Assignment5

April 7, 2021

Team number - 29

[246]:

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import sklearn
from sklearn import preprocessing
from sklearn.model_selection  import train_test_split
import sklearn
from sklearn.metrics import mean_absolute_error,mean_squared_error,r2_score
from sklearn.neighbors import KNeighborsRegressor
import seaborn as sns
```

[247]:

```python
from google.colab import drive
drive.mount("/content/drive/")
```

```
Drive already mounted at /content/drive/; to attempt to forcibly remount, call
drive.mount("/content/drive/", force_remount=True).
```

[ ]:

```
!tar -xvf  '/content/drive/MyDrive/assignment5.tar.gz' -C '/content/drive/
 ↪MyDrive/SNS'
```

```
assignment5/full.csv
assignment5/test.csv
assignment5/Assignment.pdf
assignment5/
```

[248]:

```python
FOLDER_PATH = "/content/drive/MyDrive/assignment5/full.csv"
```

[249]:

```python
data_x = pd.read_csv(FOLDER_PATH,header=None)
```

[251]:

```python
data_y = pd.read_csv("/content/drive/MyDrive/assignment5/test.csv",header=None)
```

```
/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.py:2718:
DtypeWarning: Columns (26,27,28,30,31,34,36,37,38,39,40,41) have mixed
types.Specify dtype option on import or set low_memory=False.
  interactivity=interactivity, compiler=compiler, result=result)
```

[252]:

```
dict_tcp = {'tcp':0,'udp':1,'icmp':2}
dict_ip = {'http':0 ,'smtp':1 ,'domain_u':2, 'auth':3 ,'finger':4 ,'telnet':5,␣
 ↪'eco_i':6, 'ftp':7, 'ntp_u':8,'ecr_i':9, 'other':10 ,
            'urp_i':11, 'private':12, 'pop_3':13, 'ftp_data':14 ,'netstat':15,␣
 ↪'daytime':16,'ssh':17, 'echo':18, 'time':19, 'name':20,
            'whois':21, 'domain':22, 'mtp':23, 'gopher':24, 'remote_job':
 ↪25,'rje':26, 'ctf':27, 'supdup':28, 'link':29, 'systat':30,
            'discard':31, 'X11':32, 'shell':33, 'login':34,'imap4':35, 'nntp':
 ↪36, 'uucp':37, 'pm_dump':38, 'IRC':39, 'Z39_50':40,
            'netbios_dgm':41, 'ldap':42,'sunrpc':43, 'courier':44, 'exec':45,␣
 ↪'bgp':46, 'csnet_ns':47, 'http_443':48, 'klogin':49,
            'printer':50,'netbios_ssn':51, 'pop_2':52, 'nnsp':53, 'efs':54,␣
 ↪'hostnames':55, 'uucp_path':56, 'sql_net':57,'vmnet':58,
            'iso_tsap':59, 'netbios_ns':60, 'kshell':61, 'urh_i':62 ,'http_2784':
 ↪63, 'harvest':64,'aol':65, 'tftp_u':66, 'http_8001':67,
            'tim_i':68, 'red_i':69}
dict_SF = {'SF':0, 'S2':1, 'S1':2, 'S3':3, 'OTH':4, 'REJ':5, 'RSTO':6, 'S0':7,␣
 ↪'RSTR':8, 'RSTOS0':9, 'SH':10}

dict_normal = {'normal.':0, 'buffer_overflow.':1, 'loadmodule.':2, 'perl.':3,␣
 ↪'neptune.':4, 'smurf.':5,'guess_passwd.':6, 'pod.':7,
                'teardrop.':8, 'portsweep.':9 ,'ipsweep.':10, 'land.':
 ↪11,'ftp_write.':12, 'back.':13, 'imap.':14, 'satan.':15, 'phf.':16,
                'nmap.':17, 'multihop.':18,'warezmaster.':19, 'warezclient.':20,␣
 ↪'spy.':21, 'rootkit.':22}
```

[253]:

```
data_x[1]=data_x[1].map(dict_tcp)
data_x[2]=data_x[2].map(dict_ip)
data_x[3]=data_x[3].map(dict_SF)
data_x[41]=data_x[41].map(dict_normal)
```

[254]:

```
data_x=data_x.dropna()
```

[242]:

```
print(data_x.nunique())
```

```
0      9883
1         3
2        70
3        11
4      7195
5     21493
6         2
7         3
8         6
9        30
10        6
11        2
```

