National College of Ireland

Configuration Manual

MSc Research Project
Cyber Security

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MSc Project Submission Sheet

School of Computing

Student Name**:**	Emin Varghese		
Student ID:	X23154250		
Programme:	MSc. Cybersecurity	Year**:**	2024 - 25
Module:	MSc. Research Project		
Supervisor:	Arghir Nicolae Moldovan		
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Project Title**:**	Detection of Phishing URLs using Machine Learning		
Word Count:	680 words excluding references	Page Count: 6	

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Configuration Manual

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1 Introduction

The configuration manual covers all the required tools and frameworks used to implement the research model. This manual is subdivided into different categories. Section 2 refers to environment setup needed, Section 3 discusses about tools and software's being used and Section 4 discuss about implementation of the project.

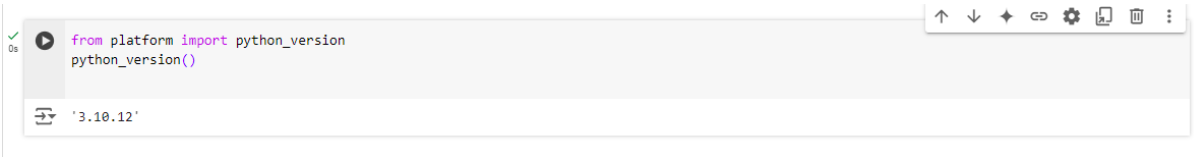
2 Environmental Setup

Processor : Intel i5
Memory : 16GB RAM
Programming Language : Python3
Python Environment : Jupyter Notebook, Anaconda Navigator, Google Colab

3 Tools and Software Used

Software Used : Google Colab (cloud-based), Python 3.10.12

Google Colab also known as Colaboratory is a powerful free Google cloud-based service for writing and running Python codes. It is integrated with Google Drive and pre-configured environment for the wide usage of data analysis, machine learning and prototyping.



