PROJECT REPORT

ON

“DATA PREPROCESSING”

BY

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Executive Summary

The dataset “Twitter Climate Change Sentiment Dataset” chosen for this project regarding “General Awareness on Climate Change” was downloaded from Kaggle. The Dataset contains texts, comments, replays extracted from the Social networking platform Twitter. The dataset contains three variables/features/columns and around 50 thousand messages/comments/replays/rows/tweets. The dataset does not contain any missing values. Using Feature Engineering two new variables were created “Word_Count” and “Text Length” containing the number of words per sentence and number of characters per sentence.

Data

1. In this project the data set used Twitter Climate change Sentiment Dataset a csv file.
2. The Dataset Contains Three Features/columns.
3. Sentiment – Numeric Variable, Range (-1: 2) specifying the sentiment a sentence pose.
4. 2(News): the tweet links to factual news about climate change
5. 1(Pro): the tweet supports the belief of man-made climate change
6. 0(Neutral: the tweet neither supports nor refutes the belief of man-made climate change
7. -1(Anti): the tweet does not believe in man-made climate change
8. Message – Character Variable containing the text/comment/replay/message/tweet.
9. Tweeted – Numeric Variable containing the specific key to locate every tweet.
10. Data Source: https://www.kaggle.com/edqian/twitter-climate-

change-sentiment-dataset.

Programming Language.

Python 3.8.

Integrated Development Environment.

PyCharm 2021.1 (Community Edition)
Build #PC-211.6693.115, built on April 6, 2021
Runtime version: 11.0.10+9-b1341.35 amd64
VM: Dynamic Code Evolution 64-Bit Server VM by JetBrains s.r.o.
Windows 10 10.0
GC: ParNew, ConcurrentMarkSweep
Memory: 3933M
Cores: 8

Modules/Libraries

The Modules/Libraries used in Data Preprocessing are:

1. Pandas
2. Nltk- Natural Language Text Kit
3. Sklearn
4. Seaborn

Importing the required libraries

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from nltk.stem import PorterStemmer
import regex as re
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
```

Exploratory Data Analysis

```
Data = pd.read_csv("twitter_sentiment_data.csv")
Data['word_counts'] = Data['message'].str.split().str.len()
Data["Text Length"] = Data["message"].str.len()
Data.groupby('sentiment')['word_counts'].mean()

# Exploratory analysis
Data.describe()
```

```
          sentiment       tweetid   word_counts   Text Length
count  43943.000000  4.394300e+04  43943.000000  43943.000000
mean       0.853924  8.367966e+17     17.400792    122.823954
std        0.853543  8.568506e+16      4.621521     24.720780
min       -1.000000  5.926334e+17      1.000000      7.000000
25%        0.000000  7.970376e+17     14.000000    111.000000
50%        1.000000  8.402301e+17     18.000000    133.000000
75%        1.000000  9.020003e+17     21.000000    140.000000
max        2.000000  9.667024e+17     97.000000    623.000000
```

Print the Columns/features in the Dataset

```
print(Data.columns)

Index(['sentiment', 'message', 'tweetid', 'word_counts', 'Text
Length'], dtype='object')
```

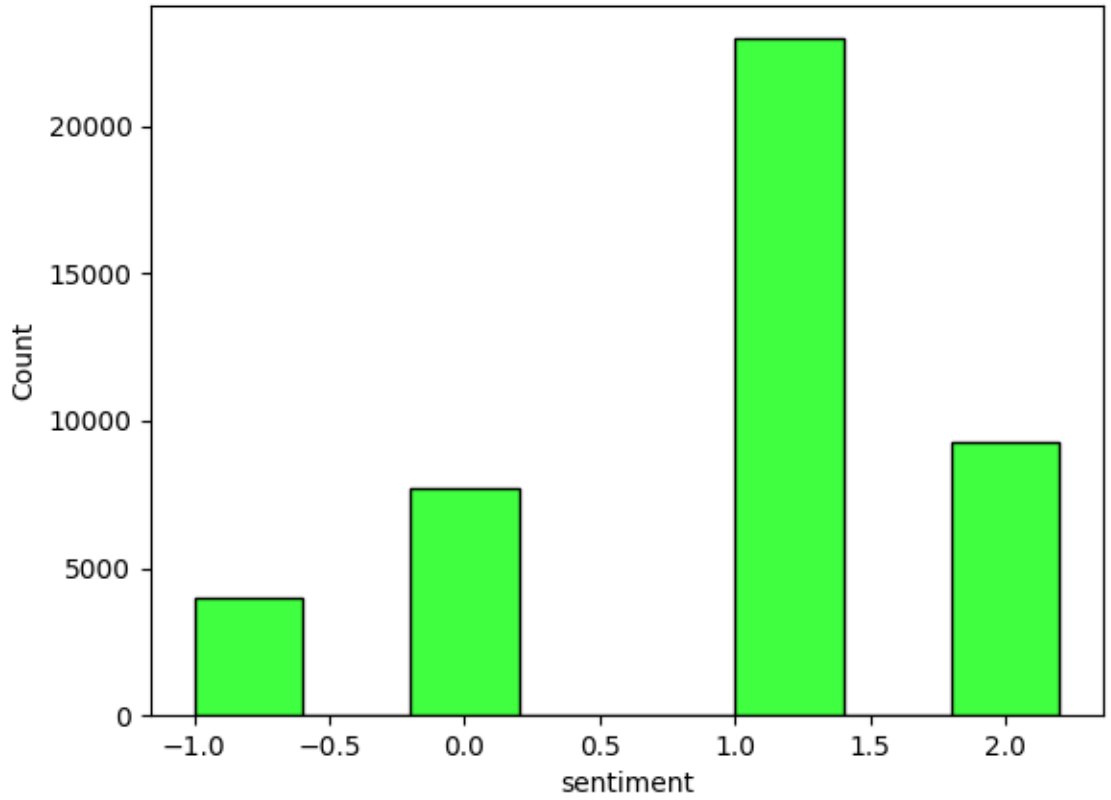
‘message variable/column/feature is the only feature with non numerical data ’