```
12       98
13        2
14        3
15       93
16       42
17        3
18       10
19        1
20        2
21        2
22      512
23      512
24       96
25       87
26       89
27       76
28      101
29       95
30       72
31      256
32      256
33      101
34      101
35      101
36       76
37      101
38      100
39      101
40      101
41       23
dtype: int64
```

[243]:

```
data_x = data_x.drop([6,11,19], axis = 1)
```

[ ]:

```
# data = data.drop(["PassengerId","Ticket","Cabin","Name"],axis=1)
```

[244]:

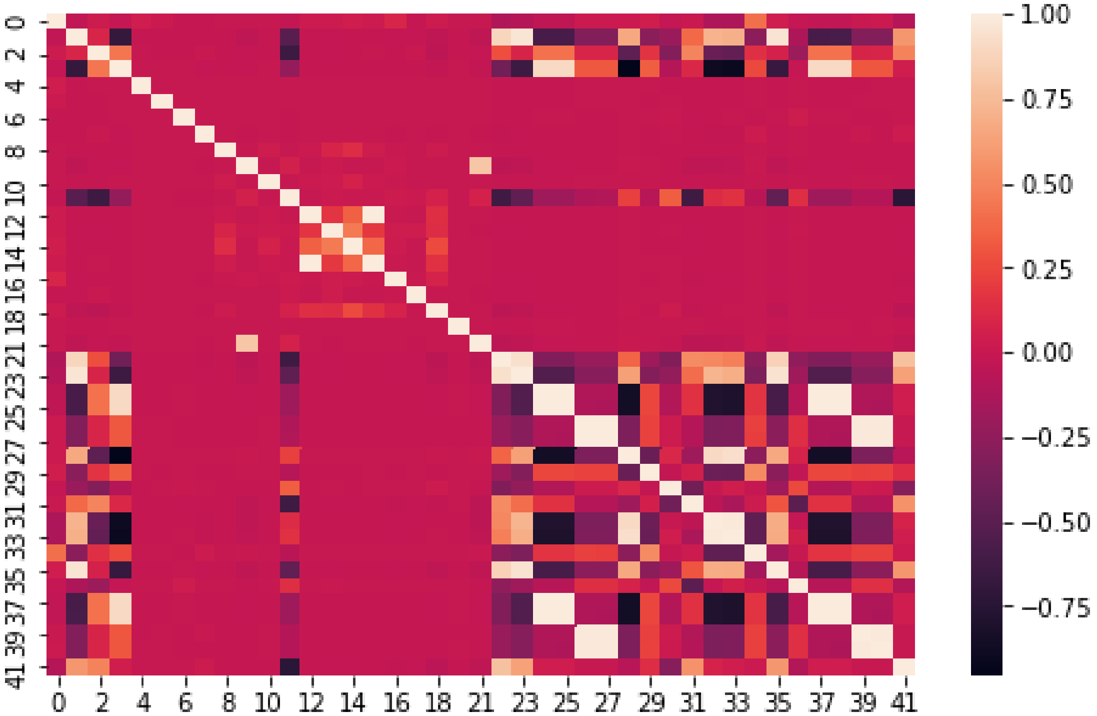
```
 import seaborn as sns
 corr = data_x.corr()

plt.figure(figsize =(8,5))

sns.heatmap(corr)
```

[244]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fdefaf34210>
```



```
[245]:
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler

X = data_x.drop([41], axis = 1).values
y = data_x[41].values

S = MinMaxScaler()
X = S.fit_transform(X)

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.3,␣
 ↪random_state = 123)

X_train.shape, X_test.shape,y_train.shape, y_test.shape
```

```
[245]: ((3428901, 40), (1469530, 40), (3428901,), (1469530,))
```

```
[150]: from sklearn.metrics import accuracy_score,precision_score,recall_score,f1_score
```

1 Decision Tree

[193]:

```
from sklearn.tree import DecisionTreeClassifier
clfd = DecisionTreeClassifier(criterion ="entropy", max_depth = 21)
```

[159]:

```
from sklearn.model_selection import GridSearchCV
parameters = {'criterion': ['entropy'],
              'max_depth': [4,8,12,13,15,17,19,20,21]
             }
```

[160]:

```
grid_obj = GridSearchCV(clfd, parameters)
grid_obj = grid_obj.fit(X_train, y_train)
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/model_selection/_split.py:667:
UserWarning: The least populated class in y has only 1 members, which is less
than n_splits=5.
  % (min_groups, self.n_splits)), UserWarning)
```

[170]:

```
# clfd = grid_obj.best_estimator_
```

[194]:

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

[194]:

```
DecisionTreeClassifier(ccp_alpha=0.0, class_weight=None, criterion='entropy',
                       max_depth=21, max_features=None, max_leaf_nodes=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, presort='deprecated',
                       random_state=None, splitter='best')
```

