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Modelling and Predicting Cyber Hacking Breaches

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ABSTRACT
Contrasted with the past, improvements in PC and correspondence innovations have given broad and propelled changes. The use of new innovations give incredible advantages to people, organizations, and governments, be that as it may, messes some up against them. For instance, the protection of significant data, security of put away information stages, accessibility of information and so forth. Contingent upon these issues, digital fear based oppression is one of the most significant issues in this day and age. Digital fear, which made a great deal of issues people and establishments, has arrived at a level that could undermine open and nation security by different gatherings, for example, criminal association, proficient people and digital activists. Along these lines, Intrusion Detection Systems (IDS) has been created to maintain a strategic distance from digital assaults.

Right now, learning the bolster support vector machine (SVM) calculations were utilized to recognize port sweep endeavors dependent on the new CICIDS2017 dataset with 97.80%, 69.79% precision rates were accomplished individually. Rather than SVM we can introduce some other algorithms like random forest, CNN, ANN where these algorithms can acquire accuracies like SVM – 93.29, CNN – 63.52, Random Forest – 99.93, ANN – 99.11.

Keywords : Hacking breach, data breach, cyber threats, cyber risk analysis, breach prediction, trend analysis, time series, cyber security data analytics

INTRODUCTION

OBJECTIVE OF THE PROJECT

The use of new innovations give incredible advantages to people, organizations, and governments, be that as it may, messes some up against them. For instance, the protection of significant data, security of put away information stages, accessibility of information and so forth. Contingent upon these issues, digital fear based oppression is one of the most significant issues in this day and age. Digital fear, which made a great deal of issues people and establishments, has arrived at a level that could undermine open and nation security by different gatherings, for example, criminal association, proficient people and digital activists. Along these lines, Intrusion Detection Systems (IDS) has been created to maintain a strategic distance from digital assaults.

THE EXISTING SYSTEM

Blameless Bayes and Principal Component Analysis (PCA) were been used with the KDD99 dataset by Almansob and Lomte [9].Similarly, PCA, SVM, and KDD99 were used Chithik and Rabbani for IDS [10]. In Aljawarneh et al's. Paper, their assessment and examinations

were conveyed reliant on the NSL-KDD dataset for their IDS model [11] Composing inspects show that KDD99 dataset is continually used for IDS [6]–[10].There are 41 highlights in KDD99 and it was created in 1999. Consequently, KDD99 is old and doesn't give any data about cutting edge new assault types, example, multi day misuses and so forth. In this manner we utilized a cutting-edge and new CICIDS2017 dataset [12] in our investigation.

PROPOSED SYSTEM

The important steps of the algorithm are given in below.

1) Normalization of every dataset.
2) Convert that dataset into the testing and training.
3) Form IDS models with the help of using RF, ANN, CNN and SVM algorithms.
4) Evaluate every model's performances

SCREENS

```
: import numpy as np
  import pandas as pd
  import matplotlib.pyplot as plt
  %matplotlib inline
```

```
: import itertools
  import seaborn as sns
  import pandas_profiling
  import statsmodels.formula.api as sm
  from statsmodels.stats.outliers_influence import variance_inflation_factor
  from patsy import dmatrices
```

```
/usr/local/lib/python3.6/dist-packages/statsmodels/tools/_testing.py:19: FutureWarning: pandas.util.testing is dep
recated. Use the functions in the public API at pandas.testing instead.
  import pandas.util.testing as tm
```

```
: from sklearn import datasets
  from sklearn.feature_selection import RFE
  import sklearn.metrics as metrics
  from sklearn.svm import SVC
  from sklearn.linear_model import LogisticRegression
  from sklearn.feature_selection import SelectKBest
  from sklearn.feature_selection import chi2, f_classif, mutual_info_classif
```

```
: train=pd.read_csv('/content/drive/My Drive/kdd/NSL_Dataset/Train.txt',sep=',')
  test=pd.read_csv('/content/drive/My Drive/kdd/NSL_Dataset/Test.txt',sep=',')
```

