SEXUAL HARASSMENT PERSONAL STORIES CLASSIFICATION

Problem Statement:

Given a Personal story, have to analyze and categorize various forms of Sexual Harassment.

Data Overview:

In recent ages , an increasing number of Personal Stories about Sexual Harassement and sexual abuse have been shared online. It is tedious to categorize the various forms of sexual harassement based on the stories, because large manual power will be required. But with the help of Machine learning it is quite easy and faster actions can be taken.This data is provided by an Online Forum SafeCity. So here the main task is to classify the various forms of sexual harassement based on the stories.There are various forms of sexual harassement but in this dataset only top three categorizes such as Commenting, Ogling/Facial Expressions/Staring and Touching/Groping are considered.

Single-Label Binary Classification:

The data for single-label classification is given in two columns, with the first column being the description of the incident and the second column being 1 if the category of sexual harassment is present and 0 if it is not.For each category, there are 7201 training samples, 990 development samples, and 1701 test samples.

-Example for Binary Classification Dataset:

Description	Groping
**Was walking along crowded street, holding mums hand, when an elderly man groped butt, I turned to look at him and he looked away, and did it again after a while.I was 12 yrs old then.	1
**This incident took place in the evening.I was in the metro when two guys started staring.	0
**Catcalls and passing comments were two of the ghastly things the Delhi police at the International Airport put me and my friend through. It is appalling that the protectors and law enforcers at the airport can make someone so uncomfortable.	0

-% Percentage Positive Split in the Binary Classification Dataset:

Category	% Positive
Commenting	39.3%
Ogling	21.4%
Groping	30.1%

Multi-Label Classification:

The data for multi-label classification is given in four columns, with the first column being the description of the incident and the second, third, and fourth column being 1 if the category of sexual harassment is present and 0 if it is not.There are 7201 training samples, 990 development samples, and 1701 test samples.

-Example for Multi-Label Classification Dataset:

Description	Commenting	Ogling	Groping
**Was walking along crowded street, holding mums hand, when an elderly man groped butt, I turned to look at h7m and he looked away, and did it again after a while.I was 12 yrs old then.	0	0	1
**This incident took place in the evening.I was in the metro when two guys started staring.	0	1	0
**Catcalls and passing comments were two of the ghastly things the Delhi police at the International Airport put me and my friend through. It is appalling that the protectors and law enforcers at the airport can make someone so uncomfortable.	1	1	0

-Number of Examples in Multi-Label Classification:

Commenting	Ogling	Groping	Examples in Dataset
1	1	1	351
1	1	0	819
1	0	1	459
0	1	1	201
1	0	0	2256
0	0	1	1966
0	1	0	743
0	0	0	3097

Business Objective and Constraints:

There is not much requirement for faster results similar to Search Engine(Eg:Google) but little lower than that like within few mins.

Performance Metrics:

This CaseStudy is based on ResearchPaper: https://arxiv.org/pdf/1809.04739.pdf

Single-Label Binary Classification:

-->Accuracy

-->F1-Score

Multi-Label Classification:

-->Hamming Loss

-->Micro F1-Score

-->Accuracy

In [81]:

```
#Importing Librarires
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from datetime import datetime

import seaborn as sns
import nltk
from sklearn.feature_extraction.text import CountVectorizer,TfidfVectorizer
from nltk.stem.porter import PorterStemmer
import re
import string
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
from nltk.stem.wordnet import WordNetLemmatizer

import pickle
from tqdm import tqdm
import os
%matplotlib inline
```

Single Label Binary Classification:

In [82]:

```
commenting_df=pd.read_csv('commenting_data_train.csv')#Loading commenting_data_train in to pandas DataFra
```

In [83]:

```
commenting_df.head()
```

Out[83]:

	Description	Category
0	Was walking along crowded street, holding mums...	0
1	This incident took place in the evening.I was ...	0
2	I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...	1
3	Incident happened inside the train	0
4	I witnessed an incident when a chain was bruta...	0

In [84]:

```
groping_df=pd.read_csv('groping_data_train.csv')#Loading groping_data_train.csv in to pandas DataFrame
```

In [85]:

```
groping_df.head()
```

Out[85]:

	Description	Category
0	Was walking along crowded street, holding mums...	1
1	This incident took place in the evening.I was ...	0
2	I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...	0
3	Incident happened inside the train	0
4	I witnessed an incident when a chain was bruta...	0

In [86]:

```
ogling_df=pd.read_csv('ogling_data_train.csv')#Loading groping_data_train.csv in to pandas DataFrame
```

In [87]:

```
ogling_df.head()
```

Out[87]:

	Description	Category
0	Was walking along crowded street, holding mums...	0
1	This incident took place in the evening.I was ...	1
2	I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...	0
3	Incident happened inside the train	0
4	I witnessed an incident when a chain was bruta...	0

In [88]:

```
print("No of Datapoints in Commenting Train Data:")#Shape of the train dataset
print(commenting_df.shape)
print('-'*125)
print("No of Datapoints in Groping Train Data:")#Shape of the train dataset
print(groping_df.shape)
print('-'*125)
print("No of Datapoints in Ogling Train Data:")#Shape of the train dataset
print(ogling_df.shape)
```

```
No of Datapoints in Commenting Train Data:
(7201, 2)
-----------------------------------------------------------------------------------------------------------
---------------
No of Datapoints in Groping Train Data:
(7201, 2)
-----------------------------------------------------------------------------------------------------------
---------------
No of Datapoints in Ogling Train Data:
(7201, 2)
```

In [89]:

```
commenting_df.isnull().sum()#checking for null values but no such empty data points
```

Out[89]:

```
Description    0
Category       0
dtype: int64
```

In [90]:

```
groping_df.isnull().sum()#checking for null values but no such empty data points
```

Out[90]:

```
Description    0
Category       0
dtype: int64
```

In [91]:

```
ogling_df.isnull().sum()#checking for null values but no such empty data points
```

Out[91]:

```
Description    0
Category       0
dtype: int64
```

Exploratory Data Analysis

Univariate Analysis:

Category

In [92]:

```
commenting_count=commenting_df['Category'].value_counts()#counting number of occurances in each of the c
groping_count=groping_df['Category'].value_counts()#counting number of occurances in each of the classes
ogling_count=ogling_df['Category'].value_counts()#counting number of occurances in each of the classes
```

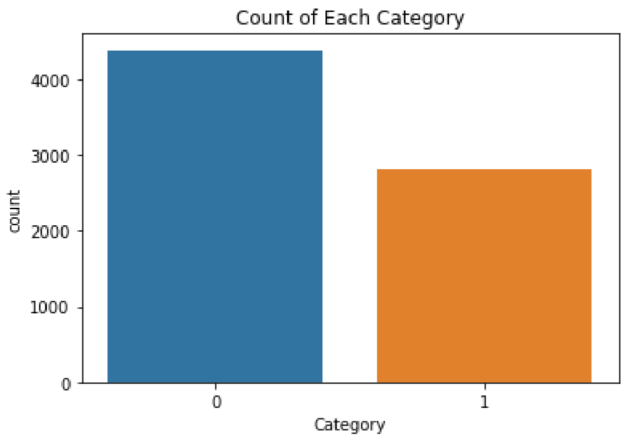
In [93]:

```
print('Percentage of Positive points in Commenting Train data: %',commenting_count[1]/commenting_df.shape
print('Percentage of Negative points in Commenting Train data: %',commenting_count[0]/commenting_df.shape
print('-'*125)
print('Percentage of Positive points in Groping Train data: %',groping_count[1]/groping_df.shape[0])
print('Percentage of Negative points in Groping Train data: %',groping_count[0]/groping_df.shape[0])
print('-'*125)
print('Percentage of Positive points in Ogling Train data: %',ogling_count[1]/ogling_df.shape[0])
print('Percentage of Negative points in Ogling Train data: %',ogling_count[0]/ogling_df.shape[0])
```

```
Percentage of Positive points in Commenting Train data: % 0.39161227607276766
Percentage of Negative points in Commenting Train data: % 0.6083877239272323
-----------------------------------------------------------------------------------------------------------
---------------
Percentage of Positive points in Groping Train data: % 0.3007915567282322
Percentage of Negative points in Groping Train data: % 0.6992084432717678
-----------------------------------------------------------------------------------------------------------
---------------
Percentage of Positive points in Ogling Train data: % 0.21191501180391611
Percentage of Negative points in Ogling Train data: % 0.7880849881960839
```

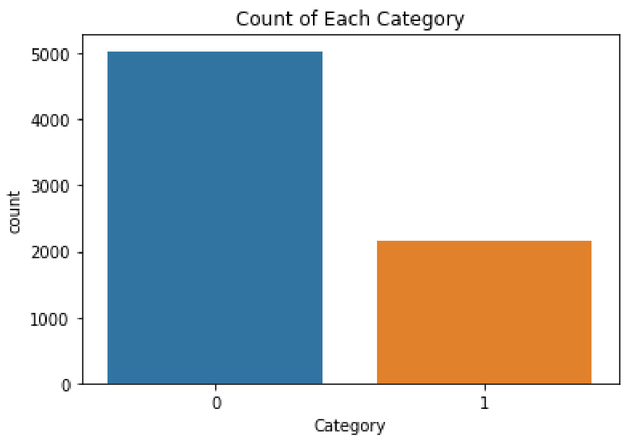
In [94]:

```
#Commenting Data
plt.title('Count of Each Category')
sns.countplot(x='Category',data=commenting_df)#count plot of Category
plt.show()
```



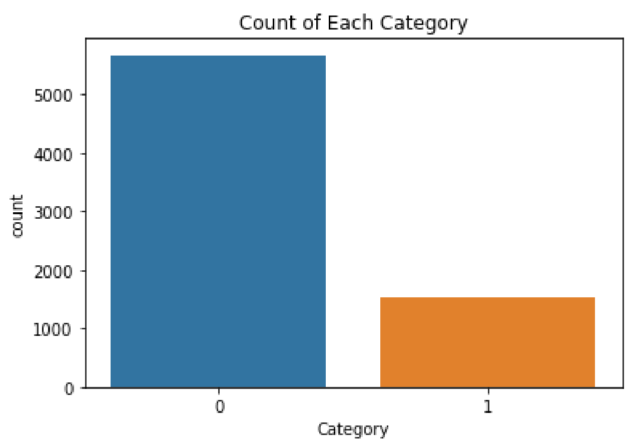
In [95]:

```
#Groping Data
plt.title('Count of Each Category')
sns.countplot(x='Category',data=groping_df)#count plot of Category
plt.show()
```



In [96]:

```
#Ogling Data
plt.title('Count of Each Category')
sns.countplot(x='Category',data=ogling_df)#count plot of Category
plt.show()
```



Observation:

This countplot on Category says that how the data is distributed.

