Sentiment Analysis of Financial News Using NLTK

We have to predict the sentiment of fiancial news using nltk

About Dataset

This dataset contains 3 csv file

cnbc headline (3080, 3)

gaurdian headline (17800, 2)

reuters headline (32770, 3)

Columns Provided in the Dataset

cnbc headline

1. time
2. headlines
3. Description

gaurdian headline

1. time
2. headline

reuters headline

1. time
2. headline
3. description

What is NLTK ?

The Natural Language Toolkit (NLTK) is a platform used for building Python programs that work with human language data for applying in statistical natural language processing (NLP).

It contains text processing libraries for tokenization, parsing, classification, stemming, tagging and semantic reasoning.

https://medium.com/@ODSC/intro-to-language-processing-with-the-nltk-59aa26b9d056

What is sentiment analysis ?

Sentiment analysis is the process of detecting positive or negative sentiment in text. It’s often used by businesses to detect sentiment in social data, gauge brand reputation, and understand customers.

https://monkeylearn.com/sentiment-analysis/

In [201]:

```
Drive already mounted at /content/drive; to attempt to forcibly remoun
t, call drive.mount("/content/drive", force_remount=True).
```

In [202]:

```
# Import all the required libraries


#import stopwords and text processing libraries
```

```
[nltk_data] Downloading package wordnet to /root/nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
```

```
[nltk_data] Downloading package punkt to /root/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
```

```
Out[202]: True
```

```
In [203]: #import machine learning libraries
```

Basic EDA on cnbc_headlines dataset

```
In [205]: # Read csv file of cnbc headlines using pandas
```

```
In [206]:
```

```
Out[206]:
```

	Headlines	Time	Description
0	Jim Cramer: A better way to invest in the Covi...	7:51 PM ET Fri, 17 July 2020	"Mad Money" host Jim Cramer recommended buying...
1	Cramer's lightning round: I would own Teradyne	7:33 PM ET Fri, 17 July 2020	"Mad Money" host Jim Cramer rings the lightnin...
2	NaN	NaN	NaN
3	Cramer's week ahead: Big week for earnings, ev...	7:25 PM ET Fri, 17 July 2020	"We'll pay more for the earnings of the non-Co...
4	IQ Capital CEO Keith Bliss says tech and healt...	4:24 PM ET Fri, 17 July 2020	Keith Bliss, IQ Capital CEO, joins "Closing Be...

```
In [207]: # check the shape of cnbc headline dataset
```

```
Out[207]: (3080, 3)
```

```
In [208]: # Check all the columns in the cnbc headline dataset
```

```
Out[208]: Index(['Headlines', 'Time', 'Description'], dtype='object')
```

In [209]:
```
# Check which columns are having categorical, numerical or boolean values
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3080 entries, 0 to 3079
Data columns (total 3 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   Headlines    2800 non-null   object
 1   Time         2800 non-null   object
 2   Description  2800 non-null   object
dtypes: object(3)
memory usage: 72.3+ KB
```

In [210]:
```
# Check for missing values in all the columnns of cnbc headline dataset
```

Out[210]:
```
Headlines      280
Time           280
Description    280
dtype: int64
```

There is 280 missing values in headlines, description and time

In [211]:
```
 # drop nan values in cnbc headline dataset
```

In [213]:
```
# drop the duplicate rows in the dataset keep the first one
```

Out[213]:

	Headlines	Time	Description
0	Jim Cramer: A better way to invest in the Covi...	7:51 PM ET Fri, 17 July 2020	"Mad Money" host Jim Cramer recommended buying...
1	Cramer's lightning round: I would own Teradyne	7:33 PM ET Fri, 17 July 2020	"Mad Money" host Jim Cramer rings the lightnin...
2	Cramer's week ahead: Big week for earnings, ev...	7:25 PM ET Fri, 17 July 2020	"We'll pay more for the earnings of the non-Co...

	Headlines	Time	Description
3	IQ Capital CEO Keith Bliss says tech and healt...	4:24 PM ET Fri, 17 July 2020	Keith Bliss, IQ Capital CEO, joins "Closing Be...
4	Wall Street delivered the 'kind of pullback I'...	7:36 PM ET Thu, 16 July 2020	"Look for the stocks of high-quality companies...
...	...	...	...
2785	Markets lack Christmas cheer	10:15 AM ET Tue, 26 Dec 2017	According to Kensho, here's how markets have f...
2786	Cramer Remix: The biggest mistake you can make...	11:12 AM ET Thu, 20 Sept 2018	Jim Cramer revealed his top rule when it comes...
2787	Cramer says owning too many stocks and too lit...	7:07 PM ET Fri, 22 Dec 2017	Jim Cramer broke down why owning fewer stocks ...
2788	Cramer: I helped investors through the 2010 fl...	7:07 PM ET Fri, 22 Dec 2017	Jim Cramer built on his "nobody ever made a di...
2789	Cramer: Never buy a stock all at once — you'll...	6:52 PM ET Fri, 22 Dec 2017	Jim Cramer doubled down on his key investing r...

2790 rows × 3 columns

In [214]:
```
# check the shape of cnbc headline dataset
```

Out[214]:
```
(2790, 3)
```

Basic EDA on Gaurdian headlines dataset

In [215]:
```
# Read csv file of gaurdian headlines using pandas
```

In [216]:
```

```

Out[216]:

	Time	Headlines
0	18-Jul-20	Johnson is asking Santa for a Christmas recovery

	Time	Headlines
1	18-Jul-20	‘I now fear the worst’: four grim tales of wor...
2	18-Jul-20	Five key areas Sunak must tackle to serve up e...
3	18-Jul-20	Covid-19 leaves firms ‘fatally ill-prepared’ f...
4	18-Jul-20	The Week in Patriarchy \n\n\n Bacardi's 'lad...

In [217]:

```
#check the shape of gaurdian headline dataset
```

Out[217]:

```
(17800, 2)
```

In [218]:

```
#check columns of gaurdian headline
```

Out[218]:

```
Index(['Time', 'Headlines'], dtype='object')
```

In [219]:

```
# Check which columns are having categorical, numerical or boolean valu
es
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 17800 entries, 0 to 17799
Data columns (total 2 columns):
 #   Column     Non-Null Count  Dtype 
---  ------     --------------  ----- 
 0   Time       17800 non-null  object
 1   Headlines  17800 non-null  object
dtypes: object(2)
memory usage: 278.2+ KB
```

In [220]:

```
# check null values in gaurdian headlines dataset
```

Out[220]:

```
Time         0
Headlines    0
dtype: int64
```

In [221]:

```
# drop duplicate rows in headlines and keep the first one
```

Out[221]:

	Time	Headlines
0	18-Jul-20	Johnson is asking Santa for a Christmas recovery
1	18-Jul-20	‘I now fear the worst’: four grim tales of wor...
2	18-Jul-20	Five key areas Sunak must tackle to serve up e...
3	18-Jul-20	Covid-19 leaves firms ‘fatally ill-prepared’ f...
4	18-Jul-20	The Week in Patriarchy \n\n\n Bacardi's 'lad...
...	...	...
17790	17-Dec-17	How investing in solar energy can create a bri...
17791	17-Dec-17	Poundland suppliers hit by insurance downgrade
17792	17-Dec-17	Cryptocurrencies: City watchdog to investigate...
17793	17-Dec-17	Unilever sells household name spreads to KKR f...
17794	17-Dec-17	The Guardian view on Ryanair’s model: a union-...

17795 rows × 2 columns

Basic EDA on reuters headlines

In [223]:

```
# Read csv file of reuters headlines using using pandas
```

In [224]:

```
```

Out[224]:

	Headlines	Time	Description
0	TikTok considers London and other locations fo...	Jul 18 2020	TikTok has been in discussions with the UK gov...
1	Disney cuts ad spending on Facebook amid growi...	Jul 18 2020	Walt Disney has become the latest company to ...
2	Trail of missing Wirecard executive leads to B...	Jul 18 2020	Former Wirecard chief operating officer Jan M...

	Headlines	Time	Description
3	Twitter says attackers downloaded data from up...	Jul 18 2020	Twitter Inc said on Saturday that hackers were...
4	U.S. Republicans seek liability protections as...	Jul 17 2020	A battle in the U.S. Congress over a new coron...