Data preprocessing

```
n [6]: columns=["duration","protocol_type","service","flag","src_bytes","dst_bytes","land",
       "wrong_fragment","urgent","hot","num_failed_logins","logged_in",
       "num_compromised","root_shell","su_attempted","num_root","num_file_creations",
       "num_shells","num_access_files","num_outbound_cmds","is_host_login",
       "is_guest_login","count","srv_count","serror_rate", "srv_serror_rate",
       "rerror_rate","srv_rerror_rate","same_srv_rate", "diff_srv_rate","srv_diff_host_rate","dst_host_count","dst_host_sr
       "dst_host_diff_srv_rate","dst_host_same_src_port_rate",
       "dst_host_srv_diff_host_rate","dst_host_serror_rate","dst_host_srv_serror_rate",
       "dst_host_rerror_rate","dst_host_srv_rerror_rate","attack", "last_flag"]
```

```
n [7]: train.columns=columns
       test.columns=columns
```

```
n [8]: train.head()
```

ut[8]:

	duration	protocol_type	service	flag	src_bytes	dst_bytes	land	wrong_fragment	urgent	hot	num_failed_logins	logged_in	num_compromised	root_s
0	0	udp	other	SF	146	0	0	0	0	0	0	0	0	
1	0	tcp	private	S0	0	0	0	0	0	0	0	0	0	
2	0	tcp	http	SF	232	8153	0	0	0	0	0	1	0	
3	0	tcp	http	SF	199	420	0	0	0	0	0	1	0	
4	0	tcp	private	REJ	0	0	0	0	0	0	0	0	0	

```
n [9]: test.head()
```

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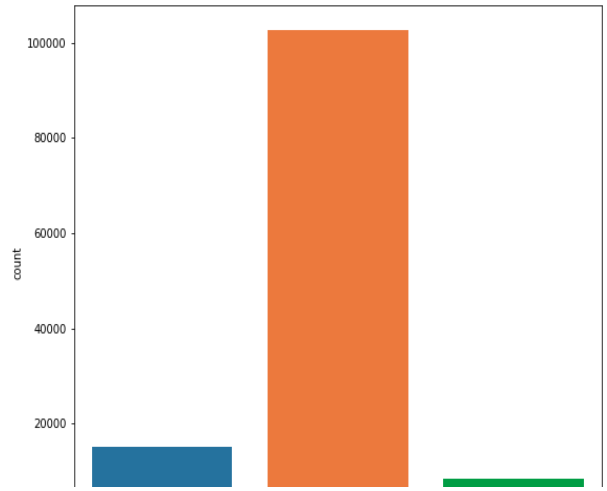
Data EDA

```
# Protocol type distribution
plt.figure(figsize=(9,8))
sns.countplot(x="protocol_type", data=train)
plt.show()
```



Model Building

```
train_X=train_new[cols]
train_y=train_new['attack_class']
test_X=test_new[cols]
test_y=test_new['attack_class']
```

ML Deploy

Logistic Regression

```
# Building Models
from sklearn.linear_model import LogisticRegression
logreg = LogisticRegression(random_state=0,solver='lbfgs',multi_class='multinomial')
logreg.fit( train_X, train_y)
logreg.predict(train_X)   #by default, it use cut-off as 0.5
```

```
list( zip( cols, logreg.coef_[0] ) )
```

```
logreg.intercept_
```

```
logreg.score(train_X,train_y)
```

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Decision Trees

```
train_X.shape
```

```
param_grid = {'max_depth': np.arange(2, 12),
              'max_features': np.arange(10,15)}
```

```
train_y.shape
```

```
from sklearn.model_selection import GridSearchCV
from sklearn.tree import DecisionTreeClassifier, export_graphviz, export
tree = GridSearchCV(DecisionTreeClassifier(), param_grid, cv = 10,verbose=1,n_jobs=-1)
tree.fit( train_X, train_y )
```

```
tree.best_score_
```

```
tree.best_estimator_
tree.best_params_
```

```
train_pred = tree.predict(train_X)
```

```
print(metrics.classification_report(train_y, train_pred))
```

```
test_pred = tree.predict(test_X)
```

