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twitter-classification-using-logistic-regrition

**introduction : Analyze and visualize sentiment patterns in social media data to understand public opinion and attitudes towards specific topics or brands.

Importing libraries

In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import re
import nltk

from sklearn.feature_extraction.text import CountVectorizer #Data transformation
from sklearn.model_selection import train_test_split #Data testing
from sklearn.linear_model import LogisticRegression #Prediction Model
from sklearn.metrics import accuracy_score #Comparison between real and predicted

from wordcloud import WordCloud #Word visualization
from nltk import word_tokenize
nltk.download('stopwords')

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

```
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\bios\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

Data Gatehering

In [2]:

```
data=pd.read_csv('twitter_training.csv',sep = ',', names=['id','country','Label','Text'])
validation=pd.read_csv('twitter_validation.csv',sep = ',', names=['id','Company','Label','Text'])
```

In [3]:

```
#show data:
data.head()
```

Out[3]:

	id	country	Label	Text
0	2401	Borderlands	Positive	im getting on borderlands and i will murder yo...
1	2401	Borderlands	Positive	I am coming to the borders and I will kill you...
2	2401	Borderlands	Positive	im getting on borderlands and i will kill you ...
3	2401	Borderlands	Positive	im coming on borderlands and i will murder you...
4	2401	Borderlands	Positive	im getting on borderlands 2 and i will murder ...

In [4]:

```
# show validation:
validation.head()
```

Out[4]:

	id	Company	Label	Text
0	3364	Facebook	Irrelevant	I mentioned on Facebook that I was struggling ...
1	352	Amazon	Neutral	BBC News - Amazon boss Jeff Bezos rejects clai...
2	8312	Microsoft	Negative	@Microsoft Why do I pay for WORD when it funct...
3	4371	CS-GO	Negative	CSGO matchmaking is so full of closet hacking,...
4	4433	Google	Neutral	Now the President is slapping Americans in the...

In [5]:

```
# drop ID column from data , validaion :

data=data.drop("id", axis='columns')

validation=validation.drop("id", axis='columns')
```

In [6]:

```
data.info()
print('\n','*'*60,'\n')
validation.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 74682 entries, 0 to 74681
Data columns (total 3 columns):
 #   Column   Non-Null Count  Dtype 
---  ------   --------------  ----- 
 0   country  74682 non-null  object
 1   Label    74682 non-null  object
 2   Text     73996 non-null  object
dtypes: object(3)
memory usage: 1.7+ MB

 ************************************************************ 

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 3 columns):
 #   Column   Non-Null Count  Dtype 
---  ------   --------------  ----- 
 0   Company  1000 non-null   object
 1   Label    1000 non-null   object
 2   Text     1000 non-null   object
dtypes: object(3)
memory usage: 23.6+ KB
```

In [7]:

```
#show null values in data , validation datasets :
print(data.isnull().sum())
print('\n','*'*60,'\n')
print(validation.isnull().sum())
```

```
country      0
Label        0
Text       686
dtype: int64

 ************************************************************ 

Company    0
Label      0
Text       0
dtype: int64
```

In [8]:

```
#show unique values:
print(data['country'].unique())
print('\n','*'*60,'\n')
validation['Company'].unique()
```

```
['Borderlands' 'CallOfDutyBlackopsColdWar' 'Amazon' 'Overwatch'
 'Xbox(Xseries)' 'NBA2K' 'Dota2' 'PlayStation5(PS5)' 'WorldOfCraft'
 'CS-GO' 'Google' 'AssassinsCreed' 'ApexLegends' 'LeagueOfLegends'
 'Fortnite' 'Microsoft' 'Hearthstone' 'Battlefield'
 'PlayerUnknownsBattlegrounds(PUBG)' 'Verizon' 'HomeDepot' 'FIFA'
 'RedDeadRedemption(RDR)' 'CallOfDuty' 'TomClancysRainbowSix' 'Facebook'
 'GrandTheftAuto(GTA)' 'MaddenNFL' 'johnson&johnson' 'Cyberpunk2077'
 'TomClancysGhostRecon' 'Nvidia']

 ************************************************************ 
```

Out[8]:

```
array(['Facebook', 'Amazon', 'Microsoft', 'CS-GO', 'Google', 'FIFA',
       'MaddenNFL', 'TomClancysRainbowSix', 'AssassinsCreed',
       'CallOfDuty', 'Dota2', 'Verizon', 'NBA2K', 'Nvidia',
       'GrandTheftAuto(GTA)', 'RedDeadRedemption(RDR)', 'Hearthstone',
       'ApexLegends', 'Overwatch', 'PlayerUnknownsBattlegrounds(PUBG)',
       'Borderlands', 'PlayStation5(PS5)', 'johnson&johnson', 'Fortnite',
       'Xbox(Xseries)', 'CallOfDutyBlackopsColdWar', 'HomeDepot',
       'Cyberpunk2077', 'TomClancysGhostRecon', 'WorldOfCraft',
       'LeagueOfLegends', 'Battlefield'], dtype=object)
```

In [9]:

```python
# Check for null values in the 'text' column
null_values = data['Text'].isnull()

# Display the rows with null values in the 'text' column
rows_with_null = data[null_values]
print(rows_with_null)
```

```
             country     Label Text
61       Borderlands   Neutral  NaN
553      Borderlands   Neutral  NaN
589      Borderlands   Neutral  NaN
745      Borderlands  Positive  NaN
1105     Borderlands  Positive  NaN
...              ...       ...  ...
73972         Nvidia  Positive  NaN
73973         Nvidia  Positive  NaN
74421         Nvidia  Positive  NaN
74422         Nvidia  Positive  NaN
74423         Nvidia  Positive  NaN

[686 rows x 3 columns]
```

In [10]:

```python
# Replace missing values in Text column with mode
data['Text'].fillna(data['Text'].mode()[0], inplace=True)
data.isnull().sum()
```

Out[10]:

```
country    0
Label      0
Text       0
dtype: int64
```

In [11]:

```python
unique_label=data['Label'].unique().tolist()
unique_label
```

Out[11]:

```
['Positive', 'Neutral', 'Negative', 'Irrelevant']
```

In [12]:

```python
data_label_count = data.Label.value_counts()
print('(data) : ','\n',data_label_count)
print('\n','*'*60,'\n')
```

```
validation_label_count=validation.Label.value_counts()
print('(validation) : ','\n',validation_label_count)
```

```
(data) :
 Negative      22542
Positive      20832
Neutral       18318
Irrelevant    12990
Name: Label, dtype: int64