In commenting data,

Percentage of Positive points in Commenting Train data: % 0.39161227607276766.

Percentage of Negative points in Commenting Train data: % 0.6083877239272323.

In groping data,

Percentage of Positive points in Groping Train data: % 0.3007915567282322.

Percentage of Negative points in Groping Train data: % 0.6992084432717678.

In ogling data,

Percentage of Positive points in Ogling Train data: % 0.21191501180391611.

Percentage of Negative points in Ogling Train data: % 0.7880849881960839.

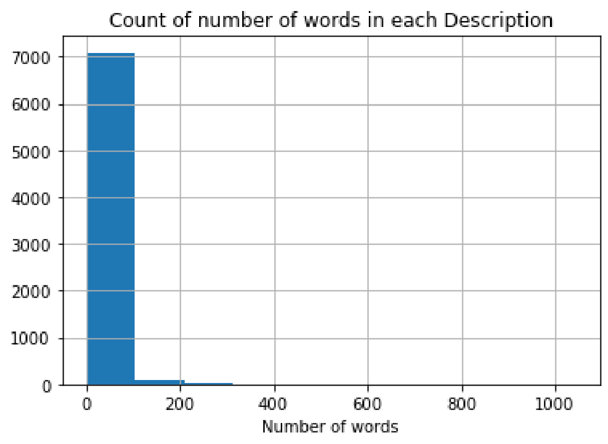
Among these three the commenting data is lightly balanced compared to remaining two, but in case of groping data and ogling data they are highly imbalanced where in the dataset more number of negative points compared to positive points and some kind of balancing techniques have to be done.

Description

Univariate Analysis:

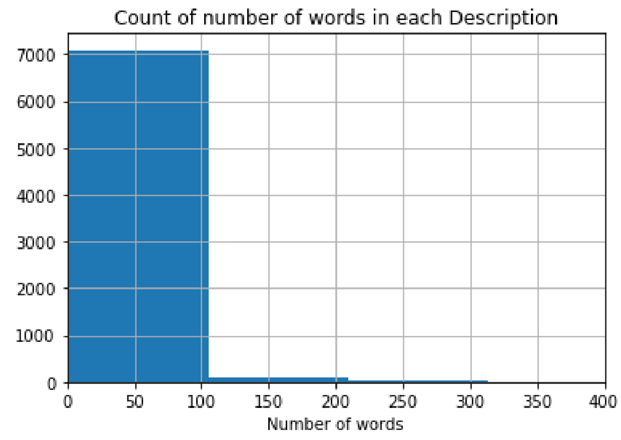
In [97]:

```
commenting_df['Description'].str.split().apply(len).hist()#creating a histogram plot of count of words ir
plt.title('Count of number of words in each Description')
plt.xlabel('Number of words')
plt.show()
```



In [98]:

```
#limiting X-axis range from 0 to 400
plt.xlim([0,400])#limiting the range of X-axis
commenting_df['Description'].str.split().apply(len).hist()#creating a histogram plot of count of words ir
plt.title('Count of number of words in each Description')
plt.xlabel('Number of words')
plt.show()
```



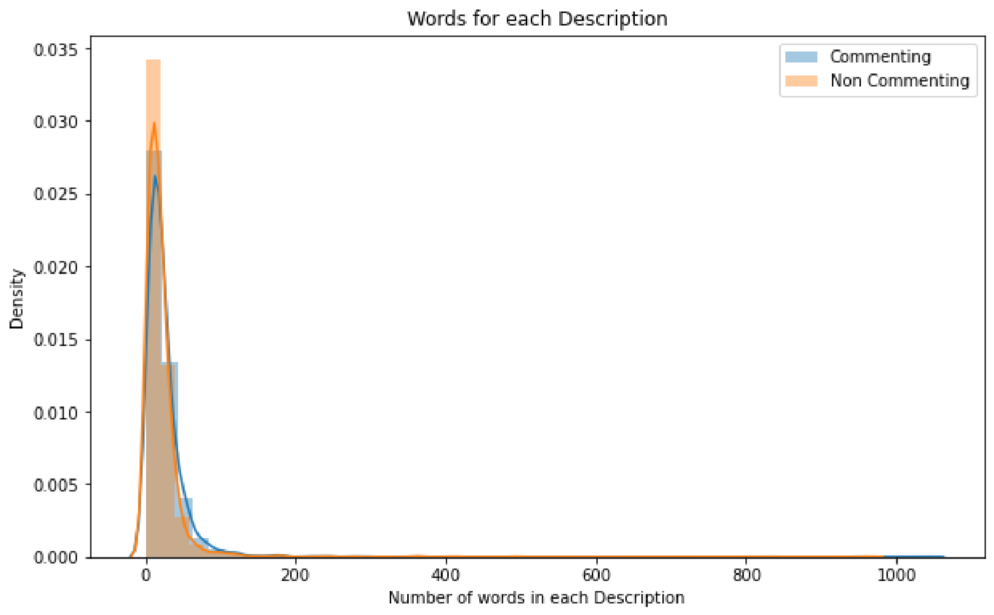
Observation:

From this plot we can see that number of words ranges from 0 to 320(approximately) very few descriptions range more than 100 and most commonly the number of words range from 0 to 110(approximately). The Personal Stories written by most people occur between this range.

In [99]:

```
word_count_0 = commenting_df[commenting_df['Category']==0]['Description'].str.split().apply(len).values#c
word_count_1 = commenting_df[commenting_df['Category']==1]['Description'].str.split().apply(len).values#c
plt.figure(figsize=(10,6))
sns.distplot(word_count_0,label='Commenting')
sns.distplot(word_count_1,label='Non Commenting')
plt.title('Words for each Description')
plt.xlabel('Number of words in each Description')
plt.legend()
plt.show()
```

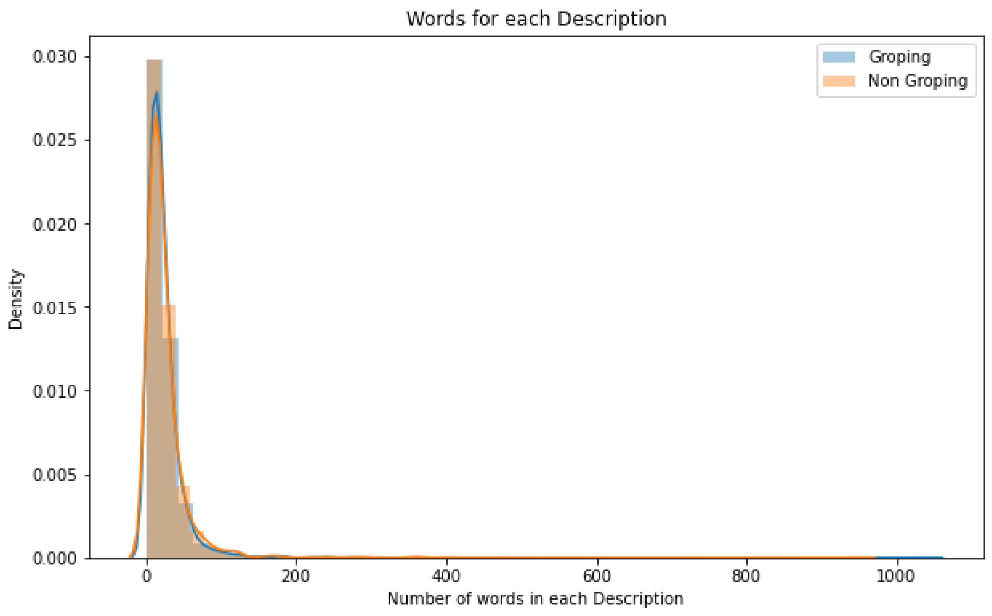
```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a
deprecated function and will be removed in a future version. Please adapt your code to use either
`displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for h
istograms).
  warnings.warn(msg, FutureWarning)
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a
deprecated function and will be removed in a future version. Please adapt your code to use either
`displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for h
istograms).
  warnings.warn(msg, FutureWarning)
```



In [100]:

```
word_count_0 = groping_df[groping_df['Category']==0]['Description'].str.split().apply(len).values#conside
word_count_1 = groping_df[groping_df['Category']==1]['Description'].str.split().apply(len).values#conside
plt.figure(figsize=(10,6))
sns.distplot(word_count_0,label='Groping')
sns.distplot(word_count_1,label='Non Groping')
plt.title('Words for each Description')
plt.xlabel('Number of words in each Description')
plt.legend()
plt.show()
```