[195]:

```
print("Test score is:", clfd.score(X_test, y_test))
```

```
Test score is: 0.9999040509550673
```

[196]:

```
y_predd = clfd.predict(X_test)
print("F1_score",f1_score(y_predd,y_test,average='micro'))
print("precision",precision_score(y_predd,y_test,average='micro'))
print("recall",recall_score(y_predd,y_test,average='micro'))
```

```
F1_score 0.9999040509550673
precision 0.9999040509550673
recall 0.9999040509550673
```

[197]:

```
print(len(np.unique(y_predd)))
```

```
20
```

2 RandomForest

```
[151]: from sklearn.ensemble import RandomForestClassifier
       clfr = RandomForestClassifier(n_estimators = 50)
       clfr.fit(X_train, y_train)
```

```
[151]: RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, class_weight=None,
                              criterion='gini', max_depth=None, max_features='auto',
                              max_leaf_nodes=None, max_samples=None,
                              min_impurity_decrease=0.0, min_impurity_split=None,
                              min_samples_leaf=1, min_samples_split=2,
                              min_weight_fraction_leaf=0.0, n_estimators=50,
                              n_jobs=None, oob_score=False, random_state=None,
                              verbose=0, warm_start=False)
```

```
[152]: print("Test score is:", clfr.score(X_test, y_test))
```

```
Test score is: 0.999916299769314
```

```
[153]: y_predr = clfr.predict(X_test)
       print("F1_score",f1_score(y_predr,y_test,average='micro'))
       print("precision",precision_score(y_predr,y_test,average='micro'))
       print("recall",recall_score(y_predr,y_test,average='micro'))
```

```
F1_score 0.999916299769314
precision 0.999916299769314
recall 0.999916299769314
```

```
[154]: print(len(np.unique(y_predr)))
```

```
17
```

3 LogisticRegression

```
[ ]: from sklearn.linear_model import LogisticRegression

     clfl = LogisticRegression(max_iter = 1200000)
     clfl.fit(X_train, y_train)
```

```
[ ]: LogisticRegression(C=1.0, class_weight=None, dual=False, fit_intercept=True,
                        intercept_scaling=1, l1_ratio=None, max_iter=1200000,
                        multi_class='auto', n_jobs=None, penalty='l2',
                        random_state=None, solver='lbfgs', tol=0.0001, verbose=0,
                        warm_start=False)
```

```
[ ]: print("Test score is:", clfr.score(X_test, y_test))
```

```
Test score is: 0.9999156192796336
```

[ ]:

```
y_predl = clfl.predict(X_test)
print("F1_score",f1_score(y_predl,y_test,average='micro'))
print("precision",precision_score(y_predl,y_test,average='micro'))
print("recall",recall_score(y_predl,y_test,average='micro'))
```

```
F1_score 0.9989295897327717
precision 0.9989295897327717
recall 0.9989295897327717
```

[198]:

```
data_y = data_y.drop([0], axis = 1)
```

[199]:

```
data_y
```

[199]:

```
        1    2        3   4    5  ...     37     38     39      40      41
0       0  udp  private  SF  105  ...  0.00.7  0.00.8  0.00.9  0.00.10  0.00.11
1       0  udp  private  SF  105  ...    0.0    0.0    0.0     0.0     0.0
2       0  udp  private  SF  105  ...    0.0    0.0    0.0     0.0     0.0
3       0  udp  private  SF  105  ...    0.0    0.0    0.0     0.0     0.0
4       0  udp  private  SF  105  ...    0.0    0.0    0.0     0.0     0.0
...    ..  ...      ...  ..  ...  ...    ...    ...    ...     ...
311024  0  udp  private  SF  105  ...      0      0      0       0       0
311025  0  udp  private  SF  105  ...      0      0      0       0       0
311026  0  udp  private  SF  105  ...      0      0      0       0       0
311027  0  udp  private  SF  105  ...      0      0      0       0       0
311028  0  udp  private  SF  105  ...      0      0      0       0       0

[311029 rows x 41 columns]
```

[200]:

```
data_y[2]=data_y[2].map(dict_tcp)
data_y[3]=data_y[3].map(dict_ip)
data_y[4]=data_y[4].map(dict_SF)
```

