NAME OF THE PROJECT

Malignant Comment Classifier

Submitted by:

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Acknowledgement:

This project has been completed with the help of training documents and live classes recordings from Data Trained Education. Few helps on coding have also been taken from few data science websites like Toward Data Science, Geek for Geeks, Stack Overflow.

INTRODUCTION

The proliferation of social media enables people to express their opinions widely online. However, at the same time, this has resulted in the emergence of conflict and hate, making online environments uninviting for users. Although researchers have found that hate is a problem across multiple platforms, there is a lack of models for online hate detection.

Online hate, described as abusive language, aggression, cyberbullying, hatefulness and many others has been identified as a major threat on online social media platforms. Social media platforms are the most prominent grounds for such toxic behavior.

There has been a remarkable increase in the cases of cyberbullying and trolls on various social media platforms. Many celebrities and influences are facing backlashes from people and have to come across hateful and offensive comments. This can take a toll on anyone and affect them mentally leading to depression, mental illness, self-hatred and suicidal thoughts.

Internet comments are bastions of hatred and vitriol. While online anonymity has provided a new outlet for aggression and hate speech, machine learning can be used to fight it. The problem we sought to solve was the tagging of internet comments that are aggressive towards other users. This means that insults to third parties such as celebrities will be tagged as un offensive, but “u are an idiot” is clearly offensive.

Our goal is to build a prototype of online hate and abuse comment classifier which can used to classify hate and offensive comments so that it can be controlled and restricted from spreading hatred and cyberbullying.

Analytical Problem Framing

Importing of necessary libraries:

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sns
import nltk
import string
from nltk.corpus import stopwords
from nltk.corpus import wordnet
from nltk.tokenize import word_tokenize
import nltk
from nltk.stem import PorterStemmer, WordNetLemmatizer
from wordcloud import WordCloud
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.naive_bayes import MultinomialNB
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report,roc_curve,roc_auc_score,auc
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score,classification_report,confusion_matrix,f1_score
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import cross_val_score,GridSearchCV
from sklearn.naive_bayes import MultinomialNB
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.ensemble import RandomForestClassifier,AdaBoostClassifier,GradientBoostingClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
import joblib # importing the libraries
```

Data preprocessing/Data Cleaning:

The data has been loaded

In [2]:
```
test_df=pd.read_csv('Malignant Test.csv')
train_df=pd.read_csv('Malignant Train.csv')
```

In [3]:
```
test_df
```

Out[3]:

	id	comment_text
0	00001cee341fdb12	Yo bitch Ja Rule is more succesful then you'll...
1	0000247867823ef7	== From RfC == \n\n The title is fine as it is...
2	00013b17ad220c46	" \n\n == Sources == \n\n * Zawe Ashton on Lap...
3	00017563c3f7919a	:If you have a look back at the source, the in...
4	00017695ad8997eb	I don't anonymously edit articles at all.
...	...	...
153159	fffcd0960ee309b5	. \n i totally agree, this stuff is nothing bu...
153160	fffd7a9a6eb32c16	== Throw from out field to home plate. == \n\n...
153161	fffda9e8d6fafa9e	" \n\n == Okinotorishima categories == \n\n I ...
153162	fffe8f1340a79fc2	" \n\n == ""One of the founding nations of the...
153163	ffffce3fb183ee80	" \n :::Stop already. Your bullshit is not wel...

153164 rows × 2 columns

In [4]:
```
train_df
```

Out[4]:

	id	comment_text	malignant	highly_malignant	rude	threat	abuse	loathe
0	0000997932d777bf	Explanation\nWhy the edits made under my usern...	0	0	0	0	0	0
1	000103f0d9cfb60f	D'aww! He matches this background colour I'm s...	0	0	0	0	0	0
2	000113f07ec002fd	Hey man, I'm really not trying to edit war. It...	0	0	0	0	0	0
3	0001b41b1c6bb37e	"\nMore\nI can't make any real suggestions on ...	0	0	0	0	0	0
4	0001d958c54c6e35	You, sir, are my hero. Any chance you remember...	0	0	0	0	0	0
...	...	...	...	...	...	...	...	...
159566	ffe987279560d7ff	":::::And for the second time of asking, when ...	0	0	0	0	0	0
159567	ffea4adeee384e90	You should be ashamed of yourself \n\nThat is ...	0	0	0	0	0	0
159568	ffee36eab5c267c9	Spitzer \n\nUmm, theres no actual article for ...	0	0	0	0	0	0
159569	fff125370e4aaaf3	And it looks like it was actually you who put ...	0	0	0	0	0	0
159570	fff46fc426af1f9a	"\nAnd ... I really don't think you understand...	0	0	0	0	0	0

159571 rows × 8 columns

Checking the data types:

In [5]:
```
test_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 153164 entries, 0 to 153163
Data columns (total 2 columns):
 #   Column        Non-Null Count   Dtype 
---  ------        --------------   ----- 
 0   id            153164 non-null  object
 1   comment_text  153164 non-null  object
dtypes: object(2)
memory usage: 2.3+ MB
```

Checking the null values from the data:

In [6]:
```
test_df.isnull().sum()
```

Out[6]:
```
id              0
comment_text    0
dtype: int64
```

In [7]:
```
train_df.isnull().sum()
```

Out[7]:
```
id                0
comment_text      0
malignant         0
highly_malignant  0
rude              0
threat            0
abuse             0
loathe            0
dtype: int64
```

Checking Data Skewness :