Random Forest

```
from sklearn.ensemble import RandomForestClassifier
pargrid_rf = {'n_estimators': [50,60,70,80,90,100],
              'max_features': [2,3,4,5,6,7]}
```

```
from sklearn.model_selection import GridSearchCV
gscv_rf = GridSearchCV(estimator=RandomForestClassifier(),
                       param_grid=pargrid_rf,
                       cv=10,
                       verbose=True, n_jobs=-1)

gscv_results = gscv_rf.fit(train_X, train_y)
```

```
gscv_results.best_params_
```

```
gscv_rf.best_score_
```

```
radm_clf = RandomForestClassifier(oob_score=True,n_estimators=80, max_features=5, n_jobs=-1)
radm_clf.fit( train_X, train_y )
```

```
radm_test_pred = pd.DataFrame( { 'actual':  test_y,
                            'predicted': radm_clf.predict( test_X ) } )
```

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Support Vector Machine (SVM)

```
from sklearn.svm import LinearSVC
svm_clf = LinearSVC(random_state=0, tol=1e-5)
svm_clf.fit(train_X,train_y)
```

```
print(svm_clf.coef_)
print(svm_clf.intercept_)
print(svm_clf.predict(train_X))
```

```
from sklearn.svm import SVC
from sklearn.pipeline import make_pipeline

model = SVC(kernel='rbf', class_weight='balanced',gamma='scale')
```

```
model.fit(train_X,train_y)
```

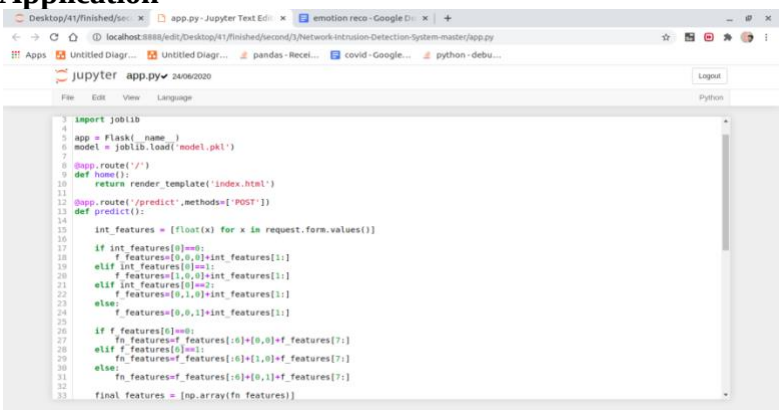
```
from sklearn.model_selection import GridSearchCV
param_grid = {'C': [1, 10],
              'gamma': [0.0001, 0.001]}
grid = GridSearchCV(model, param_grid)

grid.fit(train_X,train_y)
```

```
print(grid.best_params_)
```

From the score accuracy we concluding the DT & RF give better accuracy and building pickle file for predicting the user input

Application



Localhost - in cmd python app.py

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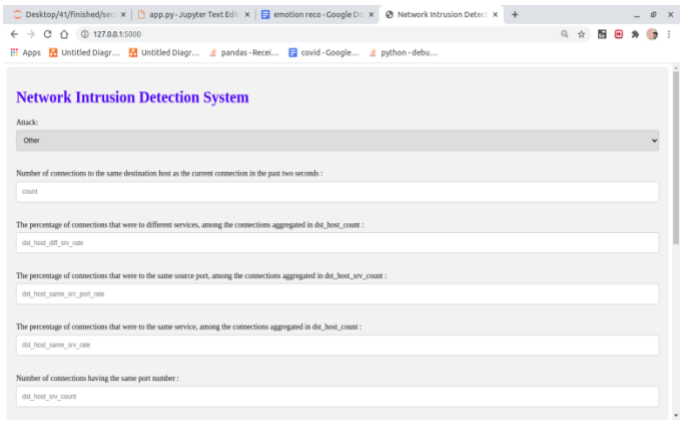
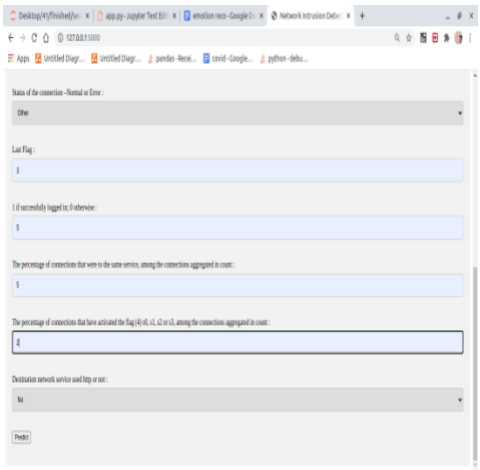


