IMPORTATION OF PYTHON PACKAGES

In [2]:
```
import pandas as pd
import numpy as np
import scipy
import re
import string
```

In [3]:
```
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
import scikitplot as skplt
import plotly.express as px
import plotly.graph_objects as go
import plotly.figure_factory as ff
from plotly.offline import download_plotlyjs, init_notebook_mode, iplot
from wordcloud import WordCloud
```

In [4]:
```
import nltk
from nltk.tokenize import word_tokenize, RegexpTokenizer
from nltk.stem import PorterStemmer
from nltk.stem import WordNetLemmatizer
nltk.download(['omw-1.4',
               'wordnet',
              'punkt',
              'vader_lexicon'])
from spacy.lang.en.stop_words import STOP_WORDS
from nltk.sentiment.vader import SentimentIntensityAnalyzer
from sklearn.feature_extraction.text import CountVectorizer, TfidfTransformer

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

```
[nltk_data] Downloading package omw-1.4 to C:\Users\Veronica
[nltk_data]     Jimoh\AppData\Roaming\nltk_data...
[nltk_data]   Package omw-1.4 is already up-to-date!
[nltk_data] Downloading package wordnet to C:\Users\Veronica
[nltk_data]     Jimoh\AppData\Roaming\nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
[nltk_data] Downloading package punkt to C:\Users\Veronica
[nltk_data]     Jimoh\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package vader_lexicon to C:\Users\Veronica
[nltk_data]     Jimoh\AppData\Roaming\nltk_data...
[nltk_data]   Package vader_lexicon is already up-to-date!
```

In [6]:
```
#Read our dataset into pandas Dataframe
#Note: Pandas was unable to read the cvs due to encoding error hence, why we set the enc
df = pd.read_csv('tourist_accommodation_reviews.csv', encoding = 'latin', skipinitialspa
```

In [7]:
```
df.head()
```

Out[7]:

	ID	Review Date	Location	Hotel/Restaurant name	Review
0	rn579778340	Reviewed 1 week ago	Kathu	Thong Dee The Kathu Brasserie	Just been for sunday roast lamb and beef truly...
1	rn576350875	Reviewed 3 weeks ago	Kathu	Thong Dee The Kathu Brasserie	Quietly set off the main road, nice atmosphere...
2	rn574921678	Reviewed 4 weeks ago	Kathu	Thong Dee The Kathu Brasserie	I made a reservation for a birthday two days i...
3	rn572905503	Reviewed April 12, 2018	Kathu	Thong Dee The Kathu Brasserie	We visit here regularly and never fail to be i...
4	rn572364712	Reviewed April 10, 2018	Kathu	Thong Dee The Kathu Brasserie	Visited this wonderful place on my travels and...

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

Out[8]:
```
(53644, 5)
```

In [9]:
```
frequentDF = df.groupby(['Location']).count().sort_values(by=['ID'], ascending =False)
frequentDF['Hotel/Restaurant name']
```

Out[9]:
```
Location
Patong              16403
Karon                5826
Kata Beach           5752
Rawai                3811
Choeng Thale         3378
Phuket Town          3356
Kamala               3162
Mai Khao             2372
Cape Panwa           1500
Chalong              1287
Thalang District     1177
Kathu                1078
Nai Yang              996
Nai Harn              881
Bang Tao Beach        600
Karon Beach           397
Wichit                395
Talat Yai             300
Koh Kaew              293
Kata Noi Beach        200
Pa Khlok              100
Ratsada                98
Talat Nuea             97
Nai Thon               94
Sakhu                  91
Name: Hotel/Restaurant name, dtype: int64
```

WE SELECT THE 30 PREFERRED HOTELS BY LOCATION

In [10]:
```
newDF = df[df['Location'] == 'Patong']
newDF
```

Out[10]:

	ID	Review Date	Location	Hotel/Restaurant name	Review
793	rn578272599	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	its very expensive in comparison to other loca...
794	rn576707124	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	We walked passed the holiday inn and decided a...
795	rn576151146	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	An atmosphere of the 70's, great comfort of th...
796	rn575977118	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	We made a reservation at the last minute to di...
797	rn574931000	Reviewed 4 weeks ago	Patong	Sam's Steaks and Grill	We had a very great time to celebrate my son b...
...	...	...	...	...	...
53639	rn162368197	Reviewed May 29, 2013	Patong	Bite in	I love this small restaurant, for the great fo...
53640	rn161843734	Reviewed May 25, 2013	Patong	Bite in	We stopped at this restaurant after shopping a...
53641	rn161734077	Reviewed May 24, 2013	Patong	Bite in	Great times ,This is one of the best restauran...
53642	rn161218072	Reviewed May 19, 2013	Patong	Bite in	Bite in, it has become my favorite restaurant ...
53643	rn161212765	Reviewed May 19, 2013	Patong	Bite in	The restaurant put in a good location in Jungc...

16403 rows × 5 columns

In [11]:

```
#We select 30 unique hotels for our choen location
UniqueDf = newDF.drop_duplicates(subset=['Hotel/Restaurant name'])['Hotel/Restaurant nam
                                        reset_index(name='Hotel/Restaurant').drop('index
UniqueDf
```

Out[11]:

	Hotel/Restaurant
0	Sam's Steaks and Grill
1	Highway Curry Indian & Thai Cuisine
2	Ao Chalong Yacht Club Restaurant
3	Naughty Nuri's Phuket
4	Natural Efe Macrobiotic World
5	Sizzle Rooftop Restaurant
6	Climax on Bangla
7	Le Brooklyn Patong
8	La Dolce Vita Restaurant
9	i-Kroon Cafe
10	Salute Italian Restaurant
11	Rustic - Eatery & Bar
12	Austrian Garden Restaurant
13	Trattoria Capri da Rico
14	Vista
15	The Blue Mango Bar and Grill
16	La Gritta
17	Sandwich Shoppe Cafe & Bar Patong Phuket
18	Halfway Inn (Restaurant)
19	ICC Indian Curry Club
20	Rosco's Restaurant & Sports Bar
21	BYD Lofts Restaurant Bistro & Bar
22	Home Dining Cafe & Lounge
23	Soul Curry Restaurant and Bar
24	Kantok Restaurant at Burasari Resort
25	Poo Nurntong Restaurant
26	EuroThai Restaurant
27	No 9 2nd Restaurant
28	Pizzeria Da Moreno
29	YamThai Restaurant

In [12]:
```
#We select every other hotels based on the uniquely selected 30
Hotel_DF = newDF[newDF['Hotel/Restaurant name'].isin(UniqueDf['Hotel/Restaurant'])]
Hotel_DF
```

Out[12]:

	ID	Review Date	Location	Hotel/Restaurant name	Review
793	rn578272599	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	its very expensive in comparison to other loca...
794	rn576707124	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	We walked passed the holiday inn and decided a...
795	rn576151146	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	An atmosphere of the 70's, great comfort of th...
796	rn575977118	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	We made a reservation at the last minute to di...
797	rn574931000	Reviewed 4 weeks ago	Patong	Sam's Steaks and Grill	We had a very great time to celebrate my son b...
...	...	...	...	...	...
11003	rn535287593	Reviewed October 23, 2017	Patong	YamThai Restaurant	Think about this restaurant YamThai when you w...
11004	rn535281383	Reviewed October 23, 2017	Patong	YamThai Restaurant	Me and my friend had very delicious food in th...
11005	rn535087530	Reviewed October 22, 2017	Patong	YamThai Restaurant	We wanted to try a few local dishes, so the Th...
11006	rn535084035	Reviewed October 22, 2017	Patong	YamThai Restaurant	The food is very very poor. The usual Thai fla...
11007	rn534774618	Reviewed October 21, 2017	Patong	YamThai Restaurant	Just across from the Horizon hotel you will fi...

2980 rows × 5 columns

EXPLORATORY DATA ANALYSIS

In [13]:
```
Hotel_DF.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2980 entries, 793 to 11007
Data columns (total 5 columns):
 #   Column                 Non-Null Count  Dtype 
---  ------                 --------------  ----- 
 0   ID                     2980 non-null   object
 1   Review Date            2980 non-null   object
 2   Location               2980 non-null   object
 3   Hotel/Restaurant name  2980 non-null   object
 4   Review                 2980 non-null   object
dtypes: object(5)
memory usage: 139.7+ KB
```

In [14]:
```
Hotel_DF.describe()
```

Out[14]:

	ID	Review Date	Location	Hotel/Restaurant name	Review
count	2980	2980	2980	2980	2980
unique	2930	719	1	30	2930
top	rn562370602	Reviewed 4 weeks ago	Patong	Sam's Steaks and Grill	Really lovely burger place with a variation of...
freq	4	68	2980	100	4

In [15]:
```
Hotel_DF.isnull().sum()
```

Out[15]:
```
ID                      0
Review Date             0
Location                0
Hotel/Restaurant name   0
Review                  0
dtype: int64
```

In [16]:
```
Hotel_DF['Hotel/Restaurant name'].value_counts().count()
```

Out[16]:
```
30
```

In [17]:
```
Hotel_DF['Hotel/Restaurant name'].count()
```

Out[17]:
```
2980
```

In [18]:
```
#We get the lenght of each reviews
Hotel_DF['Review_length'] = Hotel_DF['Review'].apply(len)
print(Hotel_DF.shape)
Hotel_DF.head()
```

