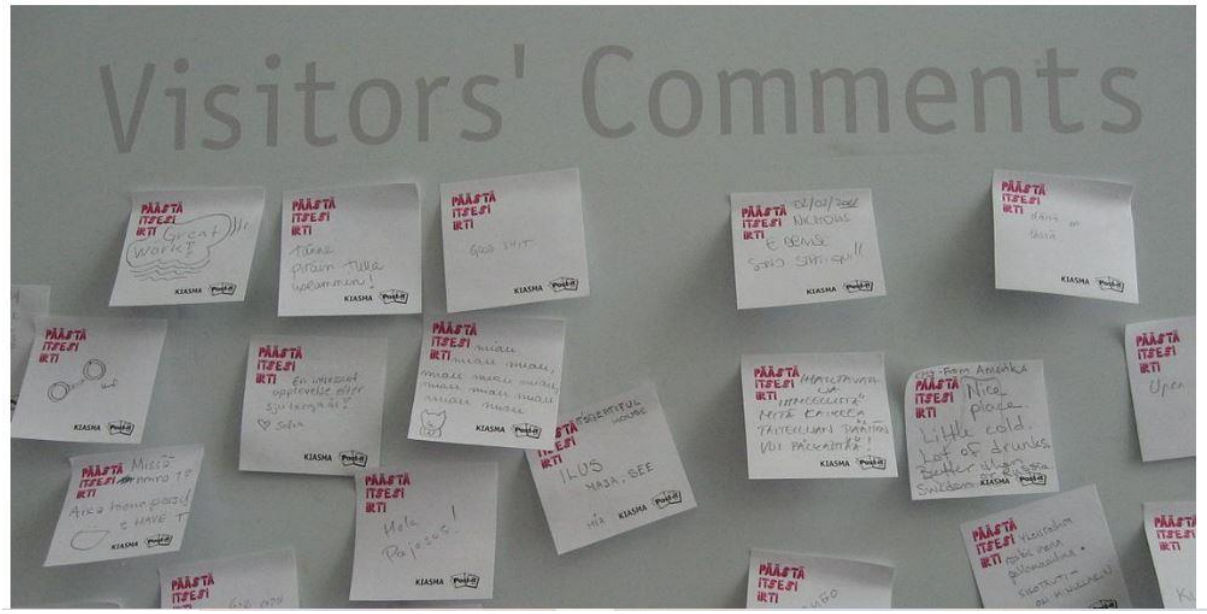
FLIP ROBO

MALIGNANT COMMENTS CLASSIFICATION



Submitted by:

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ACKNOWLEDGMENT

Working on this project has an incredible experience that will have an impact on my career.

It is pleasant gratification to present Malignant comment classification.

I have completed this project by taking the help from Google, Bing and You tube.

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.

There has been a remarkable increase in the cases of cyberbullying and trolls on various social media platforms.

Online hate, described as abusive language, aggression, cyberbullying, hatefulness and many others has been identified as a major threat on online social media platforms.

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.

Importing Libraries:

*I am importing all the library which I required for EDA, visualization, prediction and finding all matrices. The reason of doing this is that it become easier to use all the import statement at one go and we do not require to import the statement again at each point***.**

```
pip install stopwords
```

```
Requirement already satisfied: stopwords in c:\users\user\anaconda3\lib\site-packages (1.0.0)
Note: you may need to restart the kernel to use updated packages.
```

```
# import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy.stats import zscore

# models
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.linear_model import LogisticRegression
from sklearn.svm import LinearSVC
from sklearn.naive_bayes import MultinomialNB
from sklearn.metrics import classification_report,confusion_matrix,plot_confusion_matrix,roc_curve, roc_auc_score,plot_roc_curve

import warnings
warnings.filterwarnings('ignore')
% matplotlib inline
```

- Data Sources and their formats

  Now I am going to upload or read the files/data-sets using pandas. For this I used read csv method.

