PROJECT REPORT

ON

MODEL GENERATION

BY

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Executive Summery

This is the second phase of the project twitter sentiment analysis on climate change. The Data used is the pre-processed file First_Processed.csv. We have used the semi-supervised support vector machine to train the model. We downloaded the unlabelled data from Kaggle “climate-change.csv” and tuned the hyper parameters in the support vector machine to find the best results.

Machine and ide details

PyCharm 2021.1 (Community Edition)

Google-Colab notebook

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: 6933M

Cores: 8

Modules/Libraries

The modules/libraries used in model generation are

1. Sklearn
2. Pandas
3. Matplotlib
4. Nump

Importing the required libraries

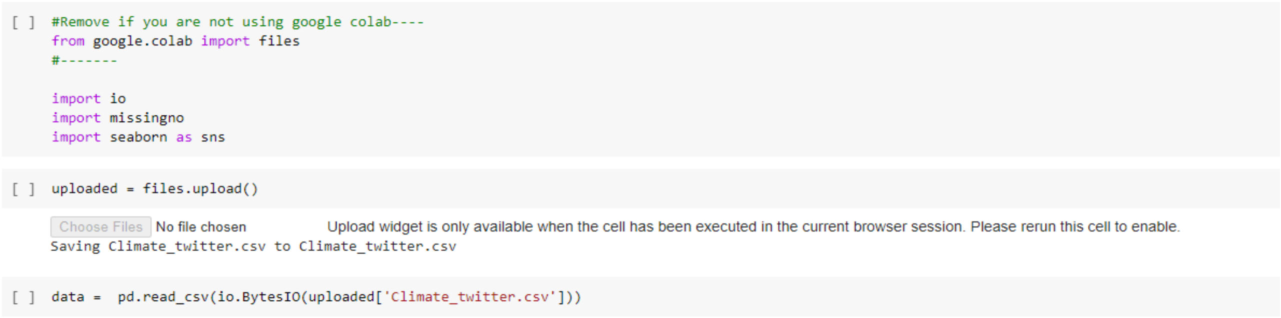
```
import pandas as pd
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split,\
    RandomizedSearchCV, GridSearchCV, cross_val_score
from sklearn import metrics
from sklearn.metrics import classification_report, confusion_matrix,\
    f1_score, precision_score, recall_score, accuracy_score
from sklearn.svm import SVC
from sklearn import preprocessing
from sklearn.multiclass import OneVsRestClassifier
```

Loading the Dataset

1. By Pycharm

```
Data = pd.read_csv("C:/Users/Um Ar/PycharmProjects/Internship-2/First_processed.csv")
X = Data["message"]
Y = Data["sentiment"]
```

2. Google Colab



```
[ ] #Remove if you are not using google colab----
    from google.colab import files
    #-------

    import io
    import missingno
    import seaborn as sns
```

```
[ ] uploaded = files.upload()

    Choose Files  No file chosen        Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
    Saving Climate_twitter.csv to Climate_twitter.csv
```

```
[ ] data =  pd.read_csv(io.BytesIO(uploaded['Climate_twitter.csv']))
```

Splitting the dataset into training, validation and testing

```
# Splitting the data
X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size=0.20, 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 tfidf vectorizer with Uni-grams, bi-grams and tri-grams

Maximum number of features = 20000

```
tfidf = TfidfVectorizer(ngram_range=(1, 3),
max_features=20000, use_idf=True)
tfidf.fit_transform(X_train)
tfidf.fit_transform(x_val)

X_train = tfidf.transform(X_train)
x_val = tfidf.transform(x_val)
```

Using Normalizer

```
MinMaxScaler = preprocessing.Normalizer()
X_train = MinMaxScaler.fit_transform(X_train)
x_val = MinMaxScaler.fit_transform(x_val)
```

Defining the Hyper-Parameters

```
param_grid = {'C': [10, 15, 0.1, 1],
'gamma': [1.5, 2, 0.0001, 0.001, 0.1, 1],
'kernel': ['rbf', 'poly', ‘linear’]}
```

Defining the grid search and classifier

Here we have used 5 fold cross-validation

```
svm = SVC(verbose=True)
grid = GridSearchCV(svm, param_grid=param_grid, cv=5,
refit=True, n_jobs=7, verbose=True)
```

Fitting the model to the data

```
grid.fit(X_train, y_train)
```

# Evaluating the model

```
predictions = svm.predict(x_val)
print("ACCURACY SCORE:", metrics.accuracy_score(y_val,
predictions))
print("::::Confusion Matrix::::")
print(confusion_matrix(y_val, predictions))
print("\n")

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

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

Plotting the confusion matrix

```
class_names = ["-1", "0", "1", "2"]
disp = metrics.plot_confusion_matrix(rfc,
tfidf.transform(X_test), y_test,
display_labels=class_names,
cmap=plt.cm.Blues)
plt.show()
```

Results

The best hyper-parameters for svm are

C = 10.