Enter the input



Predict attack -

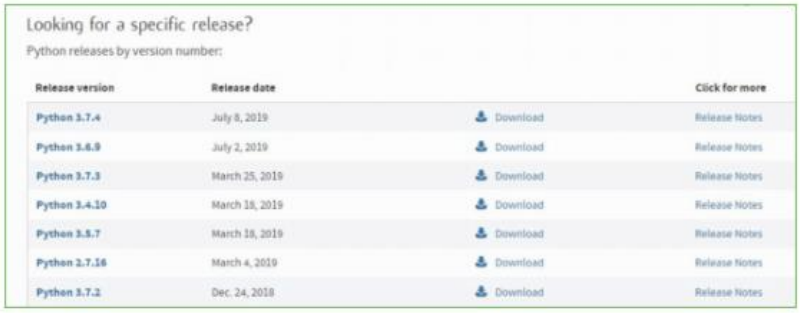
Download the Correct version into the system

Step 1: Go to the official site to download and install python using Google Chrome or any other web browser. OR Click on the following link: https://www.python.org

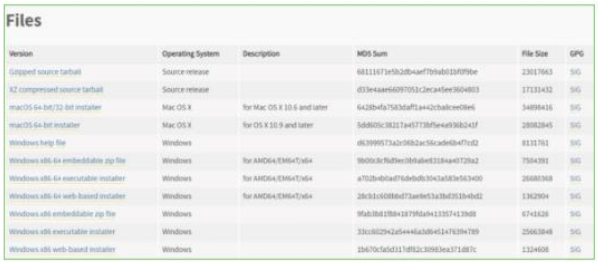
Now, check for the latest and the correct version for your operating system.

Step 2: **Click on the Download Tab.**

Step 3: **You can either select the Download Python for windows 3.7.4 button in Yellow Color or you can scroll further down and click on download with respective to their version. Here, we are downloading the most recent python version for windows 3.7.4**



Step 4: Scroll down the page until you find the Files option.
Step 5: Here you see a different version of python along with the operating system.



• To download Windows 32-bit python, you can select any one from the three options: Windows x86 embeddable zip file, Windows x86 executable installer or Windows x86 web-based installer.
•To download Windows 64-bit python, you can select any one from the three options: Windows x86-64 embeddable zip file, Windows x86-64 executable installer or Windows x86-64 web-based installer.
Here we will install Windows x86-64 web-based installer. Here your first part regarding which version of python is to be downloaded is completed. Now we move ahead with the second part in installing python i.e. Installation
Note: To know the changes or updates that are made in the version you can click on the Release Note Option.
Installation of Python
Step 1: Go to Download and Open the downloaded python version to carry out the installation process.

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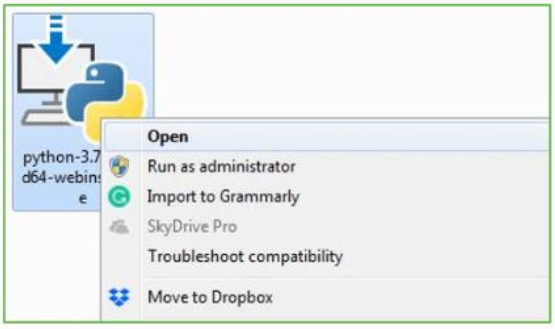

Step 2: Before you click on Install Now, Make sure to put a tick on Add Python 3.7 to PATH.

Step 3: Click on Install NOW After the installation is successful. Click on Close.

With these above three steps on python installation, you have successfully and correctly installed Python. Now is the time to verify the installation.
Note: The installation process might take a couple of minutes.

Verify the Python Installation
Step 1: Click on Start
Step 2: In the Windows Run Command, type “cmd”.

