Procesamiento y Clasificación de Datos

Tarea 2 Análisis de Sentimiento

Estudiante: Orestes Boffill Beltrán

Matrícula: 2085377

Maestría de Ciencia de Datos

Librerías

In [1]:
```
# Tratamiento de datos
# ==============================================================================
import numpy as np
import pandas as pd
import string
import re

# Gráficos
# ==============================================================================
import matplotlib.pyplot as plt
from matplotlib import style
import seaborn as sns
#style.use('ggplot') or plt.style.use('ggplot')

# Preprocesado y modelado
# ==============================================================================
from sklearn import svm
from sklearn.model_selection import train_test_split
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import confusion_matrix
from sklearn.feature_extraction.text import TfidfVectorizer
import nltk
#nltk.download('stopwords')
from nltk.corpus import stopwords

# Configuración warnings
# ==============================================================================
import warnings
warnings.filterwarnings('ignore')
```

Carga de la Base de Datos a analizar

la Base de Datos contiene tweets y provienen originalmente de la biblioteca "Data for Everyone de Crowdflower", descargada desde: https://www.kaggle.com/datasets/crowdflower/first-gop-debate-twitter-sentiment

Contiene decenas de miles de tweets sobre el debate republicano de principios de agosto en Ohio y se le pidió a los contribuyentes que hicieran análisis de sentimientos y de categorización de datos. Se preguntó a los colaboradores si el tweet era relevante, qué candidato se mencionó, qué tema se mencionó y luego cuál era el sentimiento para un tweet determinado. Los mensajes no relevantes del conjunto de datos cargado fueron eliminados previamente.

In [2]:
```
df = pd.read_csv('E:/MCD/Documentos/Sentiment.csv')
df.head()
```

Out[2]:

	id	candidate	candidate_confidence	relevant_yn	relevant_yn_confidence	sentiment	sentiment_confidence	subject_matter	subject_matter_confidenc
0	1	No candidate mentioned	1.0	yes	1.0	Neutral	0.6578	None of the above	1.000
1	2	Scott Walker	1.0	yes	1.0	Positive	0.6333	None of the above	1.000
2	3	No candidate mentioned	1.0	yes	1.0	Neutral	0.6629	None of the above	0.662
3	4	No candidate mentioned	1.0	yes	1.0	Positive	1.0000	None of the above	0.703
4	5	Donald Trump	1.0	yes	1.0	Positive	0.7045	None of the above	1.000

5 rows × 21 columns

In [3]:
```
dataset = df.drop(['id', 'candidate_confidence', 'relevant_yn', 'relevant_yn_confidence', 'subject_matter', 'subject_matter_confidence', 'candidate_gold', 'r
dataset.head()
```

Out[3]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone
0	No candidate mentioned	Neutral	0.6578	I_Am_Kenzi	5	RT @NancyLeeGrahn: How did everyone feel about...	2015-08-07 09:54:46 -0700	Quito
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN
2	No candidate mentioned	Neutral	0.6629	PussssyCroook	27	RT @TJMShow: No mention of Tamir Rice and the ...	2015-08-07 09:54:46 -0700	NaN
3	No candidate mentioned	Positive	1.0000	MattFromTexas31	138	RT @RobGeorge: That Carly Fiorina is trending ...	2015-08-07 09:54:45 -0700	Central Time (US & Canada)
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona

In [4]:
```
dataset.shape
```

```
Out[4]:(13871, 8)
```

In [5]:
```
onlypo = dataset[dataset['candidate']!='No candidate mentioned']
onlypo.head()
```

Out[5]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona
5	Ted Cruz	Positive	0.6332	DRJohnson11	228	RT @GregAbbott_TX: @TedCruz: "On my first day ...	2015-08-07 09:54:44 -0700	Central Time (US & Canada)
8	Ben Carson	Negative	0.6889	kengpdx	0	Deer in the headlights RT @lizzwinstead: Ben C...	2015-08-07 09:54:44 -0700	Pacific Time (US & Canada)
10	Donald Trump	Negative	1.0000	jnjsmom	0	@JGreenDC @realDonaldTrump In all fairness #Bi...	2015-08-07 09:54:42 -0700	Central Time (US & Canada)

In [6]:
```
onlypo.shape
```

```
Out[6]:(6380, 8)
```

In [7]:
```
onlypo = onlypo.fillna({"candidate":0})
onlypo.shape
```

```
Out[7]:(6380, 8)
```

In [8]:
```
onlypo = onlypo[onlypo['candidate']!=0]
onlypo.shape
```

```
Out[8]:(6284, 8)
```

In [9]:
```
import re

# Define a function to clean the text
def clean(text):
    # Removes all special characters and numericals leaving the alphabets
    text = re.sub('[^A-Za-z]+', ' ', text)
    return text

# Cleaning the text in the review column

dataset['Limpio'] = dataset['text'].apply(clean)
dataset.head()
```

Out[9]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone	Limpio
0	No candidate mentioned	Neutral	0.6578	I_Am_Kenzi	5	RT @NancyLeeGrahn: How did everyone feel about...	2015-08-07 09:54:46 -0700	Quito	RT NancyLeeGrahn How did everyone feel about t...
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN	RT ScottWalker Didn t catch the full GOPdebate...
2	No candidate mentioned	Neutral	0.6629	PussssyCroook	27	RT @TJMShow: No mention of Tamir Rice and the ...	2015-08-07 09:54:46 -0700	NaN	RT TJMShow No mention of Tamir Rice and the GO...
3	No candidate mentioned	Positive	1.0000	MattFromTexas31	138	RT @RobGeorge: That Carly Fiorina is trending ...	2015-08-07 09:54:45 -0700	Central Time (US & Canada)	RT RobGeorge That Carly Fiorina is trending ho...
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona	RT DanScavino GOPDebate w realDonaldTrump deli...

In [10]:
```
import nltk
nltk.download('punkt')
nltk.download('omw-1.4')
from nltk.tokenize import word_tokenize
from nltk import pos_tag
nltk.download('stopwords')
from nltk.corpus import stopwords
nltk.download('wordnet')
from nltk.corpus import wordnet
nltk.download('averaged_perceptron_tagger')

# POS tagger dictionary
pos_dict = {'J':wordnet.ADJ, 'V':wordnet.VERB, 'N':wordnet.NOUN, 'R':wordnet.ADV}

def token_stop_pos(text):
    tags = pos_tag(word_tokenize(text))
    newlist = []
    for word, tag in tags:
        if word.lower() not in set(stopwords.words('english')):
            newlist.append(tuple([word, pos_dict.get(tag[0])]))
    return newlist

dataset['POS'] = dataset['Limpio'].apply(token_stop_pos)
dataset.head()
```

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

Out[10]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone	Limpio
0	No candidate mentioned	Neutral	0.6578	I_Am_Kenzi	5	RT @NancyLeeGrahn: How did everyone feel about...	2015-08-07 09:54:46 -0700	Quito	RT NancyLeeGrahn How did everyone feel about t...
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN	RT ScottWalker Didn t catch the full GOPdebate...
2	No candidate mentioned	Neutral	0.6629	PussssyCroook	27	RT @TJMShow: No mention of Tamir Rice and the ...	2015-08-07 09:54:46 -0700	NaN	RT TJMShow No mention of Tamir Rice and the GO...
3	No candidate mentioned	Positive	1.0000	MattFromTexas31	138	RT @RobGeorge: That Carly Fiorina is trending ...	2015-08-07 09:54:45 -0700	Central Time (US & Canada)	RT RobGeorge That Carly Fiorina is trending ho...
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona	RT DanScavino GOPDebate w realDonaldTrump deli...