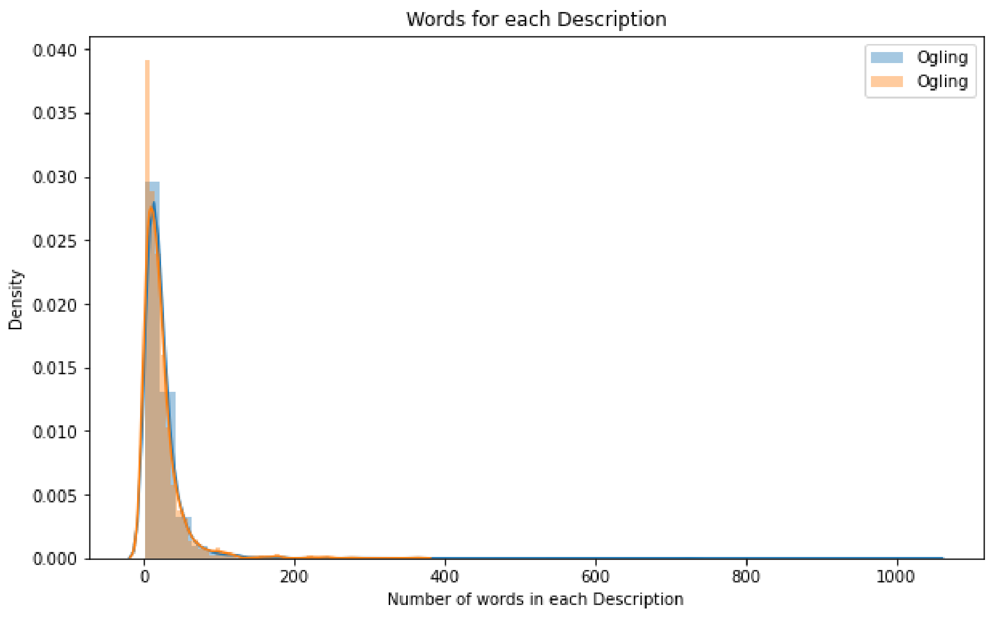
```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a
deprecated function and will be removed in a future version. Please adapt your code to use either
`displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for h
istograms).
  warnings.warn(msg, FutureWarning)
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a
deprecated function and will be removed in a future version. Please adapt your code to use either
`displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for h
istograms).
  warnings.warn(msg, FutureWarning)
```



In [101]:

```
word_count_0 = ogling_df[ogling_df['Category']==0]['Description'].str.split().apply(len).values#consideri
word_count_1 = ogling_df[ogling_df['Category']==1]['Description'].str.split().apply(len).values#consideri
plt.figure(figsize=(10,6))
sns.distplot(word_count_0,label='Ogling')
sns.distplot(word_count_1,label='Ogling')
plt.title('Words for each Description')
plt.xlabel('Number of words in each Description')
plt.legend()
plt.show()
```

```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a
deprecated function and will be removed in a future version. Please adapt your code to use either
`displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for h
istograms).
  warnings.warn(msg, FutureWarning)
C:\Users\HP\anaconda3\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a
deprecated function and will be removed in a future version. Please adapt your code to use either
`displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for h
istograms).
  warnings.warn(msg, FutureWarning)
```



Observation:

Creating Distribution plot for Number of words in each Description for each Category and after visualizing it for commenting data, groping data and ogling data moreover they seems to be similar for each category.The distribution of the number of words in each Description are moreover log-normally Distributed. The distribution for both category are overlapping with each other.

In [102]:

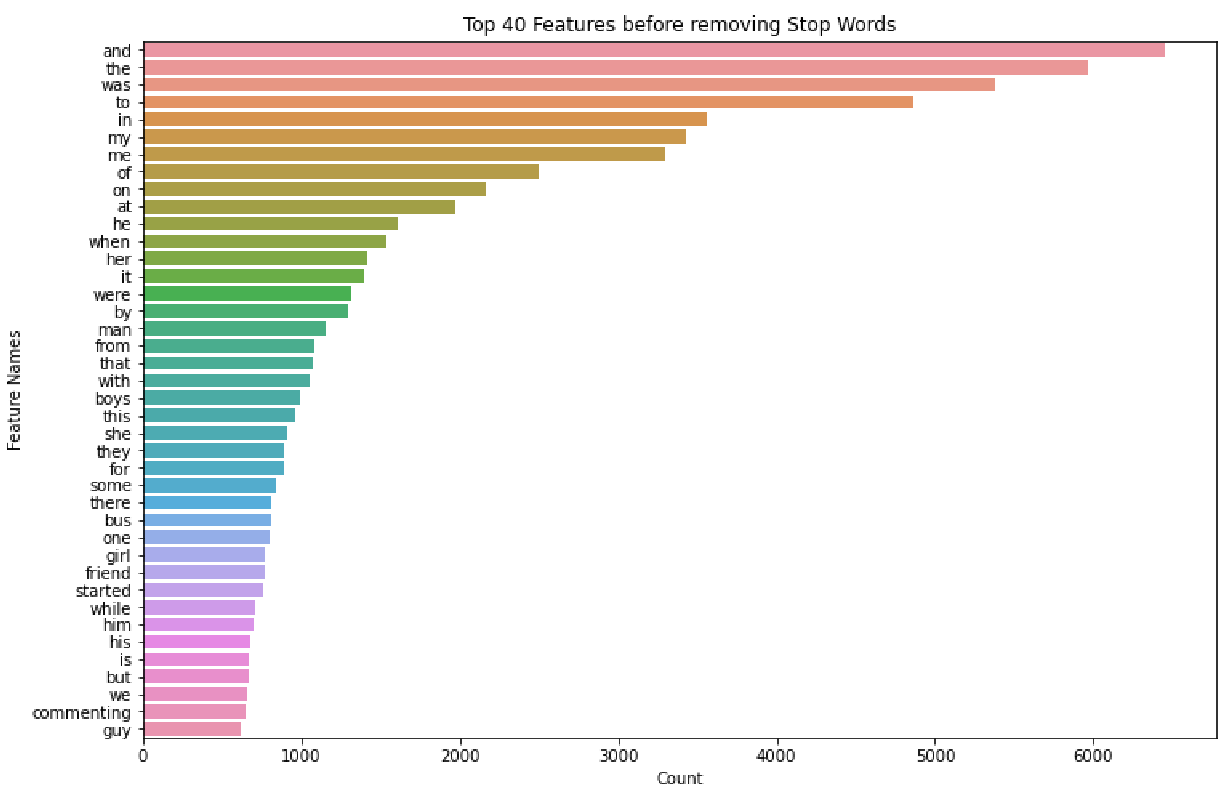
```
vect=CountVectorizer()#in the presence of stop words
output=vect.fit_transform(commenting_df['Description'])
features=vect.get_feature_names()#here we are getting the unique feature names

#https://stackoverflow.com/questions/27488446/how-do-i-get-word-frequency-in-a-corpus-using-scikit-learn-
count=output.toarray().sum(axis=0)#here we are getting the count of unique words

df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:40]#Top 40 words with most word count
df
```

Out[102]:

	0
and	6448
the	5964
was	5376
to	4866
in	3556
my	3428
me	3299
of	2501
on	2169
at	1977
he	1608
when	1533
her	1419
it	1400
were	1319
by	1291
man	1156
from	1085
that	1076
with	1052
boys	991
this	962
she	907
they	894
for	889
some	835
there	811
bus	807
one	798
girl	771
friend	769
started	761
while	708
him	699
his	674
is	666
but	666
we	658
commenting	651
guy	618