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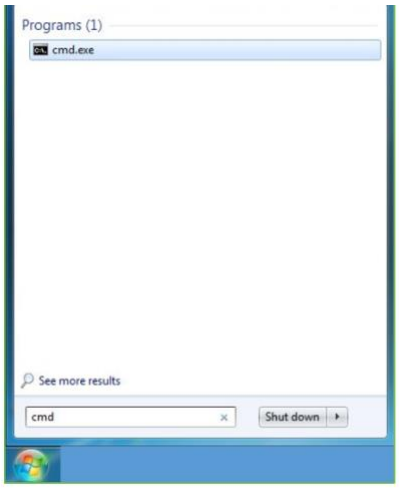
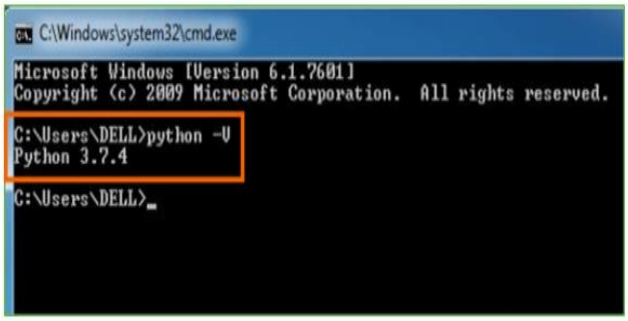
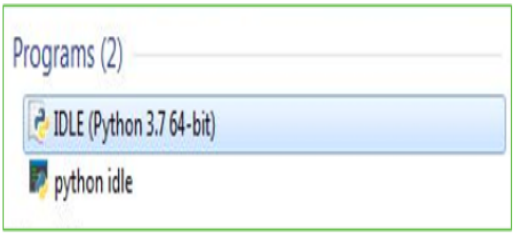


Step 3: Open the Command prompt option.
Step 4: Let us test whether the python is correctly installed. Type **python –V** and press Enter.

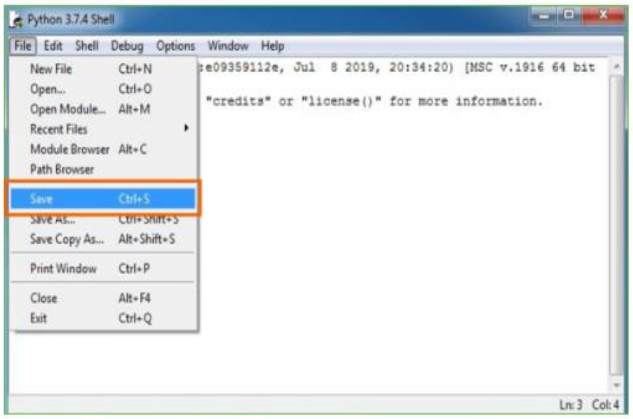


Step 5: You will get the answer as 3.7.4
Note: If you have any of the earlier versions of Python already installed. You must first uninstall the earlier version and then install the new one.

Check how the Python IDLE works
Step 1: Click on Start
Step 2: In the Windows Run command, type "python idle".



Step 3: Click on IDLE (Python 3.7 64-bit) and launch the program
Step 4: To go ahead with working in IDLE you must first save the file. **Click on File > Click on Save**



Step 5: Name the file and save as type should be Python files. Click on SAVE. Here I have named the files as Hey World.

Step 6: Now for e.g. **enter print**

Conclusion

Right now, estimations of help vector machine, ANN, CNN, Random Forest and profound learning calculations dependent on modern CICIDS2017 dataset were introduced relatively. Results show that the profound learning calculation performed fundamentally preferable outcomes over SVM, ANN, RF and CNN. We are going to utilize port sweep endeavors as well as other assault types with AI and profound learning calculations, apache Hadoop and sparkle innovations together dependent on this dataset later on. All these calculation helps us to detect the cyber attack in network. It happens in the way that when we consider long back years there may be so many attacks happened so when these attacks are recognized then the features at which values these attacks are happening will be stored in some datasets. So by using these datasets we are going to predict whether cyber attack is done or not. These predictions can be done by four algorithms like SVM, ANN, RF, CNN this paper helps to identify which algorithm predicts the best accuracy rates which helps to predict best results to identify the cyber attacks happened or not.

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