In [11]:
```
from nltk.stem import WordNetLemmatizer
wordnet_lemmatizer = WordNetLemmatizer()

def lemmatize(pos_data):
    lemma_rew = " "
    for word, pos in pos_data:
        if not pos:
            lemma = word
            lemma_rew = lemma_rew + " " + lemma
        else:
            lemma = wordnet_lemmatizer.lemmatize(word, pos=pos)
            lemma_rew = lemma_rew + " " + lemma
    return lemma_rew

dataset['Lemma'] = dataset['POS'].apply(lemmatize)
dataset.head()
```

Out[11]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone	Limpio
0	No candidate mentioned	Neutral	0.6578	I_Am_Kenzi	5	RT @NancyLeeGrahn: How did everyone feel about...	2015-08-07 09:54:46 -0700	Quito	RT NancyLeeGrahn How did everyone feel about t...
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN	RT ScottWalker Didn t catch the full GOPdebate...
2	No candidate mentioned	Neutral	0.6629	PussssyCroook	27	RT @TJMShow: No mention of Tamir Rice and the ...	2015-08-07 09:54:46 -0700	NaN	RT TJMShow No mention of Tamir Rice and the GO...
3	No candidate mentioned	Positive	1.0000	MattFromTexas31	138	RT @RobGeorge: That Carly Fiorina is trending ...	2015-08-07 09:54:45 -0700	Central Time (US & Canada)	RT RobGeorge That Carly Fiorina is trending ho...
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona	RT DanScavino GOPDebate w realDonaldTrump deli...

In [12]:
```python
dataset[['text', 'Lemma']]
```

Out[12]:

	text	Lemma
0	RT @NancyLeeGrahn: How did everyone feel about...	RT NancyLeeGrahn everyone feel Climate Chang...
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...
2	RT @TJMShow: No mention of Tamir Rice and the ...	RT TJMShow mention Tamir Rice GOPDebate hold...
3	RT @RobGeorge: That Carly Fiorina is trending ...	RT RobGeorge Carly Fiorina trend hour debate...
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...
...	...	...
13866	RT @cappy_yarbrough: Love to see men who will ...	RT cappy yarbrough Love see men never face p...
13867	RT @georgehenryw: Who thought Huckabee exceede...	RT georgehenryw think Huckabee exceed expect...
13868	RT @Lrihendry: #TedCruz As President, I will a...	RT Lrihendry TedCruz President always tell t...
13869	RT @JRehling: #GOPDebate Donald Trump says tha...	RT JRehling GOPDebate Donald Trump say time ...
13870	RT @Lrihendry: #TedCruz headed into the Presid...	RT Lrihendry TedCruz head Presidential Debat...

13871 rows × 2 columns

In [13]:
```python
from textblob import TextBlob

# function to calculate subjectivity
def getSubjectivity(review):
    return TextBlob(review).sentiment.subjectivity

# function to calculate polarity
def getPolarity(review):
    return TextBlob(review).sentiment.polarity

# function to analyze the reviews
def analysis(score):
    if score < 0:
        return 'Negative'
    elif score == 0:
        return 'Neutral'
    else:
        return 'Positive'
```

In [14]:
```python
fin_data = pd.DataFrame(dataset[['text', 'Lemma']])
```

In [15]:
```python
# fin_data['Subjectivity'] = fin_data['Lemma'].apply(getSubjectivity)
fin_data['Polarity'] = fin_data['Lemma'].apply(getPolarity)
fin_data['Analysis'] = fin_data['Polarity'].apply(analysis)
fin_data.head()
```

Out[15]:

	text	Lemma	Polarity	Analysis
0	RT @NancyLeeGrahn: How did everyone feel about...	RT NancyLeeGrahn everyone feel Climate Chang...	0.1250	Positive
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...	0.3375	Positive
2	RT @TJMShow: No mention of Tamir Rice and the ...	RT TJMShow mention Tamir Rice GOPDebate hold...	0.1000	Positive
3	RT @RobGeorge: That Carly Fiorina is trending ...	RT RobGeorge Carly Fiorina trend hour debate...	0.1000	Positive
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...	0.1600	Positive

In [16]:

```
tb_counts = fin_data.Analysis.value_counts()
tb_counts
```

Out[16]:

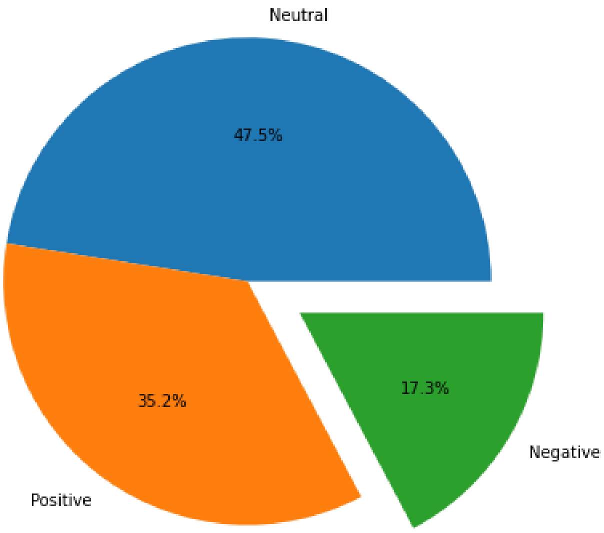
```
Neutral     6591
Positive    4885
Negative    2395
Name: Analysis, dtype: int64
```

In [17]:

```
import matplotlib.pyplot as plt
%matplotlib inline

tb_count= fin_data.Analysis.value_counts()
plt.figure(figsize=(10, 7))
plt.pie(tb_counts.values, labels = tb_counts.index, explode = (0, 0, 0.25), autopct='%1.1f%%', shadow=False)
```

Out[17]:

```
([<matplotlib.patches.Wedge at 0x24a243c1460>,
  <matplotlib.patches.Wedge at 0x24a243c1a60>,
  <matplotlib.patches.Wedge at 0x24a243fb1c0>],
 [Text(0.08573990798461832, 1.0966533947327155, 'Neutral'),
  Text(-0.6395498673104528, -0.894972606968047, 'Positive'),
  Text(1.1562133280282039, -0.696900810797308, 'Negative')],
 [Text(0.046767222537064536, 0.5981745789451175, '47.5%'),
  Text(-0.34884538216933786, -0.4881668765280256, '35.2%'),
  Text(0.7279861694992393, -0.4387893993908976, '17.3%')])
```



In [18]:

```
from vaderSentiment.vaderSentiment import SentimentIntensityAnalyzer
analyzer = SentimentIntensityAnalyzer()

# function to calculate vader sentiment
def vadersentimentanalysis(review):
    vs = analyzer.polarity_scores(review)
    return vs['compound']

fin_data['Vader Sentiment'] = fin_data['Lemma'].apply(vadersentimentanalysis)
```

In [19]:

```
# function to analyse
def vader_analysis(compound):
    if compound >= 0.5:
        return 'Positive'
    elif compound <= -0.5 :
        return 'Negative'
    else:
        return 'Neutral'

fin_data['Vader Analysis'] = fin_data['Vader Sentiment'].apply(vader_analysis)
fin_data.head()
```

Out[19]:

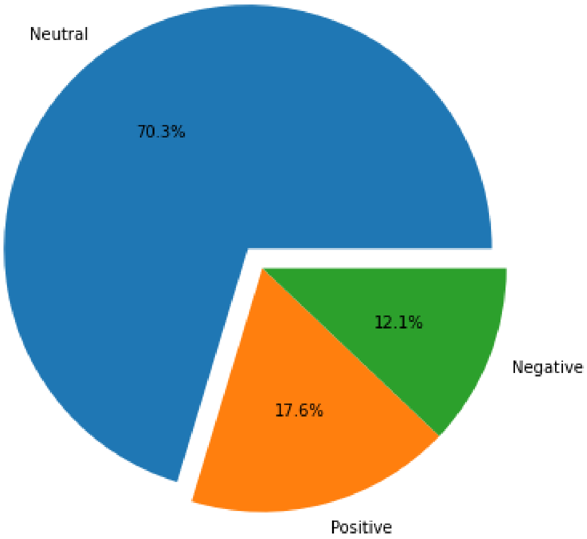
	text	Lemma	Polarity	Analysis	Vader Sentiment	Vader Analysis
0	RT @NancyLeeGrahn: How did everyone feel about...	RT NancyLeeGrahn everyone feel Climate Chang...	0.1250	Positive	0.0000	Neutral
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...	0.3375	Positive	0.6369	Positive
2	RT @TJMShow: No mention of Tamir Rice and the ...	RT TJMShow mention Tamir Rice GOPDebate hold...	0.1000	Positive	0.5859	Positive
3	RT @RobGeorge: That Carly Fiorina is trending ...	RT RobGeorge Carly Fiorina trend hour debate...	0.1000	Positive	0.0000	Neutral
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...	0.1600	Positive	0.0000	Neutral