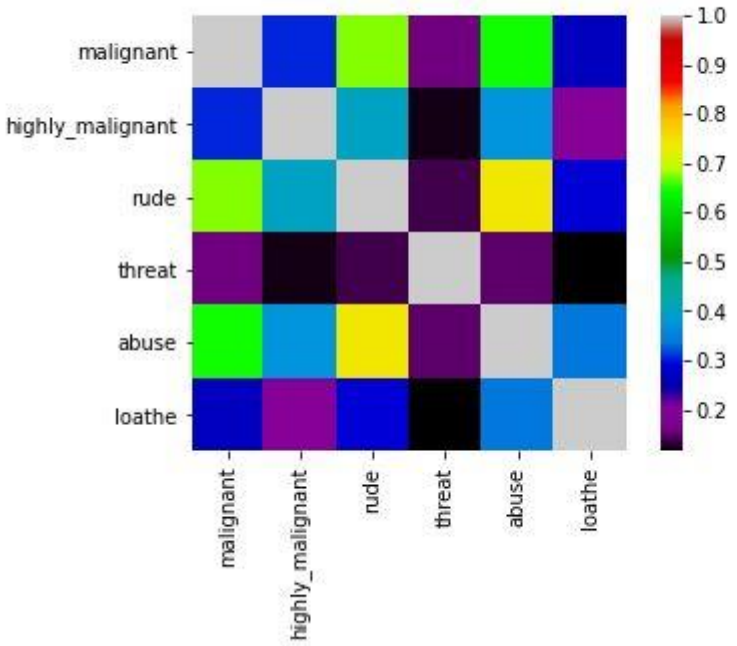
```
df = pd.read_csv('train.csv')
df.head()
```

	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

Correlation

None of the features and label are corelated with each other.

```
sns.heatmap(df.corr(), square=True, cmap='nipy_spectral')
plt.show()
```



There are 159571 rows and 8 columns in the dataset

```
df.shape
```

```
(159571, 8)
```

There are 6 columns integers type and 2 columns object type.

```
pd.set_option('display.max_rows',None)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 159571 entries, 0 to 159570
Data columns (total 8 columns):
 #   Column            Non-Null Count   Dtype 
---  ------            --------------   ----- 
 0   id                159571 non-null  object
 1   comment_text      159571 non-null  object
 2   malignant         159571 non-null  int64 
 3   highly_malignant  159571 non-null  int64 
 4   rude              159571 non-null  int64 
 5   threat            159571 non-null  int64 
 6   abuse             159571 non-null  int64 
 7   loathe            159571 non-null  int64 
dtypes: int64(6), object(2)
memory usage: 9.7+ MB
```

There are no duplicates in the dataset.

```
df.drop_duplicates(inplace = True)
```

```
df.shape
```

```
(159571, 8)
```

There are 2 columns which are continuous type and 6 target variables are categorical type.

```
In [11]: df.nunique()

Out[11]: id                159571
         comment_text      159571
         malignant              2
         highly_malignant       2
         rude                   2
         threat                 2
         abuse                  2
         loathe                 2
         dtype: int64
```

Counts in all the rows is equal.

All the minimum value is 0.

There is nothing much to analysis from the describe code.

```
df.describe()
```

	malignant	highly_malignant	rude	threat	abuse	loathe
count	159571.000000	159571.000000	159571.000000	159571.000000	159571.000000	159571.000000
mean	0.095844	0.009996	0.052948	0.002996	0.049364	0.008805
std	0.294379	0.099477	0.223931	0.054650	0.216627	0.093420
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
50%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75%	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
max	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Dropping the id columns as it is of no use.

```
df.drop('id',inplace=True,axis=1)
```

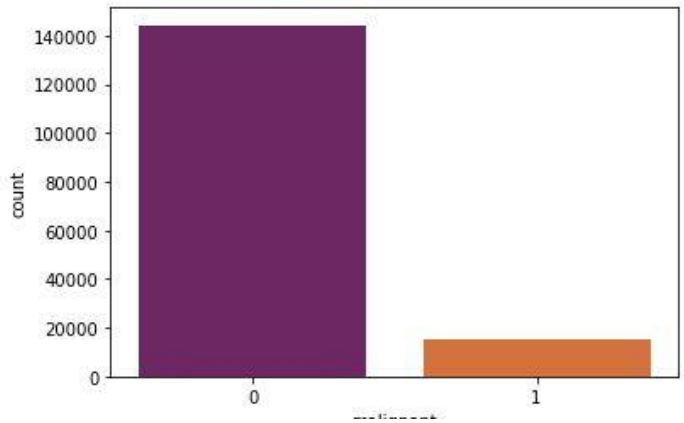
COUNT PLOT

MALIGNANT

```
df['malignant'].value_counts()
```

```
0    144277
1     15294
Name: malignant, dtype: int64
```

```
sns.countplot(df['malignant'],palette = 'inferno',data=df);
```



Malignant: It is the Label column, which includes values 0 and 1, denoting if the comment is malignant or not.