In [225]:
```
#check the shape of reuters headlines dataset
```

Out[225]:
```
(32770, 3)
```

In [226]:
```
#check the columns of reuters headline dataset
```

Out[226]:
```
Index(['Headlines', 'Time', 'Description'], dtype='object')
```

In [227]:
```
# Check which columns are having categorical, numerical or boolean valu
es
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 32770 entries, 0 to 32769
Data columns (total 3 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   Headlines    32770 non-null  object
 1   Time         32770 non-null  object
 2   Description  32770 non-null  object
dtypes: object(3)
memory usage: 768.2+ KB
```

In [228]:
```
# Check for missing values in all the columnns of reuters headlines dat
aset
```

Out[228]:
```
Headlines      0
Time           0
Description    0
dtype: int64
```

In [229]:
```
#drop the duplicate rows in reuters headlines dataset and keep the firs
```

```
t one
```

Out[229]:

	Headlines	Time	Description
0	TikTok considers London and other locations fo...	Jul 18 2020	TikTok has been in discussions with the UK gov...
1	Disney cuts ad spending on Facebook amid growi...	Jul 18 2020	Walt Disney has become the latest company to ...
2	Trail of missing Wirecard executive leads to B...	Jul 18 2020	Former Wirecard chief operating officer Jan M...
3	Twitter says attackers downloaded data from up...	Jul 18 2020	Twitter Inc said on Saturday that hackers were...
4	U.S. Republicans seek liability protections as...	Jul 17 2020	A battle in the U.S. Congress over a new coron...
...	...	...	...
32668	Malaysia says never hired British data firm at...	Mar 20 2018	The Malaysian government and the ruling party ...
32669	Prosecutors search Volkswagen headquarters in ...	Mar 20 2018	German prosecutors said on Tuesday they had se...
32670	McDonald's sets greenhouse gas reduction targets	Mar 20 2018	McDonald's Corp on Tuesday announced an approv...
32671	Pratt & Whitney to deliver spare A320neo engin...	Mar 20 2018	Pratt & Whitney will soon begin deliveries of ...
32672	UK will always consider ways to improve data l...	Mar 20 2018	Britain will consider any suggestions to give ...

32673 rows × 3 columns

Making some functions that we will need ahead

Preprocessing

1. **Lowercase** - It is necessary to convert the text to lower case as it is case sensitive.
2. **remove punctuations** - The punctuations present in the text do not add value to the data. The punctuation, when attached to any word, will create a problem in differentiating with other words. so we have to get rid of them.
3. **remove stopwords** - Stopwords include: I, he, she, and, but, was were, being, have, etc, which do not add meaning to the data. So these words must be removed which helps to reduce the features from our data. These are removed after tokenizing the text.
4. **stemming** - A technique that takes the word to its root form. It just removes suffixes from the words. The stemmed word might not be part of the dictionary, i.e it will not necessarily give meaning.
5. **lemmatizing** - Takes the word to its root form called Lemma. It helps to bring words to their dictionary form. It is applied to nouns by default. It is more accurate as it uses more informed analysis to create groups of words with similar meanings based on the context, so it is complex and takes more time. This is used where we need to retain the contextual information.

https://youtu.be/lMQzEk5vht4

https://www.pluralsight.com/guides/importance-of-text-pre-processing

In [231]:
```
# create a function for preprocessing
  #convert all to lowercase

  #remove puntuations

  #remove stopword

  #stemming


  #lemmitizing
```

SENTIMENT ANAYSIS

https://towardsdatascience.com/sentimental-analysis-using-vader-a3415fef7664

In [232]:

```
# import sentiment intensity analyzer


# create sentiment intensity analyzer object
```

```
[nltk_data] Downloading package vader_lexicon to /root/nltk_data...
[nltk_data]   Package vader_lexicon is already up-to-date!
```

In [233]:

```
#fuction to  decide sentiment as positive, negative and neutral
```

Now working with description on datasets

In [234]:

```
# concatenate cnbc headlines dataset and reuters headline dataset
```

In [235]:

```
#check the shape of this new dataset
```

Out[235]:

```
(35463, 3)
```

In [236]:

```
#make a copy of new dataset
```

In [237]:

```
# apply preprocessing to the description of new dataset
```

Out[237]:

	Headlines	Time	Description

	Headlines	Time	Description
0	Jim Cramer: A better way to invest in the Covi...	7:51 PM ET Fri, 17 July 2020	mad money host jim cramer recommend buy four c...
1	Cramer's lightning round: I would own Teradyne	7:33 PM ET Fri, 17 July 2020	mad money host jim cramer ring lightn round be...
2	Cramer's week ahead: Big week for earnings, ev...	7:25 PM ET Fri, 17 July 2020	well pay earn noncovid compani lancet publish ...
3	IQ Capital CEO Keith Bliss says tech and healt...	4:24 PM ET Fri, 17 July 2020	keith bliss iq capit ceo join close bell talk ...
4	Wall Street delivered the 'kind of pullback I'...	7:36 PM ET Thu, 16 July 2020	look stock highqual compani go low even though...
5	Cramer's lightning round: I would just stay lo...	7:23 PM ET Thu, 16 July 2020	mad money host jim cramer ring lightn round be...
6	Acorns CEO: Parents can turn $5 into five figu...	8:03 PM ET Thu, 16 July 2020	invest 5 per day compound 70000 time child rea...
7	Dividend cuts may mean rethinking your retirem...	8:54 AM ET Thu, 16 July 2020	hundr compani cut suspend dividend far year se...
8	StockX has authenticated 1 million Jordan snea...	8:25 PM ET Wed, 15 July 2020	weve abl captur cultur moment like espn releas...
9	Biohaven Pharmaceuticals lands Khloe Kardashia...	7:51 PM ET Wed, 15 July 2020	biohaven ceo vlad coric said compani brought k...
10	Cramer's lightning round: I like Beyond Meat	7:24 PM ET Wed, 15 July 2020	mad money host jim cramer ring lightn round be...
11	Cramer: We desperately need another round of f...	6:51 PM ET Wed, 15 July 2020	figur wed mayb viru contain earli fall botch r...
12	Cramer's lightning round: Buy more VMware	7:31 PM ET Tue, 14 July 2020	mad money host jim cramer ring lightn round be...
13	Wall Street did something 'highly unusual' in ...	7:23 PM ET Tue, 14 July 2020	market divid four camp mad money host said
14	Charts suggest the S&P 500 climb will stall ou...	7:02 PM ET Tue, 14 July 2020	chart interpret larri william suggest sp 500 c...
15	Salesforce's Marc Benioff: Face masks can end ...	9:05 PM ET Mon, 13 July 2020	salesforc ceo marc benioff told cnbc jim crame...

	Headlines	Time	Description
16	Crown Castle's 'good story can get even better...	8:33 PM ET Mon, 13 July 2020	either crown castl becom lean mean cell tower ...
17	Ellevest's Sallie Krawcheck says the economic ...	9:43 PM ET Mon, 13 July 2020	ellevest ceo salli krawcheck cofound digit inv...
18	Cramer's lightning round: Zoom's pullback is a...	7:38 PM ET Mon, 13 July 2020	mad money host jim cramer ring lightn round be...
19	Cramer's earnings watch: 'If the banks get ham...	7:24 PM ET Mon, 13 July 2020	week find real world go intrud stock market wo...