Gamma = 1.

Kernel = rbf.

After the results we trained and tested the model even further.

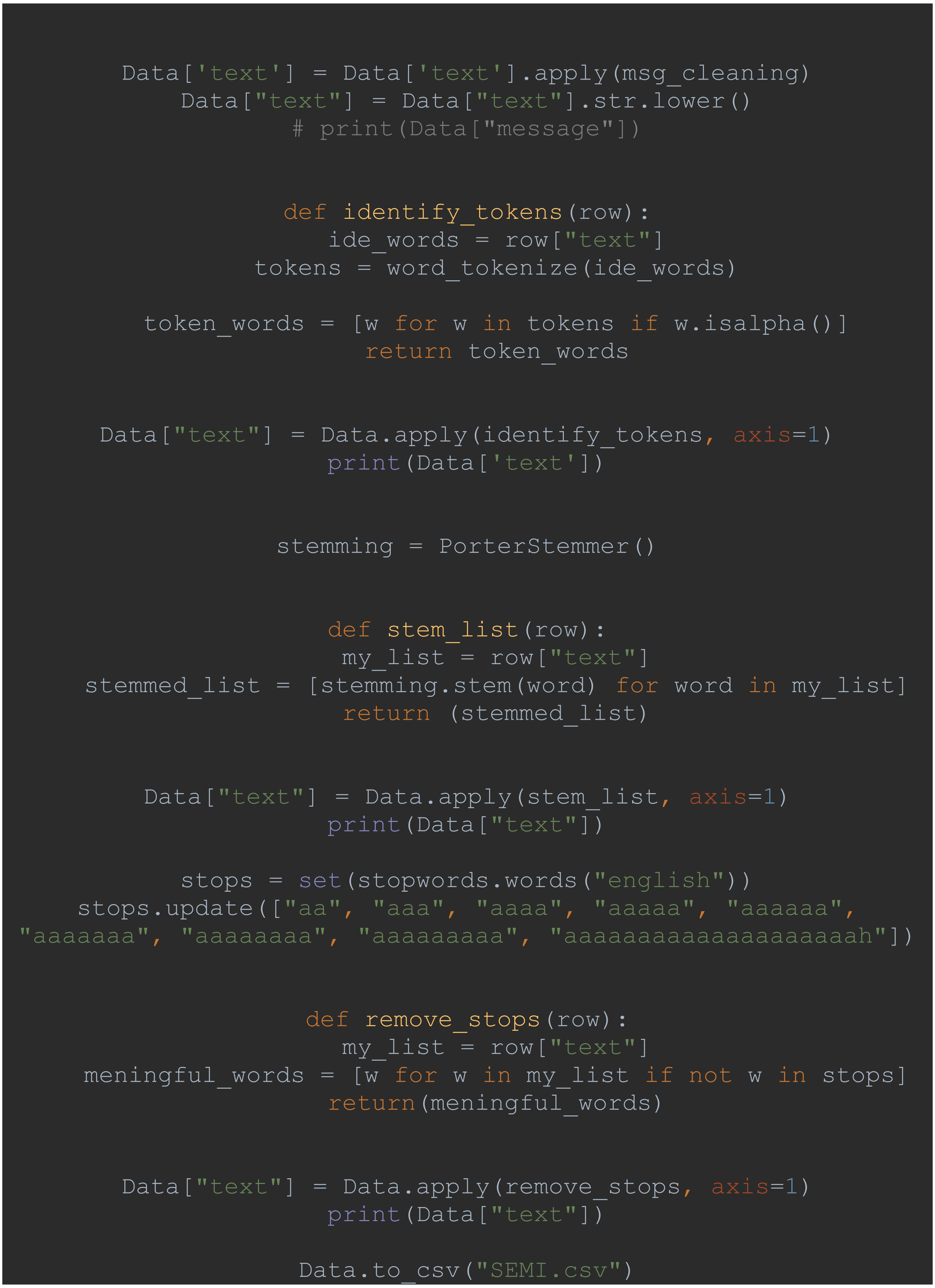
PHASE 1 COMPLETE

PHASE 2

We have trained and tested the model, and download the unlabelled data from the Kaggle website. The dataset downloaded contained 400 samples.