4 Implementation

Step 1 : Go to Google Colab and login using your google account

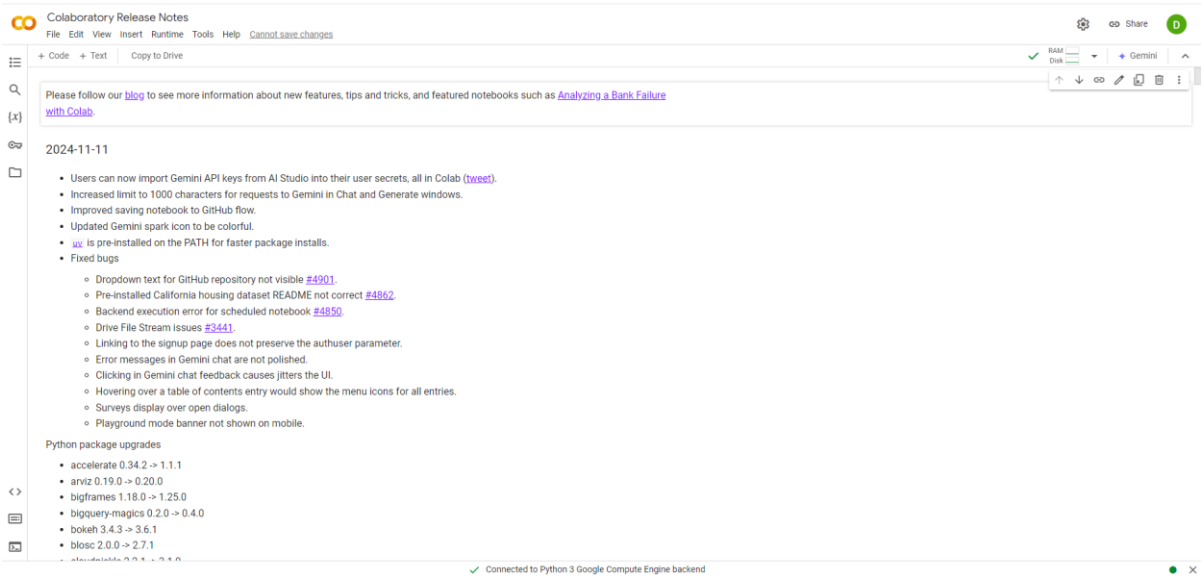


Figure 1 : Homepage of Google Colab

Step 2 : The dataset is downloaded

Step 3 : Importing essential libraries for the execution of file and machine learning algorithms.

```
#****************************************Import*************************************************
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
import warnings
from sklearn.model_selection import cross_val_score
from sklearn import metrics
from sklearn import preprocessing
import matplotlib.pyplot as plt
warnings.filterwarnings('ignore')
import time
```

Figure 2 : Importing python libraries

Step 4 : Performing feature extraction by applying preprocessing or transformation steps such as normalization, scaling and encoding

```python
import pandas as pd
import re
from urllib.parse import urlparse
import random
import string

# Load the dataset
file_path = '/content/Phishing URLs.csv'
phishing_urls = pd.read_csv(file_path)

# Specify the column name that contains URLs
url_column_name = 'url'  # Replace with the actual column name in your dataset

# Generate random file names
def generate_random_filename():
    return ''.join(random.choices(string.ascii_letters + string.digits, k=8)) + '.txt'

# Insert "File Name" column
phishing_urls.insert(0, 'File Name', [generate_random_filename() for _ in range(len(phishing_urls))])

# Feature extraction functions
def url_length(url):
    return len(url)
```

Figure 3 : Feature Extraction

```python
# Apply feature extraction
features_df = extract_features(phishing_urls, url_column_name)

# Save the resulting features to a new CSV file
output_path = 'Extracted_Phishing_URL_Features.csv'
features_df.to_csv(output_path, index=False)

# Display a preview of the extracted features
print(features_df.head())
```

```
      File Name                                              url      Type  \
0  bMqbUwbE.txt  https://docs.google.com/presentation/d/e/2PACX...  Phishing
1  DzsIlkln.txt    https://btttelecommunniccatiion.weeblysite.com/  Phishing
2  86ejFQdw.txt                          https://kq0hgp.webwave.dev/  Phishing
3  hmYaT0QF.txt  https://brittishtele1bt-69836.getresponsesite....  Phishing
4  WUOfKmTr.txt         https://bt-internet-105056.weeblysite.com/  Phishing

   URLLength                                  Domain  DomainLength  \
0        178                          docs.google.com            15
1         47     btttelecommunniccatiion.weeblysite.com            38
2         27                         kq0hgp.webwave.dev            18
3         50  brittishtele1bt-69836.getresponsesite.com            41
4         42          bt-internet-105056.weeblysite.com            33

   IsDomainIP  TLD  URLSimilarityIndex  CharContinuationRate  ...  Pay  \
0           0  com           0.184430              7.416667  ...    0
1           0  com           0.239637              6.714286  ...    0
2           0  dev           0.838010              3.857143  ...    0
3           0  com           0.171121              6.250000  ...    0
4           0  com           0.442283              4.666667  ...    0
```

Figure 4 : Preview of the extracted features

Step 5 : Loading the dataset with proper file path

```
df=pd.read_csv("/content/Extracted_Phishing_URL_Features.csv")
```