In [103]:

```
x=df.index#getting only the top 40 feature names
y=[df[0][i] for i in range(len(df))]#getting the count of top 40 feature names
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 40 Features before removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```



In [104]:

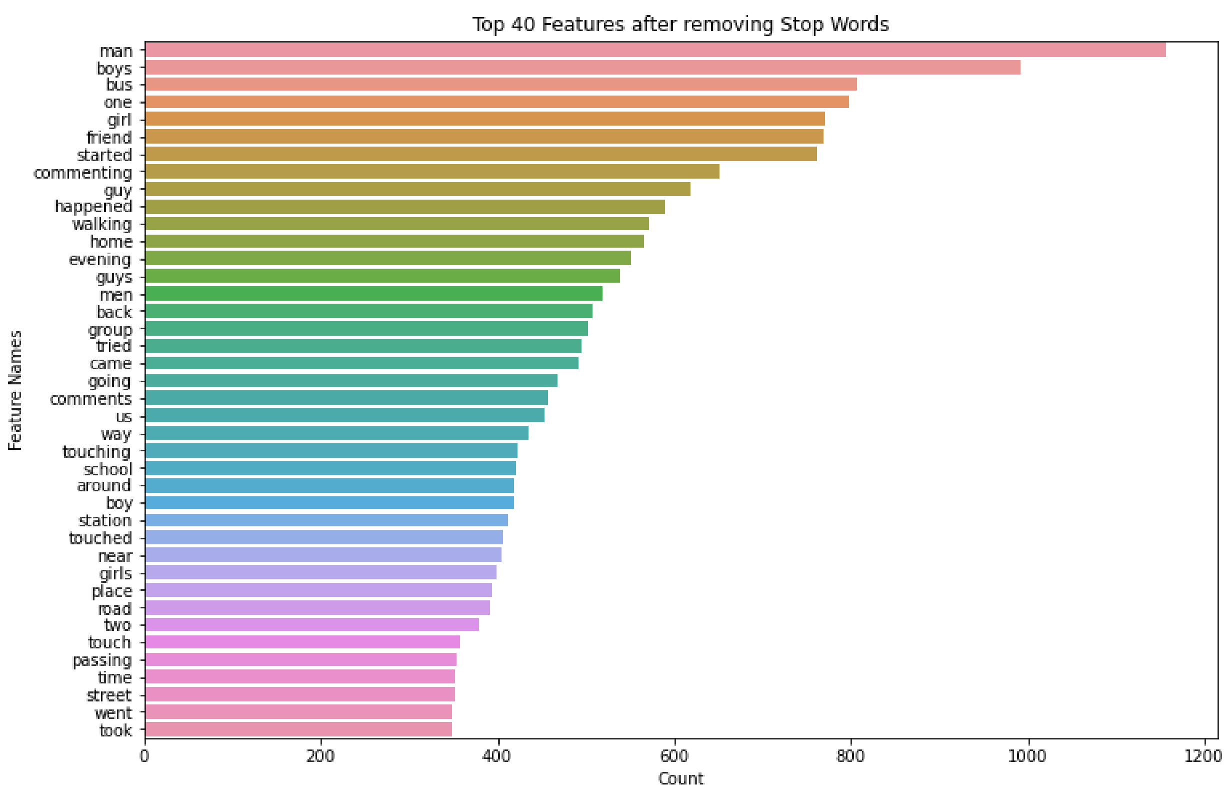
```
vect=CountVectorizer(stop_words=set(stopwords.words('english')))#in the presence of stop words
output=vect.fit_transform(commenting_df['Description'])
features=vect.get_feature_names()#here we are getting the unique feature names
count=output.toarray().sum(axis=0)#here we are getting the count of unique words
df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:40]#Top 40 words with most word count
df
```

Out[104]:

	0
man	1156
boys	991
bus	807
one	798
girl	771
friend	769
started	761
commenting	651
guy	618
happened	589
walking	571
home	566
evening	551
guys	539
men	518
back	507
group	502
tried	495
came	491
going	467
comments	456
us	454
way	436
touching	423
school	421
around	419
boy	419
station	412
touched	406
near	405
girls	398
place	394
road	391
two	379
touch	358
passing	353
time	352
street	351
went	348
took	348

In [105]:

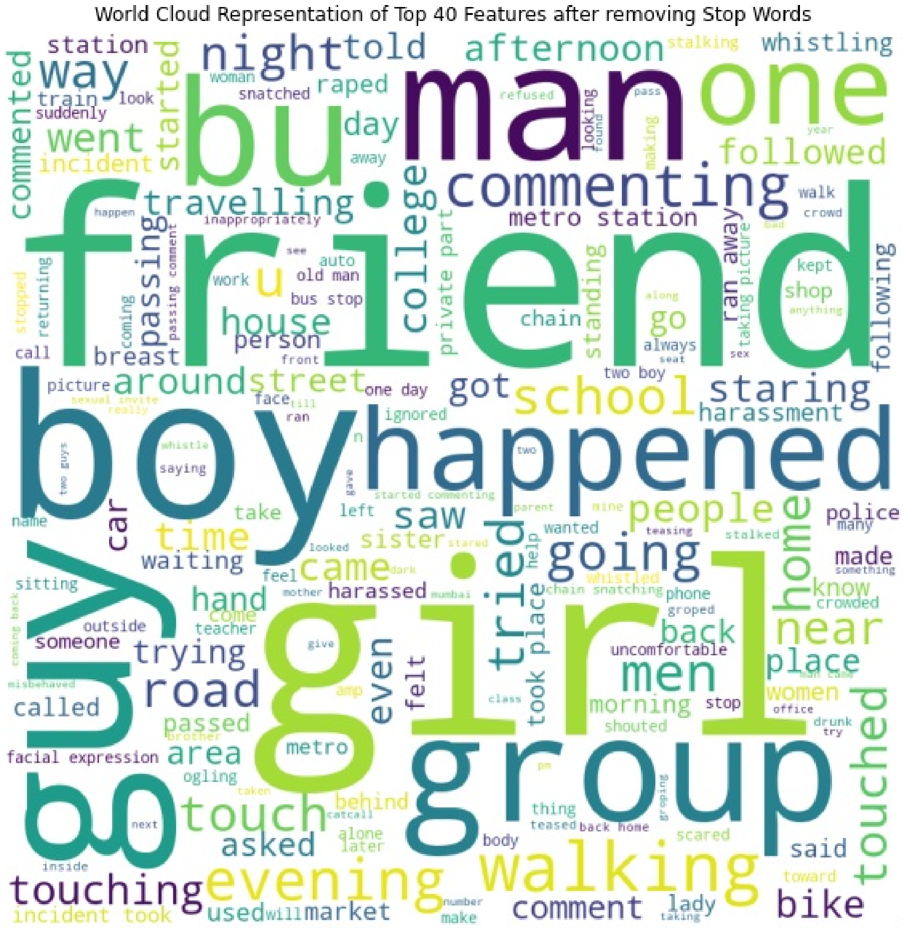
```
x=df.index
y=[df[0][i] for i in range(len(df))]
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 40 Features after removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```



In [106]:

```
#https://www.geeksforgeeks.org/generating-word-cloud-python/

# Python program to generate WordCloud

# importing all necessery modules

import matplotlib.pyplot as plt
import pandas as pd
from wordcloud import WordCloud, STOPWORDS

comment_words = ''
stopwords = set(STOPWORDS)

# iterate through the csv file
for val in commenting_df['Description']:

    # typecaste each val to string
    val = str(val)

    # split the value
    tokens = val.split()

    # Converts each token into lowercase
    for i in range(len(tokens)):
        tokens[i] = tokens[i].lower()

    comment_words += " ".join(tokens)+" "
wordcloud = WordCloud(width = 800, height = 800,
                background_color ='white',
                stopwords = stopwords,
                min_font_size = 10).generate(comment_words)

# plot the WordCloud image

plt.figure(figsize = (8, 8), facecolor = None)
plt.title('World Cloud Representation of Top 40 Features after removing Stop Words')
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```

World Cloud Representation of Top 40 Features after removing Stop Words



Observation:

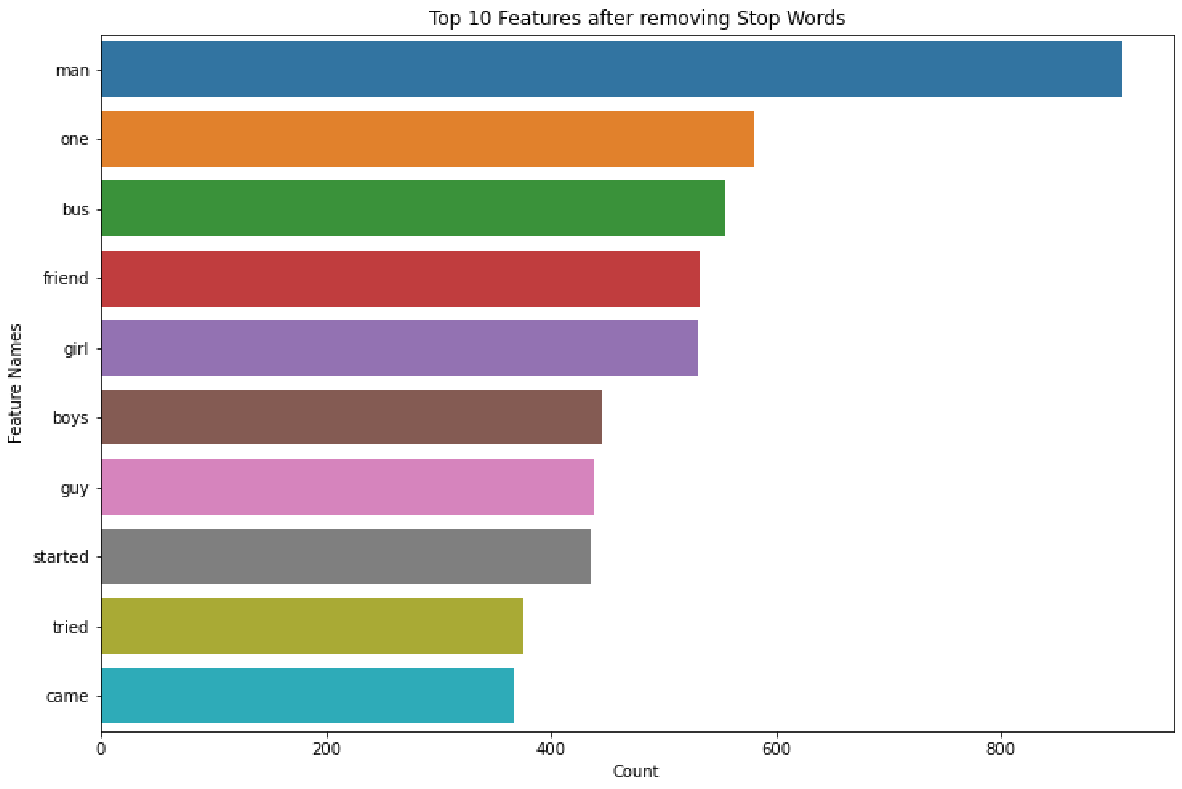
By using the Count Vectorizer, we are getting the Top 40 Features that occur more frequently in the Description. First before removing stop words we could see that more number of stopwords repeated in the whole corpus. But after removing stop words and analysing it using barplot and Word Cloud Representation we could see that man,boys,bus,one, girl,friend,started,commenting,guy,happened,walking,home etc these are the most frequent words occuring in this whole corpus. Since it is Personal Stories about Sexual Harassment written by various people through online these Top 40 Features represent that these are features people used frequently while writing the personal stories.

In [107]:

```
commenting=commenting_df[commenting_df['Category']==0]['Description']
non_commenting=commenting_df[commenting_df['Category']==1]['Description']
```

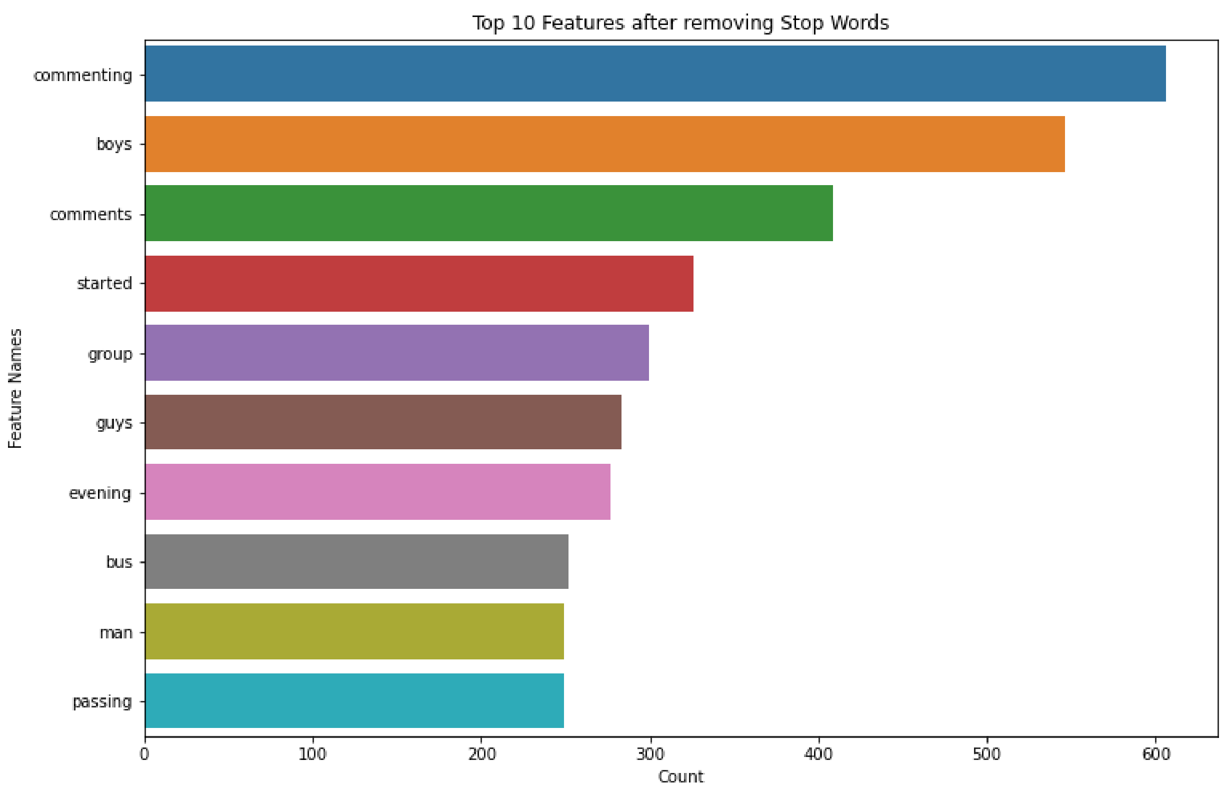
In [108]:

```
#commenting
from nltk.corpus import stopwords
vect=CountVectorizer(stop_words=set(stopwords.words('english')))#in the presence of stop words
output=vect.fit_transform(commenting)
features=vect.get_feature_names()#here we are getting the unique feature names
count=output.toarray().sum(axis=0)#here we are getting the count of unique words
df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:10]#Top 40 words with most word count

x=df.index#getting only the top 40 feature names
y=[df[0][i] for i in range(len(df))]#getting the count of top 40 feature names
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 10 Features after removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```



In [109]:

```
#non_commenting
vect=CountVectorizer(stop_words=set(stopwords.words('english')))#in the presence of stop words
output=vect.fit_transform(non_commenting)
features=vect.get_feature_names()#here we are getting the unique feature names
count=output.toarray().sum(axis=0)#here we are getting the count of unique words
df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:10]#Top 40 words with most word count

x=df.index#getting only the top 40 feature names
y=[df[0][i] for i in range(len(df))]#getting the count of top 40 feature names
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 10 Features after removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```

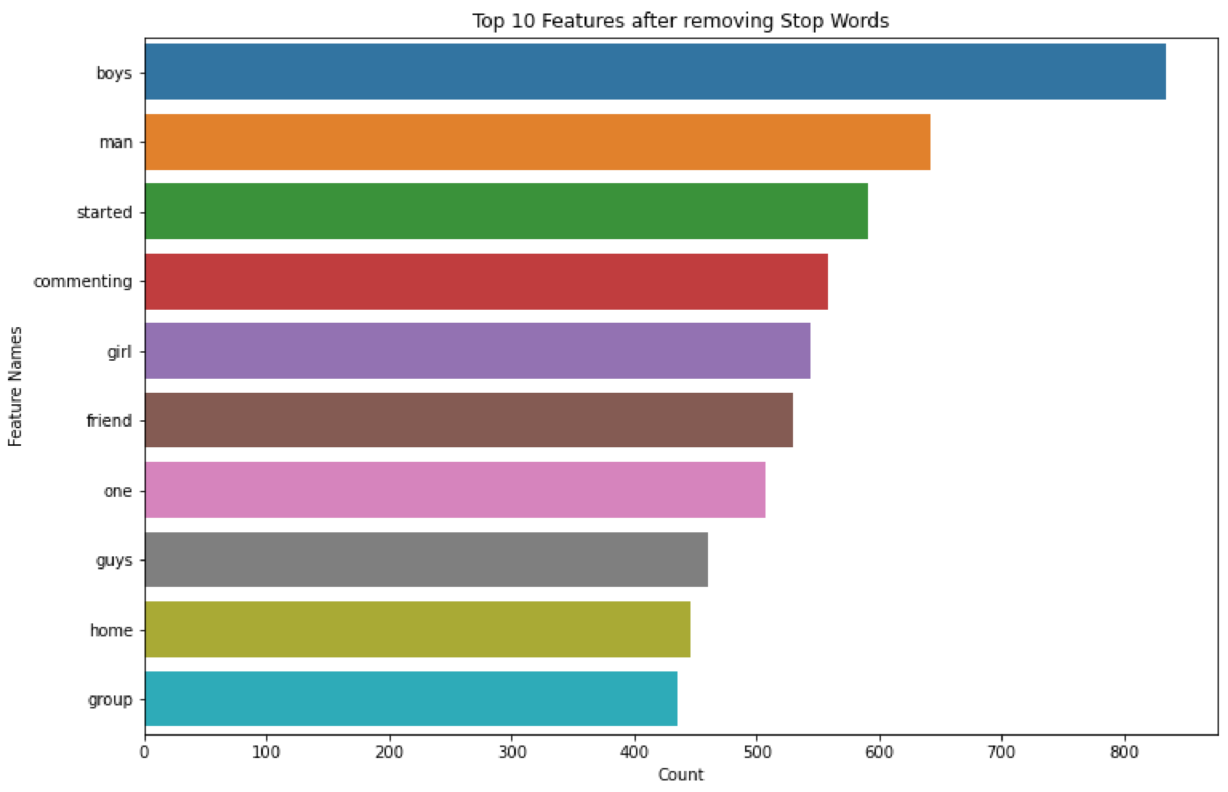


In [110]:

```
groping=groping_df[groping_df['Category']==0]['Description']
non_groping=groping_df[groping_df['Category']==1]['Description']
```

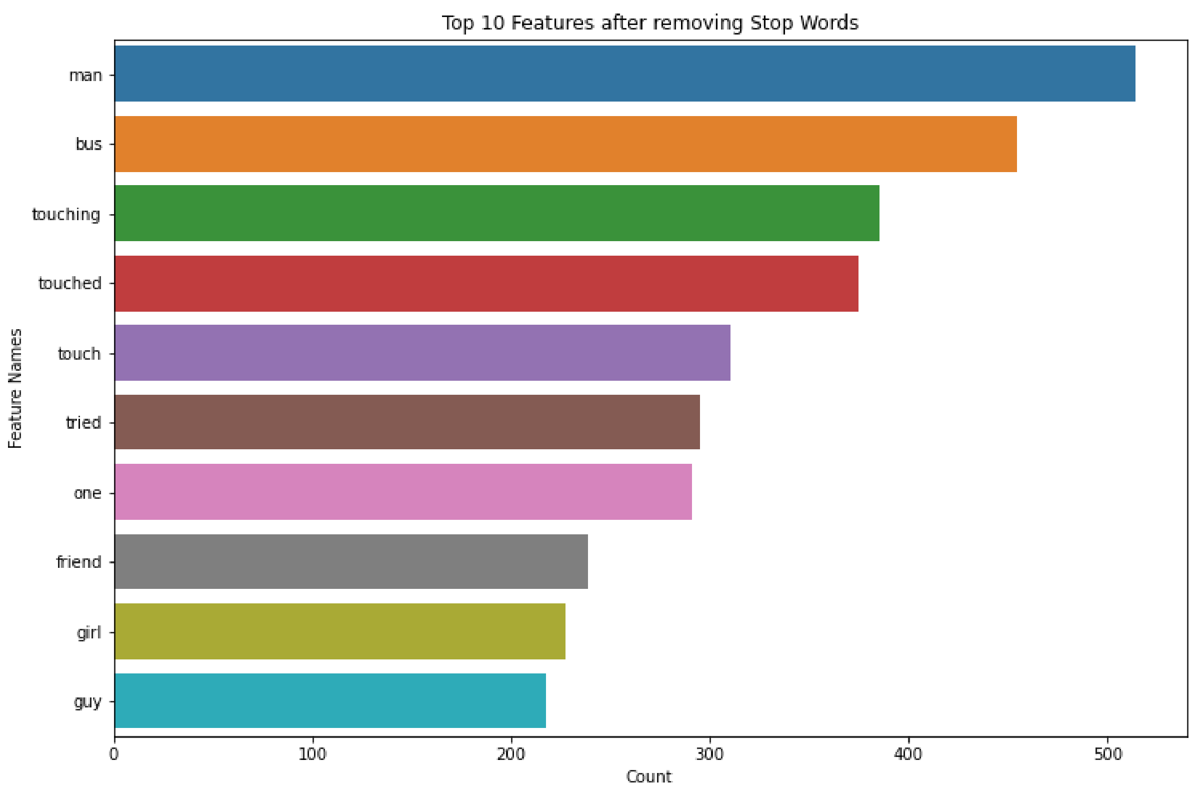
In [111]:

```
#groping
vect=CountVectorizer(stop_words=set(stopwords.words('english')))#in the presence of stop words
output=vect.fit_transform(groping)
features=vect.get_feature_names()#here we are getting the unique feature names
count=output.toarray().sum(axis=0)#here we are getting the count of unique words
df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:10]#Top 40 words with most word count

x=df.index#getting only the top 40 feature names
y=[df[0][i] for i in range(len(df))]#getting the count of top 40 feature names
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 10 Features after removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```