```
(2980, 6)
```

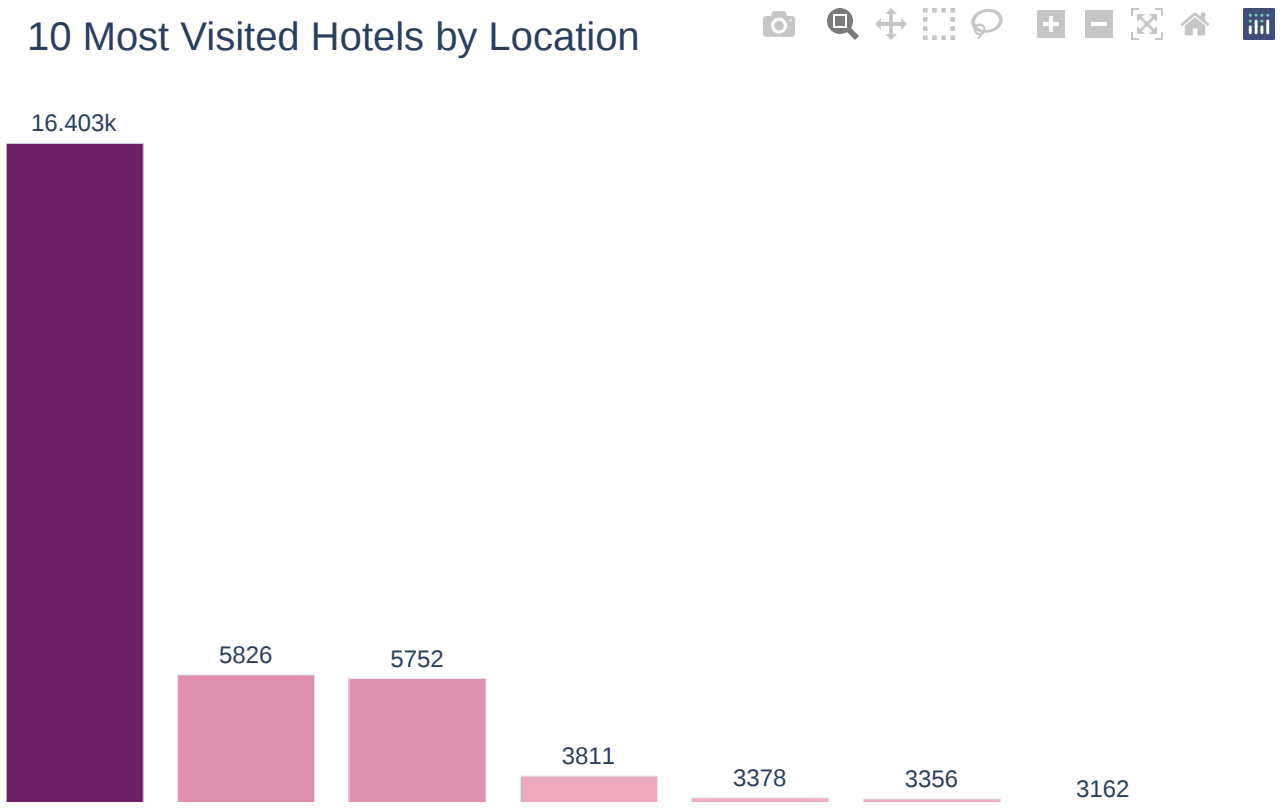
Out[18]:

	ID	Review Date	Location	Hotel/Restaurant name	Review	Review_length
793	rn578272599	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	its very expensive in comparison to other loca...	262
794	rn576707124	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	We walked passed the holiday inn and decided a...	234
795	rn576151146	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	An atmosphere of the 70's, great comfort of th...	294
796	rn575977118	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	We made a reservation at the last minute to di...	257
797	rn574931000	Reviewed 4 weeks ago	Patong	Sam's Steaks and Grill	We had a very great time to celebrate my son b...	165

In [19]:
```
Hotel_DF['Review_length'].describe()
```

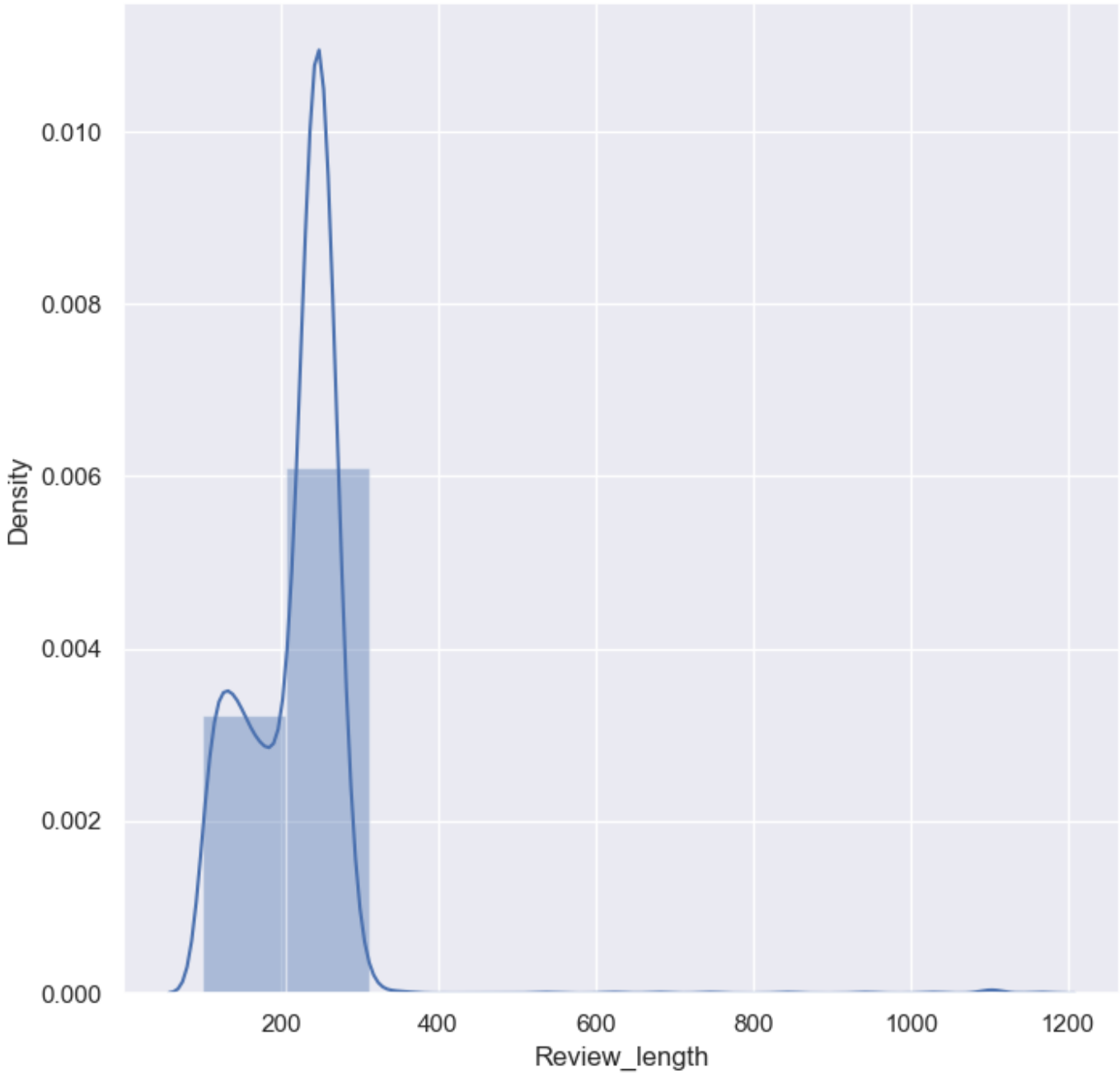
Out[19]:
```
count    2980.000000
mean      217.160403
std        69.907879
min       100.000000
25%       173.000000
50%       234.000000
75%       254.000000
max      1166.000000
Name: Review_length, dtype: float64
```

In [20]:
```
#Most frequent hotel/Restaurant bar plot
fig = px.bar(frequentDF['Hotel/Restaurant name'].head(10), title='10 Most Visited Hotels
fig.update_layout(margin=dict(t=50, b=0, l=0, r=0), titlefont=dict(size=20), xaxis_ticka
fig.update_yaxes(showticklabels=False, title=' ')
fig.update_xaxes(title=' ')
fig.update_traces(texttemplate='%{y}', textposition='outside', hovertemplate = '<b>%{x}<
fig.show()
```



In [21]:
```
#A distplot of the Review_lenght
sns.set(rc={'figure.figsize':(8,8)})
sns.distplot(Hotel_DF['Review_length'] ,hist=True, bins=10)
```

Out[21]:
```
<AxesSubplot:xlabel='Review_length', ylabel='Density'>
```



TEXT MINING (Text Preprocessing)

In [22]:
```
text_preprocessingDF = Hotel_DF.copy()
```

WE REMOVE ALL PUNCTUATION FROM THE REVIEWS

In [23]:
```
string.punctuation
```

Out[23]:
```
'!"#$%&\'()*+,-./:;<=>?@[\\]^_`{|}~'
```

In [24]:
```
def punctuation_removal(review_text):
    new_list = [char for char in review_text if char not in string.punctuation]
    new_text = ''.join(new_list)
    return new_text
```

In [25]:
```
text_preprocessingDF['Review'] = text_preprocessingDF['Review'].apply(punctuation_remova
text_preprocessingDF['Review'].head()
```

Out[25]:
```
793    its very expensive in comparison to other loca...
794    We walked passed the holiday inn and decided a...
795    An atmosphere of the 70s great comfort of the ...
796    We made a reservation at the last minute to di...
797    We had a very great time to celebrate my son b...
Name: Review, dtype: object
```

WE REMOVE ALL STOP_WORDS FROM THE REVIEWS

In [26]:
```
stop = STOP_WORDS
```

In [27]:
```
stop_words = []

for item in stop:
    new_item = punctuation_removal(item)
    stop_words.append(new_item)
print(stop_words)
```