[201]:

```
data_y
```

[201]:

```
        1  2     3  4    5  ...     37     38     39      40      41
0       0  1  12.0  0  105  ...  0.00.7  0.00.8  0.00.9  0.00.10  0.00.11
1       0  1  12.0  0  105  ...    0.0    0.0    0.0     0.0     0.0
2       0  1  12.0  0  105  ...    0.0    0.0    0.0     0.0     0.0
3       0  1  12.0  0  105  ...    0.0    0.0    0.0     0.0     0.0
4       0  1  12.0  0  105  ...    0.0    0.0    0.0     0.0     0.0
...    .. ..   ... ..  ...  ...    ...    ...    ...     ...
311024  0  1  12.0  0  105  ...      0      0      0       0       0
311025  0  1  12.0  0  105  ...      0      0      0       0       0
311026  0  1  12.0  0  105  ...      0      0      0       0       0
311027  0  1  12.0  0  105  ...      0      0      0       0       0
```

```
311028    0    1   12.0    0   105   …         0          0          0           0           0

[311029 rows x 41 columns]
```

Assigning Random values to the first row

[202]:
```
# a =[np.nan,np.nan,np.nan,np.nan,np.nan,np.nan,np.nan,np.nan,np.nan,np.nan,np.
↪nan,np.nan,np.nan,np.nan,np.nan]
for i in range(25,41):
  data_y.iloc[0:1,i]= 1.0
data_y.iloc[0:1,31]=255
data_y.iloc[0:1,32]=254
data_y.iloc[0:1,25:41]
```

[202]:
```
   26  27  28   29  30  31   32   33  34   35  36  37  38  39  40  41
0   1   1   1  1.0   1   1  255  254   1  1.0   1   1   1   1   1   1
```

Changing the Dtypes from Object to float64

[203]:
```
for i in range(26,42):
  data_y[i] = pd.to_numeric(data_y[i], errors='coerce')
```

Replacing all the nan values ,if any, generated while changing the datatype

[204]:
```
data_y = data_y.replace(np.nan, 0, regex=True)
```

Normalise the Test.csv data

[205]:
```
Normalised_y = S.fit_transform(data_y)
```

Predicting using DT Classifier

[229]:
```
y_final_pred = clfd.predict(Normalised_y)
y_final_pred_df = pd.DataFrame(y_final_pred, columns = ['Label'])
y_final_pred_df.shape
```

[229]:
```
(311029, 1)
```

[121]:
```
y_final_predr = clfr.predict(Normalised_y)
y_final_pred_dfr = pd.DataFrame(y_final_predr, columns = ['Label'])
y_final_pred_dfr.shape
```

[121]:
```
(311029, 1)
```

Exporting the testLabel.csv

[230]:
```
y_final_pred_df.to_csv (r'/content/drive/MyDrive/assignment5/testLabel.csv',␣
↪index = False, header=True)
```

```
[101]: y_final_pred_dfr.to_csv (r'/content/drive/MyDrive/assignment5/testLabelr.csv',␣
        ↪index = False, header=True)
```

Reading the generated testLabel.csv and checking

```
[231]: pd.read_csv('/content/drive/MyDrive/assignment5/testLabel.csv')
```

```
[231]:         Label
       0           0
       1           0
       2           0
       3           0
       4           0
       …         …
       311024      2
       311025      2
       311026      2
       311027      2
       311028      2

       [311029 rows x 1 columns]
```

```
[103]: pd.read_csv('/content/drive/MyDrive/assignment5/testLabelr.csv')
```

```
[103]:         Label
       0           0
       1           0
       2           0
       3           0
       4           0
       …         …
       311024      0
       311025      0
       311026      0
       311027      0
       311028      0

       [311029 rows x 1 columns]
```

```
[232]: print(y_final_pred_df.nunique())
```

```
Label    21
dtype: int64
```

```
[105]: print(y_final_pred_dfr.nunique())
```

```
Label    15
dtype: int64
```

[106]:

```
y1 =y_final_pred
y2 = y_final_predr
```

[233]:

```
print("test..",f1_score(y1,y2,average='micro'))
```

```
test.. 0.9941773918187693
```

[234]:

```
Actual_label = {0:'normal.', 1:'buffer_overflow.', 2:'loadmodule.', 3:'perl.',␣
 ↪4:'neptune.', 5:'smurf.',6:'guess_passwd.', 7:'pod.',
               8:'teardrop.', 9:'portsweep.' ,10:'ipsweep.', 11:'land.',12:
 ↪'ftp_write.', 13:'back.', 14:'imap.', 15:'satan.', 16:'phf.',
               17:'nmap.', 18:'multihop.',19:'warezmaster.', 20:'warezclient.',␣
 ↪21:'spy.', 22:'rootkit.'}
```