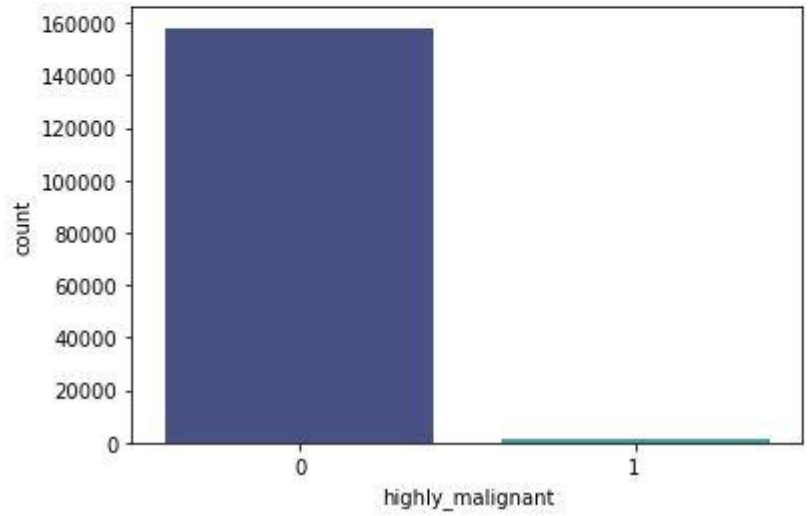
144277 represent not malignant comment and only 15294 are malignant.

HIGHLY MALIGNANT

```
df['highly_malignant'].value_counts()
```

```
0    157976
1      1595
Name: highly_malignant, dtype: int64
```

```
sns.countplot(df['highly_malignant'],palette = 'mako',data=df);
```



Highly malignant: It is the Label column, which includes values 0 and 1, denoting if the comment is highly malignant or not.

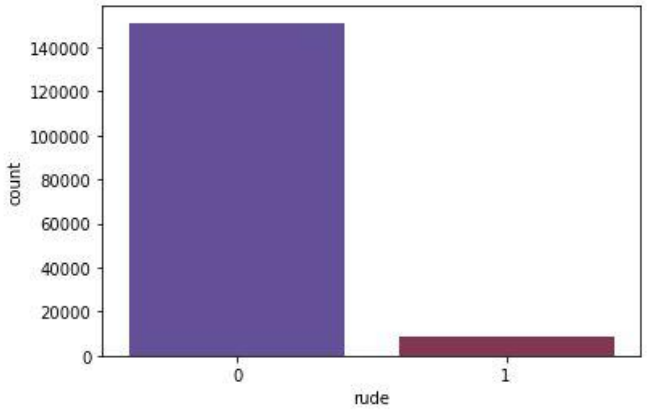
157976 represent not highly malignant comment and only 1595 are malignant.

RUDE

```
df['rude'].value_counts()
```

```
0    151122
1      8449
Name: rude, dtype: int64
```

```
sns.countplot(df['rude'],palette = 'twilight',data=df);
```



Rude: It denotes comments that are very rude and offensive.

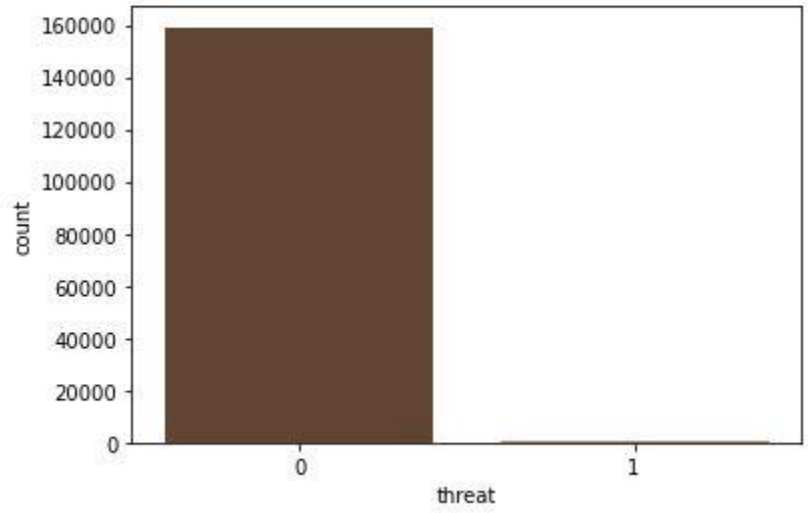
151122 represent not rude comment and only 8449 are rude

THREAT

```
df['threat'].value_counts()
```

```
0    159093
1       478
Name: threat, dtype: int64
```

```
sns.countplot(df['threat'],palette = 'copper',data=df);
```



Threat: It contains indication of the comments that are giving any threat to someone.