```
['back', 'just', 'afterwards', 'nt', 'much', 'during', 'thru', 'formerly', 'i', 'me', 't
hence', 'had', 'last', 'here', 'could', 'elsewhere', 'nor', 'this', 'an', '‘ll', 'excep
t', 'not', 'yet', 'more', 'myself', 'us', 'hence', 'my', 'empty', 'neither', 'should',
'd', 'her', 'front', 'so', 'namely', 'would', 'over', 'least', '‘ve', 'without', 'but',
'was', 'they', 'two', 'him', 'wherein', 'in', 'its', 'together', 'whereafter', 'still',
'doing', 'has', 'nobody', 'ten', 'being', '‘d', 'your', 'thereafter', 'do', 'whether',
'whenever', 'some', 'hundred', 'perhaps', 'quite', 'somehow', 'thereupon', 'wherever',
'five', 'therefore', 'now', 'those', 'might', 'what', 'into', 'mine', 'both', 'any', 'sh
e', 'twelve', 'where', 'only', 'few', 'through', 'whence', 'whereby', 'down', 'forty',
'very', 'first', 'another', 're', 'something', 'does', 'or', 'own', 'who', 'indeed', 'al
ready', 'anything', 'been', 'off', 'nevertheless', 'six', 'nowhere', 'otherwise', 'ca',
'why', 'give', 'all', 'along', 'did', 'anywhere', 'though', 'amongst', 'meanwhile', 'mov
e', 'almost', 'up', '‘s', 'before', 'ourselves', 'next', 'regarding', 'anyway', 'most',
'then', 'by', 'too', 'say', 'whatever', 'really', 'will', 've', 'how', 'fifty', 'same',
'‘re', 're', 'out', 'even', 'became', 'if', 'sometimes', 'one', 'seem', 'serious', 'her
s', 'that', 'you', 'twenty', 'when', 'four', 'n’t', 'whereas', 'be', 'between', 'becom
e', 'sixty', 'whereupon', 'behind', 'always', 'thus', 'whose', 'everything', 'onto', 'fo
rmer', 'seeming', '’d', 'our', 'whoever', 'eleven', 'third', 'than', 'a', 'go', 'side',
'various', 'however', '‘m', 'since', 'which', 'ours', '’ll', 'less', 'put', 'from', 'you
rs', 'among', 'often', 'used', 'whom', 'anyone', 'please', 'make', 'bottom', 'because',
'although', 'either', 'anyhow', 'm', 'beside', 'again', '’m', 'keep', 'll', '’re', 'hav
e', 'on', 'seems', 'and', 'further', 'via', 'moreover', 'somewhere', 'fifteen', 'using',
'enough', 'mostly', 'top', 'upon', 'must', 'of', 'at', '’s', 'can', 'cannot', 'nothing',
'besides', 'with', 'am', 'per', 'throughout', 'many', 'amount', 'these', 'becoming', 'he
reupon', 'until', 'see', 'whither', 'well', 'hereafter', 'herein', 'against', 'whole',
'we', 'no', 's', 'as', 'are', 'itself', 'below', 'else', 'towards', 'while', 'is', 'towa
rd', 'about', 'he', 'beforehand', 'latterly', 'herself', 'n‘t', 'done', 'everywhere', 'n
oone', 'three', '’ve', 'beyond', 'their', 'each', 'other', 'hereby', 'after', 'get', 'ev
eryone', 'also', 'them', 'sometime', 'around', 'part', 'others', 'latter', 'under', 'see
med', 'alone', 'nine', 'yourselves', 'for', 'becomes', 'several', 'his', 'thereby', 't
o', 'may', 'none', 'ever', 'therein', 'show', 'rather', 'were', 'it', 'unless', 'full',
'yourself', 'the', 'such', 'himself', 'eight', 'name', 'every', 'made', 'someone', 'du
e', 'call', 'there', 'themselves', 'above', 'never', 'take', 'once', 'within', 'across']
```

In [28]:
```
def stopwords_removal(review_text):
    review_text = word_tokenize(review_text)
    return [word.lower() for word in review_text
            if word.lower() not in stop_words]
```

In [29]:
```
text_preprocessingDF['Review'] = text_preprocessingDF['Review'].apply(stopwords_removal)
text_preprocessingDF['Review'].head()
```

Out[29]:
```
793    [expensive, comparison, local, restaurants, th...
794    [walked, passed, holiday, inn, decided, minute...
795    [atmosphere, 70s, great, comfort, armchairs, e...
796    [reservation, minute, dine, sam s, staying, ho...
797    [great, time, celebrate, son, birthday, trip, ...
Name: Review, dtype: object
```

WE REMOVE ALL NUMBERS FROM THE REVIEWS

In [30]:
```
def numbers_removal(text):
    new_text = []
    for i in text:
        if not re.search('\d', i):
            new_text.append(i)
    return ' '.join(new_text)
```

In [31]:
```
text_preprocessingDF['Review'] = text_preprocessingDF['Review'].apply(numbers_removal)
text_preprocessingDF['Review'].head()
```

Out[31]:
```
793    expensive comparison local restaurants thats a...
794    walked passed holiday inn decided minute steak...
795    atmosphere great comfort armchairs efficient s...
796    reservation minute dine sam s staying hotel di...
797    great time celebrate son birthday trip phuket ...
Name: Review, dtype: object
```

WE REMOVE FREQUENT WORDS FROM THE REVIEWS

In [32]:
```
frequent_words = ['restaurants', 'restaurant', 'trip','phuket', 'hotel', 'thai', 'patong
                  'review', 'arrive']
```

In [33]:
```
text_preprocessingDF['Review'] = text_preprocessingDF['Review'].\
                                        apply(lambda x: " ".join([i for i in x.split
text_preprocessingDF['Review'].head()
```

Out[33]:
```
793    expensive comparison local thats apple orange ...
794    walked passed holiday inn decided minute steak...
795    atmosphere great comfort armchairs efficient s...
796    reservation minute dine sam s staying didn t f...
797    great time celebrate son birthday service grea...
Name: Review, dtype: object
```

In [34]:
```
#We perform split on the reviews so we can apply lemmatization
text_preprocessingDF['Review'] = text_preprocessingDF['Review'].apply(lambda x: x.split(
text_preprocessingDF['Review'].head()
```

Out[34]:
```
793    [expensive, comparison, local, thats, apple, o...
794    [walked, passed, holiday, inn, decided, minute...
795    [atmosphere, great, comfort, armchairs, effici...
796    [reservation, minute, dine, sam s, staying, di...
797    [great, time, celebrate, son, birthday, servic...
Name: Review, dtype: object
```

WE RETURN WORDS TO THEIR ROOT FORM

In [35]:
```
lemma = WordNetLemmatizer()
```

In [36]:
```
def lem_update(Review_text):
    new_list = []
    for word in Review_text:
        word = lemma.lemmatize(word, pos = 'n')
        word = lemma.lemmatize(word, pos = 'a')
        word = lemma.lemmatize(word, pos = 'v')
```