The First step was to pre-process the unlabelled data, we used the same techniques.

```
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


Data = pd.read_csv("Semi-Supervised_SVM/Climate_twitter.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()
print(Data.columns)
Data.head()

# print(Data["message"])
# Data Visualization
# sns.histplot(data=Data, x="sentiment", binwidth=0.4, color='lime')
# sns.histplot(x=Data["sentiment"], y=Data["Text Length"], color='blue', binwidth=0.4)

# Checking for missing values
Data.isna().sum()


# Cleaning the data
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)
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
```



```
Data['text'] = Data['text'].apply(msg_cleaning)
Data["text"] = Data["text"].str.lower()
# print(Data["message"])


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

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


Data["text"] = Data.apply(identify_tokens, axis=1)
print(Data['text'])


stemming = PorterStemmer()


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


Data["text"] = Data.apply(stem_list, axis=1)
print(Data["text"])

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


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


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

Data.to_csv("SEMI.csv")
```

The pre-processed unlabelled dataset was saved as a csv file.

PHASE 3

Labelling the Unlabelled data with our support vector machine model.

Reading the datasets

```
import pandas as pd
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.svm import SVC
from sklearn import preprocessing

Data = pd.read_csv("C:/Users/Um Ar/PycharmProjects/Internship-2/First_processed.csv")
X = Data["message"]
Y = Data["sentiment"]

# Splitting the data
val = pd.read_csv("C:/Users/Um Ar/PycharmProjects/Internship-2/SEMI.csv")
x_val = val["text"]
```

Using tfidf-vectorizer

```
tfidf = TfidfVectorizer(ngram_range=(1, 3),
max_features=20000, use_idf=True)
tfidf.fit_transform(X)
tfidf.fit_transform(x_val)

X = tfidf.transform(X)
MinMaxScaler = preprocessing.Normalizer()

X = MinMaxScaler.fit_transform(X)
x_val = tfidf.transform(x_val)
x_val = MinMaxScaler.fit_transform(x_val)
```

Fitting the model to the data

```
svm = SVC(C=10, gamma=1, kernel='rbf', verbose=True)
svm.fit(X, Y)
```

Saving the predictions/labels for our unlabelled data

```
predictions = svm.predict(x_val)
val["sentiment"] = predictions
val.to_csv("SEMI_PREDICTED.csv")
```

PHASE 4

Importing the modules and reading the datasets

```
import pandas as pd
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split,\
RandomizedSearchCV, GridSearchCV, cross_val_score
from sklearn import metrics
from sklearn.metrics import classification_report,
confusion_matrix,\
f1_score, precision_score, recall_score, accuracy_score
from sklearn.svm import SVC
from sklearn import preprocessing
from sklearn.multiclass import OneVsRestClassifier

Data = pd.read_csv("C:/Users/Um Ar/PycharmProjects/Internship-
2/First_processed.csv")
val = pd.read_csv("C:/Users/Um Ar/PycharmProjects/Internship-
2/SEMI_PREDICTED.csv")

Data_Set = pd.concat([Data, val])
X = Data_Set["message"]
Y = Data_Set["sentiment"]
```

Splitting the Dataset into training and testing sets

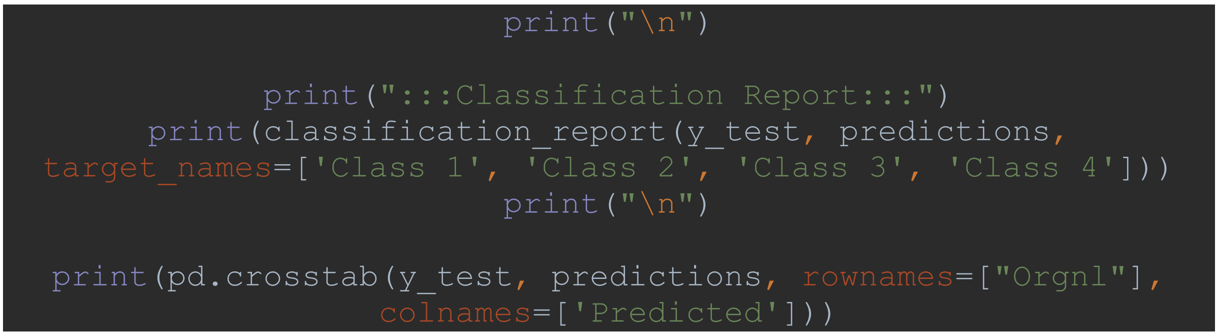
```
X_train, X_test, y_train, y_test = train_test_split(X, Y,
test_size=0.20, shuffle=True, random_state=1103)
```