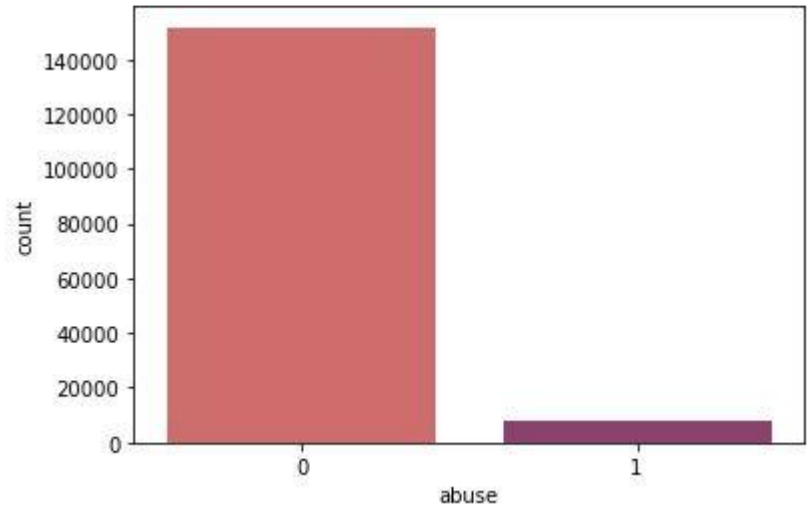
159093 represent not threat comment and only 478 comments are threat type.

ABUSE

```
df['abuse'].value_counts()
```

```
0    151694
1      7877
Name: abuse, dtype: int64
```

```
sns.countplot(df['abuse'],palette = 'flare',data=df);
```



Abuse: It is for comments that are abusive in nature.

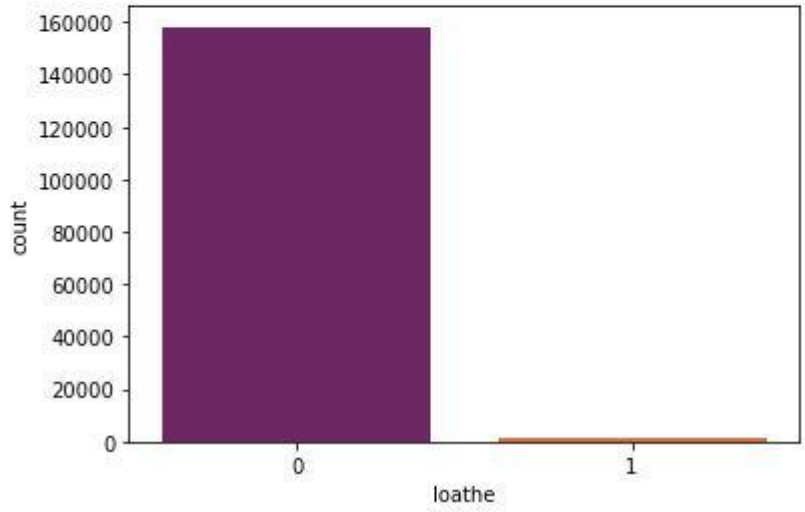
159093 represent not threat comment and only 478 comments are threat type.

LOATHE

```
df['loathe'].value_counts()
```

```
0    158166
1      1405
Name: loathe, dtype: int64
```

```
sns.countplot(df['loathe'],palette = 'inferno',data=df);
```



Loathe: It describes the comments which are hateful and loathing in nature.

158166 represent not loathe comments and only 1405 comments are loathe type.

COMMENT TEXT COLUMNS

```
df['comment_text'][0]
```

```
"Explanation\nWhy the edits made under my username Hardcore Metallica Fan were reverted? They weren't vandalisms, just closure on some GAs after I voted at New York Dolls FAC. And please don't remove the template from the talk page since I'm retired now 89.205.38.27"
```

Comment text columns contains the information of all the comments in the features variable.

NATURAL LANGUAGE TOOLKIT

```
import nltk
nltk.download()
```

I have import nltk that is Natural Language Toolkit which help me to inbuilt all the libraries in one go.