```
        new_list.append(word)
    return new_list
```

In [37]:
```
text_preprocessingDF['Review'] = text_preprocessingDF['Review'].apply(lem_update)
text_preprocessingDF['Review'].head()
```

Out[37]:
```
793    [expensive, comparison, local, thats, apple, o...
794    [walk, pass, holiday, inn, decide, minute, ste...
795    [atmosphere, great, comfort, armchair, efficie...
796    [reservation, minute, dine, sam□s, stay, didn□...
797    [great, time, celebrate, son, birthday, servic...
Name: Review, dtype: object
```

In [38]:
```
#We joined the splitted lemmatized words
text_preprocessingDF['Review'] = text_preprocessingDF['Review'].apply(lambda x: ' '.join
text_preprocessingDF['Review'].head()
```

Out[38]:
```
793    expensive comparison local thats apple orange ...
794    walk pass holiday inn decide minute steak dinn...
795    atmosphere great comfort armchair efficient sm...
796    reservation minute dine sam□s stay didn□t feel...
797    great time celebrate son birthday service grea...
Name: Review, dtype: object
```

SENTIMENT ANALYSIS

In [39]:
```
sentiment = SentimentIntensityAnalyzer()
```

In [40]:
```
#We get the sentiments polarity our of each reviews
text_preprocessingDF['compound'] =[sentiment.polarity_scores(review)['compound'] for rev
text_preprocessingDF['neg'] =[sentiment.polarity_scores(review)['neg'] for review in tex
text_preprocessingDF['neu'] =[sentiment.polarity_scores(review)['neu'] for review in tex
text_preprocessingDF['pos'] =[sentiment.polarity_scores(review)['pos'] for review in tex
```

In [41]:
```
text_preprocessingDF.head()
```

Out[41]:

	ID	Review Date	Location	Hotel/Restaurant name	Review	Review_length	compound	neg	neu	
793	rn578272599	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	expensive comparison local thats apple orange ...	262	0.7579	0.000	0.745	0.
794	rn576707124	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	walk pass holiday inn decide minute steak dinn...	234	0.7506	0.000	0.714	0.
795	rn576151146	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	atmosphere great comfort armchair efficient sm...	294	0.9818	0.000	0.341	0.
796	rn575977118	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	reservation minute dine sam□s stay didn□t feel...	257	0.9468	0.057	0.422	0.
797	rn574931000	Reviewed 4 weeks ago	Patong	Sam's Steaks and Grill	great time celebrate son birthday service grea...	165	0.9169	0.000	0.402	0.

In [42]:
```
text_preprocessingDF[['neu', 'neg', 'pos', 'compound']].describe()
```

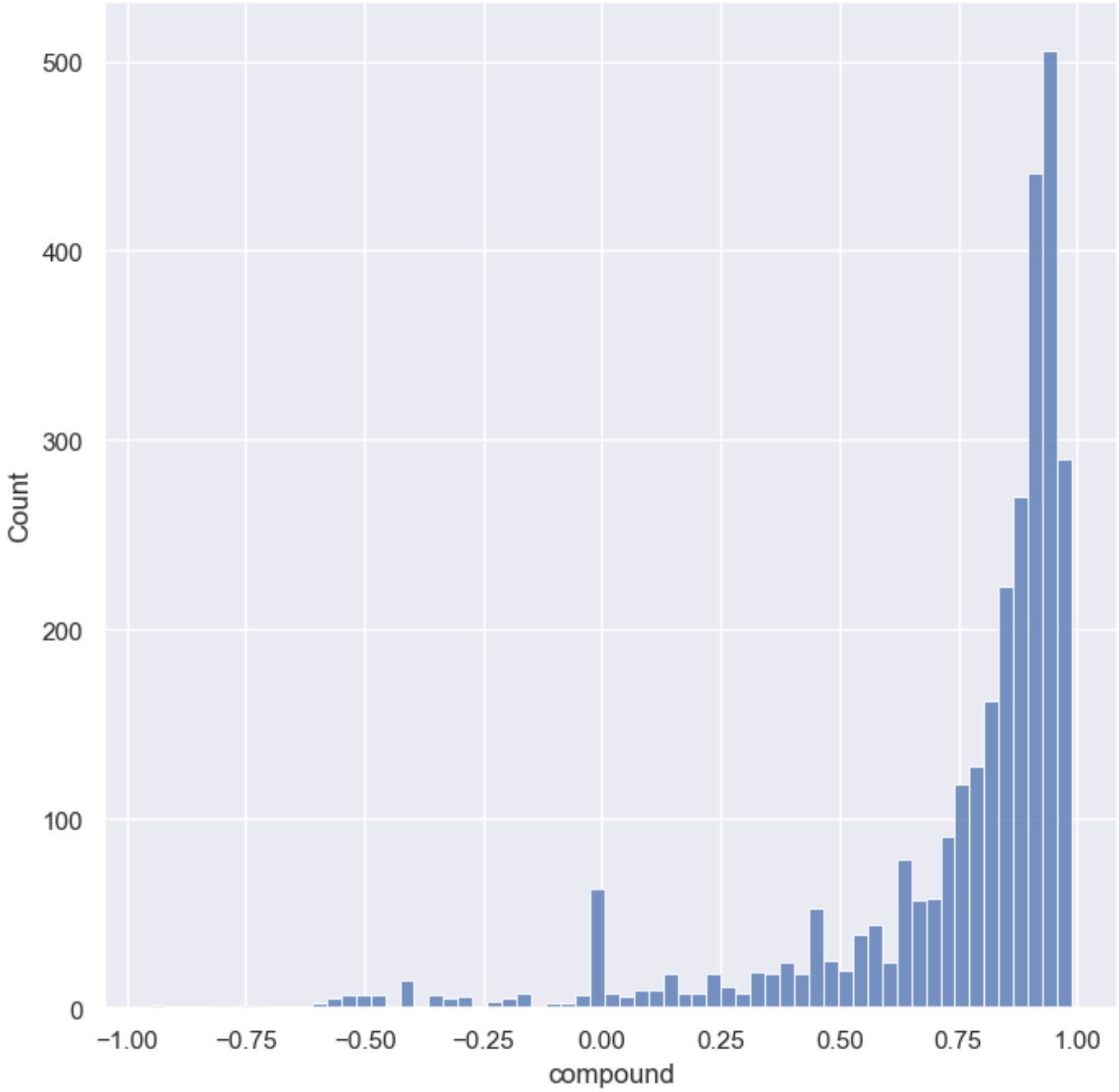
Out[42]:

	neu	neg	pos	compound
count	2980.000000	2980.000000	2980.000000	2980.000000
mean	0.547092	0.032428	0.420479	0.745894
std	0.164030	0.064113	0.176514	0.310946
min	0.163000	0.000000	0.000000	-0.949300
25%	0.429000	0.000000	0.305000	0.709600
50%	0.531000	0.000000	0.439000	0.868900
75%	0.655000	0.050250	0.549250	0.931300
max	1.000000	0.582000	0.837000	0.989100

VISUALIZATION OF POLARITY SCORES

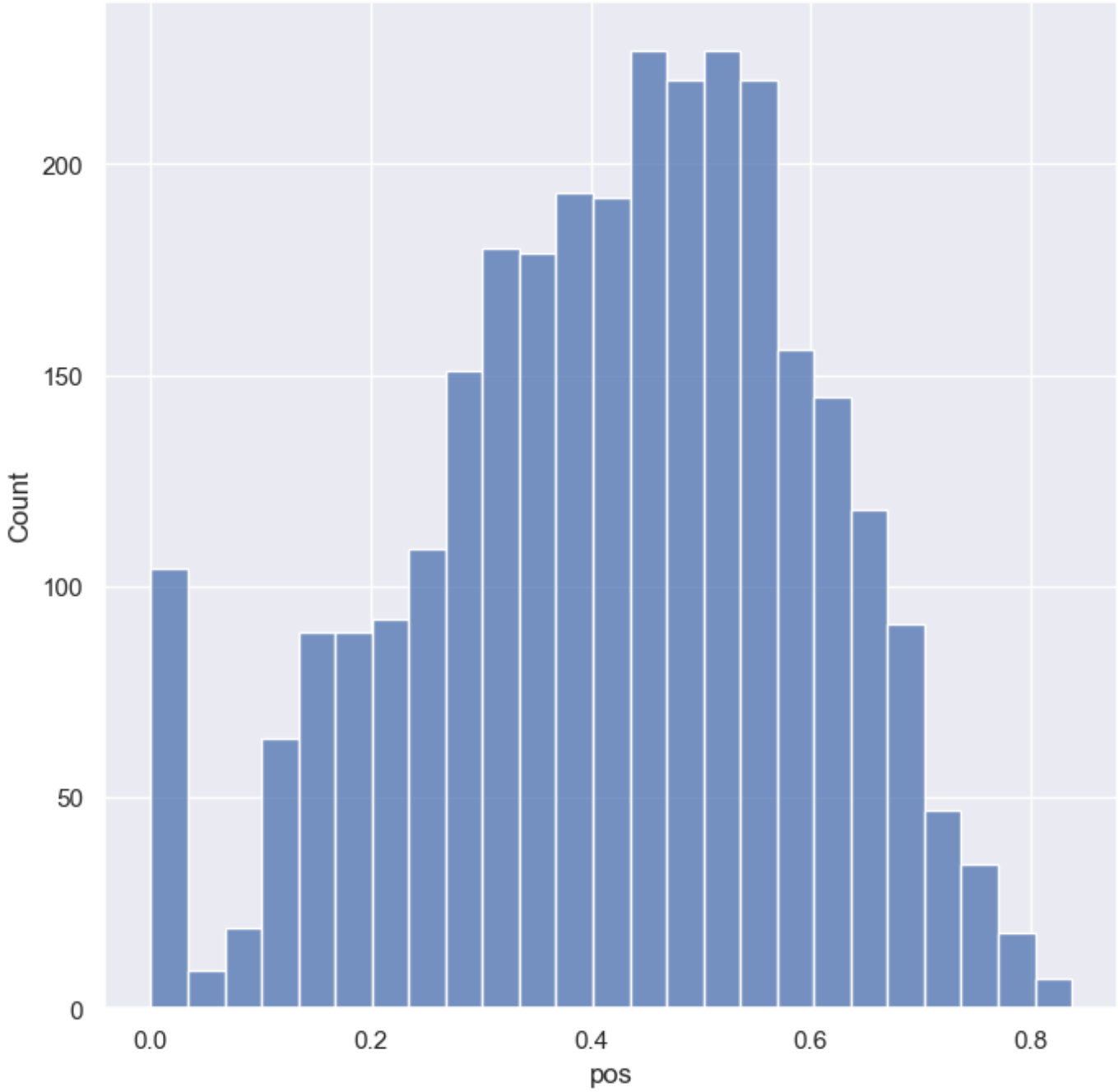
In [43]:
```
#Histogram plot for the compound score
sns.histplot(text_preprocessingDF['compound'])
```

Out[43]:
```
<AxesSubplot:xlabel='compound', ylabel='Count'>
```



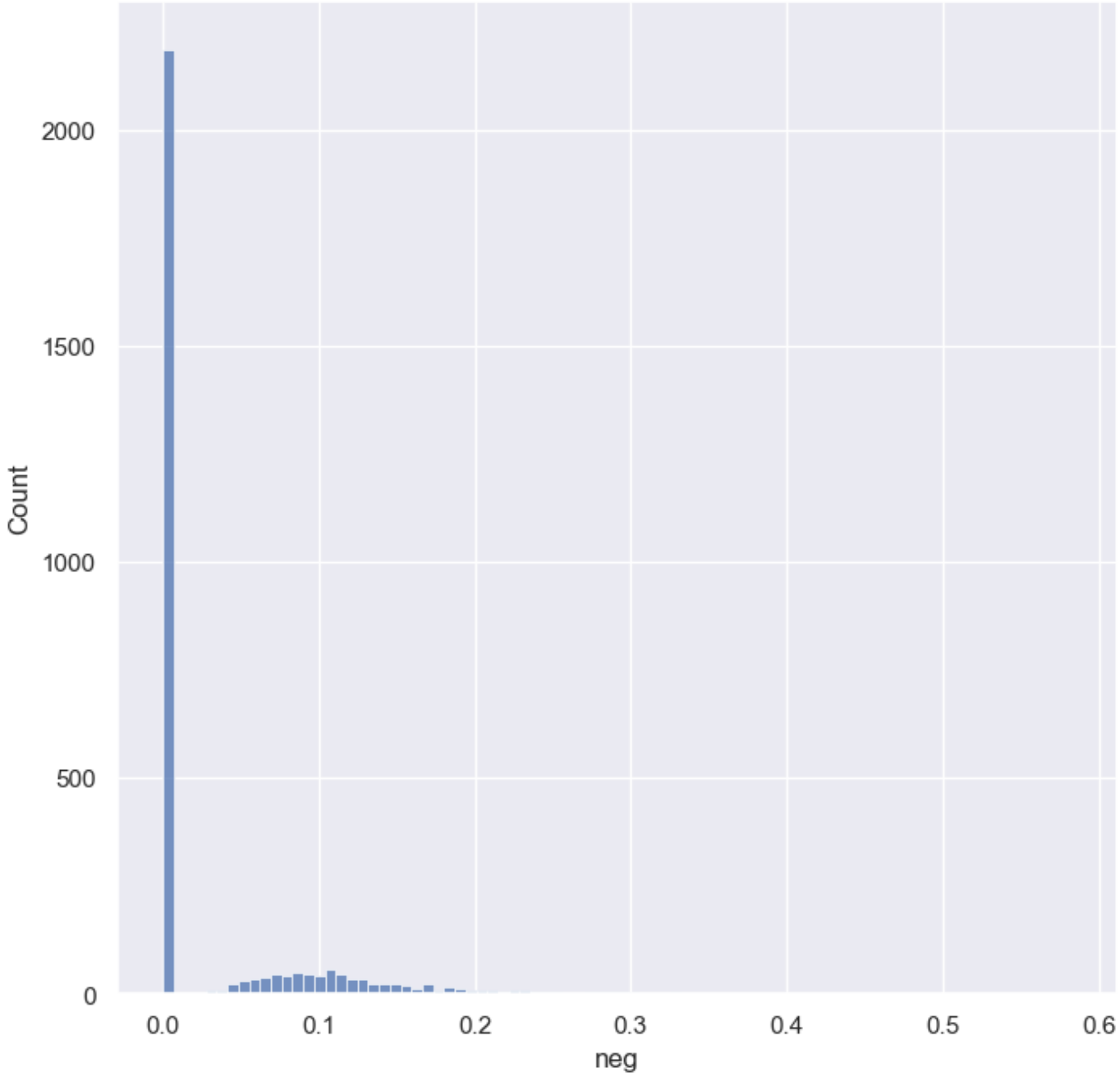
In [44]:
```
#Histogram plot for the positive score
sns.histplot(text_preprocessingDF['pos'])
```

Out[44]:
```
<AxesSubplot:xlabel='pos', ylabel='Count'>
```



In [45]:
```
#Histogram plot for the negative score
sns.histplot(text_preprocessingDF['neg'])
```

Out[45]:
```
<AxesSubplot:xlabel='neg', ylabel='Count'>
```



USING THE COMPOUND SCORE OF NEGATIVE <= 0 AND POSITIVE > 0

In [46]:
```
#We look how negative reviews we have per hotel
(text_preprocessingDF['compound']<=0).groupby(text_preprocessingDF['Hotel/Restaurant nam
```

Out[46]:
```
Hotel/Restaurant name
Ao Chalong Yacht Club Restaurant              3
Austrian Garden Restaurant                    5
BYD Lofts Restaurant Bistro & Bar             6
Climax on Bangla                              5
EuroThai Restaurant                           8
Halfway Inn (Restaurant)                      9
Highway Curry Indian & Thai Cuisine           4
Home Dining Cafe & Lounge                     6
ICC Indian Curry Club                        17
Kantok Restaurant at Burasari Resort          7
La Dolce Vita Restaurant                      2
La Gritta                                     6
Le Brooklyn Patong                            5
Natural Efe Macrobiotic World                 6
Naughty Nuri's Phuket                         6
No 9 2nd Restaurant                           5
Pizzeria Da Moreno                            8
Poo Nurntong Restaurant                       6
Rosco's Restaurant & Sports Bar               7
Rustic - Eatery & Bar                         2
Salute Italian Restaurant                     3
Sam's Steaks and Grill                        2
Sandwich Shoppe Cafe & Bar Patong Phuket      1
Sizzle Rooftop Restaurant                     6
Soul Curry Restaurant and Bar                 8
The Blue Mango Bar and Grill                  7
Trattoria Capri da Rico                       2
Vista                                         6
YamThai Restaurant                            6
i-Kroon Cafe                                  3
Name: compound, dtype: int64
```

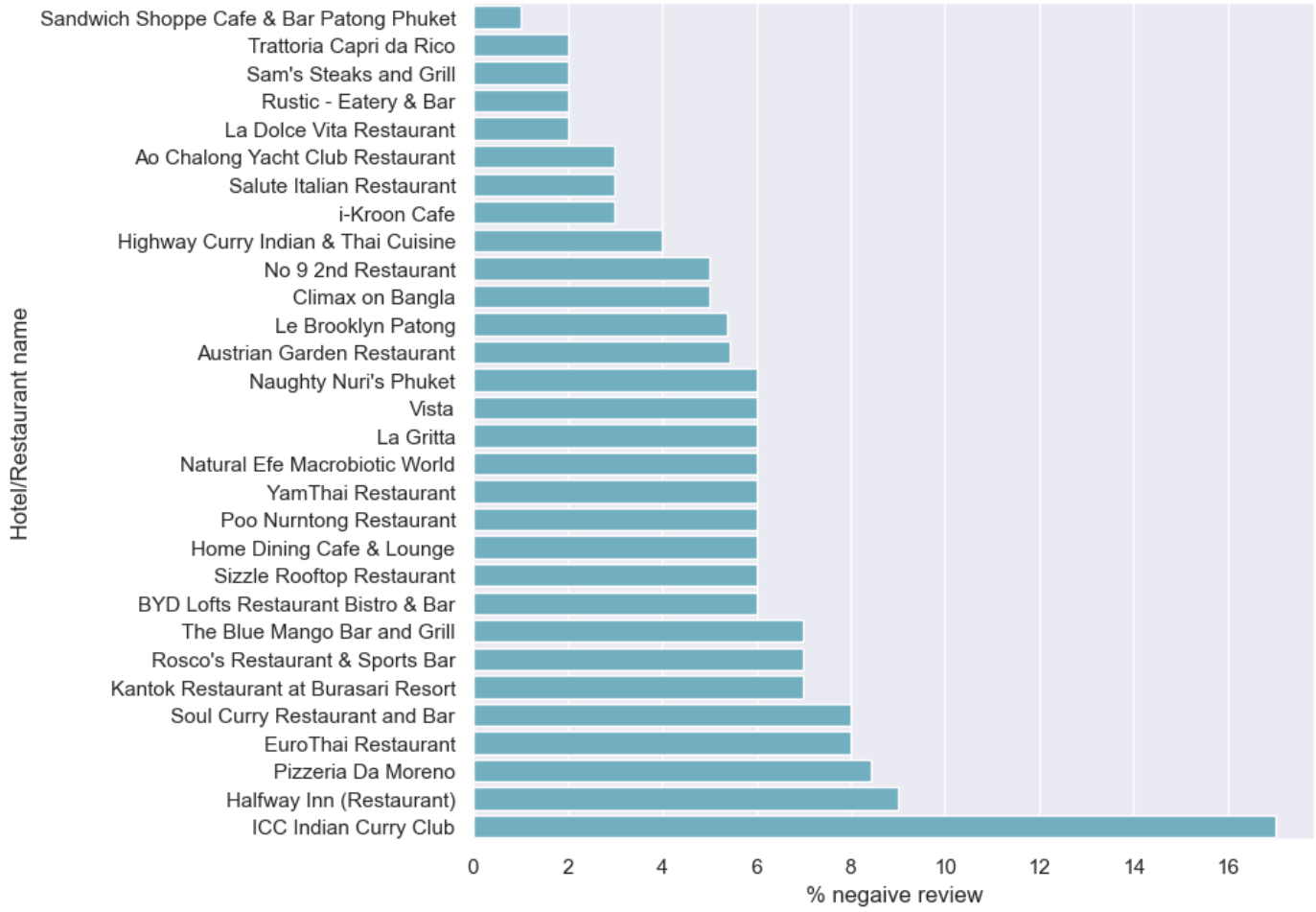
In [47]:
```
#Percetage of total reviews