In [20]:
```
vader_counts = fin_data['Vader Analysis'].value_counts()
vader_counts
```

Out[20]:
```
Neutral     9752
Positive    2443
Negative    1676
Name: Vader Analysis, dtype: int64
```

In [21]:
```
vader_counts= fin_data['Vader Analysis'].value_counts()
plt.figure(figsize=(10, 7))
plt.pie(vader_counts.values, labels = vader_counts.index, explode = (0.1, 0, 0), autopct='%1.1f%%', shadow=False)
```

Out[21]:
```
([<matplotlib.patches.Wedge at 0x24a26856100>,
  <matplotlib.patches.Wedge at 0x24a26856820>,
  <matplotlib.patches.Wedge at 0x24a26856f40>],
 [Text(-0.7146106524112953, 0.9640184725721304, 'Neutral'),
  Text(0.2809893415436816, -1.0635059896111767, 'Positive'),
  Text(1.021697839838303, -0.4075948037815812, 'Negative')],
 [Text(-0.4168562139065889, 0.5623441090004093, '70.3%'),
  Text(0.15326691356928088, -0.5800941761515509, '17.6%'),
  Text(0.5572897308208924, -0.222324438426317, '12.1%')])
```



In [22]:
```
nltk.download('sentiwordnet')
from nltk.corpus import sentiwordnet as swn

def sentiwordnetanalysis(pos_data):
    sentiment = 0
    tokens_count = 0
    for word, pos in pos_data:
        if not pos:
            continue
        lemma = wordnet_lemmatizer.lemmatize(word, pos=pos)
        if not lemma:
            continue

        synsets = wordnet.synsets(lemma, pos=pos)
        if not synsets:
            continue

        # Take the first sense, the most common
        synset = synsets[0]
        swn_synset = swn.senti_synset(synset.name())
        sentiment += swn_synset.pos_score() - swn_synset.neg_score()
        tokens_count += 1
        # print(swn_synset.pos_score(),swn_synset.neg_score(),swn_synset.obj_score())
    if not tokens_count:
        return 0
    if sentiment>0:
        return "Positive"
    if sentiment==0:
        return "Neutral"
    else:
        return "Negative"

fin_data['SWN analysis'] = dataset['POS'].apply(sentiwordnetanalysis)
fin_data.head()
```

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

Out[22]:

	text	Lemma	Polarity	Analysis	Vader Sentiment	Vader Analysis	SWN analysis
0	RT @NancyLeeGrahn: How did everyone feel about...	RT NancyLeeGrahn everyone feel Climate Chang...	0.1250	Positive	0.0000	Neutral	Negative
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...	0.3375	Positive	0.6369	Positive	Positive
2	RT @TJMShow: No mention of Tamir Rice and the ...	RT TJMShow mention Tamir Rice GOPDebate hold...	0.1000	Positive	0.5859	Positive	Negative
3	RT @RobGeorge: That Carly Fiorina is trending ...	RT RobGeorge Carly Fiorina trend hour debate...	0.1000	Positive	0.0000	Neutral	Neutral
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...	0.1600	Positive	0.0000	Neutral	Negative

In [23]:

```
swn_counts= fin_data['SWN analysis'].value_counts()
swn_counts
```

Out[23]:

```
Positive    5989
Negative    4219
Neutral     3638
0             25
Name: SWN analysis, dtype: int64
```

In [24]:

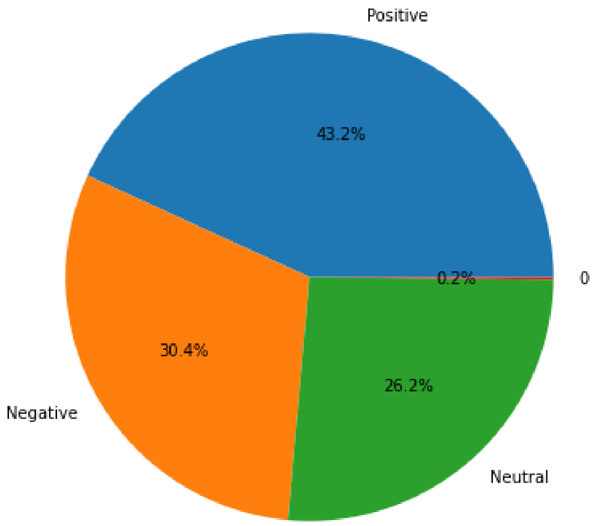
```
import matplotlib.pyplot as plt
```

In [25]:

```
swn_counts= fin_data['SWN analysis'].value_counts()
plt.figure(figsize=(10, 7))
plt.pie(swn_counts.values, labels = swn_counts.index, autopct='%1.1f%%', shadow=False)
```

Out[25]:

```
([<matplotlib.patches.Wedge at 0x24a2d1e70d0>,
  <matplotlib.patches.Wedge at 0x24a2d1e77f0>,
  <matplotlib.patches.Wedge at 0x24a2d1e7df0>,
  <matplotlib.patches.Wedge at 0x24a2d1f0550>],
 [Text(0.23400435018219426, 1.0748218290004206, 'Positive'),
  Text(-0.9508582850710655, -0.5530538144807542, 'Negative'),
  Text(0.7380657512183892, -0.8156340765799543, 'Neutral'),
  Text(1.0999823680342276, -0.006228162956532336, '0')],
 [Text(0.12763873646301505, 0.5862664521820474, '43.2%'),
  Text(-0.5186499736751266, -0.3016657169895023, '30.4%'),
  Text(0.4025813188463941, -0.4448913144981569, '26.2%'),
  Text(0.5999903825641241, -0.0033971797944721827, '0.2%')])
```