STOPWARDS

```
import nltk
nltk.download('stopwords')
```

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

```
True
```

```
import nltk
from nltk.corpus import stopwords

stops = set(stopwords.words('english'))
print(stops)
```

```
{'into', 'yours', 'against', 'all', "needn't", 'yourself', 'themselves', "that'll", 'then', 'with', "should've", 'why', 'your',
'that', 'does', 'under', 'couldn', 'aren', 'own', 'was', 'once', 'll', 'them', 'his', 'which', 'this', 'it', 'its', 'above', 't
han', "aren't", 'doesn', 'hadn', 'has', 'should', 'between', "shouldn't", 'here', 'some', 'during', 'as', 'ours', 'over', 'ma',
'been', 'other', 'only', 'won', 'm', 'wasn', 'of', "it's", 'about', 'my', "you'll", 'what', "couldn't", "hasn't", 'down', 'itse
lf', 'same', 'those', 'few', 'an', "wasn't", 'such', 'so', 'am', 'having', 'until', 'just', "wouldn't", 'too', 'is', 'being',
't', 'shan', "shan't", 'myself', 've', 'ourselves', 'while', 'will', 'haven', 'i', 'or', 'ain', 'yourselves', 'she', 'isn', 've
ry', 'their', 'did', "you're", 'up', 'me', 'by', 'were', 'out', 'himself', 'her', 'mightn', 'after', 'now', "weren't", 'who',
"hadn't", 'herself', 'again', "won't", 'through', 'do', 'further', 's', 'wouldn', "doesn't", 'have', 'not', "didn't", 'he',
'a', 'd', 'more', 'needn', 'before', 'they', 'hasn', 'mustn', 're', "isn't", 'you', "don't", 'had', 'each', 'no', 'because', 'w
here', 'off', 'shouldn', 'theirs', 'when', 'weren', 'in', 'are', 'our', 'but', 'how', 'whom', 'and', 'him', "haven't", 'these',
'from', 'nor', "you've", "you'd", 'on', 'y', 'hers', 'most', 'doing', 'for', 'o', 'to', 'can', "she's", 'both', "mightn't", 'th
e', 'there', 'don', 'any', "mustn't", 'if', 'below', 'be', 'didn', 'at', 'we'}
```

I have import stopwards that help me to identify all the common words which i can remove it from comments columns.

LEMMATIZATION & STEMMING

```
from nltk.stem import WordNetLemmatizer
```

```
from nltk.stem.porter import PorterStemmer
```

Lemmatization is the process of converting a word to its base form.

The difference between stemming and lemmatization is, lemmatization considers the context and converts the word to its meaningful base form, whereas stemming just removes the last few characters, often leading to incorrect meanings and spelling errors.

REGULAR EXPRESSION

```
import re
```

Regular expressions are typically used in applications that involve a lot of text processing.

For example, they are commonly used as search patterns in text editing programs used by developers, including vi, emacs, and modern IDEs

```
comment_text = ["comment_text"]
```

```
ps = PorterStemmer()
wordnet=WordNetLemmatizer()
sentences = nltk.sent_tokenize(df['comment_text'][0])
corpus = []
for i in range(len(sentences)):
    review = re.sub('[^a-zA-Z]', ' ', sentences[i])
    review = review.lower()
    review = review.split()
    review = [ps.stem(word) for word in review if not word in set(stopwords.words('english'))]
    review = ' '.join(review)
    corpus.append(review)
```

I have used the Porter Stemmer and Word Net Lemmatizer in comment text columns so that i can minimize the numbers of words from the columns and get some meaningful information out of it. It will also help us to improve the accuracy score.

COUNT VECTORIZER

```
from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer(max_features = 159571)
X = cv.fit_transform(corpus).toarray()
```

I have Created the Bag of Words model for model prediction. This will convert the words into numbers.

LABELS COLUMNS

```
labels = ['malignant', 'highly_malignant', 'rude', 'threat', 'abuse', 'loathe']
```

I have put all the labels in dictionary for model buildings.

MODEL BUILDING

```
train, test = train_test_split(df, test_size=0.33, random_state=42, shuffle=True)
```

I have used 33% for testing and 67% for training purpose.

```
train.shape, test.shape
```

```
((106912, 7), (52659, 7))
```

There are 106912 rows and 7 columns will be used for training purpose and remaining 52659 rows and 7 columns will be used for testing purpose.