percent_negative = pd.DataFrame((text_preprocessingDF['compound']<=0).groupby(text_prepr
                        /text_preprocessingDF['Hotel/Restaurant name'].\
                                groupby(text_preprocessingDF['Hotel/Restaurant name']).c
                       columns=['% negaive review']).sort_values(by = '% negaive review'
percent_negative
```

Out[47]:

Hotel/Restaurant name	% negaive review
Sandwich Shoppe Cafe & Bar Patong Phuket	1.000000
Trattoria Capri da Rico	2.000000
Sam's Steaks and Grill	2.000000
Rustic - Eatery & Bar	2.000000
La Dolce Vita Restaurant	2.000000
Ao Chalong Yacht Club Restaurant	3.000000
Salute Italian Restaurant	3.000000
i-Kroon Cafe	3.000000
Highway Curry Indian & Thai Cuisine	4.000000
No 9 2nd Restaurant	5.000000
Climax on Bangla	5.000000
Le Brooklyn Patong	5.376344
Austrian Garden Restaurant	5.434783
Naughty Nuri's Phuket	6.000000
Vista	6.000000
La Gritta	6.000000
Natural Efe Macrobiotic World	6.000000
YamThai Restaurant	6.000000
Poo Nurntong Restaurant	6.000000
Home Dining Cafe & Lounge	6.000000
Sizzle Rooftop Restaurant	6.000000
BYD Lofts Restaurant Bistro & Bar	6.000000
The Blue Mango Bar and Grill	7.000000
Rosco's Restaurant & Sports Bar	7.000000
Kantok Restaurant at Burasari Resort	7.000000
Soul Curry Restaurant and Bar	8.000000
EuroThai Restaurant	8.000000
Pizzeria Da Moreno	8.421053
Halfway Inn (Restaurant)	9.000000
ICC Indian Curry Club	17.000000

In [48]:
```
#A PLOT OF THE HOTELS WITH HIGHEST % OF NEGATIVE REVIEW
sns.barplot(data = percent_negative, x = '% negaive review', y= percent_negative.index,
```

Out[48]:
```
<AxesSubplot:xlabel='% negaive review', ylabel='Hotel/Restaurant name'>
```



In [49]:
```
#We look how positive reviews we have per hotel
(text_preprocessingDF['compound']>0).groupby(text_preprocessingDF['Hotel/Restaurant name
```

Out[49]:
```
Hotel/Restaurant name
Ao Chalong Yacht Club Restaurant             97
Austrian Garden Restaurant                   87
BYD Lofts Restaurant Bistro & Bar            94
Climax on Bangla                             95
EuroThai Restaurant                          92
Halfway Inn (Restaurant)                     91
Highway Curry Indian & Thai Cuisine          96
Home Dining Cafe & Lounge                    94
ICC Indian Curry Club                        83
Kantok Restaurant at Burasari Resort         93
La Dolce Vita Restaurant                     98
La Gritta                                    94
Le Brooklyn Patong                           88
Natural Efe Macrobiotic World                94
Naughty Nuri's Phuket                        94
No 9 2nd Restaurant                          95
Pizzeria Da Moreno                           87
Poo Nurntong Restaurant                      94
Rosco's Restaurant & Sports Bar              93
Rustic - Eatery & Bar                        98
Salute Italian Restaurant                    97
Sam's Steaks and Grill                       98
Sandwich Shoppe Cafe & Bar Patong Phuket     99
Sizzle Rooftop Restaurant                    94
Soul Curry Restaurant and Bar                92
The Blue Mango Bar and Grill                 93
Trattoria Capri da Rico                      98
Vista                                        94
YamThai Restaurant                           94
i-Kroon Cafe                                 97
Name: compound, dtype: int64
```

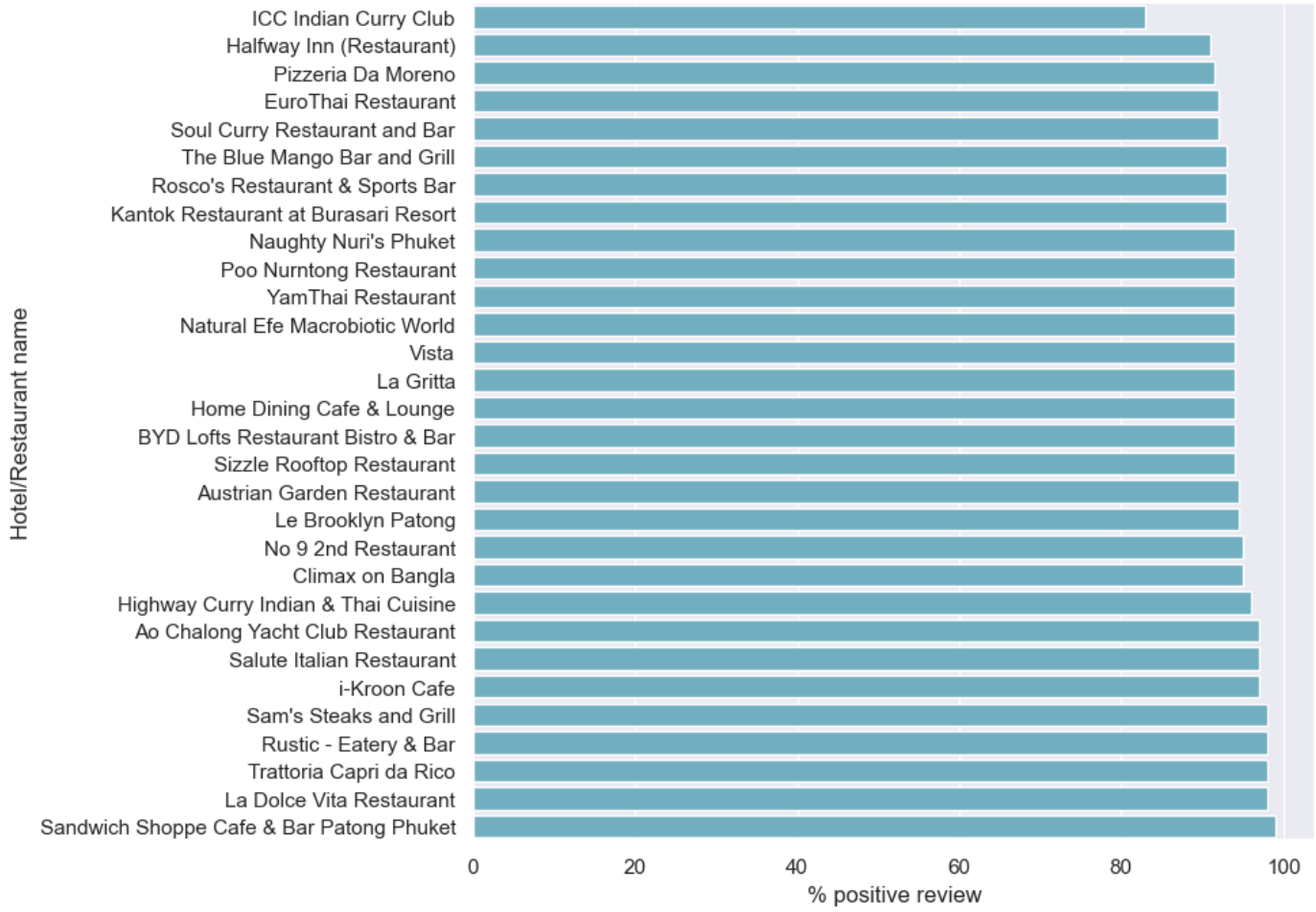
In [50]:
```
#Percetage of total reviews
percent_positive = pd.DataFrame((text_preprocessingDF['compound']>0).groupby(text_prepro
                        /text_preprocessingDF['Hotel/Restaurant name'].\
                                groupby(text_preprocessingDF['Hotel/Restaurant name']).c
                       columns=['% positive review']).sort_values(by = '% positive revie
percent_positive
```

Out[50]:

Hotel/Restaurant name	% positive review
ICC Indian Curry Club	83.000000
Halfway Inn (Restaurant)	91.000000
Pizzeria Da Moreno	91.578947
EuroThai Restaurant	92.000000
Soul Curry Restaurant and Bar	92.000000
The Blue Mango Bar and Grill	93.000000
Rosco's Restaurant & Sports Bar	93.000000
Kantok Restaurant at Burasari Resort	93.000000
Naughty Nuri's Phuket	94.000000
Poo Nurntong Restaurant	94.000000
YamThai Restaurant	94.000000
Natural Efe Macrobiotic World	94.000000
Vista	94.000000
La Gritta	94.000000
Home Dining Cafe & Lounge	94.000000
BYD Lofts Restaurant Bistro & Bar	94.000000
Sizzle Rooftop Restaurant	94.000000
Austrian Garden Restaurant	94.565217
Le Brooklyn Patong	94.623656
No 9 2nd Restaurant	95.000000
Climax on Bangla	95.000000
Highway Curry Indian & Thai Cuisine	96.000000
Ao Chalong Yacht Club Restaurant	97.000000
Salute Italian Restaurant	97.000000
i-Kroon Cafe	97.000000
Sam's Steaks and Grill	98.000000
Rustic - Eatery & Bar	98.000000
Trattoria Capri da Rico	98.000000
La Dolce Vita Restaurant	98.000000
Sandwich Shoppe Cafe & Bar Patong Phuket	99.000000

In [51]:
```
#A PLOT OF THE HOTELS WITH HIGHEST % OF POSITIVE REVIEW
sns.barplot(data = percent_positive, x = '% positive review', y= percent_positive.index,
```

Out[51]:
```
<AxesSubplot:xlabel='% positive review', ylabel='Hotel/Restaurant name'>
```



A QUICK FOCUS ON ONE OF THE HOTEL WITH HIGHEST NEGATIVE & POSITIVE REVIEW.

In [52]:
```
Review_negative_subset = text_preprocessingDF.loc[(text_preprocessingDF['Hotel/Restauran
                                                   & (text_preprocessingDF['compound']<=0)