```
print(Data["message"])

0        @tiniebeany climate change is an interesting h...
1        RT @NatGeoChannel: Watch #BeforeTheFlood right...
2        Fabulous! Leonardo #DiCaprio's film on #climat...
3        RT @Mick_Fanning: Just watched this amazing do...
4        RT @cnalive: Pranita Biswasi, a Lutheran from ...
                              ...
43938    Dear @realDonaldTrump,\nYeah right. Human Medi...
```

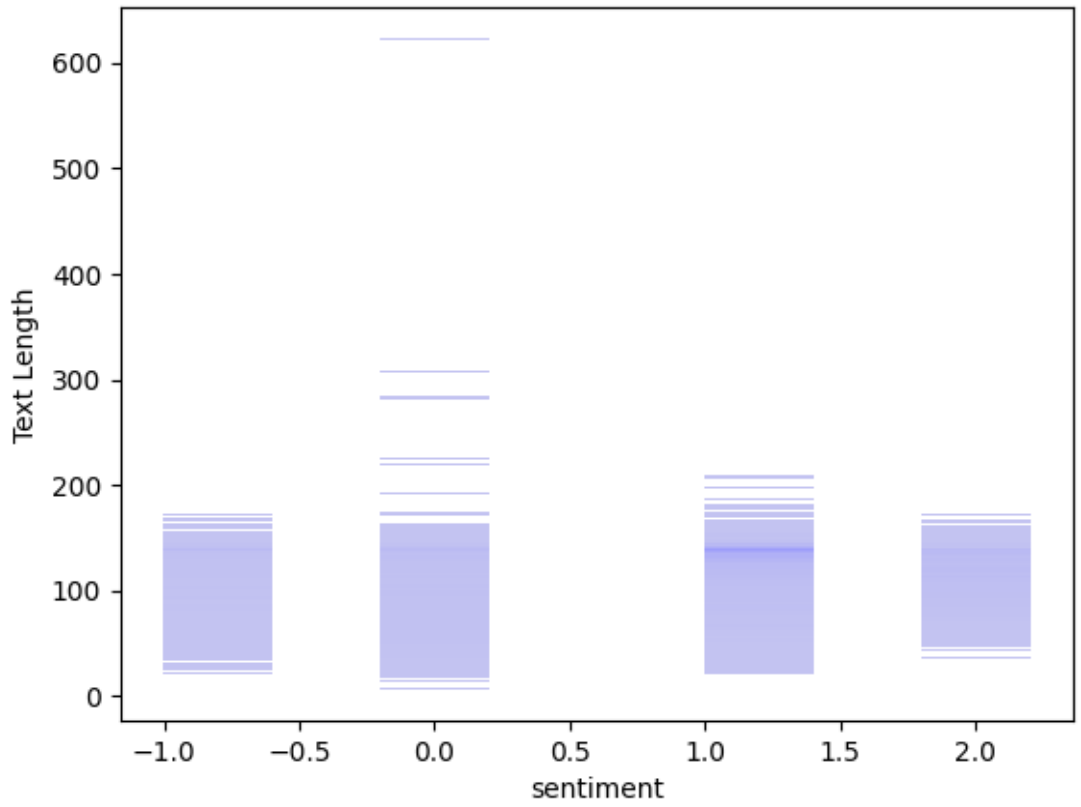
Data Visualization

Plotting seaborn histplot(Histogram) to check the distribution of data



The histogram show that most of the tweets are pro climate change, and has low number of anti-climate change tweets. This shows that people are aware of the climate change

Plotting a seaborn histplot(Histogram) to check the relation between variables text length and sentiment



The Histogram show that there isn't much difference in the text length of different classes. The major difference seen is in the neutral class as people tend to write more if they are neutral (0) some tweets going as far as 600 characters.

Checking the dataset for missing values