In [238]:

```
# analyze polarity score of values in description and  add new column of it in dataset
```

Out[238]:

	Headlines	Time	Description	ds_score
0	Jim Cramer: A better way to invest in the Covi...	7:51 PM ET Fri, 17 July 2020	mad money host jim cramer recommend buy four c...	0.2500
1	Cramer's lightning round: I would own Teradyne	7:33 PM ET Fri, 17 July 2020	mad money host jim cramer ring lightn round be...	-0.4939
2	Cramer's week ahead: Big week for earnings, ev...	7:25 PM ET Fri, 17 July 2020	well pay earn noncovid compani lancet publish ...	0.5574
3	IQ Capital CEO Keith Bliss says tech and healt...	4:24 PM ET Fri, 17 July 2020	keith bliss iq capit ceo join close bell talk ...	0.7096
4	Wall Street delivered the 'kind of pullback I'...	7:36 PM ET Thu, 16 July 2020	look stock highqual compani go low even though...	-0.6486
...	...	...	...	...
32668	Malaysia says never hired British data firm at...	Mar 20 2018	malaysian govern rule parti tuesday deni ever ...	0.0000
32669	Prosecutors search Volkswagen headquarters in ...	Mar 20 2018	german prosecutor said tuesday search volkswag...	0.0000
32670	McDonald's sets greenhouse gas reduction targets	Mar 20 2018	mcdonald corp tuesday announc approv scienc ba...	-0.2732
32671	Pratt & Whitney to deliver spare A320neo engin...	Mar 20 2018	pratt whitney soon begin deliveri spare engin ...	-0.3818

	Headlines	Time	Description	ds_score
32672	UK will always consider ways to improve data l...	Mar 20 2018	britain consid suggest give bodi charg uphold ...	0.3818

35463 rows × 4 columns

In [239]:

```
# apply the function  which decides sentiment to  polarity score column
```

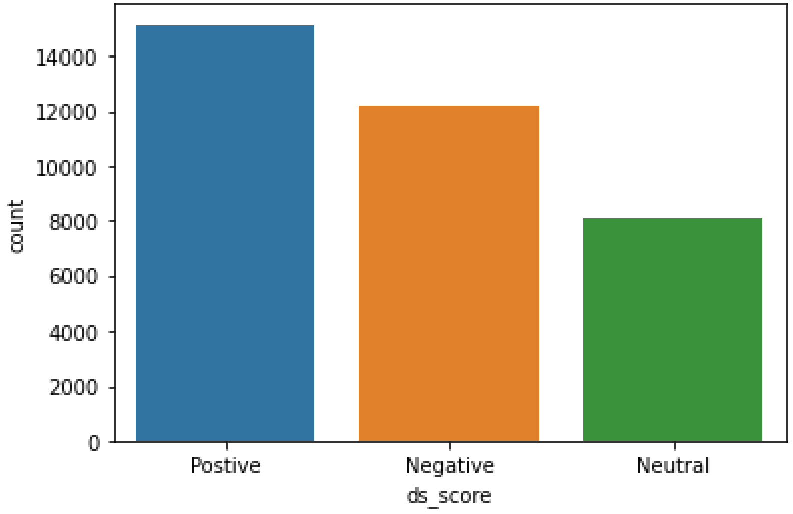
Out[239]:

	Headlines	Time	Description	ds_score
0	Jim Cramer: A better way to invest in the Covi...	7:51 PM ET Fri, 17 July 2020	mad money host jim cramer recommend buy four c...	Postive
1	Cramer's lightning round: I would own Teradyne	7:33 PM ET Fri, 17 July 2020	mad money host jim cramer ring lightn round be...	Negative
2	Cramer's week ahead: Big week for earnings, ev...	7:25 PM ET Fri, 17 July 2020	well pay earn noncovid compani lancet publish ...	Postive
3	IQ Capital CEO Keith Bliss says tech and healt...	4:24 PM ET Fri, 17 July 2020	keith bliss iq capit ceo join close bell talk ...	Postive
4	Wall Street delivered the 'kind of pullback I'...	7:36 PM ET Thu, 16 July 2020	look stock highqual compani go low even though...	Negative
...	...	...	...	...
32668	Malaysia says never hired British data firm at...	Mar 20 2018	malaysian govern rule parti tuesday deni ever ...	Neutral
32669	Prosecutors search Volkswagen headquarters in ...	Mar 20 2018	german prosecutor said tuesday search volkswag...	Neutral
32670	McDonald's sets greenhouse gas reduction targets	Mar 20 2018	mcdonald corp tuesday announc approv scienc ba...	Negative
32671	Pratt & Whitney to deliver spare A320neo engin...	Mar 20 2018	pratt whitney soon begin deliveri spare engin ...	Negative
32672	UK will always consider ways to improve data l...	Mar 20 2018	britain consid suggest give bodi charg uphold ...	Postive

35463 rows × 4 columns

In [240]:
```
# plot a count plot on description score column
```

Out[240]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb199e49fd0>
```



In the description

there are approx

14000 positive statment

12000 negative statment

8000 neutral statment

In [241]:
```
# pie chart on description score column
```

In the dataset

description contains

42.6% positive statments

34.5% negtive statements

22.9% neutral statments

Modelling on description

In [242]:
```
# split the dataset  into test and train
# 90% train , 10% test and random state 212
```

LINEAR SUPPORT VECTOR MACHINE

In [243]:
```
%%time
# pipeline creation
# 1. tfidVectorization
# 2. linearSVC model



# Fit the pipeline to the data

# predict on test dataset

# print accuracy score

#print confusion matrix

#print classification report
```

```
MODEL - LINEAR SVC
accuracy score: 93.43%
[[1122   48   54]
 [  26  771   19]
 [  53   33 1421]]
              precision    recall  f1-score   support

    Negative       0.93      0.92      0.93      1224
     Neutral       0.90      0.94      0.92       816
     Postive       0.95      0.94      0.95      1507

    accuracy                           0.93      3547
   macro avg       0.93      0.93      0.93      3547
weighted avg       0.93      0.93      0.93      3547
```

```
CPU times: user 2.1 s, sys: 90.5 ms, total: 2.19 s
Wall time: 2.19 s
```

LOGISTIC REGRESSION

In [244]:

```
%%time
# pipeline creation
# 1. CountVectorization
# 2. TfidTransformer
# 3. Logistic Regression


# fit the pipeline to the train data


# predict on test dataset

#print accuracy


#print confusion matrix

# print classification report

```

```
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.p
y:940: ConvergenceWarning:

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
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
```

```
MODEL - LOGISTIC REGRESSION
accuracy: 57.26%
[[ 672  145  407]
 [ 191  291  334]
 [ 249  190 1068]]
              precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

CPU times: user 11 s, sys: 5.99 s, total: 17 s
Wall time: 11.4 s
```

MULTINOMIAL NAIVE BAYES

In [245]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. MultinomialNB


# fit the pipeline to the train data

#predict on test data


#print accuracy

#print confusion matrix

# print classification report

```

```
MULTINOMIAL NAIVE BAYES
accuracy: 57.26%
[[ 672  145  407]
 [ 191  291  334]
 [ 249  190 1068]]
              precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

CPU times: user 5.87 s, sys: 77.8 ms, total: 5.95 s
Wall time: 5.93 s
```

BERNOULLI NAIVE BAYES

In [246]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. BernoulliNB



# fit the pipeline to the train data

#predict on test dataset

#print accuracy

#print confusion matrix


# print classification report
```

```
BERNOULLIS NAIVE BAYES
accuracy: 57.26%
[[ 672  145  407]
 [ 191  291  334]
 [ 249  190 1068]]
              precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

CPU times: user 5.14 s, sys: 85.5 ms, total: 5.23 s
Wall time: 5.23 s
```

GRADIENT BOOSTING CLASSIFICATION MODEL

In [247]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. GradientBoostingClassifier

# Fit the pipeline to the data


# predict on test data


#print accuracy


#print confusion matrix
```

```
# print classification report
```

```
GRADIENT BOOST
accuracy: 57.26%
[[ 672  145  407]
 [ 191  291  334]
 [ 249  190 1068]]
              precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

CPU times: user 18.9 s, sys: 308 ms, total: 19.2 s
Wall time: 19.2 s
```

XGBOOST CLASSIFICATION MODEL

In [248]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. XGBClassifier


# Fit the pipeline to the data

# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
XGBOOST
accuracy: 57.26%
[[ 672  145  407]
 [ 191  291  334]
 [ 249  190 1068]]
              precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

CPU times: user 10.6 s, sys: 91.3 ms, total: 10.7 s
Wall time: 10.7 s
```

DECISION TREE CLASSIFICATION MODEL

In [249]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. Decision tree classifier




# Fit the pipeline to the data

# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
DECISION TREE
accuracy: 57.26%
[[ 672  145  407]
 [ 191  291  334]
 [ 249  190 1068]]
              precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

CPU times: user 7.33 s, sys: 35.9 ms, total: 7.37 s
Wall time: 7.35 s
```