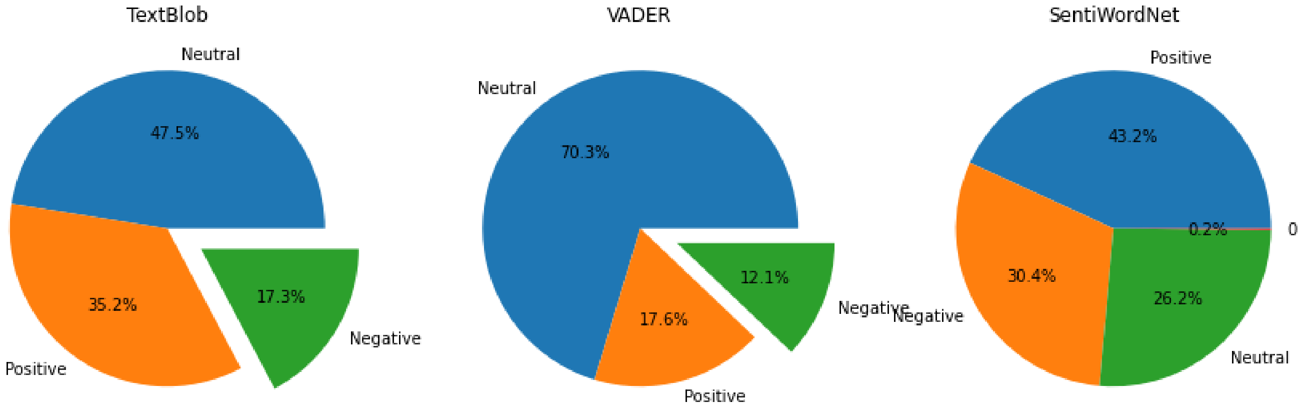


In [26]:

```
import matplotlib.pyplot as plt
%matplotlib inline

plt.figure(figsize=(15,7))
plt.subplot(1,3,1)
plt.title("TextBlob")
```

```
        plt.pie(tb_counts.values, labels = tb_counts.index, explode = (0, 0, 0.25), autopct='%1.1f%%', shadow=False)
        plt.subplot(1,3,2)
        plt.title("VADER")
        plt.pie(vader_counts.values, labels = vader_counts.index, explode = (0, 0, 0.25), autopct='%1.1f%%', shadow=False)
        plt.subplot(1,3,3)
        plt.title("SentiWordNet")
        plt.pie(swn_counts.values, labels = swn_counts.index, autopct='%1.1f%%', shadow=False)
```

```
Out[26]:([<matplotlib.patches.Wedge at 0x24a2d2de280>,
          <matplotlib.patches.Wedge at 0x24a2d2dea00>,
          <matplotlib.patches.Wedge at 0x24a2d2ec160>,
          <matplotlib.patches.Wedge at 0x24a2d2ec880>],
         [Text(0.23400435018219426, 1.0748218290004206, 'Positive'),
          Text(-0.9508582850710655, -0.5530538144807542, 'Negative'),
          Text(0.7380657512183892, -0.8156340765799543, 'Neutral'),
          Text(1.0999823680342276, -0.006228162956532336, '0')],
         [Text(0.12763873646301505, 0.5862664521820474, '43.2%'),
          Text(-0.5186499736751266, -0.3016657169895023, '30.4%'),
          Text(0.4025813188463941, -0.4448913144981569, '26.2%'),
          Text(0.5999903825641241, -0.003397179794472182 7, '0.2%')])
```



```
In [27]: import numpy as np
         import pandas as pd
         import re
         import nltk
         import matplotlib.pyplot as plt
         %matplotlib inline
```

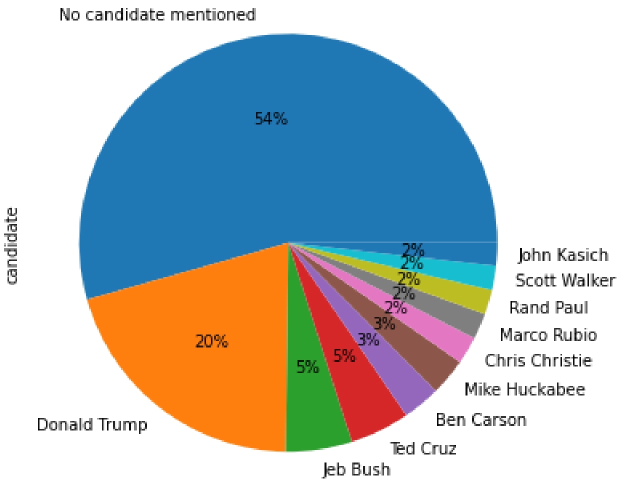
```
In [28]: po_tweets = pd.read_csv('E:/MCD/Documentos/Sentiment.csv')
```

```
In [29]: plot_size = plt.rcParams["figure.figsize"]
         print(plot_size[0])
         print(plot_size[1])

         plot_size[0] = 8
         plot_size[1] = 6
         plt.rcParams["figure.figsize"] = plot_size
```

```
6.0
4.0
```

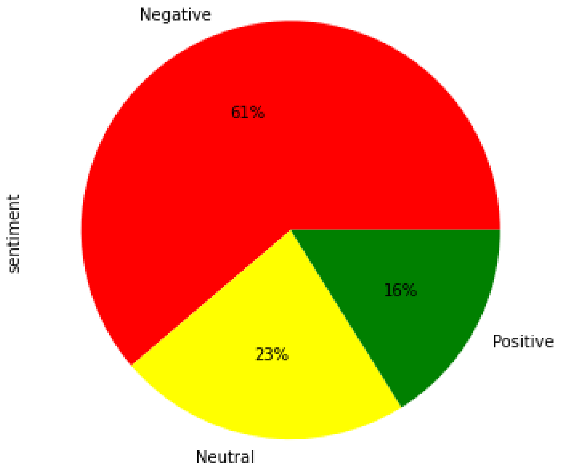
```
In [30]: po_tweets.candidate.value_counts().plot(kind='pie', autopct='%1.0f%%')
```

```
Out[30]:<AxesSubplot:ylabel='candidate'>
```



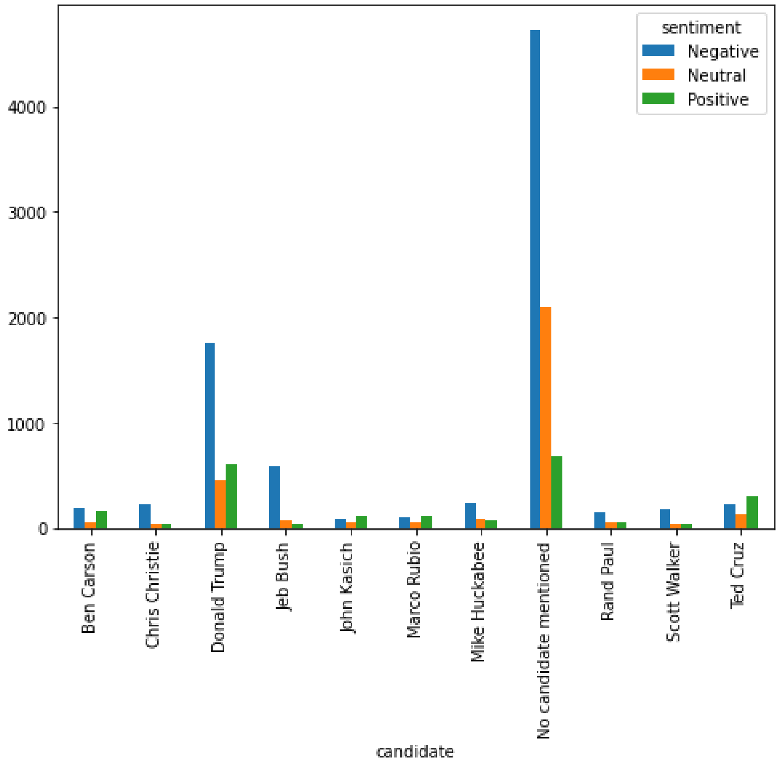
```
In [31]: po_tweets.sentiment.value_counts().plot(kind='pie', autopct='%1.0f%%', colors=["red", "yellow", "green"])
```

```
Out[31]:<AxesSubplot:ylabel='sentiment'>
```



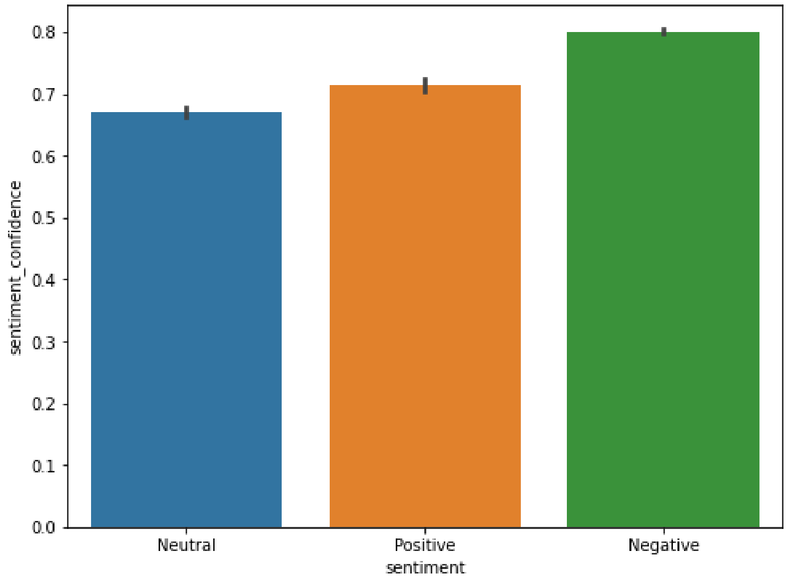
In [32]:
```
po_sentiment = po_tweets.groupby(['candidate', 'sentiment']).sentiment.count().unstack()
po_sentiment.plot(kind='bar')
```

```
Out[32]:<AxesSubplot:xlabel='candidate'>
```