[235]:

```
ydtdf = y_final_pred_df
# yrfdf = y_final_pred_dfr
ydtdf
```

[235]:

```
        Label
0           0
1           0
2           0
3           0
4           0
…       …
311024      2
311025      2
311026      2
311027      2
311028      2

[311029 rows x 1 columns]
```

[236]:

```
ydtdf['Label']=ydtdf['Label'].map(Actual_label)
# yrfdf['Label']=yrfdf['Label'].map(Actual_label)
```

[237]:

```
print(ydtdf['Label'].unique())
ydtdf
```

```
['normal.' 'loadmodule.' 'smurf.' 'portsweep.' 'warezmaster.' 'imap.'
 'satan.' 'pod.' 'rootkit.' 'ipsweep.' 'back.' 'neptune.' 'multihop.'
 'warezclient.' 'nmap.' 'land.' 'guess_passwd.' 'spy.' 'teardrop.' 'phf.'
 'buffer_overflow.']
```

[237]:

```
              Label
0           normal.
1           normal.
```

```
2           normal.
3           normal.
4           normal.
…             …
311024  loadmodule.
311025  loadmodule.
311026  loadmodule.
311027  loadmodule.
311028  loadmodule.

[311029 rows x 1 columns]
```

[221]:

```
print(yrfdf['Label'].unique())
yrfdf
```

```
['normal.' 'portsweep.' 'smurf.' 'ipsweep.' 'satan.' 'pod.' 'back.'
 'neptune.' 'warezmaster.' 'warezclient.' 'ftp_write.' 'nmap.' 'teardrop.'
 'land.' 'phf.']
```

[221]:

```
          Label
0       normal.
1       normal.
2       normal.
3       normal.
4       normal.
…         …
311024  normal.
311025  normal.
311026  normal.
311027  normal.
311028  normal.

[311029 rows x 1 columns]
```

[238]:

```
ydtdf=ydtdf.rename(columns ={'Label' : 'target'} )
```

[239]:

```
ydtdf.reset_index(level=0, inplace=True)
```

[240]:

```
ydtdf
```

[240]:

```
         index      target
0            0     normal.
1            1     normal.
2            2     normal.
3            3     normal.
4            4     normal.
…        …          …
```

```
311024  311024  loadmodule.
311025  311025  loadmodule.
311026  311026  loadmodule.
311027  311027  loadmodule.
311028  311028  loadmodule.

[311029 rows x 2 columns]
```

[241]:
```
ydtdf.to_csv('submission.csv',index=False,header=True)
```

[222]:
```
ydtdf.to_csv (r'/content/drive/MyDrive/assignment5/testLabelActualDT.csv',␣
 ↪index = True, header=['target'])
```

[135]:
```
pd1=pd.read_csv('/content/drive/MyDrive/assignment5/testLabelActualDT.csv')

# pd1
pd1 = pd1.rename(columns={'Unnamed: 0': 'index', 'target': 'target'})
pd1
```

[135]:
```
         index       target
0            0  warezclient.
1            1       normal.
2            2       normal.
3            3       normal.
4            4       normal.
…          …             …
311024  311024       normal.
311025  311025       normal.
311026  311026       normal.
311027  311027       normal.
311028  311028       normal.

[311029 rows x 2 columns]
```

[223]:
```
pd1.to_csv (r'/content/drive/MyDrive/assignment5/testLabelActualDT.csv', index␣
 ↪= False, header=True)
```

[225]:
```
print(pd1['target'].unique())
```

```
['warezclient.' 'normal.' 'satan.' 'smurf.' 'ipsweep.' 'neptune.'
 'portsweep.' 'back.' 'land.' 'buffer_overflow.' 'nmap.' 'teardrop.']
```

[136]:
```
yrfdf.to_csv (r'/content/drive/MyDrive/assignment5/testLabelActualRF.csv',␣
 ↪index = True, header=['target'])
```

[137]:
```
pd2=pd.read_csv('/content/drive/MyDrive/assignment5/testLabelActualRF.csv')

```

```
# pd1
pd2 = pd2.rename(columns={'Unnamed: 0': 'index', 'target': 'target'})
pd2
```

```
[137]:          index   target
        0           0  normal.
        1           1  normal.
        2           2  normal.
        3           3  normal.
        4           4  normal.
        …         …       …
        311024  311024  normal.
        311025  311025  normal.
        311026  311026  normal.
        311027  311027  normal.
        311028  311028  normal.

        [311029 rows x 2 columns]
```

```
[140]: pd2.to_csv (r'/content/drive/MyDrive/assignment5/testLabelActualRF.csv', index␣
        ↪= False, header=True)
```