In [112]:

```
#non_groping
vect=CountVectorizer(stop_words=set(stopwords.words('english')))#in the presence of stop words
output=vect.fit_transform(non_groping)
features=vect.get_feature_names()#here we are getting the unique feature names
count=output.toarray().sum(axis=0)#here we are getting the count of unique words
df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:10]#Top 40 words with most word count

x=df.index#getting only the top 40 feature names
y=[df[0][i] for i in range(len(df))]#getting the count of top 40 feature names
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 10 Features after removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```

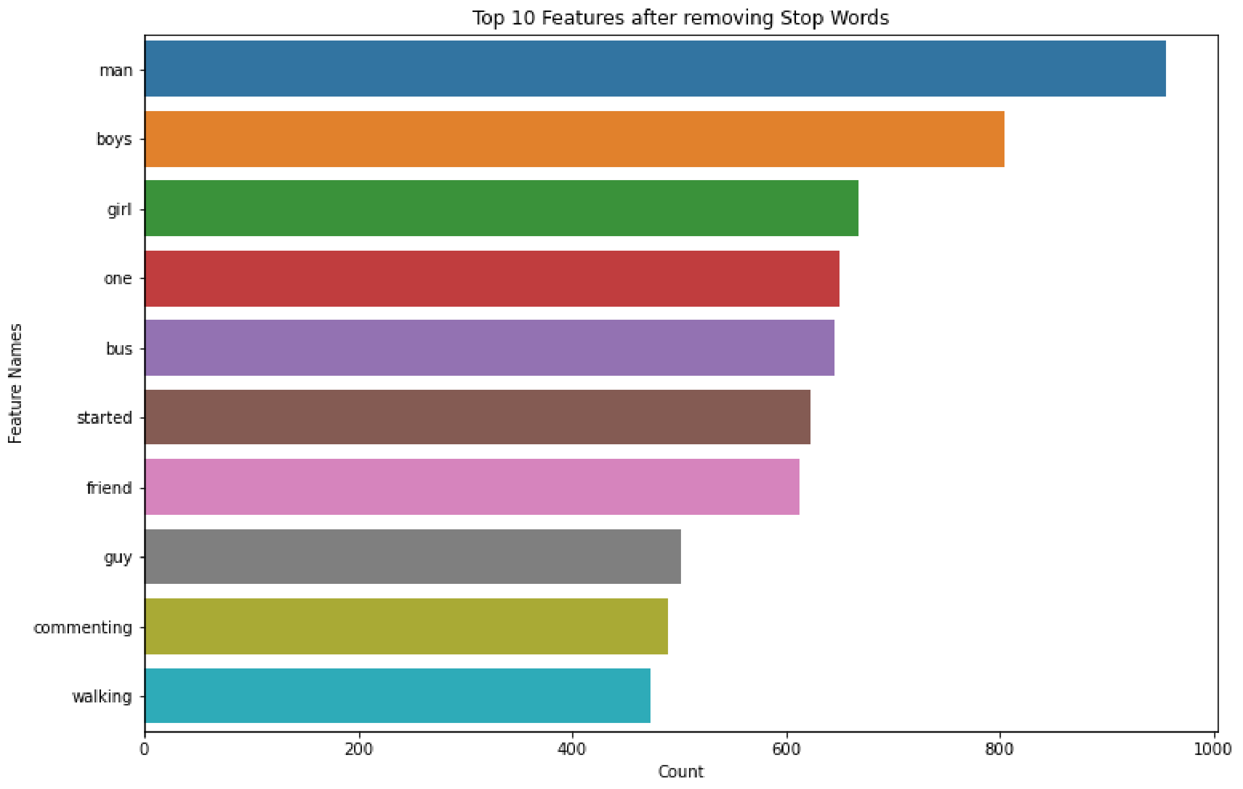


In [113]:

```
ogling=ogling_df[ogling_df['Category']==0]['Description']
non_ogling=ogling_df[ogling_df['Category']==1]['Description']
```

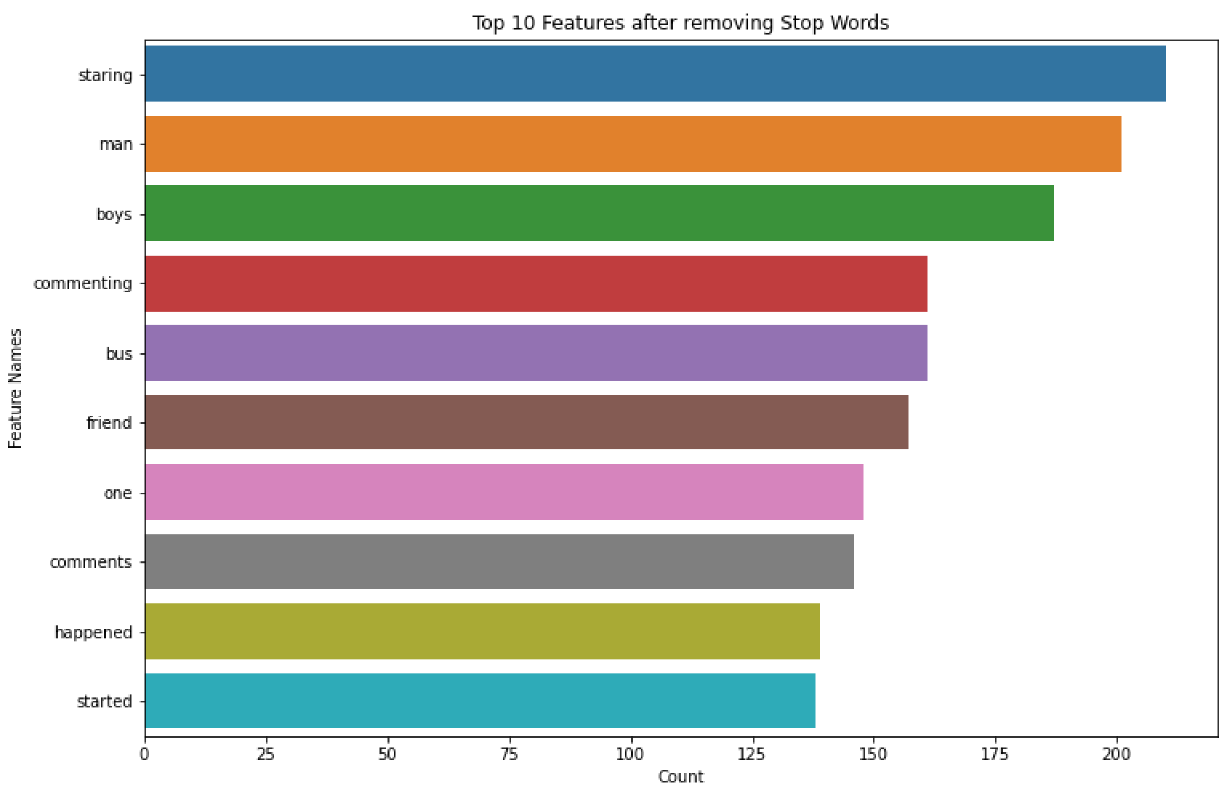
In [114]:

```
#ogling
vect=CountVectorizer(stop_words=set(stopwords.words('english')))#in the presence of stop words
output=vect.fit_transform(ogling)
features=vect.get_feature_names()#here we are getting the unique feature names
count=output.toarray().sum(axis=0)#here we are getting the count of unique words
df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:10]#Top 40 words with most word count

x=df.index#getting only the top 40 feature names
y=[df[0][i] for i in range(len(df))]#getting the count of top 40 feature names
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 10 Features after removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```



In [115]:

```
#non_ogling
vect=CountVectorizer(stop_words=set(stopwords.words('english')))#in the presence of stop words
output=vect.fit_transform(non_ogling)
features=vect.get_feature_names()#here we are getting the unique feature names
count=output.toarray().sum(axis=0)#here we are getting the count of unique words
df=pd.DataFrame(count,features)#Loading the feature and count to the DataFrame
df=df.sort_values(by=0,ascending=False)#Sorting the DataFrame to get the most occurances
df=df[:10]#Top 40 words with most word count

x=df.index#getting only the top 40 feature names
y=[df[0][i] for i in range(len(df))]#getting the count of top 40 feature names
plt.figure(figsize=(12,8))
sns.barplot(x=y,y=x)
plt.title('Top 10 Features after removing Stop Words')
plt.xlabel('Count')
plt.ylabel('Feature Names')
plt.show()
```



Observations:

Similar to that of the Top 40 features that we analysed before here we are analysing the Top 40 features for each category for each commenting data, groping data and ogling data and visualizing it through barplot.

In [116]:

```
from nltk.corpus import stopwords
vect=TfidfVectorizer(stop_words=set(stopwords.words('english')))
output=vect.fit_transform(commenting_df['Description'])
features=vect.get_feature_names()
idf_values=vect.idf_
df=pd.DataFrame(idf_values,features)
df=df.sort_values(by=0,ascending=False)
df=df[:40]
df
```

Out[116]:

```
                       0
           spilt  9.188967
       rebelled  9.188967
        societal  9.188967
        goapune  9.188967
       societies  9.188967
        societys  9.188967
             gnr  9.188967
         glimpse  9.188967
   sociocultural  9.188967
       reference  9.188967
       sociology  9.188967
noidabhajanpura  9.188967
          noisay  9.188967
        glancing  9.188967
         glanced  9.188967
           socks  9.188967
       refectory  9.188967
       goddesses  9.188967
         nodding  9.188967
           goers  9.188967
            soap  9.188967
    snatchingeve  9.188967
          goning  9.188967
        sneaking  9.188967
           snide  9.188967
       reflected  9.188967
         snobbed  9.188967
        golambar  9.188967
       socialise  9.188967
         gokulam  9.188967
       gokarting  9.188967
         goining  9.188967
            sobo  9.188967
            goin  9.188967
            gogo  9.188967
            soda  9.188967
        sodomise  9.188967
      sodomising  9.188967
           getup  9.188967
         ghastly  9.188967
```

Observation:

These are some of the rare words used in the whole text, which is obtained by taking the idf values and sorting them in the descending order of the idf values.