Defining and fitting the classifier to the data

```
svm = SVC(C=10, gamma=1, kernel='rbf',
decision_function_shape='ovr', verbose=True)
svm.fit(X_train, y_train)
```

Evaluating the model

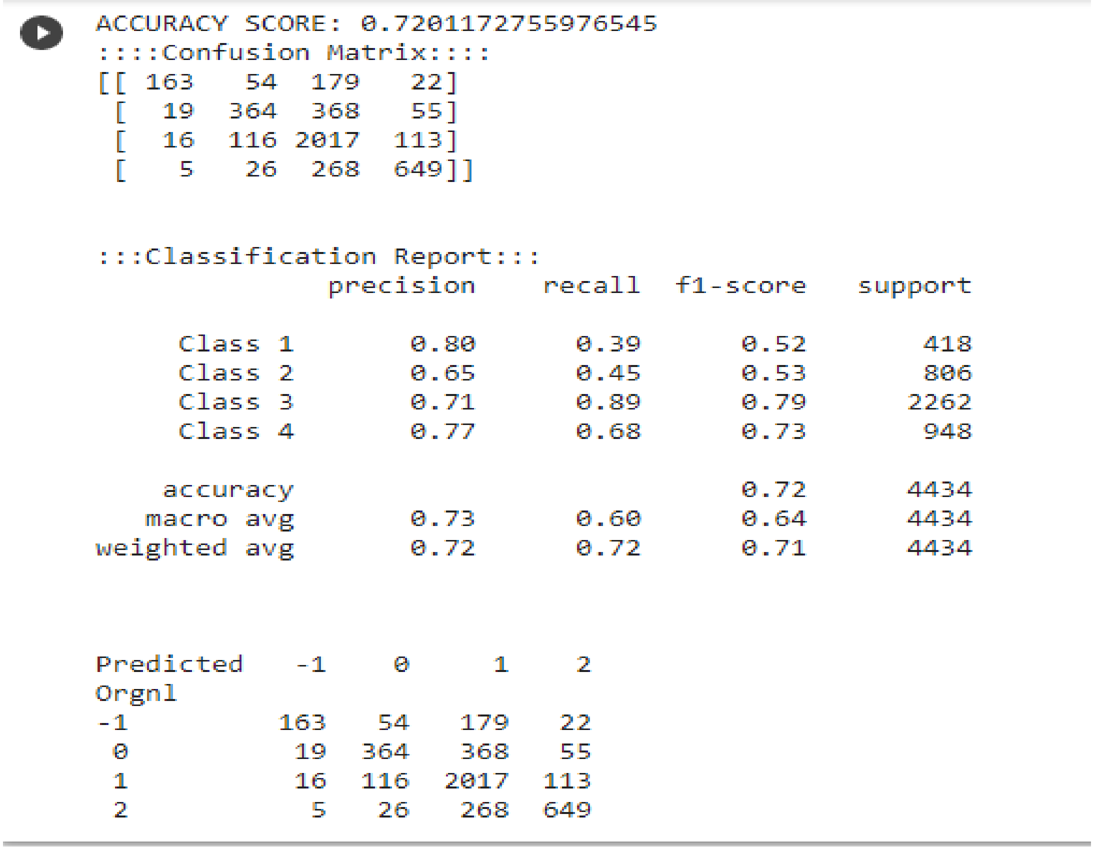
```
predictions = svm.predict(X_test)
print("ACCURACY SCORE:", metrics.accuracy_score(y_test,
predictions))
print("::::Confusion Matrix::::")
print(confusion_matrix(y_test, predictions))
```



```
print("\n")

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

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

Result/Finding

Output:



```
ACCURACY SCORE: 0.7201172755976545
::::Confusion Matrix::::
[[ 163   54  179   22]
 [   19  364  368   55]
 [   16  116 2017  113]
 [    5   26  268  649]]


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

     Class 1       0.80      0.39      0.52       418
     Class 2       0.65      0.45      0.53       806
     Class 3       0.71      0.89      0.79      2262
     Class 4       0.77      0.68      0.73       948

    accuracy                           0.72      4434
   macro avg       0.73      0.60      0.64      4434
weighted avg       0.72      0.72      0.71      4434



Predicted   -1    0     1    2
Orgnl
-1         163   54   179   22
 0          19  364   368   55
 1          16  116  2017  113
 2           5   26   268  649
```

The result show that using semi-supervised support vector machine can improve the accuracy. In this test we only used 400 new samples/unlabelled data, using more sample may significantly increase the accuracy