K- NEAREST NEIGHBOUR CLASSIFIER MODEL

In [250]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. KNN classifier



# Fit the pipeline to the data

# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
K NEAREST NEIGHBOR
```

```
accuracy: 57.26%
[[ 672  145  407]
 [ 191  291  334]
 [ 249  190 1068]]
              precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

CPU times: user 5.2 s, sys: 37.7 ms, total: 5.23 s
Wall time: 5.2 s
```

In [251]:

```
# helper function for comparing models matric

    # the libraries we need


    # create a dataframe with column matric and metric name as value


    # then predict on the test set

```

In [252]:

```
# list of model objects

# list of model names

# print the comparison of models
```

```
linearSVC
Classification Report
               precision    recall  f1-score   support

    Negative       0.93      0.92      0.93      1224
```

```
     Neutral       0.90      0.94      0.92       816
     Postive       0.95      0.94      0.95      1507

    accuracy                           0.93      3547
   macro avg       0.93      0.93      0.93      3547
weighted avg       0.93      0.93      0.93      3547

-----------------------------------------------------------------------
----------------
logisitc
Classification Report
               precision    recall  f1-score   support

    Negative       0.90      0.86      0.88      1224
     Neutral       0.84      0.91      0.87       816
     Postive       0.92      0.92      0.92      1507

    accuracy                           0.89      3547
   macro avg       0.89      0.89      0.89      3547
weighted avg       0.90      0.89      0.89      3547

-----------------------------------------------------------------------
----------------
MultinomialNB
Classification Report
               precision    recall  f1-score   support

    Negative       0.73      0.60      0.66      1224
     Neutral       0.87      0.12      0.21       816
     Postive       0.57      0.92      0.70      1507

    accuracy                           0.62      3547
   macro avg       0.72      0.54      0.52      3547
weighted avg       0.69      0.62      0.57      3547

-----------------------------------------------------------------------
----------------
BernoulliNB
Classification Report
               precision    recall  f1-score   support
    Negative       0.73      0.72      0.72      1224
     Neutral       0.78      0.61      0.68       816
     Postive       0.73      0.82      0.77      1507

    accuracy                           0.74      3547
   macro avg       0.74      0.72      0.73      3547
weighted avg       0.74      0.74      0.73      3547

-----------------------------------------------------------------------
----------------
gradientboost
Classification Report
               precision    recall  f1-score   support

    Negative       0.82      0.01      0.01      1224
     Neutral       0.00      0.00      0.00       816
     Postive       0.43      1.00      0.60      1507

    accuracy                           0.43      3547
   macro avg       0.41      0.34      0.20      3547
weighted avg       0.46      0.43      0.26      3547

-----------------------------------------------------------------------
----------------
XGB
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/metrics/_classification.
py:1272: UndefinedMetricWarning:

Precision and F-score are ill-defined and being set to 0.0 in labels wi
th no predicted samples. Use `zero_division` parameter to control this
behavior.
```

```
Classification Report
               precision    recall  f1-score   support

    Negative       0.88      0.24      0.37      1224
     Neutral       0.00      0.00      0.00       816
     Postive       0.46      0.98      0.62      1507

    accuracy                           0.50      3547
   macro avg       0.45      0.40      0.33      3547
weighted avg       0.50      0.50      0.39      3547

-----------------------------------------------------------------------
----------------
decisiontree
Classification Report
               precision    recall  f1-score   support

    Negative       0.41      0.89      0.56      1224
     Neutral       0.00      0.00      0.00       816
     Postive       0.84      0.48      0.61      1507

    accuracy                           0.51      3547
   macro avg       0.41      0.46      0.39      3547
weighted avg       0.50      0.51      0.45      3547

-----------------------------------------------------------------------
----------------
KNN
Classification Report
               precision    recall  f1-score   support

    Negative       0.60      0.55      0.58      1224
     Neutral       0.46      0.36      0.40       816
     Postive       0.59      0.71      0.64      1507

    accuracy                           0.57      3547
   macro avg       0.55      0.54      0.54      3547
weighted avg       0.57      0.57      0.57      3547

-----------------------------------------------------------------------
----------------
```

working with test dataset

```
In [253]: # Perforn the prediction on the test dataset
```

```
Out[253]: array(['Negative', 'Negative', 'Negative', ..., 'Negative', 'Postive',
                 'Neutral'], dtype=object)
```

```
In [254]: # creating a dataframe of predicted results
```

```
In [255]:
```

```
Out[255]:
```

	0
0	Negative
1	Negative
2	Negative
3	Negative
4	Postive

Now working with headlines + description

```
In [257]: # merge headlines and description of new dataset and name it info
```

```
Out[257]:
```

	Headlines	Time	Description	ds_score	info
0	Jim Cramer: A better way to invest in the Covi...	7:51 PM ET Fri, 17 July 2020	mad money host jim cramer recommend buy four c...	Postive	Jim Cramer: A better way to invest in the Covi...
1	Cramer's lightning round: I would own Teradyne	7:33 PM ET Fri, 17 July 2020	mad money host jim cramer ring lightn round be...	Negative	Cramer's lightning round: I would own Teradyne...
2	Cramer's week ahead: Big week for earnings, ev...	7:25 PM ET Fri, 17 July 2020	well pay earn noncovid compani lancet publish ...	Postive	Cramer's week ahead: Big week for earnings, ev...

	Headlines	Time	Description	ds_score	info
3	IQ Capital CEO Keith Bliss says tech and healt...	4:24 PM ET Fri, 17 July 2020	keith bliss iq capit ceo join close bell talk ...	Postive	IQ Capital CEO Keith Bliss says tech and healt...
4	Wall Street delivered the 'kind of pullback I'...	7:36 PM ET Thu, 16 July 2020	look stock highqual compani go low even though...	Negative	Wall Street delivered the 'kind of pullback I'...

In [258]:

```
# only keep info and time column . drop all remaining columns
```

Out[258]:

	Time	info
0	7:51 PM ET Fri, 17 July 2020	Jim Cramer: A better way to invest in the Covi...
1	7:33 PM ET Fri, 17 July 2020	Cramer's lightning round: I would own Teradyne...
2	7:25 PM ET Fri, 17 July 2020	Cramer's week ahead: Big week for earnings, ev...
3	4:24 PM ET Fri, 17 July 2020	IQ Capital CEO Keith Bliss says tech and healt...
4	7:36 PM ET Thu, 16 July 2020	Wall Street delivered the 'kind of pullback I'...

In [259]:

```
# apply preprocessing on info column
```

Out[259]:

	Time	info
0	7:51 PM ET Fri, 17 July 2020	jim cramer good way invest covid19 vaccin gold...
1	7:33 PM ET Fri, 17 July 2020	cramer lightn round would teradynemad money ho...
2	7:25 PM ET Fri, 17 July 2020	cramer week ahead big week earn even big week ...
3	4:24 PM ET Fri, 17 July 2020	iq capit ceo keith bliss say tech healthcar ra...
4	7:36 PM ET Thu, 16 July 2020	wall street deliv kind pullback ive wait jim c...
5	7:23 PM ET Thu, 16 July 2020	cramer lightn round would stay long wexmad mon...
6	8:03 PM ET Thu, 16 July 2020	acorn ceo parent turn 5 five figur kid power c...
7	8:54 AM ET Thu, 16 July 2020	dividend cut may mean rethink retir incom stra...

	Time	info
8	8:25 PM ET Wed, 15 July 2020	stockx authent 1 million jordan sneaker year c...
9	7:51 PM ET Wed, 15 July 2020	biohaven pharmaceut land khloe kardashian infl...
10	7:24 PM ET Wed, 15 July 2020	cramer lightn round like beyond meatmad money ...
11	6:51 PM ET Wed, 15 July 2020	cramer desper need anoth round feder stimulu d...
12	7:31 PM ET Tue, 14 July 2020	cramer lightn round buy vmwaremad money host j...
13	7:23 PM ET Tue, 14 July 2020	wall street someth highli unusu tuesday sessio...
14	7:02 PM ET Tue, 14 July 2020	chart suggest sp 500 climb stall end juli jim ...
15	9:05 PM ET Mon, 13 July 2020	salesforc marc benioff face mask end us corona...
16	8:33 PM ET Mon, 13 July 2020	crown castl good stori get even good activist ...
17	9:43 PM ET Mon, 13 July 2020	ellevest salli krawcheck say econom crisi caus...
18	7:38 PM ET Mon, 13 July 2020	cramer lightn round zoom pullback buy opportun...
19	7:24 PM ET Mon, 13 July 2020	cramer earn watch bank get hammer thing could ...

In [260]:

```
# analyze polarity score of values in info and  add new column of it in dataset
```

Out[260]:

	Time	info	info_score
0	7:51 PM ET Fri, 17 July 2020	jim cramer good way invest covid19 vaccin gold...	0.7964
1	7:33 PM ET Fri, 17 July 2020	cramer lightn round would teradynemad money ho...	0.0000
2	7:25 PM ET Fri, 17 July 2020	cramer week ahead big week earn even big week ...	0.3612
3	4:24 PM ET Fri, 17 July 2020	iq capit ceo keith bliss say tech healthcar ra...	0.8625
4	7:36 PM ET Thu, 16 July 2020	wall street deliv kind pullback ive wait jim c...	-0.2263
...	...	...	...
32668	Mar 20 2018	malaysia say never hire british data firm cent...	0.0000
32669	Mar 20 2018	prosecutor search volkswagen headquart new emi...	0.0000
32670	Mar 20 2018	mcdonald set greenhous ga reduct targetsmcdona...	-0.2732

	Time	info	info_score
32671	Mar 20 2018	pratt whitney deliv spare a320neo engin soon i...	-0.3818
32672	Mar 20 2018	uk alway consid way improv data law pm may spo...	0.3818

35463 rows × 3 columns

In [261]:
```
# apply the function  which decides sentiment to  polarity score column
```

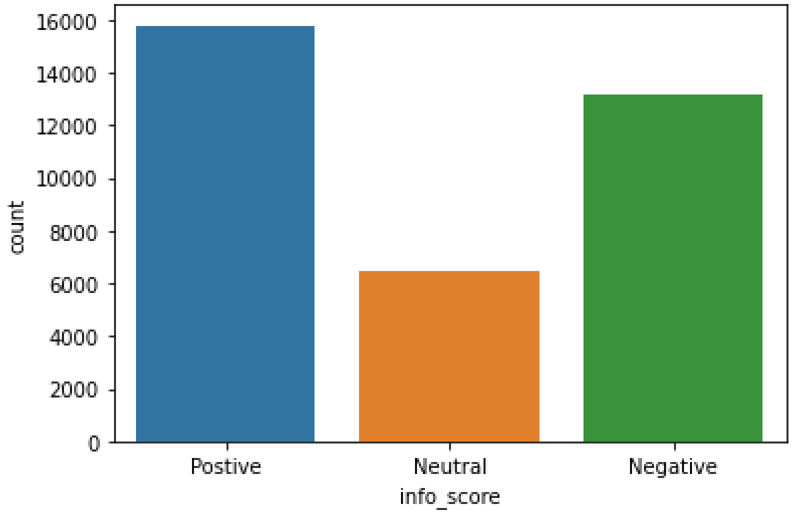
Out[261]:

	Time	info	info_score
0	7:51 PM ET Fri, 17 July 2020	jim cramer good way invest covid19 vaccin gold...	Postive
1	7:33 PM ET Fri, 17 July 2020	cramer lightn round would teradynemad money ho...	Neutral
2	7:25 PM ET Fri, 17 July 2020	cramer week ahead big week earn even big week ...	Postive
3	4:24 PM ET Fri, 17 July 2020	iq capit ceo keith bliss say tech healthcar ra...	Postive
4	7:36 PM ET Thu, 16 July 2020	wall street deliv kind pullback ive wait jim c...	Negative
...	...	...	...
32668	Mar 20 2018	malaysia say never hire british data firm cent...	Neutral
32669	Mar 20 2018	prosecutor search volkswagen headquart new emi...	Neutral
32670	Mar 20 2018	mcdonald set greenhous ga reduct targetsmcdona...	Negative
32671	Mar 20 2018	pratt whitney deliv spare a320neo engin soon i...	Negative
32672	Mar 20 2018	uk alway consid way improv data law pm may spo...	Postive

35463 rows × 3 columns

In [262]:
```
# perform count plot on info_score column
```

Out[262]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb19c3d4e90>
```



In the info

there are approx

15500 positive statment

13000 negative statment

6500 neutral statment

In [263]:

```
# perform pie chart on info_score column
```

In the dataset

info contains

44.5% positive statments

37.2% negtive statements

18.3% neutral statments

modeling on headlines + description

```
In [264]: # split the dataset  into test and train
          # 90% train , 10% test and random state 212
```

LINEAR SUPPORT VECTOR MACHINE

In [265]:
```
%%time
# pipeline creation
# 1. tfidVectorization
# 2. linearSVC model


# Fit the pipline to the data

#predict on test dataset


#print accuracy

#print confusion matrix

# print classification report
```

```
MODEL - LINEAR SVC
accuracy score: 90.98%
[[1164   78   81]
 [  22  619   17]
 [  65   57 1444]]
              precision    recall  f1-score   support

    Negative       0.93      0.88      0.90      1323
     Neutral       0.82      0.94      0.88       658
     Postive       0.94      0.92      0.93      1566

    accuracy                           0.91      3547
   macro avg       0.90      0.91      0.90      3547
weighted avg       0.91      0.91      0.91      3547

CPU times: user 2.1 s, sys: 72.2 ms, total: 2.18 s
Wall time: 2.18 s
```

LOGISTIC REGRESSION

In [266]:

```
%%time
# pipeline creation
# 1. CountVectorization
# 2. TfidTransformer
# 3. Logistic Regression



# Fit the pipeline to the data

#predict on test data


#print accuracy

#print confusion matrix

# print classification report
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.p
y:940: ConvergenceWarning:

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
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
```

```
MODEL - LOGISTIC REGRESSION
accuracy: 56.16%
[[ 686  183  454]
 [ 156  245  257]
 [ 303  202 1061]]
```

```
              precision    recall  f1-score   support

    Negative       0.60      0.52      0.56      1323
     Neutral       0.39      0.37      0.38       658
     Postive       0.60      0.68      0.64      1566

    accuracy                           0.56      3547
   macro avg       0.53      0.52      0.52      3547
weighted avg       0.56      0.56      0.56      3547

CPU times: user 14 s, sys: 9.41 s, total: 23.4 s
Wall time: 14.8 s
```

MULTINOMIAL NAIVE BAYES

In [267]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. MultinomialNB


# Fit the pipeline to the data

#predict on test data

#print accuracy

#print confusion matrix

# print classification report

```

```
MULTINOMIAL NAIVE BAYES
accuracy: 56.16%
[[ 686  183  454]
 [ 156  245  257]
 [ 303  202 1061]]
              precision    recall  f1-score   support
              precision    recall  f1-score   support

    Negative       0.60      0.52      0.56      1323
     Neutral       0.39      0.37      0.38       658
     Postive       0.60      0.68      0.64      1566

    accuracy                           0.56      3547
   macro avg       0.53      0.52      0.52      3547
weighted avg       0.56      0.56      0.56      3547

CPU times: user 5.67 s, sys: 57.6 ms, total: 5.72 s
Wall time: 5.74 s
```

BERNOULLI NAIVE BAYES

In [268]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. BernoulliNB

# Fit the pipeline to the data

#predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
BERNOULLIS NAIVE BAYES
accuracy: 56.16%
[[ 686  183  454]
 [ 156  245  257]
 [ 303  202 1061]]
              precision    recall  f1-score   support

    Negative       0.60      0.52      0.56      1323
    Negative       0.60      0.52      0.56      1323
     Neutral       0.39      0.37      0.38       658
     Postive       0.60      0.68      0.64      1566

    accuracy                           0.56      3547
   macro avg       0.53      0.52      0.52      3547
weighted avg       0.56      0.56      0.56      3547

CPU times: user 5.64 s, sys: 90 ms, total: 5.73 s
Wall time: 5.73 s
```

GRADIENT BOOSTING CLASSIFICATION MODEL

In [270]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. GradientBoostingClassifier



# Fit the pipeline to the data

# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
GRADIENT BOOST
accuracy: 56.16%
[[ 686  183  454]
 [ 156  245  257]
 [ 303  202 1061]]
              precision    recall  f1-score   support
```