Review_positive_subset = text_preprocessingDF.loc[(text_preprocessingDF['Hotel/Restauran
                                                   & (text_preprocessingDF['compound']>0),
```

In [53]:
```
#WORDCLOUD FOR HOTEL/RESTAURANT WITH HIGHEST PERCENTAGE OF POSITIVE REVIEW
Review_positive = []

for review in Review_positive_subset.Review:
    Review_positive.append(review)
Review_positive = ' '.join(Review_positive)
Review_positive[:]

wordcloud = WordCloud(background_color="white",\
                      max_font_size=40, relative_scaling=.5, colormap='viridis').generat
plt.figure(figsize=(13,13))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```

In [54]:
```
#WORDCLOUD FOR HOTEL/RESTAURANT WITH HIGHEST PERCENTAGE OF NEGATIVE REVIEW
Review_negative = []

for review in Review_negative_subset.Review:
    Review_negative.append(review)
Review_negative = ' '.join(Review_negative)
Review_negative[:]

wordcloud = WordCloud(background_color="black",\
                      max_font_size=40, relative_scaling=.5, colormap='RdBu').generate(R
plt.figure(figsize=(13,13))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```

WE SET COMPOUND > 0.05 AS POSITIVE,
COMPOUND =< 0.05 AND > -0.05 AS NEUTRAL

AND COMPOUND <= -0.05 AS NEGATIVE. THIS ALLOWS US TO ACCOMMODATE NEUTRAL REVIEWS

In [55]:
```
def review(x):
    if x['compound'] > 0.05:
        return 'Positive'
    elif x['compound'] <= -0.05:
        return 'Negative'
    else:
        return 'Neutral'
```

In [56]:
```
text_preprocessingDF['Sentiment_reviews'] = text_preprocessingDF[['compound']].apply(rev
text_preprocessingDF.head()
```

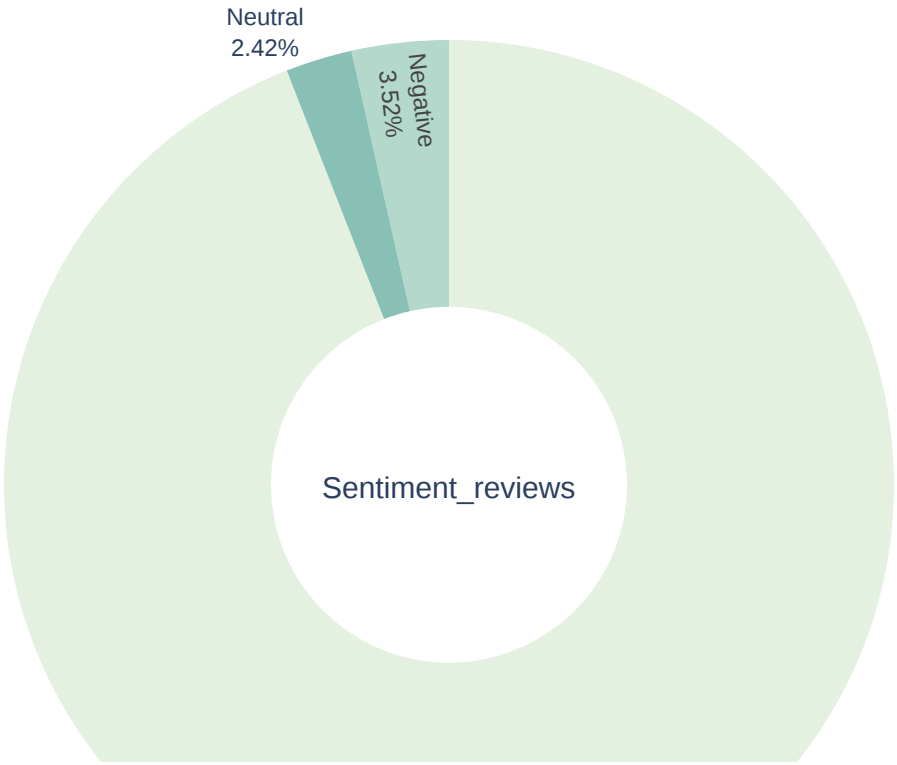
Out[56]:

	ID	Review Date	Location	Hotel/Restaurant name	Review	Review_length	compound	neg	neu	
793	rn578272599	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	expensive comparison local thats apple orange ...	262	0.7579	0.000	0.745	0.
794	rn576707124	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	walk pass holiday inn decide minute steak dinn...	234	0.7506	0.000	0.714	0.
795	rn576151146	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	atmosphere great comfort armchair efficient sm...	294	0.9818	0.000	0.341	0.
796	rn575977118	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	reservation minute dine sam□s stay didn□t feel...	257	0.9468	0.057	0.422	0.
797	rn574931000	Reviewed 4 weeks ago	Patong	Sam's Steaks and Grill	great time celebrate son birthday service grea...	165	0.9169	0.000	0.402	0.

In [57]:
```
#Value count of each Sentiment Polarity
text_preprocessingDF['Sentiment_reviews'].value_counts()
```

Out[57]:
```
Positive    2803
Negative     105
Neutral       72
Name: Sentiment_reviews, dtype: int64
```

In [58]:
```
#Visualization of the Sentiment Polarity
fig = go.Figure(data=[go.Pie(labels=['Positive','Negative', 'Neutral'],
                 values=text_preprocessingDF['Sentiment_reviews'].value_counts(), title="
fig.update_layout(margin=dict(t=40, b=40, l=0, r=0), font=dict(size=12), showlegend=True
fig.show()
```



WE CREATE A DATAFRAME FOR ALL THE CLASSIFICATION

In [59]:
```
#Dataframe of positive reviews
positive_df = text_preprocessingDF[['ID','Review Date', 'Location', 'Hotel/Restaurant na
                                    'compound',
                                   'pos', 'Sentiment_reviews']][text_preprocessingDF.Sen
positive_df['% of Positive'] = positive_df['compound']*100
positive_df.head()
```

Out[59]:

	ID	Review Date	Location	Hotel/Restaurant name	Review	Review_length	compound	pos	Sentimen
793	rn578272599	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	expensive comparison local thats apple orange ...	262	0.7579	0.255	
794	rn576707124	Reviewed 2 weeks ago	Patong	Sam's Steaks and Grill	walk pass holiday inn decide minute steak dinn...	234	0.7506	0.286	
795	rn576151146	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	atmosphere great comfort armchair efficient sm...	294	0.9818	0.659	
796	rn575977118	Reviewed 3 weeks ago	Patong	Sam's Steaks and Grill	reservation minute dine sam□s stay didn□t feel...	257	0.9468	0.521	
797	rn574931000	Reviewed 4 weeks ago	Patong	Sam's Steaks and Grill	great time celebrate son birthday service grea...	165	0.9169	0.598	

In [60]:

```
#Dataframe of neutral reviews
nuetral_df = text_preprocessingDF[['ID','Review Date', 'Location', 'Hotel/Restaurant nam
                                   'compound',
                                  'neu', 'Sentiment_reviews']][text_preprocessingDF.Sen
nuetral_df['% of Neutral'] = nuetral_df['compound']*100
nuetral_df.head()
```

Out[60]:

	ID	Review Date	Location	Hotel/Restaurant name	Review	Review_length	compound	neu	Sentim
854	rn548453193	Reviewed December 21, 2017	Patong	Sam's Steaks and Grill	fancy escape couple hour place come walk trans...	239	0.0258	0.784	
1395	rn577855512	Reviewed 2 weeks ago	Patong	Highway Curry Indian & Thai Cuisine	food twice stay food authentic food taste serv...	125	0.0000	1.000	
1486	rn536763794	Reviewed October 28, 2017	Patong	Highway Curry Indian & Thai Cuisine	tasty authentic taste shahi paneer dal makhni ...	135	0.0000	1.000	
2112	rn550805054	Reviewed January 1, 2018	Patong	Ao Chalong Yacht Club Restaurant	try even recomended	123	0.0000	1.000	
2157	rn399542444	Reviewed July 31, 2016	Patong	Ao Chalong Yacht Club Restaurant	couldnt handle amaze crispy pork meat cook cri...	263	-0.0147	0.713	

In [61]:

```
#Dataframe for negative reviews
negative_df = text_preprocessingDF[['ID','Review Date', 'Location', 'Hotel/Restaurant na
                                    'compound',
                                   'neg', 'Sentiment_reviews']][text_preprocessingDF.Sen
negative_df['% of Negative'] = negative_df['compound']*100
negative_df.head()
```

Out[61]:

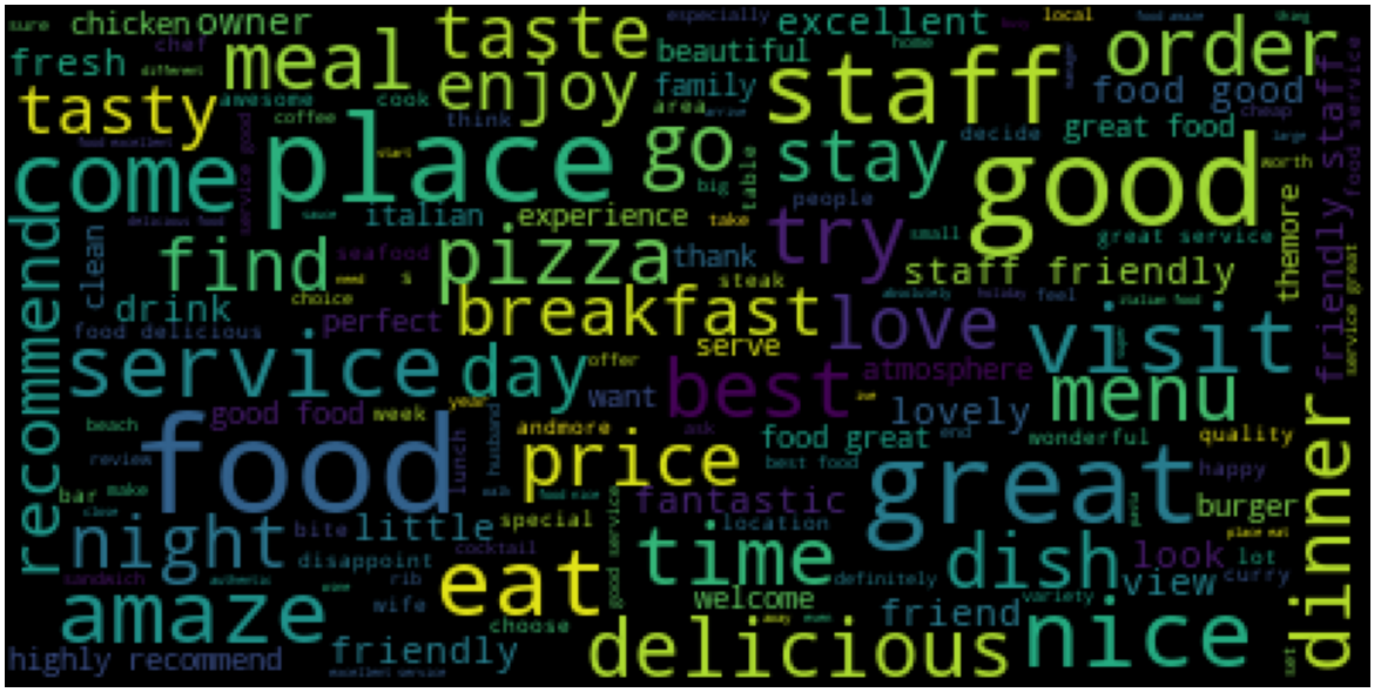
	ID	Review Date	Location	Hotel/Restaurant name	Review	Review_length	compound	neg	Sentimer
848	rn552126319	Reviewed January 6, 2018	Patong	Sam's Steaks and Grill	return sam□s year have eat numerous time previ...	260	-0.2960	0.126	
877	rn536593727	Reviewed October 28, 2017	Patong	Sam's Steaks and Grill	go dinner walk andall table take busy decide w...	252	-0.4215	0.135	
1401	rn575325214	Reviewed 3 weeks ago	Patong	Highway Curry Indian & Thai Cuisine	eat opposite ikon patal road high rate place n...	239	-0.4717	0.170	
1446	rn553674899	Reviewed January 13, 2018	Patong	Highway Curry Indian & Thai Cuisine	karon hard find vegetarian food menu apperentl...	252	-0.2023	0.157	
2203	rn580013520	Reviewed 1 week ago	Patong	Naughty Nuri's Phuket	openning hour clear indicate close day ago wal...	256	-0.2263	0.174	

WORD CLOUD PLOT OF ALL THE SENTIMENT REVIEWS

In [62]:

```
#Positve reviews
positive_words =[]
for review in positive_df.Review:
    positive_words.append(review)
positive_words = ' '.join(positive_words)

wordcloud = WordCloud(background_color="black",max_words=len(positive_words),\
                      max_font_size=40, relative_scaling=.5, colormap='viridis').generat
plt.figure(figsize=(15,15))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```



In [63]:
```
#Negative reivews
negative_words = []

for review in negative_df.Review:
    negative_words.append(review)
negative_words = ' '.join(negative_words)

wordcloud = WordCloud(background_color="black",max_words=len(negative_words),\
                      max_font_size=40, relative_scaling=.5, colormap='RdBu').generate(n
plt.figure(figsize=(13,13))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```

In [64]:
```
#Neutral reviews
neutral_words = []

for review in nuetral_df.Review:
    words.append(review)
```

```
neutral_words = ' '.join(neutral_words)

wordcloud = WordCloud(background_color="black",max_words=len(neutral_words),\
                      max_font_size=40, relative_scaling=.5, colormap='summer').generate
plt.figure(figsize=(13,13))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```

PREPROCESSING FOR MODELING

In [65]:
```
model_df = text_preprocessingDF[['Review', 'Sentiment_reviews']]
```

In [66]:
```
model_df
```

Out[66]:

	Review	Sentiment_reviews
793	expensive comparison local thats apple orange ...	Positive
794	walk pass holiday inn decide minute steak dinn...	Positive
795	atmosphere great comfort armchair efficient sm...	Positive
796	reservation minute dine sam□s stay didn□t feel...	Positive
797	great time celebrate son birthday service grea...	Positive
...	...	...
11003	think yamthai want eat seafood good service ch...	Positive
11004	friend delicious food specially food real tast...	Positive
11005	want try local dish food good order prawn dish...	Positive
11006	food poor usual flavour present ask spicy come...	Positive
11007	horizon find little gem great value money amaz...	Positive