MULTINOMIAL NAÏVE BAYES

```
for category in labels:
    model1.fit(X_train, train[category])
    accuracy = model1.score(X_test, test[category])
    accuracies[0].append(accuracy)
    print("Accuracy For {0} Class Is {1}%".format(category,round(accuracy*100,2)))
```

```
Accuracy For malignant Class Is 91.67%
Accuracy For highly_malignant Class Is 99.0%
Accuracy For rude Class Is 95.02%
Accuracy For threat Class Is 99.71%
Accuracy For abuse Class Is 95.13%
Accuracy For loathe Class Is 99.1%
```

Linear Support Vector Classifier

```
from sklearn.svm import LinearSVC
model2 = LinearSVC()
for category in labels:
    model2.fit(X_train, train[category])
    accuracy = model2.score(X_test, test[category])
    accuracies[1].append(accuracy)
    print("Accuracy For {0} Class Is {1}%".format(category,round(accuracy*100,2)))
```

```
Accuracy For malignant Class Is 96.15%
Accuracy For highly_malignant Class Is 99.07%
Accuracy For rude Class Is 97.9%
Accuracy For threat Class Is 99.75%
Accuracy For abuse Class Is 97.19%
Accuracy For loathe Class Is 99.21%
```

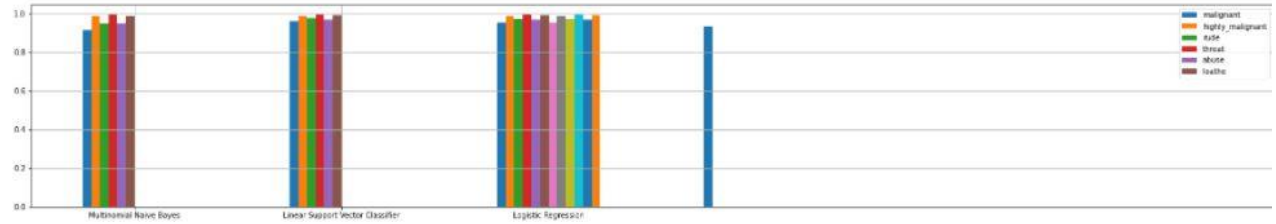
Logistic Regression

```
from sklearn.linear_model import LogisticRegression
model3 = LogisticRegression(n_jobs=1, solver='liblinear')
for category in labels:
    model3.fit(X_train, train[category])
    accuracy = model3.score(X_test, test[category])
    accuracies[2].append(accuracy)
    print("Accuracy For {0} Class Is {1}%".format(category,round(accuracy*100,2)))
```

```
Accuracy For malignant Class Is 95.62%
Accuracy For highly_malignant Class Is 99.1%
Accuracy For rude Class Is 97.57%
Accuracy For threat Class Is 99.73%
Accuracy For abuse Class Is 96.98%
Accuracy For loathe Class Is 99.17%
```

Bar Plot for 3 model prediction

```
accuracies = pd.DataFrame(accuracies)
fig = accuracies.plot.bar(figsize=(30, 5), grid=True)
plt.xticks(np.arange(3),('Multinomial Naive Bayes','Linear Support Vector Classifier','Logistic Regression'),rotation=0)
plt.legend(labels)
plt.show()
```



I can say that all the 3 models prediction is almost same with minor accuracy difference.

AGGREGATE ACCURACY

```
for i in range(3):
    print("Model -",i+1,"... Aggregate Accuracy -",np.mean(accuracies.iloc[i,:]))
```

```
Model - 1 ... Aggregate Accuracy - 0.9660773403723327
Model - 2 ... Aggregate Accuracy - 0.9821049899668939
Model - 3 ... Aggregate Accuracy - 0.9802945998468132
```

I have used 3 model for model prediction and after doing the aggregate the best model accuracy is 98.21% that is Linear Support Vector Classifier.

Interpretation of the Results

- I have used visualization tool such as count Plot to understand the data in a better way.
- I used describe method for five-point summary analysis and also found the number of rows and columns in dataset.
- I have done the model building with 3 algorithms and the best model is Linear Support Vector Classifier with an accuracy score of 98.21%

CONCLUSION

- I have managed out how to prepare a model that gives users for a novel best approach at future lodging value predictions.
- I have train dataset from which I had to extract information.
- I had used pandas library to read the Dataset which provide me to explore & visualize the Data properly based on Rows & Columns.
- I did exploratory data analysis on main data frame and tried to see all visualizations.
- Based on visualization knowledge, I use various EDA TECHNIQUES to plot the count plot.
- After from all these I split the Features & Labels into 2 parts.
- On this data, I have applied our machine learning classification models such as Logistic regression, Linear Support Vector Classifier and Multinomial Naive Bayes train dataset.
-) After which I found Linear Support Vector Classifier has the High accuracy score(98.21%) and best among all the regressor models.