matrix,classification_report
from sklearn.feature_extraction.text import TfidfVectorizer
import pandas as pd
import seaborn as sns
import numpy as np
import nltk
from nltk.corpus import stopwords
from wordcloud import WordCloud, STOPWORDS, ImageColorGenerator
import matplotlib.pyplot as plt
% matplotlib inline
```

```
UsageError: Line magic function `%` not found.
```

In [122]:
```
# Load the dataset and read the top 5 dataset using pandas head function

df = pd.read_csv('Reviews.csv')
df.head()
```

Out[122]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	1303862400	Good Quality Dog Food	I have bought several of the Vitality canned d...
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	1219017600	"Delight" says it all	This is a confection that has been around a fe...
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	2	1307923200	Cough Medicine	If you are looking for the secret ingredient i...
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	5	1350777600	Great taffy	Great taffy at a great price. There was a wid...

In [123]:
```
1 df.describe()
```

Out[123]:

	Id	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time
count	568454.000000	568454.000000	568454.00000	568454.000000	5.684540e+05
mean	284227.500000	1.743817	2.22881	4.183199	1.296257e+09
std	164098.679298	7.636513	8.28974	1.310436	4.804331e+07
min	1.000000	0.000000	0.00000	1.000000	9.393408e+08
25%	142114.250000	0.000000	0.00000	4.000000	1.271290e+09
50%	284227.500000	0.000000	1.00000	5.000000	1.311120e+09
75%	426340.750000	2.000000	2.00000	5.000000	1.332720e+09
max	568454.000000	866.000000	923.00000	5.000000	1.351210e+09

In [124]:
```
1 # We are going to drop some columns which we not required for analysis.
2
3 data = df.drop(labels=["ProductId", "ProfileName","HelpfulnessNumerator","HelpfulnessDenominator","Time"]
```

In [125]:
```
1 data
```

Out[125]:

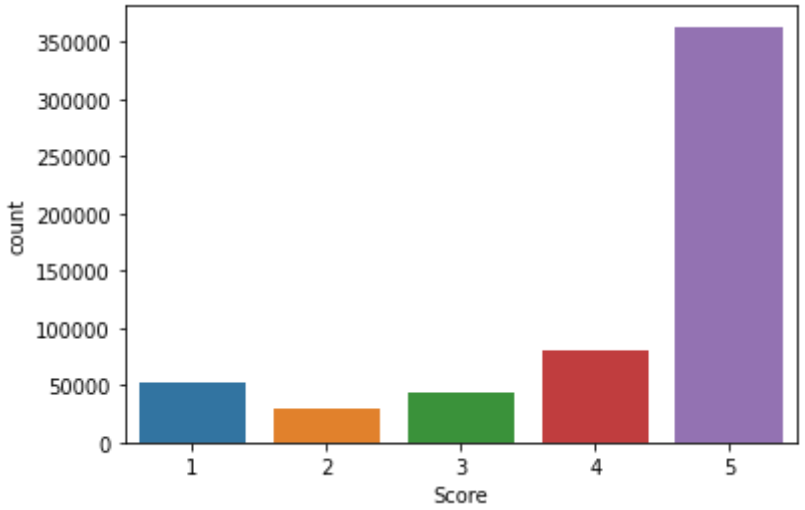
	Id	UserId	Score	Summary	Text
0	1	A3SGXH7AUHU8GW	5	Good Quality Dog Food	I have bought several of the Vitality canned d...
1	2	A1D87F6ZCVE5NK	1	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...
2	3	ABXLMWJIXXAIN	4	"Delight" says it all	This is a confection that has been around a fe...
3	4	A395BORC6FGVXV	2	Cough Medicine	If you are looking for the secret ingredient i...
4	5	A1UQRSCLF8GW1T	5	Great taffy	Great taffy at a great price. There was a wid...
...	...	...	...	...	...
568449	568450	A28KG5XORO54AY	5	Will not do without	Great for sesame chicken..this is a good if no...
568450	568451	A3I8AFVPEE8KI5	2	disappointed	I'm disappointed with the flavor. The chocolat...
568451	568452	A121AA1GQV751Z	5	Perfect for our maltipoo	These stars are small, so you can give 10-15 o...
568452	568453	A3IBEVCTXKNOH	5	Favorite Training and reward treat	These are the BEST treats for training and rew...
568453	568454	A3LGQPJCZVL9UC	5	Great Honey	I am very satisfied ,product is as advertised,...

568454 rows × 5 columns

In [126]:
```
# Data Explanation of Score

sns.countplot(data['Score'])
plt.show()
```

```
/home/shekhar/.virtualenvs/cv/lib/python3.8/site-packages/seaborn/_decorators.py:36: FutureWarning: Pass th
e following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `da
ta`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```



The above charts shows that the rating of 5 is very high which means that the data itself has a very high positive customer reviews. So, now we are going to create a positive and negative sentiments.