```
In [10]: 1 train_df.skew()
```

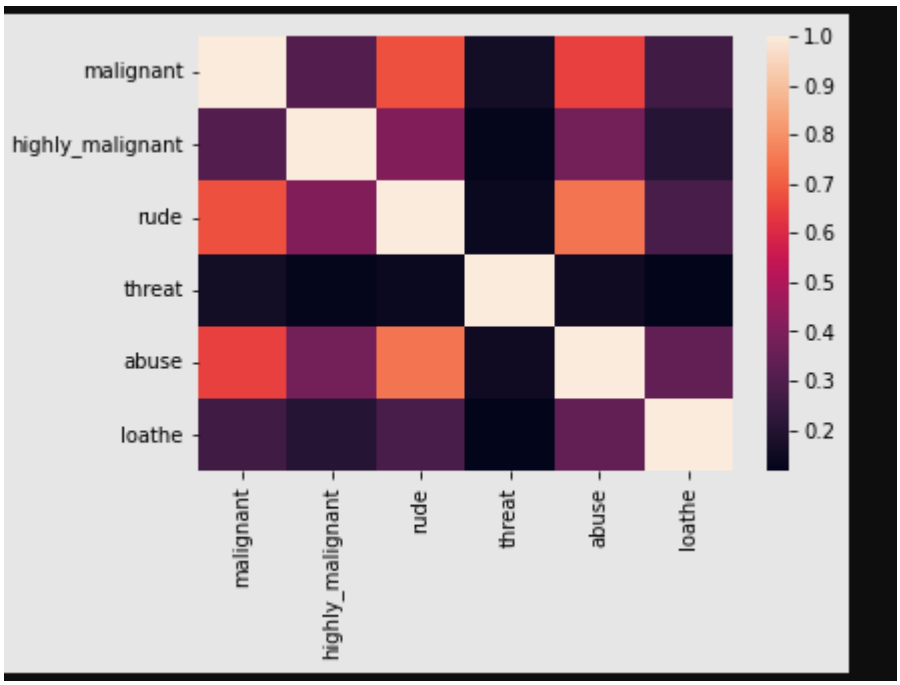
```
Out[10]: malignant            2.745854
         highly_malignant     9.851722
         rude                 3.992817
         threat              18.189001
         abuse                4.160540
         loathe              10.515923
         dtype: float64
```

Checking Multicollinearity:

i) Heat Map:

```
In [8]: 1 print(train_df.corr())
        2 print(sns.heatmap(train_df.corr()))
```

```
                  malignant  highly_malignant      rude    threat     abuse  \
malignant          1.000000          0.308619  0.676515  0.157058  0.647518
highly_malignant   0.308619          1.000000  0.403014  0.123601  0.375807
rude               0.676515          0.403014  1.000000  0.141179  0.741272
threat             0.157058          0.123601  0.141179  1.000000  0.150022
abuse              0.647518          0.375807  0.741272  0.150022  1.000000
loathe             0.266009          0.201600  0.286867  0.115128  0.337736

                   loathe
malignant        0.266009
highly_malignant 0.201600
rude             0.286867
threat           0.115128
abuse            0.337736
loathe           1.000000
AxesSubplot(0.125,0.125;0.62x0.755)
```



From the heat map it can be observed that there is no issue of multicollinearity in the data..

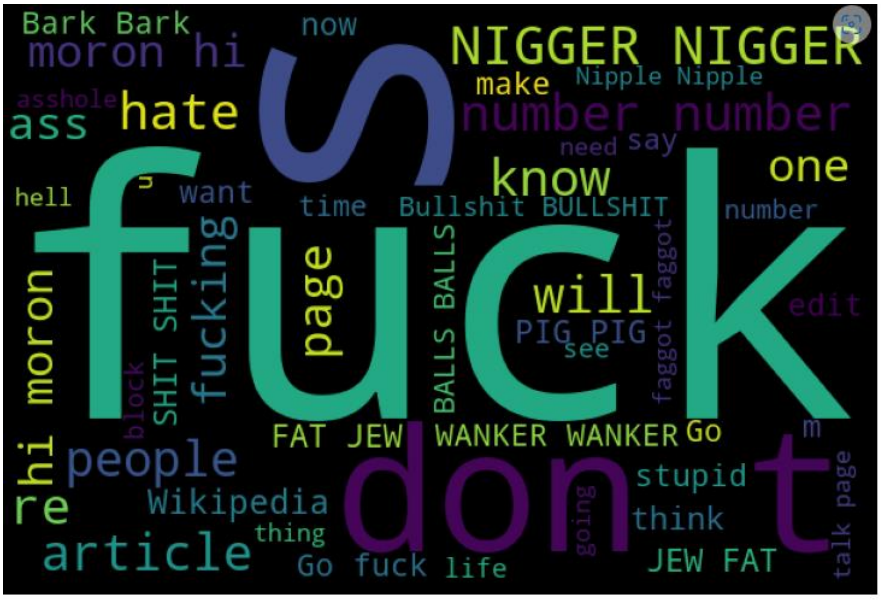
Replacing email address, phone numbers, web address and white space:

In [12]:
```
# Replace email addresses with 'email'
train_df['comment_text'] = train_df['comment_text'].str.replace(r'^.+@[^\.].*\.[a-z]{2,}$','emailaddress')