In [117]:

```
#Sentimental Analysis
```

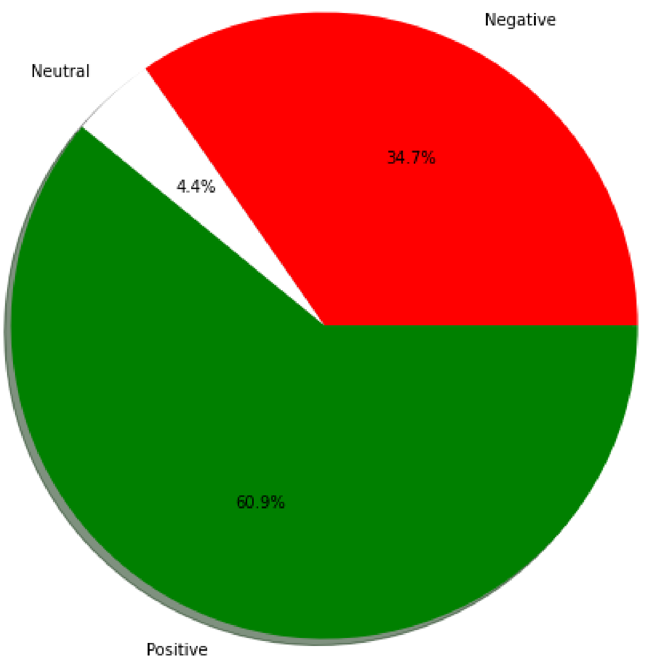
```
import nltk
from nltk.sentiment.vader import SentimentIntensityAnalyzer
sid = SentimentIntensityAnalyzer()

import numpy as np
def sentiment_score(X,feature):
    count,count1,count2=0,0,0
    for i in range(len(X)):
        for_sentiment=X[feature].iloc[i]#getting the corresponding sentence based on the index values
        ss=sid.polarity_scores(for_sentiment)#doing sentimental Analysis for each sentence
        lst=list(ss.values())#storing the sentinmental values for each sentence in a list
        maximum=np.argsort(lst)[-2]#getting the position of the highest score
        if maximum==0:
            count+=1
        elif maximum==1:
            count1+=1
        else:
            count2+=1
    return count,count1,count2#returning the negative_count,neutral_count,positive_count
```

In [118]:

```
negative_count,neutral_count,positive_count=sentiment_score(commenting_df,'Description')
```

In [119]:

```
#pie plot of count of maximamal sentimental score of each sentence
plt.figure(figsize=(12,8))
plt.pie([negative_count,neutral_count,positive_count],labels=['Negative','Neutral','Positive'],shadow=Tru
        colors=['red','white','green'])
plt.axis('equal')
plt.show()
```



Multilabel Classification:

In [120]:

```
df_train=pd.read_csv('train.csv')#loading the train.csv in the Dataframe
df_train.head()
```

Out[120]:

	Description	Commenting	Ogling/Facial Expressions/Staring	Touching /Groping
0	Was walking along crowded street, holding mums...	0	0	1
1	This incident took place in the evening.I was ...	0	1	0
2	I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...	1	0	0
3	Incident happened inside the train	0	0	0
4	I witnessed an incident when a chain was bruta...	0	0	0

In [121]:

```
df_train.columns=['Description','commenting','ogling','groping']#renaming column names
df_train.head()
```

Out[121]:

	Description	commenting	ogling	groping
0	Was walking along crowded street, holding mums...	0	0	1
1	This incident took place in the evening.I was ...	0	1	0
2	I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...	1	0	0
3	Incident happened inside the train	0	0	0
4	I witnessed an incident when a chain was bruta...	0	0	0

In [122]:

```
df_train.iloc[:,1:].sum()#getting the columns except description and counting the values for each catego
```

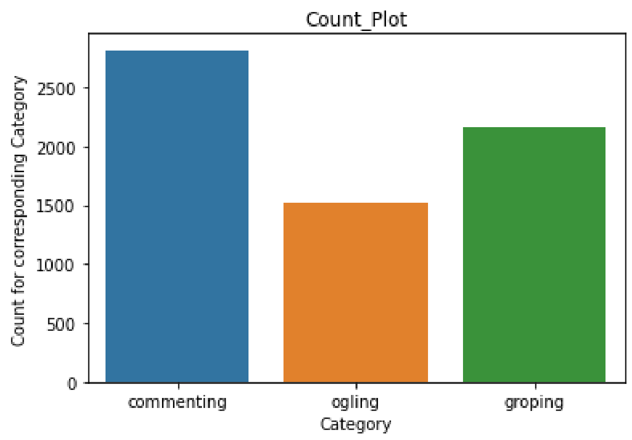
Out[122]:

```
commenting    2820
ogling        1526
groping       2166
dtype: int64
```

In [123]:

```
#Count plot for each category
sns.barplot(df_train.columns[1:].values,df_train.iloc[:,1:].sum().values)
plt.title("Count_Plot")
plt.xlabel("Category")
plt.ylabel("Count for corresponding Category")
plt.show()
```

```
C:\Users\HP\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following
variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, an
d passing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```



Observation:

From this plot we can see the corresponding count for each category.

commenting-->2820

ogling -->1526

groping -->2166

In [124]:

```
df_train.iloc[:,1:].sum(1).value_counts()#counting no of text points having multilabels
```

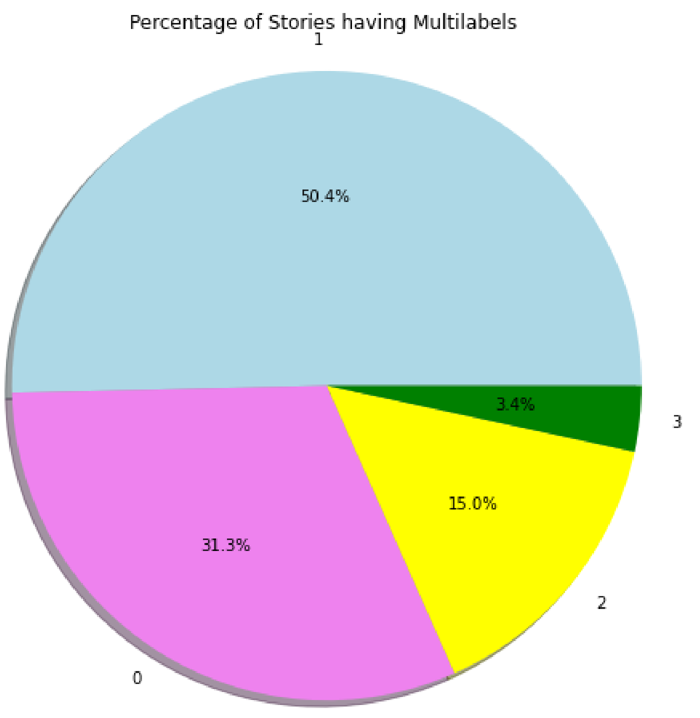
Out[124]:

```
1    3627
0    2253
2    1078
3     243
dtype: int64
```

In [125]:

```
#plotting percentage of stories having Multilabels
values=df_train.iloc[:,1:].sum(1).value_counts()
plt.figure(figsize=(12,8))
plt.pie(values,labels=['1','0','2','3'],shadow=True,autopct='%1.1f%%',\
        colors=['lightblue','violet','yellow','green'])
```

```
plt.axis('equal')
plt.title('Percentage of Stories having Multilabels ')
plt.show()
```



Observation:

This plot gives the visual representation of the no of text data points which has multilabels in the dataset.

-->2253 points have no labels which clearly depicts that the story does not correpond to any Sexual Harassment Activity.

-->3627 points corresponds to any one of Category which may be commenting or groping or ogling.

-->1078 points corresponds to any of two Category which may be (commenting and groping) or (commenting and ogling) or (ogling and groping).

-->243 points corresponds to all the three Category such as commenting,ogling and groping.

Preprocessing

Single Label Binary Classification:

In [126]:

```
commenting_df.info()#info about the data
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7201 entries, 0 to 7200
Data columns (total 2 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   Description  7201 non-null   object
 1   Category     7201 non-null   int64 
dtypes: int64(1), object(1)
memory usage: 112.6+ KB
```

In [127]:

```
groping_df.info()#info about the data
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7201 entries, 0 to 7200
Data columns (total 2 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   Description  7201 non-null   object
 1   Category     7201 non-null   int64 
dtypes: int64(1), object(1)
memory usage: 112.6+ KB
```

In [128]:

```
ogling_df.info()#info about the data
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7201 entries, 0 to 7200
Data columns (total 2 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   Description  7201 non-null   object
 1   Category     7201 non-null   int64 
dtypes: int64(1), object(1)
memory usage: 112.6+ KB
```

In [129]:

```
#Displaying some random text data points for analysing before preprocessing on that.
print(commenting_df['Description'][0])
print("-"*125)
print(commenting_df['Description'][100])
print("-"*125)
print(commenting_df['Description'][600])
print("-"*125)
print(commenting_df['Description'][1000])
print("-"*125)

#after visualizing that we can see that just basic preprocessing is enough.
```

```
Was walking along crowded street, holding mums hand, when an elderly man groped butt, I turned to look at
h7m and he looked away, and did it again after a while.I was 12 yrs old then.
---------------------------------------------------------------------------------------------------------
---------------
I was at the tap when a boy came to pour water.  He found a 14 years old girl waiting  to fetch water
and just grabbed her hands and dragged her away.
---------------------------------------------------------------------------------------------------------
---------------
A friend of mine who lives beside our house is usaully harassed.When she is going out to read, a man by
name John, always harass her because he has an advantage over her but she did not like the idea.
---------------------------------------------------------------------------------------------------------
---------------
taking pictures and commenting rude behaviour ,catcalls
---------------------------------------------------------------------------------------------------------
---------------
```

In [130]:

```
# https://gist.github.com/sebleier/554280
# we are removing the words from the stop words list: 'no', 'nor', 'not'
stopwords= ['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're", "you've",\
            "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he', 'him', 'his', 'himself',
            'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its', 'itself', 'they', 'them', 'the
            'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this', 'that', "that'll", 'these', '
            'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have', 'has', 'had', 'having', 'do',
            'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'as', 'until', 'while'
            'at', 'by', 'for', 'with', 'about', 'against', 'between', 'into', 'through', 'during', 'befor
            'above', 'below', 'to', 'from', 'up', 'down', 'in', 'out', 'on', 'off', 'over', 'under', 'aga
            'then', 'once', 'here', 'there', 'when', 'where', 'why', 'how', 'all', 'any', 'both', 'each',
            'most', 'other', 'some', 'such', 'only', 'own', 'same', 'so', 'than', 'too', 'very', \
            's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "should've", 'now', 'd', 'll', 'm',
            've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'didn', "didn't", 'doesn', "doesn't
            "hadn't", 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "mightn't", '
            "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'wasn', "wasn't", 'w
            'won', "won't", 'wouldn', "wouldn't"]
```

In [131]:

```
lemmatizer=WordNetLemmatizer()
def preprocessing(text_data):
    text = re.sub('[^A-Za-z0-9]+', ' ', text_data)#replacing characters other than alphabets and numbers
    text = ' '.join([word.lower() for word in text.split()])#lowering all the words
    text = [word for word in text.split() if word not in stopwords]#removing the stopwords
    text = ' '.join([lemmatizer.lemmatize(word) for word in text])#lemmatizing the words
    return text
```

In [132]:

```
commenting_df['cleaned_text']=commenting_df['Description'].apply(preprocessing)
commenting_df
```

Out[132]:

```
                                          Description  Category                                     cleaned_text
   0          Was walking along crowded street, holding mums...         0       walking along crowded street holding mum hand
                                                                                                                 ...
   1               This incident took place in the evening.I was ...         0   incident took place evening metro two guy star...
   2    I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...         1      waiting bus man came bike offering liftvto you...
   3                         Incident happened inside the train         0                        incident happened inside train
   4           I witnessed an incident when a chain was bruta...         0    witnessed incident chain brutally snatched eld...
 ...                                                        ...       ...                                                  ...
7196            There was this person near a construction site...         0     person near construction site probably laborer...
7197          He threatened me by making inappropriate conve...         1  threatened making inappropriate conversation t...
7198         happened during morning at university metro st...         1  happened morning university metro station guy ...
7199          one day my aunt was returniec frm office .. sh...         0    one day aunt returniec frm office shaunt e fou...
7200                          was victim of sxual assault RAPE         0                           victim sxual assault rape
```

7201 rows × 3 columns

In [133]:

```
groping_df['cleaned_text']=groping_df['Description'].apply(preprocessing)
groping_df
```

Out[133]:

```
                                          Description  Category                                     cleaned_text
   0          Was walking along crowded street, holding mums...         1       walking along crowded street holding mum hand
                                                                                                                 ...
   1               This incident took place in the evening.I was ...         0   incident took place evening metro two guy star...
   2    I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...         0      waiting bus man came bike offering liftvto you...
   3                         Incident happened inside the train         0                        incident happened inside train
   4           I witnessed an incident when a chain was bruta...         0    witnessed incident chain brutally snatched eld...
 ...                                                        ...       ...                                                  ...
7196            There was this person near a construction site...         0     person near construction site probably laborer...
7197          He threatened me by making inappropriate conve...         0  threatened making inappropriate conversation t...
7198         happened during morning at university metro st...         0  happened morning university metro station guy ...
7199          one day my aunt was returniec frm office .. sh...         0    one day aunt returniec frm office shaunt e fou...
7200                          was victim of sxual assault RAPE         0                           victim sxual assault rape
```

7201 rows × 3 columns

In [134]:

```
ogling_df['cleaned_text']=ogling_df['Description'].apply(preprocessing)
ogling_df
```

Out[134]:

	Description	Category	cleaned_text
0	Was walking along crowded street, holding mums...	0	walking along crowded street holding mum hand ...
1	This incident took place in the evening.I was ...	1	incident took place evening metro two guy star...
2	I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...	0	waiting bus man came bike offering liftvto you...
3	Incident happened inside the train	0	incident happened inside train
4	I witnessed an incident when a chain was bruta...	0	witnessed incident chain brutally snatched eld...
...	...	...	...
7196	There was this person near a construction site...	1	person near construction site probably laborer...
7197	He threatened me by making inappropriate conve...	0	threatened making inappropriate conversation t...
7198	happened during morning at university metro st...	0	happened morning university metro station guy ...
7199	one day my aunt was returniec frm office .. sh...	0	one day aunt returniec frm office shaunt e fou...
7200	was victim of sxual assault RAPE	0	victim sxual assault rape

7201 rows × 3 columns

In [135]:

```
#after preprocessing displaying a random data point
print(commenting_df['Description'][2435])
print("-"*125)
print(commenting_df['Description'][145])
print("-"*125)
print(commenting_df['Description'][455])
print("-"*125)
print(commenting_df['Description'][5660])
print("-"*125)
```

```
This incident took place on 21st March 2013 around 6pm.Two guys on a bike were following a girl and were
passing comments on her.
--------------------------------------------------------------------------------------------------------------
---------------
Harassment by boys who comment, take pictures and whistle
--------------------------------------------------------------------------------------------------------------
---------------
it was on Saturday when I was going to the shop and I heard someone whistling at me when I turned to see
who it was I saw another boy coming towards me and I pretended not to have seen him and walked away
--------------------------------------------------------------------------------------------------------------
---------------
it was really bad.
--------------------------------------------------------------------------------------------------------------
---------------
```

MultiLabel Classification:

In [136]:

```
df_train.info()#info about the data
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7201 entries, 0 to 7200
Data columns (total 4 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   Description  7201 non-null   object
 1   commenting   7201 non-null   int64 
 2   ogling       7201 non-null   int64 
 3   groping      7201 non-null   int64 
dtypes: int64(3), object(1)
memory usage: 225.2+ KB
```

In [138]:

```
df_train['cleaned_text']=df_train['Description'].apply(preprocessing)
df_train
```

Out[138]:

	Description	commenting	ogling	groping	cleaned_text
0	Was walking along crowded street, holding mums...	0	0	1	walking along crowded street holding mum hand ...
1	This incident took place in the evening.I was ...	0	1	0	incident took place evening metro two guy star...
2	I WAS WAITING FOR THE BUS. A MAN CAME ON A BIK...	1	0	0	waiting bus man came bike offering liftvto you...
3	Incident happened inside the train	0	0	0	incident happened inside train
4	I witnessed an incident when a chain was bruta...	0	0	0	witnessed incident chain brutally snatched eld...
...	...	...	...	...	...
7196	There was this person near a construction site...	0	1	0	person near construction site probably laborer...
7197	He threatened me by making inappropriate conve...	1	0	0	threatened making inappropriate conversation t...
7198	happened during morning at university metro st...	1	0	0	happened morning university metro station guy ...
7199	one day my aunt was returniec frm office .. sh...	0	0	0	one day aunt returniec frm office shaunt e fou...
7200	was victim of sxual assault RAPE	0	0	0	victim sxual assault rape

7201 rows × 5 columns

In [139]:

```
#Preprocessing of Validation and Test datasets.
```

In [140]:

```
commenting_df_val=pd.read_csv('commenting_data_val.csv')
commenting_df_test=pd.read_csv('commenting_data_test.csv')
groping_df_val=pd.read_csv('groping_data_val.csv')
groping_df_test=pd.read_csv('groping_data_test.csv')
ogling_df_val=pd.read_csv('ogling_data_test.csv')
ogling_df_test=pd.read_csv('ogling_data_test.csv')
```

In [141]:

```
commenting_df_val['cleaned_text']=commenting_df_val['Description'].apply(preprocessing)
commenting_df_test['cleaned_text']=commenting_df_test['Description'].apply(preprocessing)
groping_df_val['cleaned_text']=groping_df_val['Description'].apply(preprocessing)
groping_df_test['cleaned_text']=groping_df_test['Description'].apply(preprocessing)
ogling_df_val['cleaned_text']=ogling_df_val['Description'].apply(preprocessing)
ogling_df_test['cleaned_text']=ogling_df_test['Description'].apply(preprocessing)
```

In [142]:

```
df_val=pd.read_csv('dev.csv')
df_test=pd.read_csv('test.csv')
```

In [143]:

```
df_val.columns=['Description','commenting','ogling','groping']#renaming column names
df_test.columns=['Description','commenting','ogling','groping']#renaming column names
```

In [144]:

```
df_val['cleaned_text']=df_val['Description'].apply(preprocessing)
df_test['cleaned_text']=df_test['Description'].apply(preprocessing)
```

In [145]:

```
df_train.to_csv('preprocessed_data_train.csv')
df_val.to_csv('preprocessed_data_val.csv')
df_test.to_csv('preprocessed_data_test.csv')
commenting_df.to_csv('train_commenting_data.csv')
groping_df.to_csv('train_groping_data.csv')
ogling_df.to_csv('train_ogling_data.csv')
```

In [146]:

```
commenting_df_val.to_csv('val_commenting_data.csv')
groping_df_val.to_csv('val_groping_data.csv')
ogling_df_val.to_csv('val_ogling_data.csv')
commenting_df_test.to_csv('test_commenting_data.csv')
groping_df_test.to_csv('test_groping_data.csv')
ogling_df_test.to_csv('test_ogling_data.csv')
```