 ************************************************************

(validation) :
 Neutral       285
Positive      277
Negative      266
Irrelevant    172
Name: Label, dtype: int64
```

Data Preprocessing

In [13]:
```
## Text transformation
data["lower"]=data.Text.str.lower() #lowercase
data["lower"]=[str(data) for data in data.lower] #converting all to string
data["lower"]=data.lower.apply(lambda x: re.sub('[^A-Za-z0-9 ]+', ' ', x)) #regex
validation["lower"]=validation.Text.str.lower() #lowercase
validation["lower"]=[str(data) for data in validation.lower] #converting all to stringv
validation["lower"]=validation.lower.apply(lambda x: re.sub('[^A-Za-z0-9 ]+', ' ', x)) #regex
```

In [14]:
```
data
```

Out[14]:

	country	Label	Text	lower
0	Borderlands	Positive	im getting on borderlands and i will murder yo...	im getting on borderlands and i will murder yo...
1	Borderlands	Positive	I am coming to the borders and I will kill you...	i am coming to the borders and i will kill you...
2	Borderlands	Positive	im getting on borderlands and i will kill you ...	im getting on borderlands and i will kill you ...
3	Borderlands	Positive	im coming on borderlands and i will murder you...	im coming on borderlands and i will murder you...
4	Borderlands	Positive	im getting on borderlands 2 and i will murder ...	im getting on borderlands 2 and i will murder ...
...	...	...	...	...
74677	Nvidia	Positive	Just realized that the Windows partition of my...	just realized that the windows partition of my...

74678	Nvidia	Positive	Just realized that my Mac window partition is ...	just realized that my mac window partition is ...
74679	Nvidia	Positive	Just realized the windows partition of my Mac ...	just realized the windows partition of my mac ...
74680	Nvidia	Positive	Just realized between the windows partition of...	just realized between the windows partition of...
74681	Nvidia	Positive	Just like the windows partition of my Mac is l...	just like the windows partition of my mac is l...

74682 rows × 4 columns

In [15]:
```
validation
```

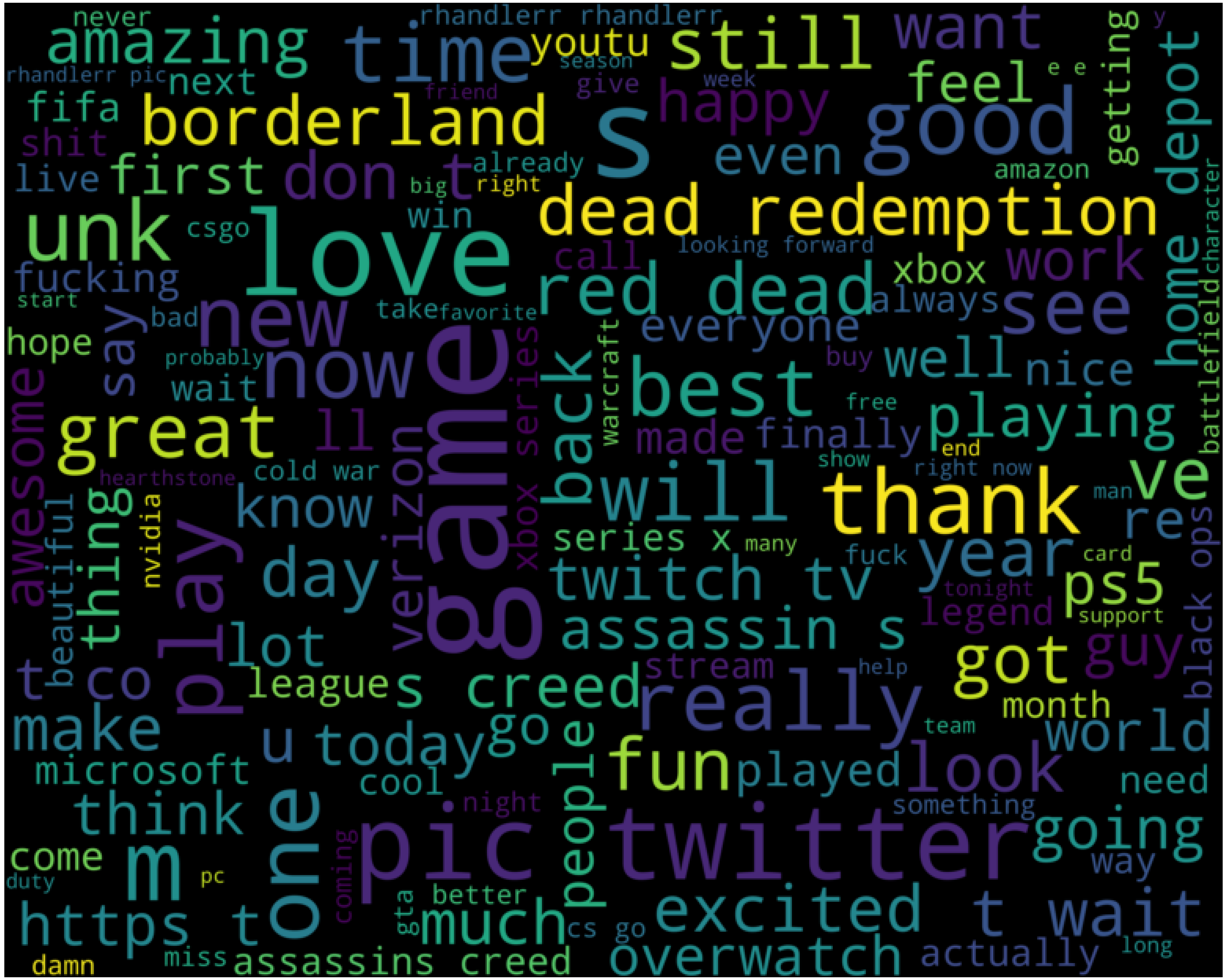
Out[15]:

	Company	Label	Text	lower
0	Facebook	Irrelevant	I mentioned on Facebook that I was struggling ...	i mentioned on facebook that i was struggling ...
1	Amazon	Neutral	BBC News - Amazon boss Jeff Bezos rejects clai...	bbc news amazon boss jeff bezos rejects clai...
2	Microsoft	Negative	@Microsoft Why do I pay for WORD when it funct...	microsoft why do i pay for word when it funct...
3	CS-GO	Negative	CSGO matchmaking is so full of closet hacking,...	csgo matchmaking is so full of closet hacking ...
4	Google	Neutral	Now the President is slapping Americans in the...	now the president is slapping americans in the...
...	...	...	...	...
995	GrandTheftAuto(GTA)	Irrelevant	⭐ Toronto is the arts and culture capital of ...	toronto is the arts and culture capital of c...
996	CS-GO	Irrelevant	tHIS IS ACTUALLY A GOOD MOVE TOT BRING MORE VI...	this is actually a good move tot bring more vi...
997	Borderlands	Positive	Today sucked so it's time to drink wine n play...	today sucked so it s time to drink wine n play...
998	Microsoft	Positive	Bought a fraction of Microsoft today. Small wins.	bought a fraction of microsoft today small wins
999	johnson&johnson	Neutral	Johnson & Johnson to stop selling talc baby po...	johnson johnson to stop selling talc baby po...

1000 rows × 4 columns

Positive Wordcloud on Label

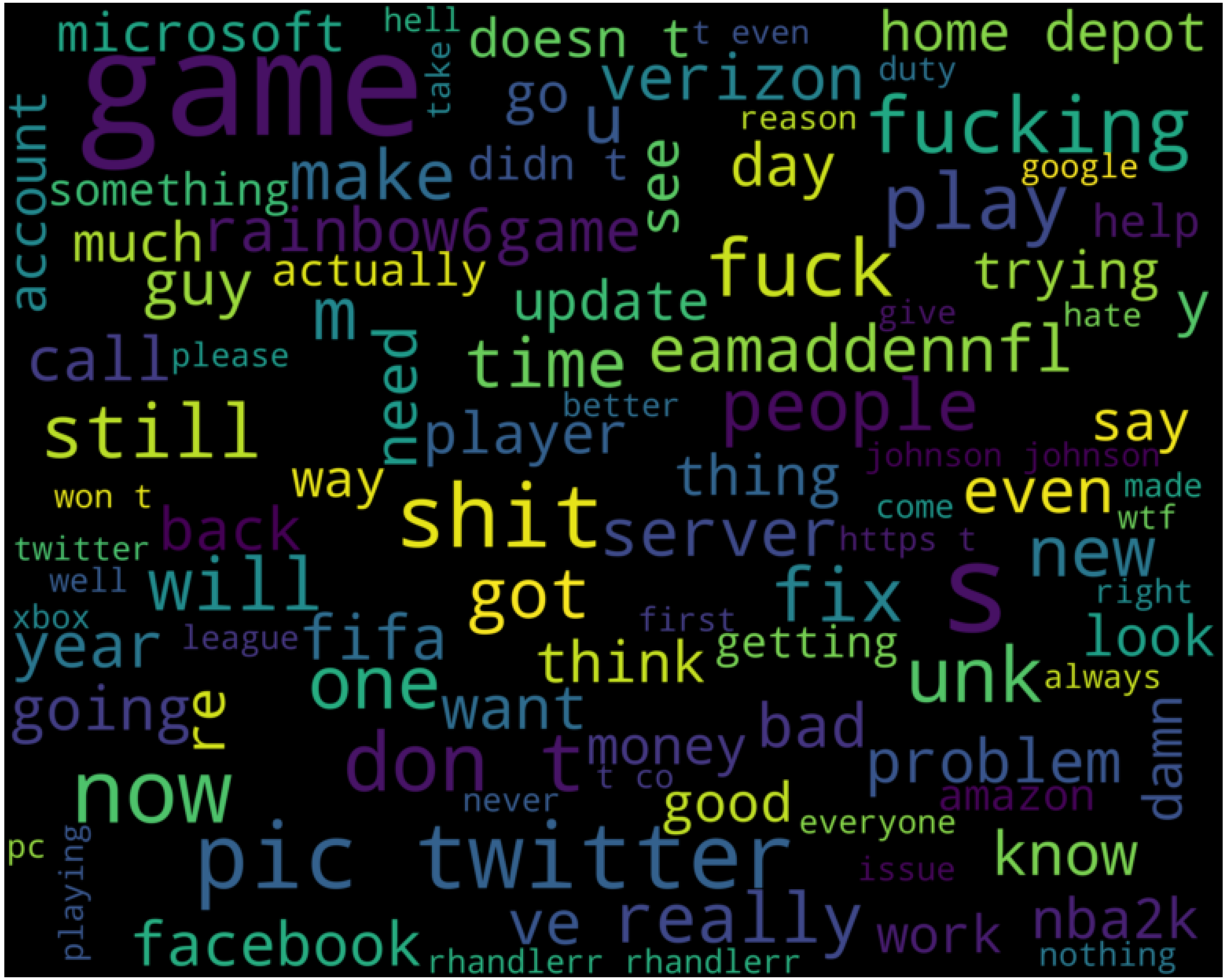
In [16]:
```
word_cloud_text = ''.join(data[data["Label"]=="Positive"].lower)
#Creation of wordcloud
wordcloud = WordCloud(
    max_font_size=120,
    max_words=150,
    background_color="black",
    scale=10,
    width=1000,
    height=800
).generate(word_cloud_text)
#Figure properties
plt.figure(figsize=(10,10))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")
plt.show()
```



Negative Wordcloud on Label

In [17]:

```
word_cloud_text = ''.join(data[data["Label"]=="Negative"].lower)
#Creation of wordcloud
wordcloud = WordCloud(
    max_font_size=120,
    max_words=100,
    background_color="black",
    scale=10,
    width=1000,
    height=800
).generate(word_cloud_text)
#Figure properties
plt.figure(figsize=(10,10))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")
plt.show()
```

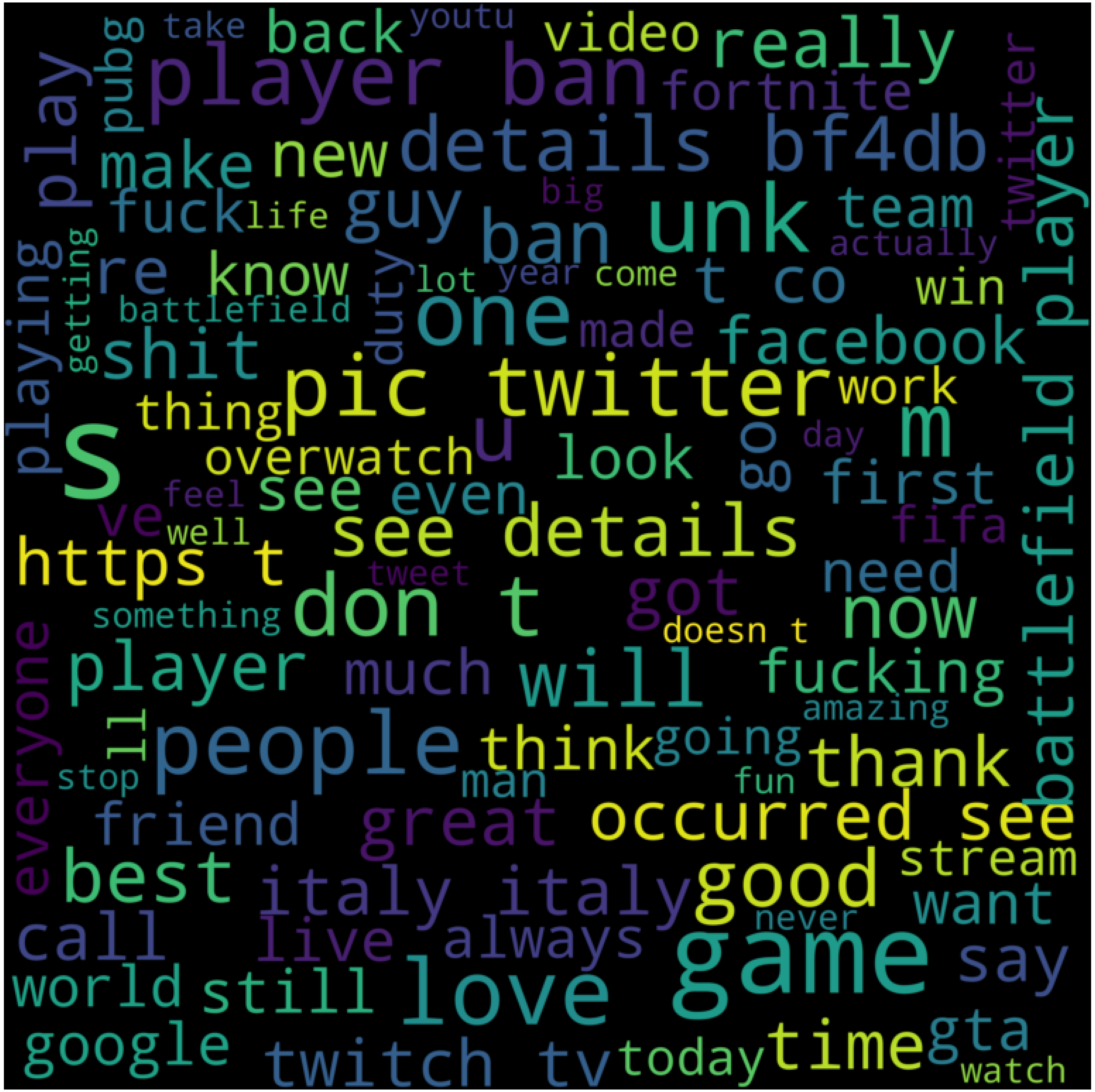


Irrelevant Wordcloud on Label

In [18]:

```
word_cloud_text = ''.join(data[data["Label"]=="Irrelevant"].lower)
#Creation of wordcloud
```

```
wordcloud = WordCloud(
    max_font_size=100,
    max_words=100,
    background_color="black",
    scale=10,
    width=800,
    height=800
).generate(word_cloud_text)
#Figure properties
plt.figure(figsize=(10,10))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis("off")
plt.show()
```


pubg
take
back
youtu
video
really
player ban
fortnite
twitter
play
make
new
details bf4db
player
fuck
life
guy
big
team
ban
unk
actually
getting
playing
re
know
duty
lot
year
come
t co
win
battlefield
one
made
facebook
shit
pic twitter
work
thing
s
u
m
day
go
overwatch
look
battlefield player
feel
see
even
first
ve
fifa
well
see details
https t
tweet
need
something
don t
got
doesn t
now
everyone
player
much
will
fucking
amazing
ll
people
think
going
thank
stop
man
fun
friend
great
occurred see
best
stream
italy italy
good
want
call
live
always
never
game
say
world
still
love
google
twitch tv
today
time
gta
watch

In [19]:

```
#Count information per category
plot1=data.groupby(by=["country","Label"]).count().reset_index()
plot1.head(12)
```

Out[19]:

	country	Label	Text	lower
0	Amazon	Irrelevant	192	192
1	Amazon	Negative	576	576
2	Amazon	Neutral	1236	1236
3	Amazon	Positive	312	312
4	ApexLegends	Irrelevant	192	192
5	ApexLegends	Negative	600	600
6	ApexLegends	Neutral	942	942
7	ApexLegends	Positive	642	642
8	AssassinsCreed	Irrelevant	264	264
9	AssassinsCreed	Negative	378	378
10	AssassinsCreed	Neutral	156	156
11	AssassinsCreed	Positive	1446	1446

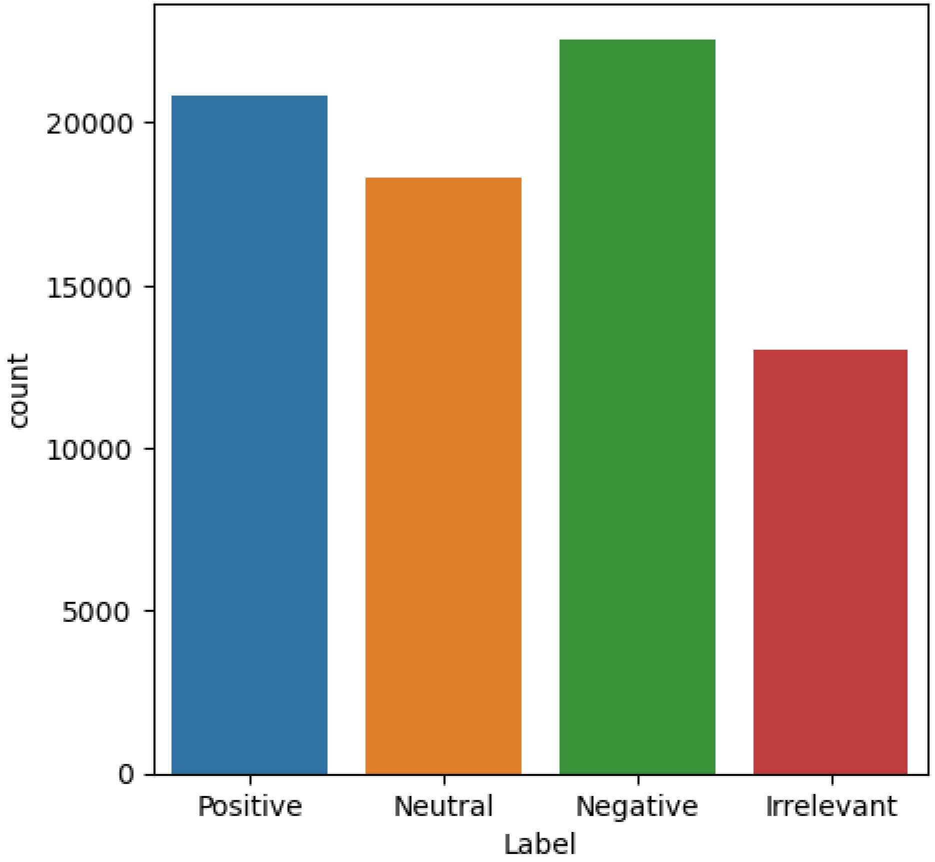
Count number on positive or negative or neutral or irrevelent

In [20]:

```
fig = plt.figure(figsize=(5,5))
sns.countplot(x='Label', data = data)
```

Out[20]:

```
<Axes: xlabel='Label', ylabel='count'>
```



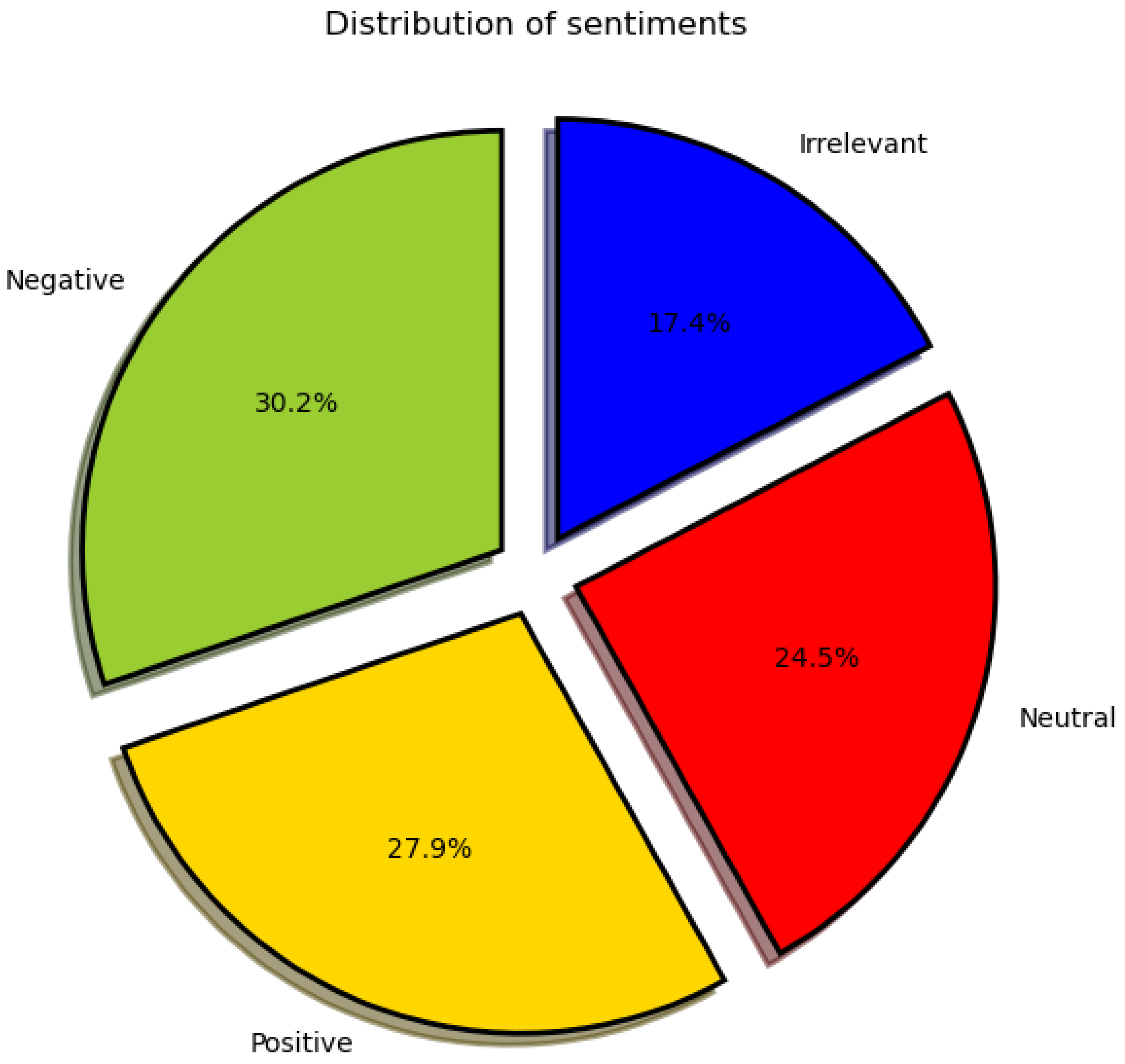
Label on Data

In [21]:

```
fig = plt.figure(figsize=(7,7))
colors = ("yellowgreen", "gold", "red","blue")
wp = {'linewidth':2, 'edgecolor':"black"}
tags = data['Label'].value_counts()
explode = (0.1,0.1,0.1,0.1)
tags.plot(kind='pie', autopct='%1.1f%%', shadow=True, colors = colors,
         startangle=90, wedgeprops = wp, explode = explode, label='')
plt.title('Distribution of sentiments')
```

Out[21]:

```
Text(0.5, 1.0, 'Distribution of sentiments')
```



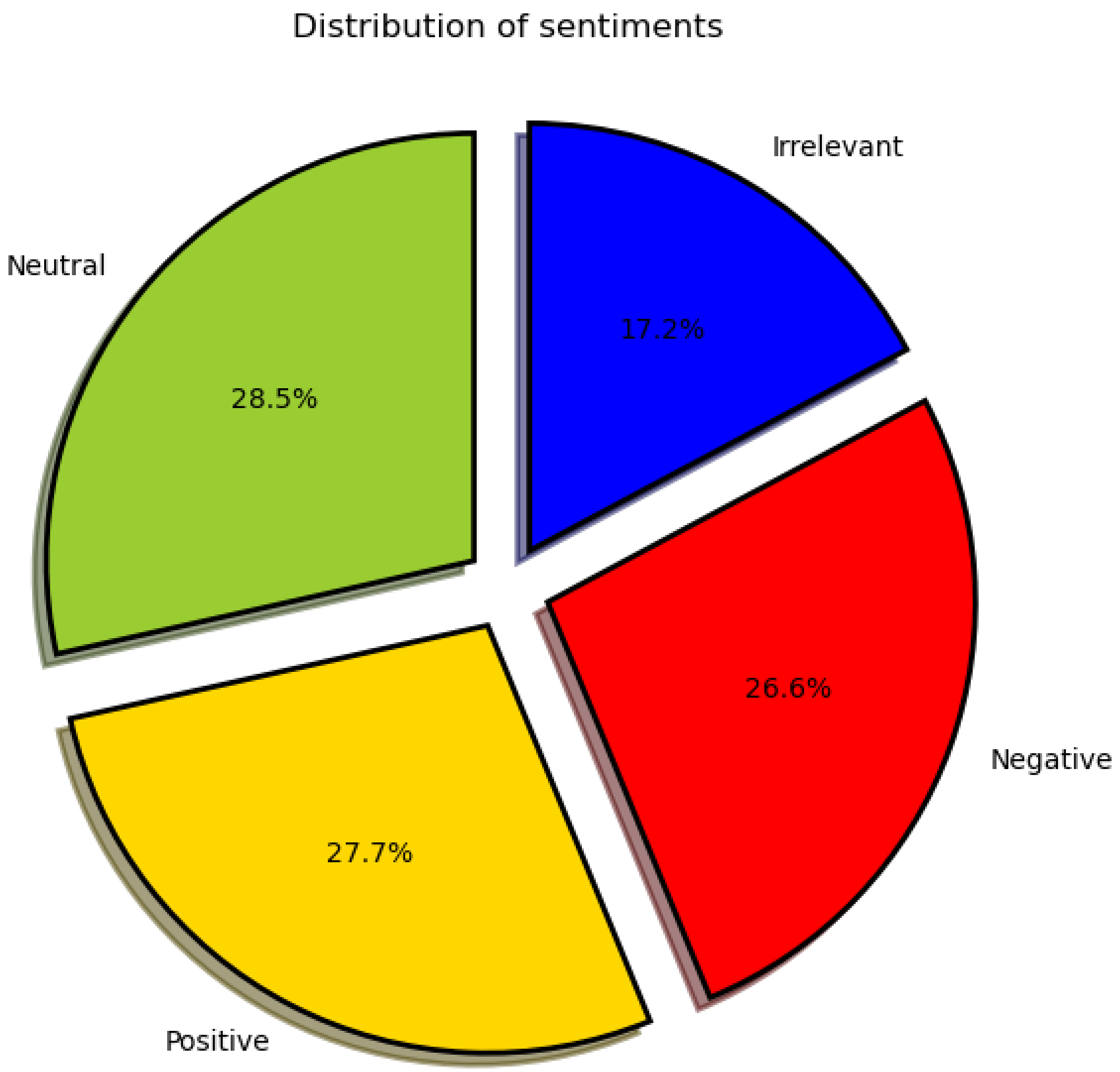
Label on Validation

In [22]:

```
fig = plt.figure(figsize=(7,7))
colors = ("yellowgreen", "gold", "red","blue")
wp = {'linewidth':2, 'edgecolor':"black"}
tags = validation['Label'].value_counts()
explode = (0.1,0.1,0.1,0.1)
tags.plot(kind='pie', autopct='%1.1f%%', shadow=True, colors = colors,
         startangle=90, wedgeprops = wp, explode = explode, label='')
plt.title('Distribution of sentiments')
```

Out[22]:

```
Text(0.5, 1.0, 'Distribution of sentiments')
```



In [23]:

```
validation
```

Out[23]:

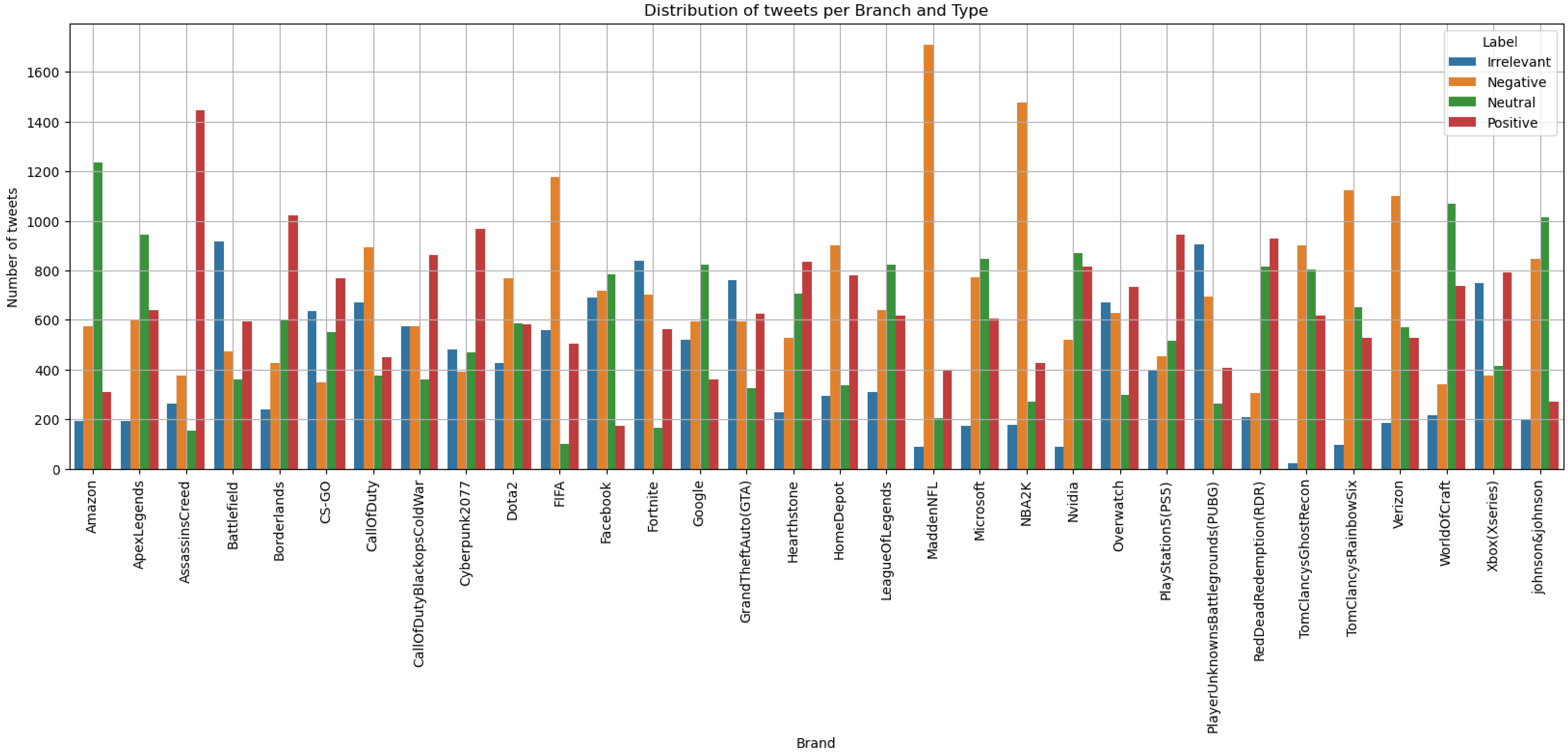
	Company	Label	Text	lower
0	Facebook	Irrelevant	I mentioned on Facebook that I was struggling ...	i mentioned on facebook that i was struggling ...
1	Amazon	Neutral	BBC News - Amazon boss Jeff Bezos rejects clai...	bbc news amazon boss jeff bezos rejects clai...
2	Microsoft	Negative	@Microsoft Why do I pay for WORD when it funct...	microsoft why do i pay for word when it funct...

3	CS-GO	Negative	CSGO matchmaking is so full of closet hacking,...	csgo matchmaking is so full of closet hacking ...
4	Google	Neutral	Now the President is slapping Americans in the...	now the president is slapping americans in the...
...	...	...	...	...
995	GrandTheftAuto(GTA)	Irrelevant	⭐ Toronto is the arts and culture capital of ...	toronto is the arts and culture capital of c...
996	CS-GO	Irrelevant	tHIS IS ACTUALLY A GOOD MOVE TOT BRING MORE VI...	this is actually a good move tot bring more vi...
997	Borderlands	Positive	Today sucked so it’s time to drink wine n play...	today sucked so it s time to drink wine n play...
998	Microsoft	Positive	Bought a fraction of Microsoft today. Small wins.	bought a fraction of microsoft today small wins
999	johnson&johnson	Neutral	Johnson & Johnson to stop selling talc baby po...	johnson johnson to stop selling talc baby po...

1000 rows × 4 columns

In [24]:

```
#Figure of comparison per branch
plt.figure(figsize=(20,6))
sns.barplot(data=plot1,x="country",y="Text",hue="Label")
plt.xticks(rotation=90)
plt.xlabel("Brand")
plt.ylabel("Number of tweets")
plt.grid()
plt.title("Distribution of tweets per Branch and Type");
```



In [25]:

```
texts = data['Text']
```

In [26]:

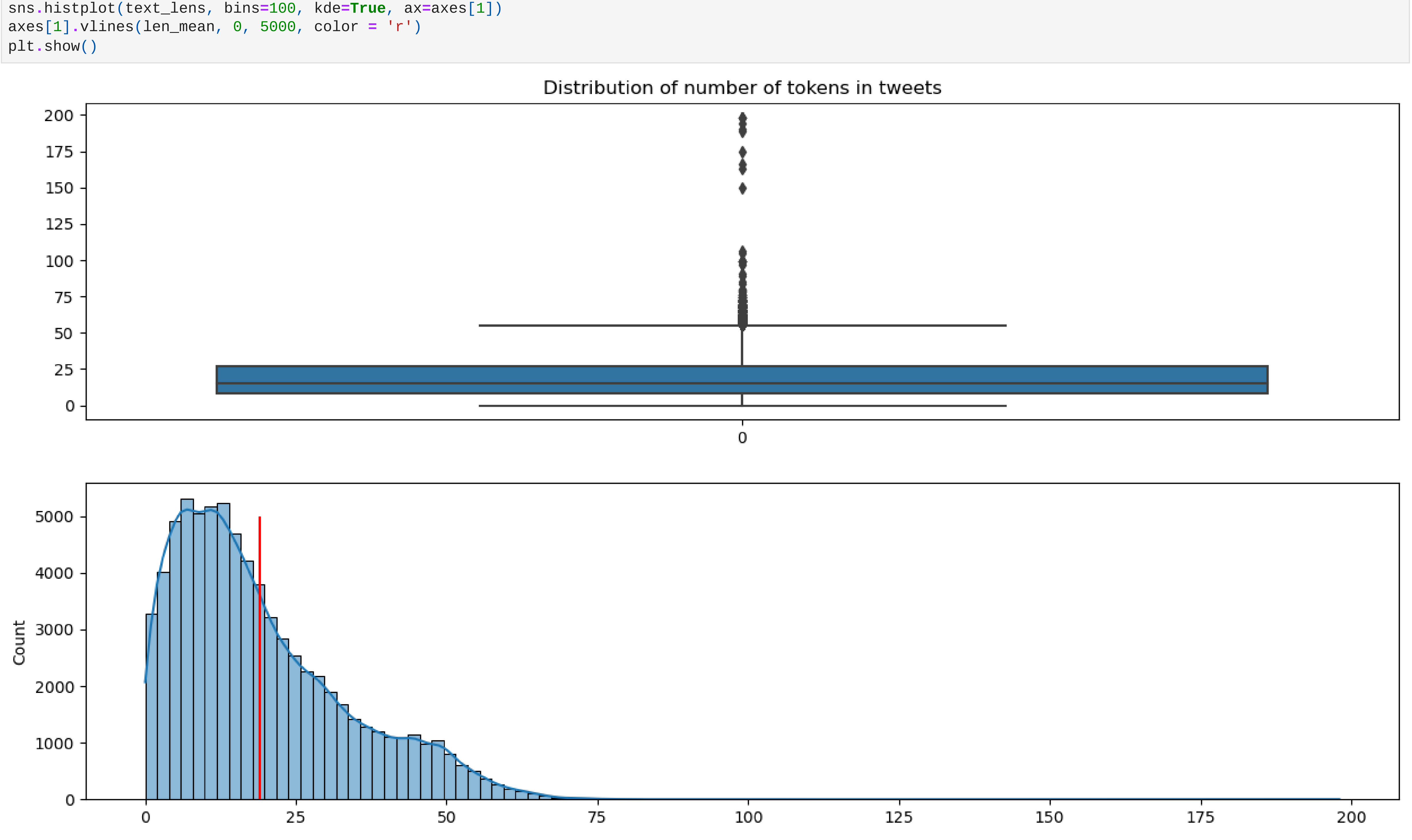
```
text_lens = [len(t.split()) for t in texts.values]
len_mean = np.mean(text_lens)
len_mean
```

Out[26]:

```
19.05001205109665
```

In [27]:

```
fig, axes = plt.subplots(2, 1, figsize=(15, 8))
axes[0].set_title('Distribution of number of tokens in tweets')
sns.boxplot(text_lens, ax=axes[0])
```



```
sns.histplot(text_lens, bins=100, kde=True, ax=axes[1])
axes[1].vlines(len_mean, 0, 5000, color = 'r')
plt.show()
```

fIND Unique Words

In [28]:
```
#Choosing english stopwords
stopwords_nltk = nltk.corpus.stopwords
stop_words = stopwords_nltk.words('english')
stop_words[:10]
```

Out[28]:
```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're"]
```

In [29]:
```
#Initial Bag of Words
bow_counts = CountVectorizer(
    tokenizer=word_tokenize,
    stop_words=stop_words, #English Stopwords
    ngram_range=(1, 1) #analysis of one word
)
bow_counts
```

Out[29]:
```
▾                          CountVectorizer
CountVectorizer(stop_words=['i', 'me', 'my', 'myself', 'we', 'our', 'ours',
                            'ourselves', 'you', "you're", "you've", "you'll",
                            "you'd", 'your', 'yours', 'yourself', 'yourselves',
                            'he', 'him', 'his', 'himself', 'she', "she's",
                            'her', 'hers', 'herself', 'it', "it's", 'its',
                            'itself', ...],
                tokenizer=<function word_tokenize at 0x000001D9FD70DC60>)
```

Train - Test splitting

In [90]:
```
reviews_train, reviews_test = train_test_split(data, test_size=0.2, random_state=0)
```

In [91]:
```
#Labels for train and test encoding
y_train_bow = reviews_train['Label']
y_test_bow = reviews_test['Label']
```

In [92]:
```
import nltk
nltk.download('punkt')
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\bios\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

```
Out[92]: True
```

In [93]:

```
#Creation of encoding related to train dataset
X_train_bow = bow_counts.fit_transform(reviews_train.lower)
#Transformation of test dataset with train encoding
X_test_bow = bow_counts.transform(reviews_test.lower)
```

Logistic Regression Model

In [94]:

```
# Logistic regression
model1 = LogisticRegression(C=1, solver="liblinear",max_iter=200)
model1.fit(X_train_bow, y_train_bow)
# Prediction
test_pred = model1.predict(X_test_bow)
print("Accuracy: ", accuracy_score(y_test_bow, test_pred) * 100)
```

```
Accuracy:  81.40858271406574
```

In [95]:

```
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix, ConfusionMatrixDisplay
print(confusion_matrix(y_test_bow, test_pred))
print("\n")
print(classification_report(y_test_bow, test_pred))
```

```
[[1641  312  180  450]
 [  62 3872  135  400]
 [  86  250 2904  429]
 [  85  252  136 3743]]


              precision    recall  f1-score   support

  Irrelevant       0.88      0.64      0.74      2583
    Negative       0.83      0.87      0.85      4469
     Neutral       0.87      0.79      0.83      3669
    Positive       0.75      0.89      0.81      4216

    accuracy                           0.81     14937
   macro avg       0.83      0.80      0.80     14937
weighted avg       0.82      0.81      0.81     14937
```

In [47]:

```
#train test split
X_train=data.drop(['Label'] , axis=1)
X_test=validation.drop(['Label'] , axis=1)
```

```
y_train=data['Label']
y_test=validation['Label']
```

In [110…

```
X_train.head(5)
```

Out[110]:

	country	Text	lower
0	Borderlands	im getting on borderlands and i will murder yo...	im getting on borderlands and i will murder yo...
1	Borderlands	I am coming to the borders and I will kill you...	i am coming to the borders and i will kill you...
2	Borderlands	im getting on borderlands and i will kill you ...	im getting on borderlands and i will kill you ...
3	Borderlands	im coming on borderlands and i will murder you...	im coming on borderlands and i will murder you...
4	Borderlands	im getting on borderlands 2 and i will murder ...	im getting on borderlands 2 and i will murder ...

In [49]:

```
y_train
```

Out[49]:

```
0         Positive
1         Positive
2         Positive
3         Positive
4         Positive
            ...   
74677     Positive
74678     Positive
74679     Positive
74680     Positive
74681     Positive
Name: Label, Length: 74682, dtype: object
```

count the no of words by CountVectorizer

</p>

In [52]:

```
#count the no of words in a sentence
from sklearn.feature_extraction.text import CountVectorizer
```

In [72]:

```
v=CountVectorizer()
X_train_count=v.fit_transform(X_train.Text)
X_train_count[0]
```

Out[72]:

```
<1x31062 sparse matrix of type '<class 'numpy.int64'>'
	with 9 stored elements in Compressed Sparse Row format>
```

In [59]:

```
data.Label.unique()
```

Out[59]:

```
array(['Positive', 'Neutral', 'Negative', 'Irrelevant'], dtype=object)
```

label Encoding

In [73]:

```
#label Encoding
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()
y_train=le.fit_transform(y_train)
y_test=le.fit_transform(y_test)
```

In [74]:

```
y_train
```

Out[74]:

```
array([3, 3, 3, ..., 3, 3, 3], dtype=int64)
```

MultinomialNB Model

In [81]:

```
#model
from sklearn.naive_bayes import MultinomialNB
model=MultinomialNB()
y_pred=model.fit(X_train_count,y_train)
```

In [83]:

```
X_test_count=v.transform(X_test.Text)
X_test_count.toarray()
```

Out[83]:

```
array([[0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       ...,
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0],
       [0, 0, 0, ..., 0, 0, 0]], dtype=int64)
```

In [84]:

```
X_test_count.shape
```

Out[84]:

```
(1000, 31062)
```

In [89]:

```
model.score(X_test_count,y_test)
```

Out[89]:

```
0.825
```

Test MultinomialNB Model

In [103…

```
comment=[
    'I am coming to the borders and I will kill you.'
]
comment_count=v.transform(comment)
model.predict(comment_count)
```

Out[103]:

```
array([3], dtype=int64)
```

In [105…

```
comment=['i hard like me rare london de handsome.']
comment_count=v.transform(comment)
model.predict(comment_count)
```

Out[105]:

```
array([2], dtype=int64)
```

In [112…

```
comment=['love']
comment_count=v.transform(comment)
model.predict(comment_count)
```

Out[112]:

```
array([3], dtype=int64)
```