In [33]:
```
import seaborn as sns

sns.barplot(x='sentiment', y='sentiment_confidence' , data=po_tweets)
```

```
Out[33]:<AxesSubplot:xlabel='sentiment', ylabel='sentiment_confidence'>
```



In [34]:
```
features = po_tweets.iloc[:, 15].values
```

```
labels = po_tweets.iloc[:, 5].values
```

In [35]:
```
processed_features = []

for sentence in range(0, len(features)):
    # Remove all the special characters
    processed_feature = re.sub(r'\W', ' ', str(features[sentence]))
    # remove all single characters
    processed_feature= re.sub(r'\s+[a-zA-Z]\s+', ' ', processed_feature)
    # Remove single characters from the start
    processed_feature = re.sub(r'\^[a-zA-Z]\s+', ' ', processed_feature)
    # Substituting multiple spaces with single space
    processed_feature = re.sub(r'\s+', ' ', processed_feature, flags=re.I)
    # Removing prefixed 'b'
    processed_feature = re.sub(r'^b\s+', '', processed_feature)
    # Converting to Lowercase
    processed_feature = processed_feature.lower()

    processed_features.append(processed_feature)
```

In [36]:
```
from nltk.corpus import stopwords
from sklearn.feature_extraction.text import TfidfVectorizer

vectorizer = TfidfVectorizer (max_features=2500, min_df=7, max_df=0.8, stop_words=stopwords.words('english'))
processed_features = vectorizer.fit_transform(processed_features).toarray()
```

In [37]:
```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(processed_features, labels, test_size=0.2, random_state=0)
```

In [38]:
```
from sklearn.ensemble import RandomForestClassifier

text_classifier = RandomForestClassifier(n_estimators=200, random_state=0)
text_classifier.fit(X_train, y_train)
```

Out[38]:
```
RandomForestClassifier(n_estimators=200, random_state=0)
```

In [39]:
```
predictions = text_classifier.predict(X_test)
```

In [40]:
```
from sklearn.metrics import classification_report, confusion_matrix, accuracy_score

print(confusion_matrix(y_test,predictions))
print(classification_report(y_test,predictions))
print(accuracy_score(y_test, predictions))
```

```
[[1521  110   39]
 [ 428  182   32]
 [ 219   43  201]]
              precision    recall  f1-score   support

    Negative       0.70      0.91      0.79      1670
     Neutral       0.54      0.28      0.37       642
    Positive       0.74      0.43      0.55       463

    accuracy                           0.69      2775
   macro avg       0.66      0.54      0.57      2775
weighted avg       0.67      0.69      0.65      2775

0.6861261261261261
```

Sólo con los políticos

In [41]:
```
onlypo['Limpio'] = onlypo['text'].apply(clean)
onlypo.head()
```

Out[41]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone	Limpio
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN	RT ScottWalker Didn t catch the full GOPdebate...
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona	RT DanScavino GOPDebate w realDonaldTrump deli...
5	Ted Cruz	Positive	0.6332	DRJohnson11	228	RT @GregAbbott_TX: @TedCruz: "On my first day ...	2015-08-07 09:54:44 -0700	Central Time (US & Canada)	RT GregAbbott TX TedCruz On my first day I wil...
8	Ben Carson	Negative	0.6889	kengpdx	0	Deer in the headlights RT @lizzwinstead: Ben C...	2015-08-07 09:54:44 -0700	Pacific Time (US & Canada)	Deer in the headlights RT lizzwinstead Ben Car...
10	Donald Trump	Negative	1.0000	jnjsmom	0	@JGreenDC @realDonaldTrump In all fairness #Bi...	2015-08-07 09:54:42 -0700	Central Time (US & Canada)	JGreenDC realDonaldTrump In all fairness Bill...

In [42]:
```
onlypo['POS'] = onlypo['Limpio'].apply(token_stop_pos)
onlypo.head()
```

Out[42]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone	Limpio	
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN	RT ScottWalker Didn t catch the full GOPdebate...	((
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona	RT DanScavino GOPDebate w realDonaldTrump deli...	((
5	Ted Cruz	Positive	0.6332	DRJohnson11	228	RT @GregAbbott_TX: @TedCruz: "On my first day ...	2015-08-07 09:54:44 -0700	Central Time (US & Canada)	RT GregAbbott TX TedCruz On my first day I wil...	(T
8	Ben Carson	Negative	0.6889	kengpdx	0	Deer in the headlights RT @lizzwinstead: Ben C...	2015-08-07 09:54:44 -0700	Pacific Time (US & Canada)	Deer in the headlights RT lizzwinstead Ben Car...	(F
10	Donald Trump	Negative	1.0000	jnjsmom	0	@JGreenDC @realDonaldTrump In all fairness #Bi...	2015-08-07 09:54:42 -0700	Central Time (US & Canada)	JGreenDC realDonaldTrump In all fairness Bill...	(re

In [43]:
```
onlypo['Lemma'] = onlypo['POS'].apply(lemmatize)
onlypo.head()
```

Out[43]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone	Limpio	
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN	RT ScottWalker Didn t catch the full GOPdebate...	((
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona	RT DanScavino GOPDebate w realDonaldTrump deli...	((
5	Ted Cruz	Positive	0.6332	DRJohnson11	228	RT @GregAbbott_TX: @TedCruz: "On my first day ...	2015-08-07 09:54:44 -0700	Central Time (US & Canada)	RT GregAbbott TX TedCruz On my first day I wil...	(T
8	Ben Carson	Negative	0.6889	kengpdx	0	Deer in the headlights RT @lizzwinstead: Ben C...	2015-08-07 09:54:44 -0700	Pacific Time (US & Canada)	Deer in the headlights RT lizzwinstead Ben Car...	(F
10	Donald Trump	Negative	1.0000	jnjsmom	0	@JGreenDC @realDonaldTrump In all fairness #Bi...	2015-08-07 09:54:42 -0700	Central Time (US & Canada)	JGreenDC realDonaldTrump In all fairness Bill...	(re

In [44]:
```
onlypo[['text', 'Lemma']]
```

Out[44]:

	text	Lemma
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...
5	RT @GregAbbott_TX: @TedCruz: "On my first day ...	RT GregAbbott TX TedCruz first day rescind e...
8	Deer in the headlights RT @lizzwinstead: Ben C...	Deer headlight RT lizzwinstead Ben Carson ma...
10	@JGreenDC @realDonaldTrump In all fairness #Bi...	JGreenDC realDonaldTrump fairness BillClinto...
...	...	...
13865	RT @RWSurferGirl: Fox is cherry picking the ca...	RT RWSurferGirl Fox cherry pick candidate Je...
13867	RT @georgehenryw: Who thought Huckabee exceede...	RT georgehenryw think Huckabee exceed expect...
13868	RT @Lrihendry: #TedCruz As President, I will a...	RT Lrihendry TedCruz President always tell t...
13869	RT @JRehling: #GOPDebate Donald Trump says tha...	RT JRehling GOPDebate Donald Trump say time ...
13870	RT @Lrihendry: #TedCruz headed into the Presid...	RT Lrihendry TedCruz head Presidential Debat...