```
Data.isna().sum()

sentiment       0
message         0
tweetid         0
word_counts     0
Text Length     0
dtype: int64
```

There are no missing values (NA’s) in the dataset.

Natural Language Processing

```
print(Data["message"])
0        @tiniebeany climate change is an interesting h...
1        RT @NatGeoChannel: Watch #BeforeTheFlood right...
2        Fabulous! Leonardo #DiCaprio's film on #climat...
3        RT @Mick_Fanning: Just watched this amazing do...
4        RT @cnalive: Pranita Biswasi, a Lutheran from ...
                              ...
43938    Dear @realDonaldTrump,\nYeah right. Human Medi...
43939    What will your respective parties do to preven...
43940    RT @MikkiL: UN Poll Shows Climate Change Is th...
43941    RT @taehbeingextra: i still can$q$t believe th...
43942    @Likeabat77 @zachhaller \n\nThe wealthy + foss...
```

Processing the main feature of the dataset (message). The message feature is a character variable to process the variable we will have to clean the variable first as their as many unwanted characters in the variable which do not contribute to the meaning of the sentence.

Using Regular Expression to clean the variable message.

```
def msg_cleaning(msg):
    # Removing @abc12
    msg = re.sub(r'@[A-Za-z0-9]+', '', msg)
    # Removing Hashtags
    msg = re.sub(r'#', '', msg)
    # Removing Chines
    msg = re.sub(r'[^\x00-\x7F]+', '', msg)
    # Removing Retweets
    msg = re.sub(r'RT[\s]+', '', msg)
    # Removing HyperLinks
    msg = re.sub(r'https?:\/\/\s+', '', msg)
    # Removing numeric values
    msg = re.sub(r'\d+', '', msg)
    msg = re.sub(r'aa[A-Za-z0-9]+', '', msg)
    msg = re.sub(r'zz[A-Za-z0-9]+', '', msg)
    return msg
```

In the function msg_cleaning, we are getting rid of

1. Mentions (@tini).
2. Hashtags (#happyworld).
3. Retweets (RT).
4. Hyperlinks (https/http).
5. Numbers (0-9).
6. Chinees words.

Changing the characters of the message feature into lowercase.

```
Data["message"] = Data["message"].str.lower()

0         climate change is an interesting hustle as it...
1        : watch beforetheflood right here, as  travels...
2        fabulous! leonardo dicaprio's film on climate ...
3        _fanning: just watched this amazing documentar...
4        : pranita biswasi, a lutheran from odisha, giv...
                              ...
43938    dear ,\nyeah right. human mediated climate cha...
43939    what will your respective parties do to preven...
43940    : un poll shows climate change is the lowest o...
43941    : i still can$q$t believe this gif of taehyung...
43942      \n\nthe wealthy + fossil fuel industry know ...
Name: message, Length: 43943, dtype: object
```

Tokenization

Using Word Tokenization

```
def identify_tokens(row):
    ide_words = row["message"]
    tokens = word_tokenize(ide_words)

    token_words = [w for w in tokens if w.isalpha()]
    return token_words


Data["message"] = Data.apply(identify_tokens, axis=1)
print(Data['message'])
0        [climate, change, is, an, interesting, hustle,...
1        [watch, beforetheflood, right, here, as, trave...
2        [fabulous, leonardo, dicaprio, film, on, clima...
3        [just, watched, this, amazing, documentary, by...
4        [pranita, biswasi, a, lutheran, from, odisha, ...
                               ...
43938    [dear, yeah, right, human, mediated, climate, ...
43939    [what, will, your, respective, parties, do, to...
43940    [un, poll, shows, climate, change, is, the, lo...
43941    [i, still, can, q, t, believe, this, gif, of, ...
43942    [the, wealthy, fossil, fuel, industry, know, c...
```

Stemming the words

```
stemming = PorterStemmer()


def stem_list(row):
    my_list = row["message"]
    stemmed_list = [stemming.stem(word) for word in my_list]
    return (stemmed_list)


Data["message"] = Data.apply(stem_list, axis=1)
print(Data["message"])
0        [climat, chang, is, an, interest, hustl, as, i...
1        [watch, beforetheflood, right, here, as, trave...
2        [fabul, leonardo, dicaprio, film, on, climat, ...
3        [just, watch, thi, amaz, documentari, by, leon...
4        [pranita, biswasi, a, lutheran, from, odisha, ...
                               ...
43938    [dear, yeah, right, human, mediat, climat, cha...
43939    [what, will, your, respect, parti, do, to, pre...
43940    [un, poll, show, climat, chang, is, the, lowes...
43941    [i, still, can, q, t, believ, thi, gif, of, ta...
```