```
    Negative       0.60      0.52      0.56      1323
     Neutral       0.39      0.37      0.38       658
     Postive       0.60      0.68      0.64      1566

    accuracy                           0.56      3547
   macro avg       0.53      0.52      0.52      3547
weighted avg       0.56      0.56      0.56      3547

CPU times: user 24 s, sys: 338 ms, total: 24.4 s
Wall time: 24.3 s
```

XGBOOST CLASSIFICATION MODEL

In [271]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. XGBClassifier


# Fit the pipeline to the data

# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
XGBOOST
accuracy: 56.16%
[[ 686  183  454]
 [ 156  245  257]
 [ 303  202 1061]]
              precision    recall  f1-score   support

    Negative       0.60      0.52      0.56      1323
     Neutral       0.39      0.37      0.38       658
     Neutral       0.39      0.37      0.38       658
     Postive       0.60      0.68      0.64      1566

    accuracy                           0.56      3547
   macro avg       0.53      0.52      0.52      3547
weighted avg       0.56      0.56      0.56      3547

CPU times: user 13 s, sys: 106 ms, total: 13.1 s
Wall time: 13 s
```

DECISION TREE CLASSIFICATION MODEL

In [272]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. Decision tree classifier



# Fit the pipeline to the data

# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
DECISION TREE
accuracy: 56.16%
[[ 686  183  454]
 [ 156  245  257]
 [ 303  202 1061]]
              precision    recall  f1-score   support

    Negative       0.60      0.52      0.56      1323

     Neutral       0.39      0.37      0.38       658
     Neutral       0.39      0.37      0.38       658
     Postive       0.60      0.68      0.64      1566

    accuracy                           0.56      3547
   macro avg       0.53      0.52      0.52      3547
weighted avg       0.56      0.56      0.56      3547

CPU times: user 8.16 s, sys: 33.7 ms, total: 8.2 s
Wall time: 8.21 s
```

K- NEAREST NEIGHBOUR CLASSIFIER MODEL

In [273]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. KNN classifier


# Fit the pipeline to the data

# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
K NEAREST NEIGHBOR
accuracy: 56.16%
[[ 686  183  454]
 [ 156  245  257]
 [ 303  202 1061]]
              precision    recall  f1-score   support

    Negative       0.60      0.52      0.56      1323
     Neutral       0.39      0.37      0.38       658
     Postive       0.60      0.68      0.64      1566
    accuracy                           0.56      3547
   macro avg       0.53      0.52      0.52      3547
weighted avg       0.56      0.56      0.56      3547

CPU times: user 5.16 s, sys: 31.1 ms, total: 5.19 s
Wall time: 5.21 s
```

In [274]:

```
# helper function for comparing models matric

    # the libraries we need

    # create a dataframe with column matric and metric name as value

    # then predict on the test set
```

In [276]:

```
# list of model objects

# list of model names

# print the comparison of models
```

```
linearSVC
Classification Report
               precision    recall  f1-score   support

    Negative       0.93      0.75      0.83      1323
     Neutral       0.47      0.99      0.63       658
     Postive       0.96      0.66      0.78      1566

    accuracy                           0.76      3547
   macro avg       0.78      0.80      0.75      3547
weighted avg       0.85      0.76      0.77      3547

-----------------------------------------------------------------------

----------------
logisitc
```

```
Classification Report
               precision    recall  f1-score   support

    Negative       0.91      0.66      0.76      1323
     Neutral       0.39      0.99      0.56       658
     Postive       0.96      0.56      0.71      1566

    accuracy                           0.68      3547
   macro avg       0.75      0.74      0.68      3547
weighted avg       0.83      0.68      0.70      3547

-----------------------------------------------------------------------
----------------
MultinomialNB
Classification Report
               precision    recall  f1-score   support

    Negative       0.79      0.58      0.66      1323
     Neutral       0.33      0.99      0.49       658
     Postive       0.91      0.35      0.50      1566

    accuracy                           0.55      3547
   macro avg       0.67      0.64      0.55      3547
weighted avg       0.75      0.55      0.56      3547

-----------------------------------------------------------------------
----------------
BernoulliNB
Classification Report
               precision    recall  f1-score   support

    Negative       0.78      0.79      0.78      1323
     Neutral       0.59      0.92      0.72       658
     Postive       0.87      0.65      0.75      1566

    accuracy                           0.75      3547
   macro avg       0.75      0.79      0.75      3547
weighted avg       0.78      0.75      0.76      3547

-----------------------------------------------------------------------
```

```
----------------
gradientboost
Classification Report
               precision    recall  f1-score   support

    Negative       0.00      0.00      0.00      1323
     Neutral       0.19      1.00      0.31       658
     Postive       0.00      0.00      0.00      1566

    accuracy                           0.19      3547
   macro avg       0.06      0.33      0.10      3547
weighted avg       0.03      0.19      0.06      3547

-----------------------------------------------------------------------
----------------
XGB
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/metrics/_classification.
py:1272: UndefinedMetricWarning:

Precision and F-score are ill-defined and being set to 0.0 in labels wi
th no predicted samples. Use `zero_division` parameter to control this
behavior.
```

```
Classification Report
               precision    recall  f1-score   support

    Negative       0.77      0.26      0.39      1323
     Neutral       0.25      0.99      0.41       658
     Postive       0.81      0.28      0.42      1566

    accuracy                           0.40      3547
   macro avg       0.61      0.51      0.40      3547
weighted avg       0.69      0.40      0.40      3547

-----------------------------------------------------------------------
----------------

decisiontree
Classification Report
```

```
              precision    recall  f1-score   support

    Negative       0.77      0.21      0.33      1323
     Neutral       0.25      0.99      0.40       658
     Postive       0.81      0.29      0.42      1566

    accuracy                           0.39      3547
   macro avg       0.61      0.49      0.38      3547
weighted avg       0.69      0.39      0.38      3547

-----------------------------------------------------------------------
----------------
KNN
Classification Report
              precision    recall  f1-score   support

    Negative       0.76      0.48      0.59      1323
     Neutral       0.29      0.91      0.44       658
     Postive       0.80      0.33      0.47      1566

    accuracy                           0.49      3547
   macro avg       0.62      0.57      0.50      3547
weighted avg       0.69      0.49      0.51      3547

-----------------------------------------------------------------------
----------------
```

working with test data

In [279]:

```
# Perforn the prediction on the test dataset
```

Out[279]:

```
array(['Negative', 'Negative', 'Negative', ..., 'Neutral', 'Postive',
       'Postive'], dtype=object)
```

In [280]:

```
# creating a dataframe of predicted results
```

In [281]:

```

```

Out[281]:

	0
0	Negative
1	Negative
2	Negative
3	Negative
4	Postive

now working on headlines

In [283]:

```
# from the dataset you have copied before delete the column of descript
ion
```

Out[283]:

	Headlines	Time
0	Jim Cramer: A better way to invest in the Covi...	7:51 PM ET Fri, 17 July 2020
1	Cramer's lightning round: I would own Teradyne	7:33 PM ET Fri, 17 July 2020
2	Cramer's week ahead: Big week for earnings, ev...	7:25 PM ET Fri, 17 July 2020
3	IQ Capital CEO Keith Bliss says tech and healt...	4:24 PM ET Fri, 17 July 2020
4	Wall Street delivered the 'kind of pullback I'...	7:36 PM ET Thu, 16 July 2020

In [285]:

```
# remane the date column in gaurdian headlines dataset  to time
```

Out[285]:

	Time	Headlines
0	18-Jul-20	Johnson is asking Santa for a Christmas recovery
1	18-Jul-20	‘I now fear the worst’: four grim tales of wor...
2	18-Jul-20	Five key areas Sunak must tackle to serve up e...

	Time	Headlines
3	18-Jul-20	Covid-19 leaves firms ‘fatally ill-prepared’ f...
4	18-Jul-20	The Week in Patriarchy \n\n\n Bacardi's 'lad...

In [286]:

```
# cancatenate the gaurdian headlines dataset and  copy of datasetto get all headlines together
```

In [287]:

Out[287]:

	Time	Headlines
0	18-Jul-20	Johnson is asking Santa for a Christmas recovery
1	18-Jul-20	‘I now fear the worst’: four grim tales of wor...
2	18-Jul-20	Five key areas Sunak must tackle to serve up e...
3	18-Jul-20	Covid-19 leaves firms ‘fatally ill-prepared’ f...
4	18-Jul-20	The Week in Patriarchy \n\n\n Bacardi's 'lad...