6284 rows × 2 columns

In [45]:
```
fin_data = pd.DataFrame(onlypo[['text', 'Lemma']])
```

In [46]:
```
fin_data['Polarity'] = fin_data['Lemma'].apply(getPolarity)
fin_data['Analysis'] = fin_data['Polarity'].apply(analysis)
fin_data.head()
```

Out[46]:

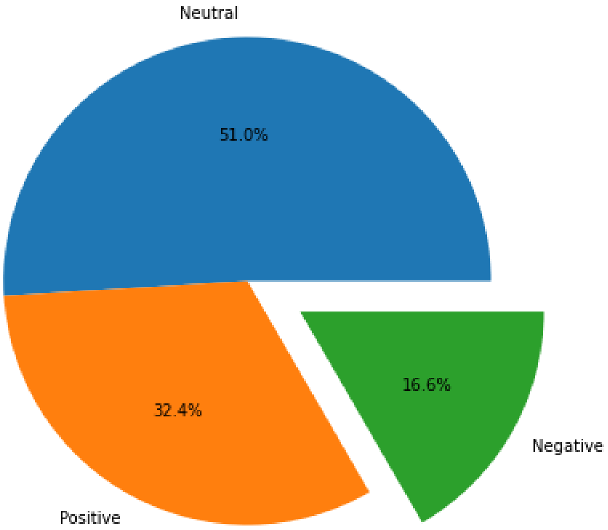
	text	Lemma	Polarity	Analysis
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...	0.3375	Positive
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...	0.1600	Positive
5	RT @GregAbbott_TX: @TedCruz: "On my first day ...	RT GregAbbott TX TedCruz first day rescind e...	-0.0500	Negative
8	Deer in the headlights RT @lizzwinstead: Ben C...	Deer headlight RT lizzwinstead Ben Carson ma...	0.0000	Neutral
10	@JGreenDC @realDonaldTrump In all fairness #Bi...	JGreenDC realDonaldTrump fairness BillClinto...	0.6000	Positive

In [47]:
```
tb_counts = fin_data.Analysis.value_counts()
tb_counts
```

Out[47]:
```
Neutral     3202
Positive    2036
Negative    1046
Name: Analysis, dtype: int64
```

In [48]:
```
%matplotlib inline

tb_count= fin_data.Analysis.value_counts()
plt.figure(figsize=(10, 7))
plt.pie(tb_counts.values, labels = tb_counts.index, explode = (0, 0, 0.25), autopct='%1.1f%%', shadow=False)
```

```
Out[48]:([<matplotlib.patches.Wedge at 0x24a4e6a0940>,
          <matplotlib.patches.Wedge at 0x24a4e6aa910>,
          <matplotlib.patches.Wedge at 0x24a4e6c26a0>],
         [Text(-0.032990806607029785, 1.0995051644623675, 'Neutral'),
          Text(-0.5205358058561896, -0.9690420397597038, 'Positive'),
          Text(1.1695840896637224, -0.6742203328330302, 'Negative')],
         [Text(-0.017994985422016246, 0.5997300897067458, '51.0%'),
          Text(-0.28392862137610336, -0.5285683853234747, '32.4%'),
          Text(0.736404797195677, -0.4245090984504264, '16.6%')])
```



In [49]:
```
fin_data['Vader Sentiment'] = fin_data['Lemma'].apply(vadersentimentanalysis)
```

In [50]:
```
fin_data['Vader Analysis'] = fin_data['Vader Sentiment'].apply(vader_analysis)
fin_data.head()
```

Out[50]:

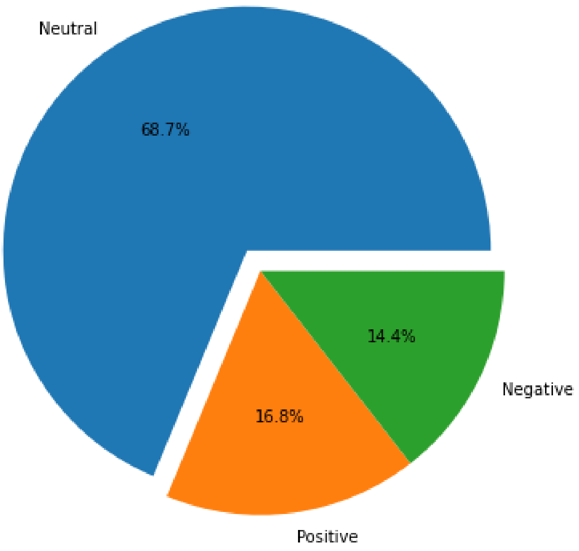
	text	Lemma	Polarity	Analysis	Vader Sentiment	Vader Analysis
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...	0.3375	Positive	0.6369	Positive
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...	0.1600	Positive	0.0000	Neutral
5	RT @GregAbbott_TX: @TedCruz: "On my first day ...	RT GregAbbott TX TedCruz first day rescind e...	-0.0500	Negative	-0.0943	Neutral
8	Deer in the headlights RT @lizzwinstead: Ben C...	Deer headlight RT lizzwinstead Ben Carson ma...	0.0000	Neutral	0.0000	Neutral
10	@JGreenDC @realDonaldTrump In all fairness #Bi...	JGreenDC realDonaldTrump fairness BillClinto...	0.6000	Positive	0.0000	Neutral

In [51]:
```
vader_counts = fin_data['Vader Analysis'].value_counts()
vader_counts
```

```
Out[51]:Neutral     4319
        Positive    1057
        Negative     908
        Name: Vader Analysis, dtype: int64
```

In [52]:
```
vader_counts= fin_data['Vader Analysis'].value_counts()
plt.figure(figsize=(10, 7))
plt.pie(vader_counts.values, labels = vader_counts.index, explode = (0.1, 0, 0), autopct='%1.1f%%', shadow=False)
```

```
Out[52]:([<matplotlib.patches.Wedge at 0x24a4e708490>,
          <matplotlib.patches.Wedge at 0x24a4e708bb0>,
          <matplotlib.patches.Wedge at 0x24a4e716310>],
         [Text(-0.6660606820206738, 0.9981799276013092, 'Neutral'),
          Text(0.14748543164963734, -1.0900679095593633, 'Positive'),
          Text(0.9885984844452821, -0.4823619352234292, 'Negative')],
         [Text(-0.388535397845393, 0.582271624434097, '68.7%'),
          Text(0.08044659908162037, -0.5945824961232891, '16.8%'),
          Text(0.5392355369701538, -0.2631065101218704, '14.4%')])
```



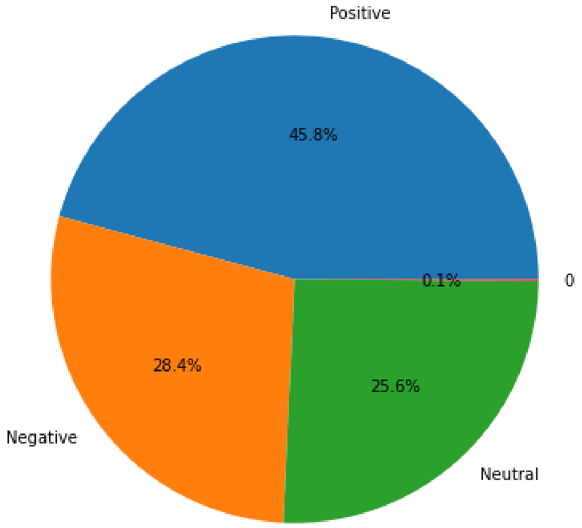
```
In [53]: fin_data['SWN analysis'] = dataset['POS'].apply(sentiwordnetanalysis)
         fin_data.head()
```

Out[53]:

	text	Lemma	Polarity	Analysis	Vader Sentiment	Vader Analysis	SWN analysis
1	RT @ScottWalker: Didn't catch the full #GOPdeb...	RT ScottWalker catch full GOPdebate last nig...	0.3375	Positive	0.6369	Positive	Positive
4	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	RT DanScavino GOPDebate w realDonaldTrump de...	0.1600	Positive	0.0000	Neutral	Negative
5	RT @GregAbbott_TX: @TedCruz: "On my first day ...	RT GregAbbott TX TedCruz first day rescind e...	-0.0500	Negative	-0.0943	Neutral	Positive
8	Deer in the headlights RT @lizzwinstead: Ben C...	Deer headlight RT lizzwinstead Ben Carson ma...	0.0000	Neutral	0.0000	Neutral	Positive
10	@JGreenDC @realDonaldTrump In all fairness #Bi...	JGreenDC realDonaldTrump fairness BillClinto...	0.6000	Positive	0.0000	Neutral	Neutral