```
43942    [the, wealthi, fossil, fuel, industri, know, c...
```

Stop word removal

```
stops = set(stopwords.words("english"))
stops.update(["aa", "aaa", "aaaa", "aaaaa", "aaaaaa", "aaaaaaa",
"aaaaaaaa", "aaaaaaaaa", "aaaaaaaaaaaaaaaaaaaah"])


def remove_stops(row):
    my_list = row["message"]
    meningful_words = [w for w in my_list if not w in stops]
    return(meningful_words)

Data["message"] = Data.apply(remove_stops, axis=1)
print(Data["message"])

0        [climat, chang, interest, hustl, wa, global, w...
1        [watch, beforetheflood, right, travel, world, ...
2        [fabul, leonardo, dicaprio, film, climat, chan...
3        [watch, thi, amaz, documentari, leonardodicapr...
4        [pranita, biswasi, lutheran, odisha, give, tes...
                               ...
43938    [dear, yeah, right, human, mediat, climat, cha...
43939    [respect, parti, prevent, climat, chang, globa...
43940    [un, poll, show, climat, chang, lowest, global...
43941    [still, q, believ, thi, gif, taehyung, save, h...
43942    [wealthi, fossil, fuel, industri, know, climat...
Name: message, Length: 43943, dtype: object
```

Saving the file

```
Data.to_csv("First_processed.csv
```

Part-1 Complete

Part- 2

Importing the required libraries

```
import pandas as pd
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split,
RandomizedSearchCV, GridSearchCV, cross_val_score
import numpy as np
from sklearn.linear_model import LogisticRegression
from sklearn import metrics
from sklearn.metrics import classification_report, confusion_matrix,
f1_score, precision_score, recall_score, accuracy_score
```

Reading in the data

```
Data = pd.read_csv("First_processed.csv")
X = Data["message"]
Y = Data["sentiment"]
```

Splitting the data into training set, validation set, test set

```
# Splitting the data
X_train, X_test, y_train, y_test = train_test_split(X, Y,
test_size=0.25, random_state=1103)

# Splitting the data into validation
X_test, x_val, y_test, y_val = train_test_split(X_test, y_test,
test_size=0.5, random_state=1103)
```

Using TF-IDF Vectorizer

Using Ngrams with N=1:3

```
tfidf = TfidfVectorizer(ngram_range=(1, 3), max_features=12000,
use_idf=True)
tfidf.fit_transform(X_train)
tfidf.fit_transform(x_val)
```

Testing the model without the features added using feature engineering

Algorithm used: Logistic Regression

```
grid = {"C": np.logspace(-1, -3, 3, 7, 9), "penalty": ["none",
"l2"]}# l1 lasso l2 ridge
logreg = LogisticRegression(n_jobs=6, max_iter=2000, verbose=True)
#logreg_cv = GridSearchCV(logreg, grid, cv=10, verbose=True)
# X_train["word_count"] = Data["word_counts"]
# X_test["word_count"] = Data["word_counts"]
# X_train["Text Length"] = Data["Text Length"]
# X_test["Text Length"] = Data["Text Length"]
logreg.fit(tfidf.transform(X_train), y_train)

rfc_predict = logreg.predict(tfidf.transform(x_val))
```

```
print("ACCURACY SCORE:", metrics.accuracy_score(y_val, rfc_predict))
print("::::Confusion Matrix::::")
print(confusion_matrix(y_val, rfc_predict))
print("\n")

print(":::Classification Report:::")
print(classification_report(y_val, rfc_predict, target_names=['Class
1', 'Class 2', 'Class 3', 'Class 4']))
print("\n")

print(pd.crosstab(y_val, rfc_predict, rownames=["Orgnl"],
colnames=['Predicted']))
```

Results

```
ACCURACY SCORE: 0.718186783178591
::::Confusion Matrix::::
[[ 196   83  203   33]
 [  28  437  432   79]
 [  28  127 2531  146]
 [   9   24  356  781]]


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

     Class 1       0.75      0.38      0.51       515
     Class 2       0.65      0.45      0.53       976
     Class 3       0.72      0.89      0.80      2832
     Class 4       0.75      0.67      0.71      1170

    accuracy                           0.72      5493
   macro avg       0.72      0.60      0.63      5493
weighted avg       0.72      0.72      0.70      5493



Predicted   -1    0     1    2
Orgnl
-1         196   83   203   33
 0          28  437   432   79
 1          28  127  2531  146
 2           9   24   356  781
```

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