In [288]:

```
# check the shape of all headlines dataset
```

Out[288]:

```
(53258, 2)
```

In [289]:

```
#apply preprocessin to the headlines column in the new dataset
```

Out[289]:

	Time	Headlines
0	18-Jul-20	johnson ask santa christma recoveri
1	18-Jul-20	‘ fear bad ’ four grim tale work life upend co...
2	18-Jul-20	five key area sunak must tackl serv econom rec...
3	18-Jul-20	covid19 leav firm ‘ fatal illprepar ’ nodeal b...
4	18-Jul-20	week patriarchi bacardi ladi vodka late long l...

In [290]:

```
# analyze polarity score of values in headlines and  add new column of
 it in dataset
```

Out[290]:

	Time	Headlines	hl_score
0	18-Jul-20	johnson ask santa christma recoveri	0.0000
1	18-Jul-20	‘ fear bad ’ four grim tale work life upend co...	-0.8860
2	18-Jul-20	five key area sunak must tackl serv econom rec...	0.0000
3	18-Jul-20	covid19 leav firm ‘ fatal illprepar ’ nodeal b...	-0.5423
4	18-Jul-20	week patriarchi bacardi ladi vodka late long l...	-0.4939
...	...	...	...
32668	Mar 20 2018	malaysia say never hire british data firm cent...	0.0000
32669	Mar 20 2018	prosecutor search volkswagen headquart new emi...	0.0000
32670	Mar 20 2018	mcdonald set greenhous ga reduct target	0.0000
32671	Mar 20 2018	pratt whitney deliv spare a320neo engin soon i...	0.0000
32672	Mar 20 2018	uk alway consid way improv data law pm may spo...	0.0000

53258 rows × 3 columns

In [291]:

```
# apply the function  which decides sentiment to  polarity score column
```

Out[291]:

	Time	Headlines	hl_score
0	18-Jul-20	johnson ask santa christma recoveri	Neutral
1	18-Jul-20	‘ fear bad ’ four grim tale work life upend co...	Negative
2	18-Jul-20	five key area sunak must tackl serv econom rec...	Neutral
3	18-Jul-20	covid19 leav firm ‘ fatal illprepar ’ nodeal b...	Negative
4	18-Jul-20	week patriarchi bacardi ladi vodka late long l...	Negative
...	...	...	...

	Time	Headlines	hl_score
32668	Mar 20 2018	malaysia say never hire british data firm cent...	Neutral
32669	Mar 20 2018	prosecutor search volkswagen headquart new emi...	Neutral
32670	Mar 20 2018	mcdonald set greenhous ga reduct target	Neutral
32671	Mar 20 2018	pratt whitney deliv spare a320neo engin soon i...	Neutral
32672	Mar 20 2018	uk alway consid way improv data law pm may spo...	Neutral

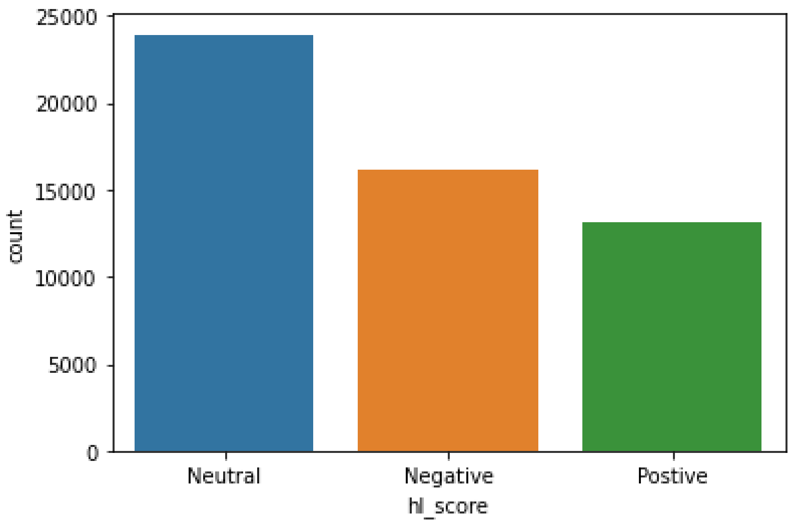
53258 rows × 3 columns

In [292]:

```
#perform countplot on headline score column
```

Out[292]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fb197378610>
```



In the headlines

there are approx

14000 positive statment

16000 negative statment

24000 neutral statment

In [293]:

```
#perform pie digram on headline score column
```

In the dataset

headlines contains

24.8% positive statments

30.3% negtive statements

44.9% neutral statments

Modeling on headlines

In [294]:

```
# split the dataset  into test and train
# 90% train , 10% test and random state 212
```

LINEAR SUPPORT VECTOR MACHINE

In [295]:

```
%%time
# pipeline creation
# 1. tfidVectorization
# 2. linearSVC model


# Fit the pipeline to the data

# predict on test dataset

#print accuracy

#print confusion matrix

# print classification report
```

```
MODEL - LINEAR SVC
accuracy score: 93.11%
[[1572   37   40]
 [ 111 2106  109]
 [  49   21 1281]]
              precision    recall  f1-score   support
              precision    recall  f1-score   support

    Negative       0.91      0.95      0.93      1649
     Neutral       0.97      0.91      0.94      2326
     Postive       0.90      0.95      0.92      1351

    accuracy                           0.93      5326
   macro avg       0.93      0.94      0.93      5326
weighted avg       0.93      0.93      0.93      5326

CPU times: user 1.69 s, sys: 79.7 ms, total: 1.77 s
Wall time: 1.77 s
```

LOGISTIC REGRESSION

In [296]:

```
%%time
# pipeline creation
# 1. CountVectorization
# 2. TfidTransformer
# 3. Logistic Regression



# Fit the pipeline to the data

# predict on test dataset


#print accuracy

#print confusion matrix

# print classification report
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.p
y:940: ConvergenceWarning:

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
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
```

```
MODEL - LOGISTIC REGRESSION
accuracy: 49.85%
[[1047  150  452]
 [ 608  648 1070]
 [ 233  158  960]]
              precision    recall  f1-score   support

    Negative       0.55      0.63      0.59      1649
     Neutral       0.68      0.28      0.39      2326
     Postive       0.39      0.71      0.50      1351

    accuracy                           0.50      5326
   macro avg       0.54      0.54      0.50      5326
weighted avg       0.57      0.50      0.48      5326

CPU times: user 11.6 s, sys: 6.95 s, total: 18.5 s
Wall time: 12.3 s
```

MULTINOMIAL NAIVE BAYES

In [297]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. MultinomialNB


# Fit the pipeline to the data
```

```
#predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
MULTINOMIAL NAIVE BAYES
accuracy: 49.85%
[[1047  150  452]
 [ 608  648 1070]
 [ 233  158  960]]
              precision    recall  f1-score   support

    Negative       0.55      0.63      0.59      1649
     Neutral       0.68      0.28      0.39      2326
     Postive       0.39      0.71      0.50      1351

    accuracy                           0.50      5326
   macro avg       0.54      0.54      0.50      5326
weighted avg       0.57      0.50      0.48      5326

CPU times: user 5.38 s, sys: 100 ms, total: 5.49 s
Wall time: 5.47 s
```

BERNOULLI NAIVE BAYES

In [298]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. BernoulliNB


# fit the pipeline to the train data

#predict on test dataset
```

```
#print accuracy


#print confusion matrix

# print classification report
```

```
BERNOULLIS NAIVE BAYES
accuracy: 49.85%
[[1047  150  452]
 [ 608  648 1070]
 [ 233  158  960]]
              precision    recall  f1-score   support

    Negative       0.55      0.63      0.59      1649
     Neutral       0.68      0.28      0.39      2326
     Postive       0.39      0.71      0.50      1351

    accuracy                           0.50      5326
   macro avg       0.54      0.54      0.50      5326
weighted avg       0.57      0.50      0.48      5326