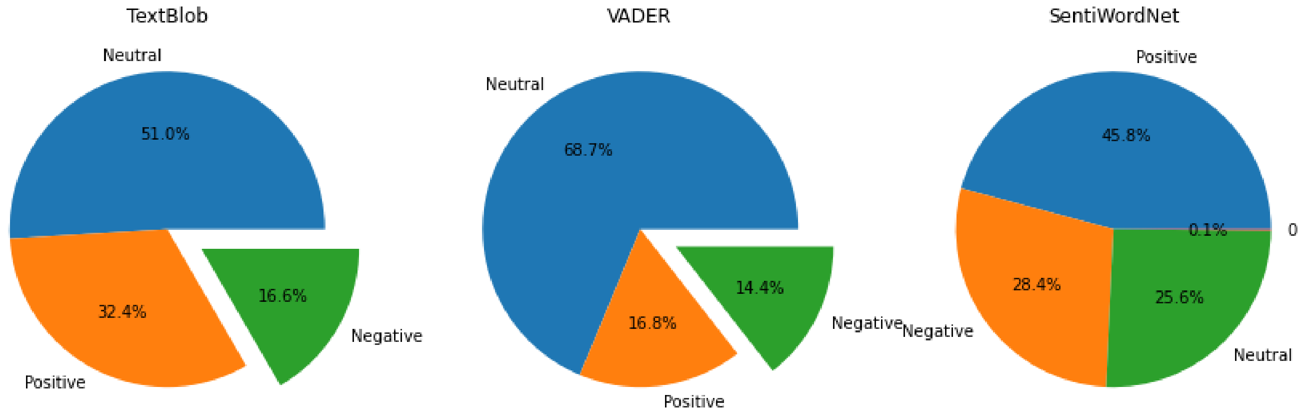
```
In [54]: swn_counts= fin_data['SWN analysis'].value_counts()
         swn_counts

Out[54]:Positive    2880
        Negative    1786
        Neutral     1610
        0              8
        Name: SWN analysis, dtype: int64

In [55]: swn_counts= fin_data['SWN analysis'].value_counts()
         plt.figure(figsize=(10, 7))
         plt.pie(swn_counts.values, labels = swn_counts.index, autopct='%1.1f%%', shadow=False)
```

```
Out[55]:([<matplotlib.patches.Wedge at 0x24a4e75a1c0>,
          <matplotlib.patches.Wedge at 0x24a4e75a8e0>,
          <matplotlib.patches.Wedge at 0x24a4e765040>,
          <matplotlib.patches.Wedge at 0x24a4e765760>],
         [Text(0.14366965333381534, 1.0905773841002488, 'Positive'),
          Text(-0.8882348187568564, -0.6488751087443366, 'Negative'),
          Text(0.7561389577669066, -0.7989079274529552, 'Neutral'),
          Text(1.0999912025322274, -0.004399358101414309, '0')],
         [Text(0.07836526545480836, 0.5948603913274083, '45.8%'),
          Text(-0.4844917193219216, -0.35393187749691085, '28.4%'),
          Text(0.41243943150922174, -0.4357679604288846, '25.6%'),
          Text(0.5999952013812149, -0.002399649873498714, '0.1%')])
```



```
In [56]: %matplotlib inline

         plt.figure(figsize=(15,7))
         plt.subplot(1,3,1)
         plt.title("TextBlob")
         plt.pie(tb_counts.values, labels = tb_counts.index, explode = (0, 0, 0.25), autopct='%1.1f%%', shadow=False)
         plt.subplot(1,3,2)
         plt.title("VADER")
         plt.pie(vader_counts.values, labels = vader_counts.index, explode = (0, 0, 0.25), autopct='%1.1f%%', shadow=False)
         plt.subplot(1,3,3)
         plt.title("SentiWordNet")
         plt.pie(swn_counts.values, labels = swn_counts.index, autopct='%1.1f%%', shadow=False)
```

```
Out[56]:([<matplotlib.patches.Wedge at 0x24a4e82ec40>,
          <matplotlib.patches.Wedge at 0x24a4e83b400>,
          <matplotlib.patches.Wedge at 0x24a4e83ba00>,
          <matplotlib.patches.Wedge at 0x24a4e84b160>],
         [Text(0.14366965333381534, 1.0905773841002488, 'Positive'),
          Text(-0.8882348187568564, -0.6488751087443366, 'Negative'),
          Text(0.7561389577669066, -0.7989079274529552, 'Neutral'),
          Text(1.0999912025322274, -0.004399358101414309, '0')],
         [Text(0.07836526545480836, 0.5948603913274083, '45.8%'),
          Text(-0.4844917193219216, -0.35393187749691085, '28.4%'),
          Text(0.41243943150922174, -0.4357679604288846, '25.6%'),
          Text(0.5999952013812149, -0.002399649873498714, '0.1%')])
```



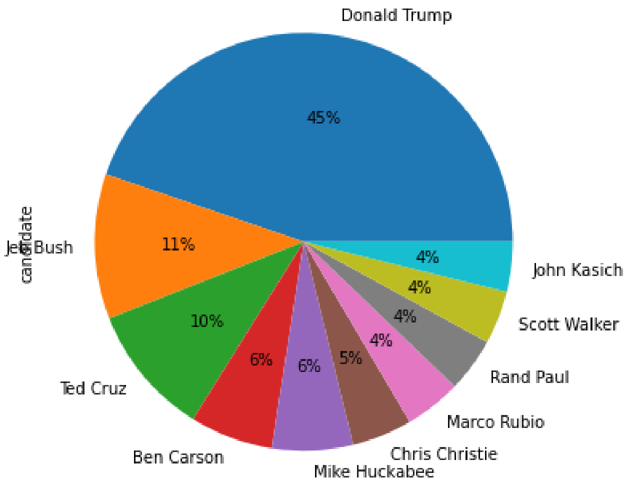
```
In [57]: plot_size = plt.rcParams["figure.figsize"]
         print(plot_size[0])
         print(plot_size[1])

         plot_size[0] = 8
```

```
plot_size[1] = 6
plt.rcParams["figure.figsize"] = plot_size
```

```
6.0
4.0
```

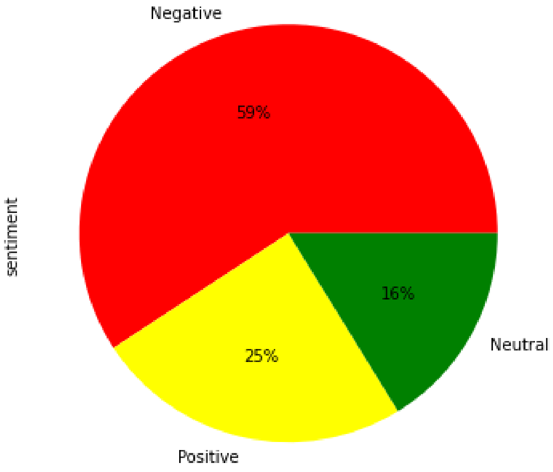
In [58]:
```
onlypo.candidate.value_counts().plot(kind='pie', autopct='%1.0f%%')
```