# Replace URLs with 'webaddress'
train_df['comment_text'] = train_df['comment_text'].str.replace(r'^http\://[a-zA-Z0-9\-\.]+\.[a-zA-Z]{2,3}(/\S*)?$','webaddr

# Replace money symbols with 'moneysymb' (£ can by typed with ALT key + 156)
train_df['comment_text'] = train_df['comment_text'].str.replace(r'£|\$', 'dollers')

# Replace 10 digit phone numbers (formats include paranthesis, spaces, no spaces, dashes) with 'phonenumber'
train_df['comment_text'] = train_df['comment_text'].str.replace(r'^\(?[\d]{3}\)?[\s-]?[\d]{3}[\s-]?[\d]{4}$','phonenumber')

# Replace numbers with 'number'
train_df['comment_text'] = train_df['comment_text'].str.replace(r'\d+(\.\d+)?', 'number')
# Remove punctuation
train_df['comment_text'] = train_df['comment_text'].str.replace(r'[^\w\d\s]', ' ')

# Replace whitespace between terms with a single space
train_df['comment_text'] = train_df['comment_text'].str.replace(r'\s+', ' ')

# Remove leading and trailing whitespace
train_df['comment_text'] = train_df['comment_text'].str.replace(r'^\s+|\s+?$', '')
```

In [13]:
```
test_df['comment_text'] = test_df['comment_text'].str.replace(r'^\s+/\s+?$' , '')
```

Using Word Cloud:

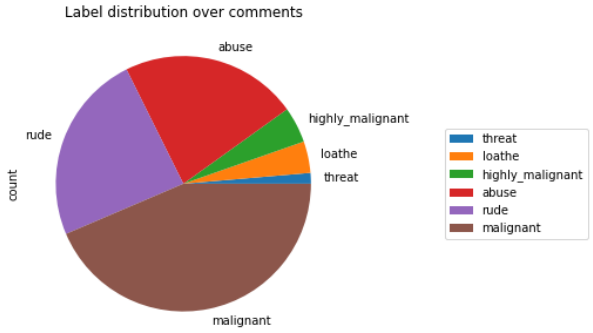
```
hams = train_df['comment_text'][train_df['malignant']==1]
spam_cloud = WordCloud(width=600, height=400, background_color = 'black', max_words=50).generate(''. join(hams))
plt.figure(figsize=(10,8), facecolor='k')
plt.imshow(spam_cloud)
plt.axis('off')
plt.tight_layout(pad=0)
plt.show()
```



Using Piechart to see the label distribution:

In [15]:
```
df_distribution = train_df[col].sum()\
                          .to_frame()\
                          .rename(columns={0: 'count'})\
                          .sort_values('count')
df_distribution.plot.pie(y = 'count',
                         title = 'Label distribution over comments',
                         figsize=(5,5))\
.legend(loc = 'center left', bbox_to_anchor = (1.3, 0.5))
```

Out[15]: <matplotlib.legend.Legend at 0x2afe358cfd0>



Model/s Development and Evaluation

(Linear Regression, Decision Tree Regressor, Random Forest Regressor and Gradient Boosting Regressor)

Multinomial NB:

```
In [30]:
x_train,x_test,y_train,y_test = train_test_split(x,y, random_state=42)
naive.fit(x_train,y_train)

Out[30]: MultinomialNB()

In [31]:
y_pred = naive.predict(x_test)

In [32]:
joblib.dump(y_pred, "model")

Out[32]: ['model']

In [33]:
y_pred

Out[33]: array([0, 0, 0, ..., 0, 0, 0], dtype=int64)
```

Saving the model:

```
In [32]:
joblib.dump(y_pred, "model")

Out[32]: ['model']

In [33]:
y_pred

Out[33]: array([0, 0, 0, ..., 0, 0, 0], dtype=int64)

In [35]:
Model=joblib.load("model")

In [36]:
Model

Out[36]: array([0, 0, 0, ..., 0, 0, 0], dtype=int64)

In [40]:
predictions=pd.DataFrame(Model)

In [41]:
predictions.to_csv("prediction_results.csv")
```