2980 rows × 2 columns

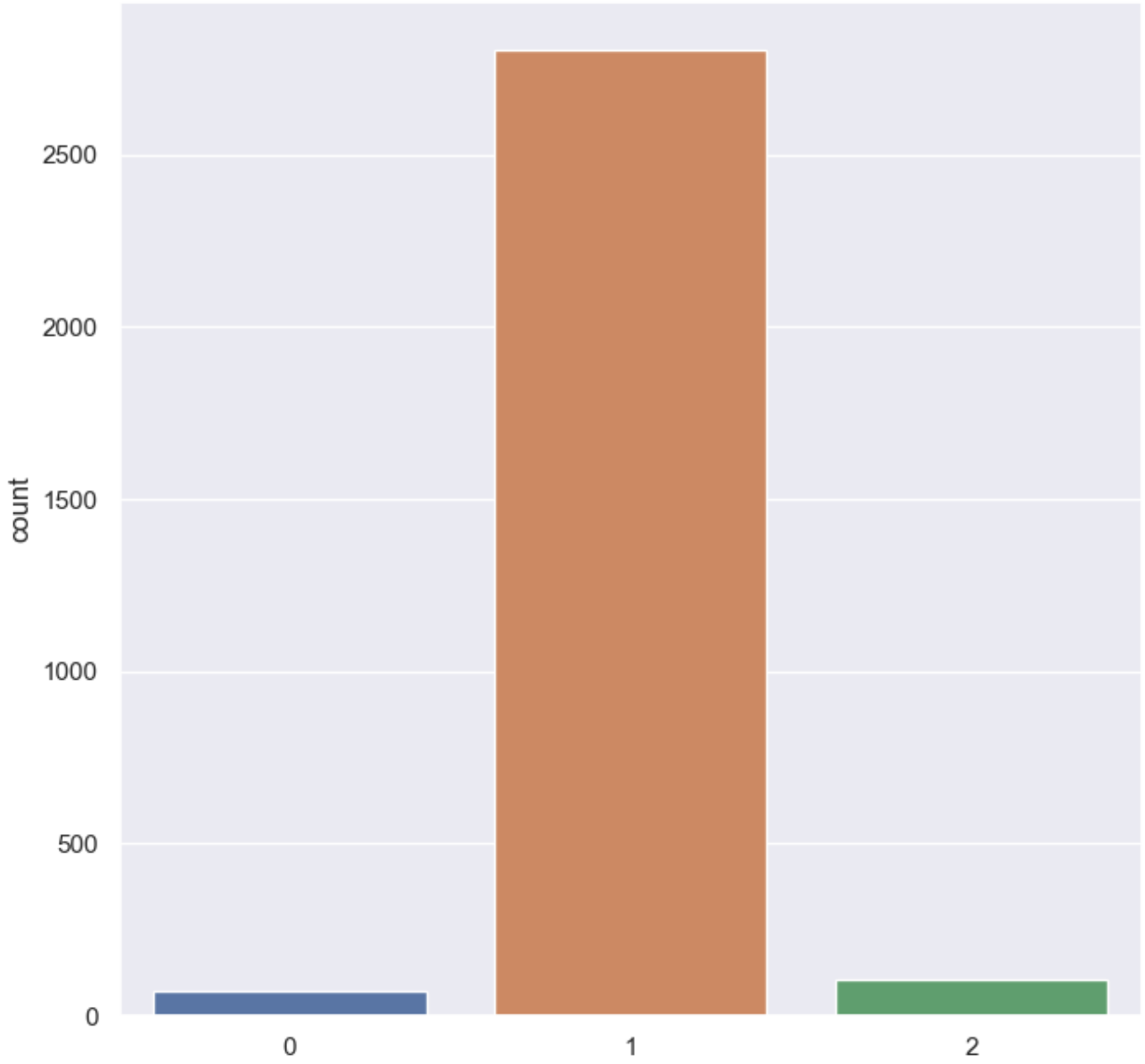
In [67]:
```
#CONVERSION OF SENTIMENT REVIEW TO BINARY NUMBERS
def binarization(x):
    if x['Sentiment_reviews'] == 'Positive':
        return 1
    elif x['Sentiment_reviews'] == 'Negative':
        return 2
    else:
        return 0
y = model_df[['Sentiment_reviews']].apply(binarization, axis=1)
```

In [68]:
```
y.value_counts()
```

Out[68]:
```
1    2803
2     105
0      72
dtype: int64
```

In [69]:
```
#LABEL COUNT PLOT
sns.countplot(y)
```

Out[69]:
```
<AxesSubplot:ylabel='count'>
```



VECTORIZATION (USING BAG OF WORDS)

In [70]:
```
vectorizer = CountVectorizer()
```

In [71]:
```
bow_transformer = vectorizer.fit(model_df['Review'])
```

In [72]:
```
print(len(bow_transformer.vocabulary_))
```

```
5519
```

WE TAKE A SAMPLE TEXT REVIEW FROM OUT PREPROCESSED DATA

In [73]:
```
Sample_random_text = text_preprocessingDF['Review'][797]
Sample_random_text
```

Out[73]:
```
'great time celebrate son birthday service great definately come visit futuremore'
```

In [74]:
```
#WE TRANSFORM THE SAMPLE TEXT REVIEW
sample_bow = bow_transformer.transform([Sample_random_text])
print(sample_bow)
```

```
  (0, 516)      1
  (0, 771)      1
  (0, 975)      1
  (0, 1257)     1
  (0, 2005)     1
  (0, 2127)     2
  (0, 4309)     1
  (0, 4484)     1
  (0, 4955)     1
  (0, 5248)     1
```

In [75]:
```
#WE APPLY THE COUNTER VECTORIZER ON OUR MODEL_DF
vectorized = bow_transformer.transform(model_df['Review'])
print(vectorized)
```

```
  (0, 221)      1
  (0, 321)      1
  (0, 413)      1
  (0, 1003)     2
  (0, 1363)     1
  (0, 1543)     1
  (0, 1682)     1
  (0, 1704)     1
  (0, 1870)     1
  (0, 2127)     1
  (0, 2452)     1
  (0, 2800)     1
  (0, 3343)     1
  (0, 3839)     1
  (0, 4065)     1
  (0, 4309)     1
  (0, 4620)     1
  (0, 4882)     1
  (0, 5104)     1
  (0, 5175)     1
  (1, 1239)     1
  (1, 1362)     1
  (1, 1647)     1
  (1, 1658)     1
  (1, 1870)     1
  :     :
  (2978, 1988)  1
  (2978, 2313)  1
  (2978, 2649)  1
  (2978, 2772)  1
  (2978, 2915)  1
  (2978, 3034)  1
  (2978, 3626)  1
  (2978, 3682)  1
  (2978, 3696)  1
  (2978, 3739)  1
  (2978, 4550)  2
  (2978, 4636)  1
  (2978, 4767)  1
  (2978, 4814)  1
  (2978, 5167)  1
  (2979, 149)   1
  (2979, 1810)  1
  (2979, 1870)  1
  (2979, 2030)  1
  (2979, 2127)  2
  (2979, 2334)  1
  (2979, 2791)  1
  (2979, 3072)  1
  (2979, 4309)  1
  (2979, 5175)  1
```

In [76]:
```
vectorized.shape
```

Out[76]:
```
(2980, 5519)
```

TERM FREQUENCY - INVERSE DOCUMENT FREQUENCY

In [77]:
```
tf_transformer = TfidfTransformer()
```

In [78]:
```
tf_transformed = tf_transformer.fit_transform(vectorized)
print(tf_transformed)
```

```
  (0, 5175)     0.17327984336092728
  (0, 5104)     0.22169554690615248
  (0, 4882)     0.21454212663445157
  (0, 4620)     0.15824440853653873
  (0, 4309)     0.07985456988040006
  (0, 4065)     0.2722125831350767
  (0, 3839)     0.14031138507483326
  (0, 3343)     0.23842186204967644
  (0, 2800)     0.16958510873437865
  (0, 2452)     0.18960227139495492
  (0, 2127)     0.08212984309261212
  (0, 1870)     0.055164181160793066
  (0, 1704)     0.20057337688940205
  (0, 1682)     0.16787643579300432
  (0, 1543)     0.2861813328801262
  (0, 1363)     0.23842186204967644
  (0, 1003)     0.5092280794725275
  (0, 413)      0.18757514698089886
  (0, 321)      0.23436409797480232
  (0, 221)      0.2483328477198518
  (1, 5284)     0.19258099679644927
  (1, 4920)     0.19757490403674297
  (1, 4620)     0.39409705454663063
  (1, 4406)     0.3563576792296103
  (1, 3750)     0.13183292128433027
  :     :
  (2978, 3696)  0.18806095964135633
  (2978, 3682)  0.22456167212346367
  (2978, 3626)  0.26569268598033013
  (2978, 3034)  0.27573180289334787
  (2978, 2915)  0.2579057419384667
  (2978, 2772)  0.1222372979355221
  (2978, 2649)  0.19537948634566474
  (2978, 2313)  0.27573180289334787
  (2978, 1988)  0.15233346714573995
  (2978, 1870)  0.11175470987726528
  (2978, 1839)  0.18046315735079288
  (2978, 975)   0.10446849141134294
  (2978, 418)   0.2579057419384667
  (2978, 416)   0.24150422847839023
  (2978, 261)   0.16248570107088237
  (2979, 5175)  0.34034113974289476
  (2979, 4309)  0.1568433742761698
  (2979, 3072)  0.37038019746165085
  (2979, 2791)  0.2606845607629031
  (2979, 2334)  0.5620923883379121
  (2979, 2127)  0.32262453454349826
  (2979, 2030)  0.34704622394761425
  (2979, 1870)  0.10834866840306316
  (2979, 1810)  0.23842454202702887
  (2979, 149)   0.21299979482068412
```

In [79]:
```
[i for i in bow_transformer.vocabulary_.items()][2:100:10]
```

Out[79]:
```
[('local', 2800),
 ('value', 5175),
 ('holiday', 2311),
 ('think', 4920),
 ('origin', 3357),
 ('pancake', 3450),
 ('like', 2772),
 ('celebrate', 771),
 ('book', 564),
 ('warm', 5298)]
```