Figure 5 : File Path

Step 6 : Train the model by feeding the preprocessed data into machine learning or deep learning models

```
df = df.reset_index(drop=True)
LABEL = df.iloc[:,-1:].columns[0]
cols = ['LineOfCode', 'NoOfExternalRef', 'LargestLineLength', 'URLLength', 'NoOfImage', 'NoOfJS', 'NoOfSelfRef', 'NoOfCSS',
        'URLCharProb', 'CharContinuationRate', 'LetterRatioInURL', 'IsHTTPS', 'SpacialCharRatioInURL','NoOfEmptyRef',
        'NoOfOtherSpecialCharsInURL', 'HasDescription', 'HasSocialNet', 'DomainLength', 'DegitRatioInURL','NoOfDegitsInURL',
        'HasCopyrightInfo', 'NoOfLettersInURL','TLDLegitimateProb', 'DomainTitleMatchScore', 'IsResponsive',
        'HasHiddenFields', 'HasSubmitButton','NoOfSubDomain', 'HasFavicon', 'HasTitle',LABEL]
df = pd.DataFrame(df[cols]).copy()
df30, df70=train_test_split(df,test_size=.1)

df30 = df30.reset_index(drop=True)
df70 = df70.reset_index(drop=True)

yTrain = pd.DataFrame(df30[LABEL]).copy()
df30.drop(LABEL, axis=1, inplace=True)
xTrain = pd.DataFrame(df30).copy()

dfX = pd.DataFrame(df70[cols]).copy()
dfX.drop(LABEL, axis=1, inplace=True)
dfY = pd.DataFrame(df70[LABEL]).copy()
print("Finished Train-Test Split.")
len(xTrain.axes[0])
```

```
Finished Train-Test Split.
49325
```

```
from sklearn.naive_bayes import BernoulliNB
from sklearn.linear_model import PassiveAggressiveClassifier
from sklearn.linear_model import SGDClassifier
Models = []
Models.append(("BernoulliNB",BernoulliNB(alpha= 0.01, binarize= 0.0, class_prior= None, fit_prior= False, force_alpha= True)))
Models.append(("PassiveAggressive",PassiveAggressiveClassifier(C= 4, fit_intercept= False, n_iter_no_change= 50, n_jobs= 10, shuffle= True, verbose= 0)))
Models.append(("SGDClassifier",SGDClassifier(alpha= 0.01, eta0= 100, n_iter_no_change= 50, n_jobs= 1)))

start = time.time()
for name, model in Models:
    model.fit(xTrain, yTrain)
end = time.time()
OneTime = int(end - start)
print("Finished first training: ", OneTime)
```

Figure 6 : Model Training

Step 7 : Evaluation of the Model using test dataset

```
newRow = {}
newRow['Mode'] = "HighSecurity"
newRow['TP'] = TP
newRow['TN'] = TN
newRow['FP'] = FP
newRow['FN'] = FN
CM = pd.concat([CM, pd.DataFrame([newRow])], ignore_index=True)
```

```
4955   1   0   525
Accuracy    :  0.9042145593869731
Precision   :  1.0
Sensitivity :  0.9041970802919708
F1 Score    :  0.9496885481552467
MCC    :  0.04146089550490179
```

```
[ ] Metrics
```

	Mode	Accuracy	Precision	Sensitivity	F1Score	MCC	OneTime	IncTime
0	LowSecurity	0.999818	0.999818	1.000000	0.999909	0.000000	1	28
1	BestSecurity	0.999818	0.999818	1.000000	0.999909	0.000000	1	28
2	HighSecurity	0.904215	1.000000	0.904197	0.949689	0.041461	1	28

```
[ ] CM
```

	Mode	TP	TN	FP	FN
0	LowSecurity	5480	0	1	0
1	BestSecurity	5480	0	1	0
2	HighSecurity	4955	1	0	525

Figure 7 : Evaluation of the Model

- **CharConRate.ipynb** : Focused on analysing character-based metrics
- **Entropy_Domain_URL.ipynb** : Computes entropy metrics for domain names or URLs
- **IdentifyClassifiers.ipynb** : Evaluates different classifiers for a machine learning task.
- **MainModel_SplitBased_OneTime90.ipynb** : Primary model implementation with data splitting configurations.

References

GitHub - arvindbitm/PhiUSIIL: PhiUSIIL: A diverse security profile empowered phishing URL detection framework based on similarity index and incremental learning. (n.d.). Retrieved December 12, 2024, from https://github.com/arvindbitm/PhiUSIIL

Python Tutorial: Basic feature extraction - YouTube. (n.d.). Retrieved December 12, 2024, from https://www.youtube.com/watch?v=kp7VwkaoJjE