Out[58]:<AxesSubplot:ylabel='candidate'>



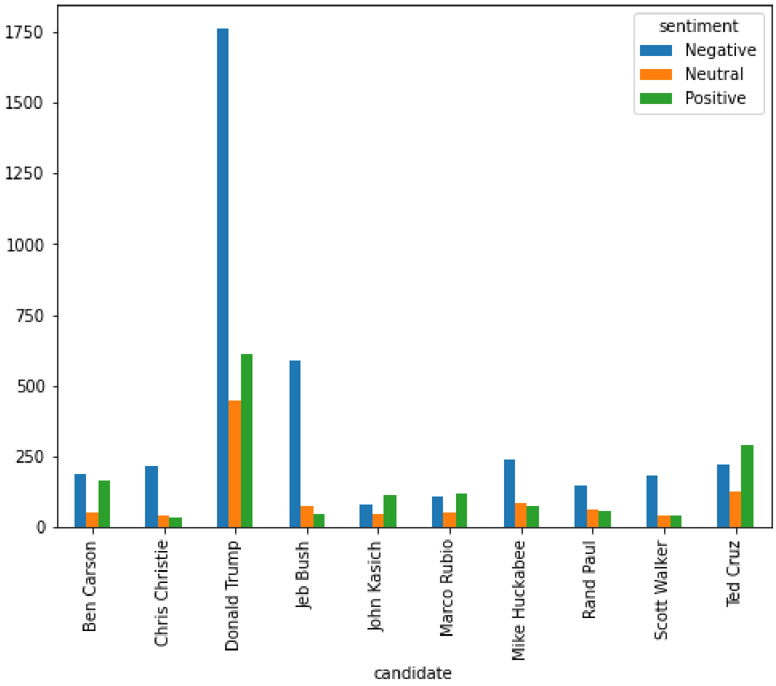
In [59]:
```
onlypo.sentiment.value_counts().plot(kind='pie', autopct='%1.0f%%', colors=["red", "yellow", "green"])
```

Out[59]:<AxesSubplot:ylabel='sentiment'>



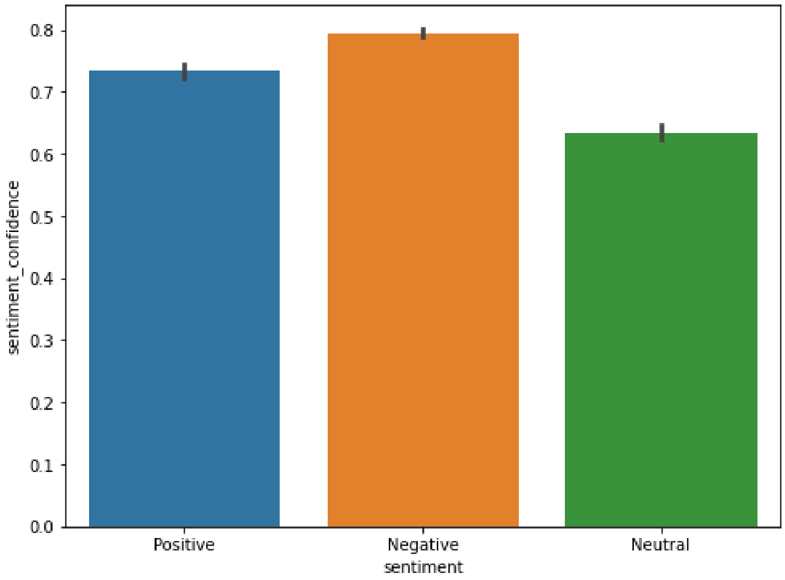
In [60]:
```
po_sentiment = onlypo.groupby(['candidate', 'sentiment']).sentiment.count().unstack()
po_sentiment.plot(kind='bar')
```

Out[60]:<AxesSubplot:xlabel='candidate'>



In [61]:
```
sns.barplot(x='sentiment', y='sentiment_confidence' , data=onlypo)
```

```
Out[61]:<AxesSubplot:xlabel='sentiment', ylabel='sentiment_confidence'>
```



```
In [62]: onlypo.head()
```

Out[62]:

	candidate	sentiment	sentiment_confidence	name	retweet_count	text	tweet_created	user_timezone	Limpio	
1	Scott Walker	Positive	0.6333	PeacefulQuest	26	RT @ScottWalker: Didn't catch the full #GOPdeb...	2015-08-07 09:54:46 -0700	NaN	RT ScottWalker Didn t catch the full GOPdebate...	((
4	Donald Trump	Positive	0.7045	sharonDay5	156	RT @DanScavino: #GOPDebate w/ @realDonaldTrump...	2015-08-07 09:54:45 -0700	Arizona	RT DanScavino GOPDebate w realDonaldTrump deli...	((
5	Ted Cruz	Positive	0.6332	DRJohnson11	228	RT @GregAbbott_TX: @TedCruz: "On my first day ...	2015-08-07 09:54:44 -0700	Central Time (US & Canada)	RT GregAbbott TX TedCruz On my first day I wil...	(T
8	Ben Carson	Negative	0.6889	kengpdx	0	Deer in the headlights RT @lizzwinstead: Ben C...	2015-08-07 09:54:44 -0700	Pacific Time (US & Canada)	Deer in the headlights RT lizzwinstead Ben Car...	(F
10	Donald Trump	Negative	1.0000	jnjsmom	0	@JGreenDC @realDonaldTrump In all fairness #Bi...	2015-08-07 09:54:42 -0700	Central Time (US & Canada)	JGreenDC realDonaldTrump In all fairness Bill...	(re

```
In [63]: features = onlypo.iloc[:, 5].values
         labels = onlypo.iloc[:, 1].values
```

```
In [64]: processed_features = []

         for sentence in range(0, len(features)):
             # Remove all the special characters
             processed_feature = re.sub(r'\W', ' ', str(features[sentence]))
             # remove all single characters
             processed_feature= re.sub(r'\s+[a-zA-Z]\s+', ' ', processed_feature)
             # Remove single characters from the start
             processed_feature = re.sub(r'\^[a-zA-Z]\s+', ' ', processed_feature)
             # Substituting multiple spaces with single space
             processed_feature = re.sub(r'\s+', ' ', processed_feature, flags=re.I)
             # Removing prefixed 'b'
             processed_feature = re.sub(r'^b\s+', '', processed_feature)
             # Converting to Lowercase
             processed_feature = processed_feature.lower()

             processed_features.append(processed_feature)
```

```
In [65]: vectorizer = TfidfVectorizer (max_features=2500, min_df=7, max_df=0.8, stop_words=stopwords.words('english'))
         processed_features = vectorizer.fit_transform(processed_features).toarray()
```

```
In [66]: X_train, X_test, y_train, y_test = train_test_split(processed_features, labels, test_size=0.2, random_state=0)
```

```
In [67]: text_classifier = RandomForestClassifier(n_estimators=200, random_state=0)
         text_classifier.fit(X_train, y_train)

Out[67]:RandomForestClassifier(n_estimators=200, random_state=0)
```

```
In [68]: predictions = text_classifier.predict(X_test)
```

```
In [69]: print(confusion_matrix(y_test,predictions))
         print(classification_report(y_test,predictions))
         print(accuracy_score(y_test, predictions))
```

```
[[679  24  41]
 [153  25  29]
 [147   6 153]]
              precision    recall  f1-score   support

    Negative       0.69      0.91      0.79       744
     Neutral       0.45      0.12      0.19       207
    Positive       0.69      0.50      0.58       306

    accuracy                           0.68      1257
   macro avg       0.61      0.51      0.52      1257
weighted avg       0.65      0.68      0.64      1257

0.6817820206841687
```

Conclusiones

Se realizó un análisis de sentimientos utilizando las tres herramientas sobre toda la BD y se obtuvieron diferentes resultados en cada caso. Se repitió el análisis utilizando las tres herramientas con la BD reducida (sólo con nombres de políticos) y los resultados obtenidos fueron similares.

Una vez aplicado a los políticos con nombre, notamos que Donald Trump fue quien recibió la mayor cantidad de sentimientos negativos, siendo este el sentimiento con mayor confiabilidad.

Se aplicó a ambos conjuntos de datos la red neuronal y el accuracy fue similar: 68%

```
In [ ]:
```