In [ ]:
```
1
```

In [127]:
```
# We create a new column postive_negative which describe about the positivity (1) or negativity (0) of t
data.dropna(inplace=True)
data[data['Score'] != 3]
data['postive_negative'] = np.where(data['Score'] > 3, 1, 0)
data.head()
```

Out[127]:

	Id	UserId	Score	Summary	Text	postive_negative
0	1	A3SGXH7AUHU8GW	5	Good Quality Dog Food	I have bought several of the Vitality canned d...	1
1	2	A1D87F6ZCVE5NK	1	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...	0
2	3	ABXLMWJIXXAIN	4	"Delight" says it all	This is a confection that has been around a fe...	1
3	4	A395BORC6FGVXV	2	Cough Medicine	If you are looking for the secret ingredient i...	0
4	5	A1UQRSCLF8GW1T	5	Great taffy	Great taffy at a great price. There was a wid...	1

In [128]:
```
# Creating wordclouds for positivity and negativity to know which words has more values in the reviews
# For that we create two different dataframes (positivity and negativity)

positive_reviews = data[data['postive_negative'] == 1]
negative_reviews = data[data['postive_negative'] == 0]
```

In [129]:
```
# We have seperated all positive reviews dataset from the dataframe data to positive_reviews
positive_reviews
```

Out[129]:

	Id	UserId	Score	Summary	Text	postive_negative
0	1	A3SGXH7AUHU8GW	5	Good Quality Dog Food	I have bought several of the Vitality canned d...	1
2	3	ABXLMWJIXXAIN	4	"Delight" says it all	This is a confection that has been around a fe...	1
4	5	A1UQRSCLF8GW1T	5	Great taffy	Great taffy at a great price. There was a wid...	1
5	6	ADT0SRK1MGOEU	4	Nice Taffy	I got a wild hair for taffy and ordered this f...	1
6	7	A1SP2KVKFXXRU1	5	Great! Just as good as the expensive brands!	This saltwater taffy had great flavors and was...	1
...	...	...	...	...	...	...
568448	568449	A1F6BHEYB7R6R7	5	Very large ground spice jars.	My only complaint is that there's so much of i...	1
568449	568450	A28KG5XORO54AY	5	Will not do without	Great for sesame chicken..this is a good if no...	1
568451	568452	A121AA1GQV751Z	5	Perfect for our maltipoo	These stars are small, so you can give 10-15 o...	1
568452	568453	A3IBEVCTXKNOH	5	Favorite Training and reward treat	These are the BEST treats for training and rew...	1
568453	568454	A3LGQPJCZVL9UC	5	Great Honey	I am very satisfied ,product is as advertised,...	1

443777 rows × 6 columns

In [130]:
```
# We have seperated all negative reviews dataset from the dataframe data to negative_reviews
negative_reviews
```

Out[130]:

	Id	UserId	Score	Summary	Text	postive_negative
1	2	A1D87F6ZCVE5NK	1	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...	0
3	4	A395BORC6FGVXV	2	Cough Medicine	If you are looking for the secret ingredient i...	0
12	13	A327PCT23YH90	1	My Cats Are Not Fans of the New Food	My cats have been happily eating Felidae Plati...	0
16	17	A3KLWF6WQ5BNYO	2	poor taste	I love eating them and they are good for watch...	0
26	27	A3RXAU2N8KV45G	1	Nasty No flavor	The candy is just red , No flavor . Just plan...	0
...	...	...	...	...	...	...
568433	568434	A1JUG9WCN1A52Z	1	Tastes horrible!	I just bought this soup today at my local groc...	0
568434	568435	ABGQPE97ZVYJ3	2	Not so good	This soup is mostly broth. Although it has a k...	0
568435	568436	A2PSB4WQHH46HN	2	Where's the tortellini?	It is mostly broth, with the advertised 3/4 cu...	0
568446	568447	A2P9W8T7NTLG2Z	2	Mixed wrong	I had ordered some of these a few months back ...	0
568450	568451	A3I8AFVPEE8KI5	2	disappointed	I'm disappointed with the flavor. The chocolat...	0

124650 rows × 6 columns

In [131]:

```
# Wordcloud — positive_reviews

# Create new stopword list
stopwords = set(STOPWORDS)
pos = " ".join(review for review in positive_reviews.Summary)
# pos
wordcloud = WordCloud(stopwords=stopwords).generate(pos)

# # Display the generated image:
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()
```

In [132]:

```
# Wordcloud – negative_reviews

pos = " ".join(review for review in negative_reviews.Summary)
# pos
wordcloud = WordCloud(stopwords=stopwords).generate(pos)

# # Display the generated image:
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis("off")
plt.show()

```

In [133]:
```
# Printing the dataframe
data
```

Out[133]:

	Id	UserId	Score	Summary	Text	postive_negative
0	1	A3SGXH7AUHU8GW	5	Good Quality Dog Food	I have bought several of the Vitality canned d...	1
1	2	A1D87F6ZCVE5NK	1	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...	0
2	3	ABXLMWJIXXAIN	4	"Delight" says it all	This is a confection that has been around a fe...	1
3	4	A395BORC6FGVXV	2	Cough Medicine	If you are looking for the secret ingredient i...	0
4	5	A1UQRSCLF8GW1T	5	Great taffy	Great taffy at a great price. There was a wid...	1
...	...	...	...	...	...	...
568449	568450	A28KG5XORO54AY	5	Will not do without	Great for sesame chicken..this is a good if no...	1
568450	568451	A3I8AFVPEE8KI5	2	disappointed	I'm disappointed with the flavor. The chocolat...	0
568451	568452	A121AA1GQV751Z	5	Perfect for our maltipoo	These stars are small, so you can give 10-15 o...	1
568452	568453	A3IBEVCTXKNOH	5	Favorite Training and reward treat	These are the BEST treats for training and rew...	1
568453	568454	A3LGQPJCZVL9UC	5	Great Honey	I am very satisfied ,product is as advertised,...	1

568427 rows × 6 columns

In [134]:
```
# Building the Model


X_train, X_test, y_train, y_test = train_test_split(data['Summary'], data['postive_negative'], random_sta
```

In [ ]:
```

```

In [135]:
```
# Printing the training data
# X_train
```

In [136]:
```
# Printing the truth value
# y_train
```

In [137]:
```
# As now we have binary dependent varibale and we can apply the logistic regression algorithm on that but
# the logistic regression will not understand the text, so we need to convert the text to matrix

vectorizer = CountVectorizer()

vector = vectorizer.fit(X_train)
vector
```

Out[137]:
```
CountVectorizer()
```

In [138]:
```
# vect.get_feature_names()[::2000]
```

In [139]:
```
len(vector.get_feature_names())

```

Out[139]:
```
29614
```

In [140]:
```
# We going to create matrix of the text

X_train_Matrix = vector.transform(X_train)
X_train_Matrix
```

Out[140]:
```
<426320x29614 sparse matrix of type '<class 'numpy.int64'>'
        with 1667616 stored elements in Compressed Sparse Row format>
```

In [141]:
```
len(vector.get_feature_names())

```

Out[141]:
```
29614
```

In [142]:
```
# Logistic Regression model
model = LogisticRegression()
model.fit(X_train_Matrix, y_train)

```

```
/home/shekhar/.virtualenvs/cv/lib/python3.8/site-packages/sklearn/linear_model/_logistic.py:763: Convergenc
eWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html (https://scikit-learn.org/stable/modules/pre
processing.html)
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression (https://scikit-learn.or
g/stable/modules/linear_model.html#logistic-regression)
  n_iter_i = _check_optimize_result(
```

Out[142]:
```
LogisticRegression()
```

In [143]:
```
# Prediction
prediction = model.predict(vector.transform(X_test))
```

In [144]:
```
# Testing
print(classification_report(prediction,y_test))

```

```
              precision    recall  f1-score   support

           0       0.66      0.81      0.72     25213
           1       0.96      0.91      0.93    116894

    accuracy                           0.89    142107
   macro avg       0.81      0.86      0.83    142107
weighted avg       0.90      0.89      0.90    142107
```

In [145]:
```
# Testing

print(model.predict(vector.transform(['The food is tasty', 'The food is not bad, I will buy them again']
```

```
[1 0]
```

We can see that above result, 1 is positive and other text is negative, so predict value 0.

Now, we are going to re-train the model. But before that, we are going to do some pre-processing on the text.

In [146]:
```
# We are now going to remove the those words who comes less than 6 times in a document
vector = TfidfVectorizer(min_df = 6).fit(X_train)
len(vector.get_feature_names())
```

Out[146]: 8927

Now we can see that our features value reduced from 29614 to 8927

In [147]:
```
X_train_TF = vector.transform(X_train)
model = LogisticRegression()
model.fit(X_train_TF, y_train)

```

```
/home/shekhar/.virtualenvs/cv/lib/python3.8/site-packages/sklearn/linear_model/_logistic.py:763: Convergenc
eWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html (https://scikit-learn.org/stable/modules/pre
processing.html)
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression (https://scikit-learn.or
g/stable/modules/linear_model.html#logistic-regression)
  n_iter_i = _check_optimize_result(
```

Out[147]:
```
LogisticRegression()
```

In [148]:
```
# Prediction
prediction = model.predict(vector.transform(X_test))
```

In [149]:
```
# Testing
print(classification_report(prediction,y_test))
```

```
              precision    recall  f1-score   support

           0       0.65      0.81      0.72     24946
           1       0.96      0.91      0.93    117161

    accuracy                           0.89    142107
   macro avg       0.80      0.86      0.83    142107
weighted avg       0.90      0.89      0.89    142107
```

We can see that in both the classification report, there is a minor accuracy change, which is because we have not done too much text normalization. After proper text normalization, the results will be very good.

In [150]:
```
# Testing

print(model.predict(vector.transform(['The food is tasty', 'The food is not bad, I will buy them again']
```

```
[1 0]
```

We can see that above result, 1 is positive and other text is negative, so predict value 0.

In [ ]:
```

```

In [ ]:
```

```