CPU times: user 5.38 s, sys: 93.5 ms, total: 5.48 s
Wall time: 5.44 s
```

GRADIENT BOOSTING CLASSIFICATION MODEL

In [299]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. GradientBoostingClassifier



# Fit the pipeline to the data
# predict on test data


#print accuracy

#print confusion matrix

# print classification report
```

```
GRADIENT BOOST
accuracy: 49.85%
[[1047  150  452]
 [ 608  648 1070]
 [ 233  158  960]]
              precision    recall  f1-score   support

    Negative       0.55      0.63      0.59      1649
     Neutral       0.68      0.28      0.39      2326
     Postive       0.39      0.71      0.50      1351

    accuracy                           0.50      5326
   macro avg       0.54      0.54      0.50      5326
weighted avg       0.57      0.50      0.48      5326

CPU times: user 14.1 s, sys: 952 ms, total: 15 s
Wall time: 15 s
```

XGBOOST CLASSIFICATION MODEL

In [300]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. XGBClassifier


# Fit the model to the data
# predict on test data


#print accuracy

#print confusion matrix

# print classification report
```

```
XGBOOST
accuracy: 49.85%
[[1047  150  452]
 [ 608  648 1070]
 [ 233  158  960]]
              precision    recall  f1-score   support

    Negative       0.55      0.63      0.59      1649
     Neutral       0.68      0.28      0.39      2326
     Postive       0.39      0.71      0.50      1351

    accuracy                           0.50      5326
   macro avg       0.54      0.54      0.50      5326
weighted avg       0.57      0.50      0.48      5326

CPU times: user 8.94 s, sys: 72.1 ms, total: 9.01 s
Wall time: 8.96 s
```

DECISION TREE CLASSIFICATION MODEL

In [301]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. Decision tree classifier



# Fit the pipeline to the data
# predict on test data

#print accuracy

#print confusion matrix

# print classification report
```

```
DECISION TREE
accuracy: 49.85%
[[1047  150  452]
 [ 608  648 1070]
 [ 233  158  960]]
              precision    recall  f1-score   support

    Negative       0.55      0.63      0.59      1649
     Neutral       0.68      0.28      0.39      2326
     Postive       0.39      0.71      0.50      1351

    accuracy                           0.50      5326
   macro avg       0.54      0.54      0.50      5326
weighted avg       0.57      0.50      0.48      5326

CPU times: user 6.49 s, sys: 65.3 ms, total: 6.55 s
Wall time: 6.54 s
```

K- NEAREST NEIGHBOUR CLASSIFIER MODEL

In [302]:

```
%%time
# pipeline creation
# 1. CountVectorizer
# 2. TfidTransformer
# 3. KNN classifier


# Fit the pipeline to the data


# prect on test data
```

```
#print accuracy


#print confusion matrix


# print classification report
```

```
K NEAREST NEIGHBOR
accuracy: 49.85%
[[1047  150  452]
 [ 608  648 1070]
 [ 233  158  960]]
              precision    recall  f1-score   support

    Negative       0.55      0.63      0.59      1649
     Neutral       0.68      0.28      0.39      2326
     Postive       0.39      0.71      0.50      1351

    accuracy                           0.50      5326
   macro avg       0.54      0.54      0.50      5326
weighted avg       0.57      0.50      0.48      5326

CPU times: user 5.28 s, sys: 72.2 ms, total: 5.36 s
Wall time: 5.35 s
```

In [303]:

```
# helper function for comparing models matric

    # the libraries we need


    # create a dataframe with column matric and metric name as value


    # then predict on the test set

```

In [304]:
```
# list of model objects

# list of model names

# print the comparison of models
```

```
linearSVC
Classification Report
              precision    recall  f1-score   support

    Negative       0.97      0.95      0.96      1649
     Neutral       0.98      1.00      0.99      2326
     Postive       0.97      0.96      0.96      1351

    accuracy                           0.97      5326
   macro avg       0.97      0.97      0.97      5326
weighted avg       0.97      0.97      0.97      5326

------------------------------------------------------------------------
----------------
logisitc
Classification Report
              precision    recall  f1-score   support

    Negative       0.96      0.90      0.93      1649
     Neutral       0.92      1.00      0.96      2326
     Postive       0.96      0.90      0.93      1351

    accuracy                           0.94      5326
   macro avg       0.95      0.93      0.94      5326
weighted avg       0.94      0.94      0.94      5326

------------------------------------------------------------------------
----------------
MultinomialNB
Classification Report
              precision    recall  f1-score   support

    Negative       0.84      0.83      0.84      1649
     Neutral       0.82      0.97      0.89      2326
     Postive       0.90      0.64      0.75      1351

    accuracy                           0.84      5326
   macro avg       0.86      0.81      0.83      5326
weighted avg       0.85      0.84      0.84      5326

-----------------------------------------------------------------------
----------------
BernoulliNB
Classification Report
              precision    recall  f1-score   support

    Negative       0.84      0.88      0.86      1649
     Neutral       0.95      0.92      0.94      2326
     Postive       0.85      0.84      0.85      1351

    accuracy                           0.89      5326
   macro avg       0.88      0.88      0.88      5326
weighted avg       0.89      0.89      0.89      5326

-----------------------------------------------------------------------
----------------
gradientboost
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/metrics/_classification.
py:1272: UndefinedMetricWarning:

Precision and F-score are ill-defined and being set to 0.0 in labels wi
th no predicted samples. Use `zero_division` parameter to control this
behavior.
```

```
Classification Report
              precision    recall  f1-score   support

    Negative       0.00      0.00      0.00      1649
     Neutral       0.44      1.00      0.61      2326
     Postive       0.00      0.00      0.00      1351

    accuracy                           0.44      5326
```

```
   macro avg       0.15      0.33      0.20      5326
weighted avg       0.19      0.44      0.27      5326

-----------------------------------------------------------------------
----------------
XGB
Classification Report
               precision    recall  f1-score   support

    Negative       0.93      0.27      0.42      1649
     Neutral       0.53      1.00      0.69      2326
     Postive       0.87      0.30      0.45      1351

    accuracy                           0.60      5326
   macro avg       0.78      0.52      0.52      5326
weighted avg       0.74      0.60      0.55      5326

-----------------------------------------------------------------------
----------------
decisiontree
Classification Report
               precision    recall  f1-score   support

    Negative       0.93      0.25      0.40      1649
     Neutral       0.53      1.00      0.69      2326
     Postive       0.87      0.30      0.45      1351

    accuracy                           0.59      5326
   macro avg       0.78      0.52      0.51      5326
weighted avg       0.74      0.59      0.54      5326

-----------------------------------------------------------------------
----------------
KNN
Classification Report
               precision    recall  f1-score   support

    Negative       0.69      0.56      0.62      1649
     Neutral       0.63      0.83      0.71      2326
     Postive       0.68      0.47      0.56      1351
    accuracy                           0.65      5326
   macro avg       0.67      0.62      0.63      5326
weighted avg       0.66      0.65      0.64      5326

------------------------------------------------------------------------
----------------
```

now working with test data

In [306]:
```python
# Perforn the prediction on the test dataset
```

Out[306]:
```
array(['Postive', 'Negative', 'Neutral', ..., 'Neutral', 'Postive',
       'Postive'], dtype=object)
```

In [307]:
```python
# creating a dataframe of predicted results
```

In [308]:
```python

```

Out[308]:

	0
0	Postive
1	Negative
2	Neutral
3	Negative
4	Neutral

Prediction

you can check the result on real time news headlines

Here i have used two fiancial news headlines

and predicted its sentiment

You can try more

```
In [309]: sent1 = ['GST officers detect Rs 4,000 crore of ITC fraud in April-Jun
          e']
          y_predict = linear_svc_model_hl.predict(sent1)
          y_predict

Out[309]: array(['Negative'], dtype=object)
```

```
In [310]: sent2 = ["Finance Ministry releases Rs 9,871 crore to 17 states as gran
          t"]
          y_predict = linear_svc_model_hl.predict(sent2)
          y_predict

Out[310]: array(['Postive'], dtype=object)
```

Conclusion

We learn about NLTK, sentiment analysis in this assigment.

we conclude that using nltk it is easy to classify financial news and more we improve the traning data more we can get accurate

Congratulation for completing the assignment.

You have learned a lot while doing this assignment.