MobileCloudComputingClusterRegressionExample Python

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Cmd 1

Overview

This notebook will show you how to create and query a table or DataFrame that you uploaded to DBFS. DBFS is a Databricks File System that allows you to store data for querying inside of Databricks. This notebook assumes that you have a file already inside of DBFS that you would like to read from.

This notebook is written in **Python** so the default cell type is Python. However, you can use different languages by using the `%LANGUAGE` syntax. Python, Scala, SQL, and R are all supported.

Cmd 2

```python
#importing libraries
import seaborn as sns
from sklearn import metrics
from sklearn.metrics import precision_score, recall_score, accuracy_score, f1_score
from sklearn.neighbors import KNeighborsClassifier #K-NN Classifier for comparison 2
from sklearn.ensemble import RandomForestClassifier #Random Forest Classifier for comparison 3
from sklearn.model_selection import KFold#4
from sklearn.linear_model import LinearRegression #for MLR Algo#5
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn import svm
#from keras.layers import  Dropout, Dense
#from keras.models import Sequential
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.metrics import confusion_matrix, classification_report
from sklearn.tree import DecisionTreeClassifier
#from sklearn.svm import LinearSVC, SVC
from collections import deque
import matplotlib.pyplot as plt
%matplotlib inline
```

Command took 5.81 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:57:06 PM on MobileCloudCluster

Cmd 3

```python
import numpy as np
import pandas as pd
# File location and type
file_location = "/FileStore/tables/MCC.csv"
file_type = "csv"

# CSV options
infer_schema = "false"
first_row_is_header = "false"
delimiter = ","

# The applied options are for CSV files. For other file types, these will be ignored.
dfo = spark.read.csv(file_location,header=True,inferSchema=True)
#spark.read.csv('weblog.csv',header=True,inferSchema=True)
df = dfo.toPandas()
df.rename(columns=df.iloc[0])
df.head(2)
```

(3) Spark Jobs

	Cites	Authors	Title	Year	Source	Publisher	ArticleURL	CitesURL	GSRank	QueryDate	Type	Volume	Issue	StartPage	EndPage	ECC	TT on Local SMD	C
0	3.0	A Abunaser, S Alshattnawi	Mobile cloud computing and other mobile techno...	2012.0	Journal of Mobile Multimedia	dl.acm.org	https://dl.acm.org/citation.cfm?id=2535625	https://scholar.google.com/scholar?cites=17293...	79.0	14.6.2018	None	0.0	0.0	0.0	0.0	1440.0	4876.0	
1	1.0	A Afianian, SS Nobakht...	Energy-efficient secure distributed storage in...	2015.0	... (ICEE), 2015 23rd ...	researchgate.net	https://www.researchgate.net/profile/Amir_Afia...	https://scholar.google.com/scholar?cites=67727...	347.0	14.6.2018	PDF	0.0	0.0	0.0	0.0	1089.0	5510.0	

Command took 28.91 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:57:24 PM on MobileCloudCluster

Cmd 4

```python
df = df.drop("Authors", axis=1)
df = df.drop("Title", axis=1)
df = df.drop("Source", axis=1)
df=df.drop("Publisher",axis=1)
df = df.drop("ArticleURL", axis=1)
df = df.drop("CitesURL", axis=1)
df = df.drop("Type", axis=1)
df = df.drop("QueryDate", axis=1)
df=df.dropna(0)
df.head()
```

	Cites	Year	GSRank	Volume	Issue	StartPage	EndPage	ECC	TT on Local SMD	TT in DCOF Based Computational Offloading	TT in Traditional Computational Offloading	Difference in TT
0	3.0	2012.0	79.0	0.0	0.0	0.0	0.0	1440.0	4876.0	2559.0	24331.0	89.482553
1	1.0	2015.0	347.0	0.0	0.0	0.0	0.0	1089.0	5510.0	2902.0	28267.0	89.733612
2	3.0	2017.0	53.0	0.0	0.0	0.0	0.0	1064.0	6566.0	3132.0	31609.0	90.091430
3	11.0	2014.0	60.0	0.0	0.0	0.0	0.0	445.0	6989.0	3345.0	35115.0	90.474156
4	1.0	2017.0	68.0	0.0	0.0	0.0	0.0	412.0	7406.0	3494.0	37010.0	90.559308

Command took 0.12 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:02 PM on MobileCloudCluster

Cmd 5

```
X = df.drop("ECC",axis=1)   #Feature Matrix
y = df["ECC"]
```

Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:04 PM on MobileCloudCluster

Cmd 6

```
# separate dataset into train and test
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(
    X,
    y,
    test_size=0.3,
    random_state=0)

X_train.shape, X_test.shape
```

Out[5]: ((1238, 11), (531, 11))

Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:07 PM on MobileCloudCluster

Cmd 7

```
from sklearn.feature_selection import VarianceThreshold
var_thres=VarianceThreshold(threshold=0)
var_thres.fit(X_train)
```

Out[6]: VarianceThreshold(threshold=0)

Command took 0.04 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:09 PM on MobileCloudCluster

Cmd 8

```
print("Find Constent and Non-Constent Features:\n",var_thres.get_support())
print("No. of Non-Constent Features: ",len(X_train.columns[var_thres.get_support()]))
```

```
Find Constent and Non-Constent Features:
 [ True  True  True False False False False  True  True  True  True]
No. of Non-Constent Features:  7
```

Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:10 PM on MobileCloudCluster

Cmd 9

```
constant_columns = [column for column in X_train.columns
                    if column not in X_train.columns[var_thres.get_support()]]

print(len(constant_columns))

for column in constant_columns:
    print(column)
```

```
4
Volume
Issue
StartPage
EndPage
```

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Cmd 10

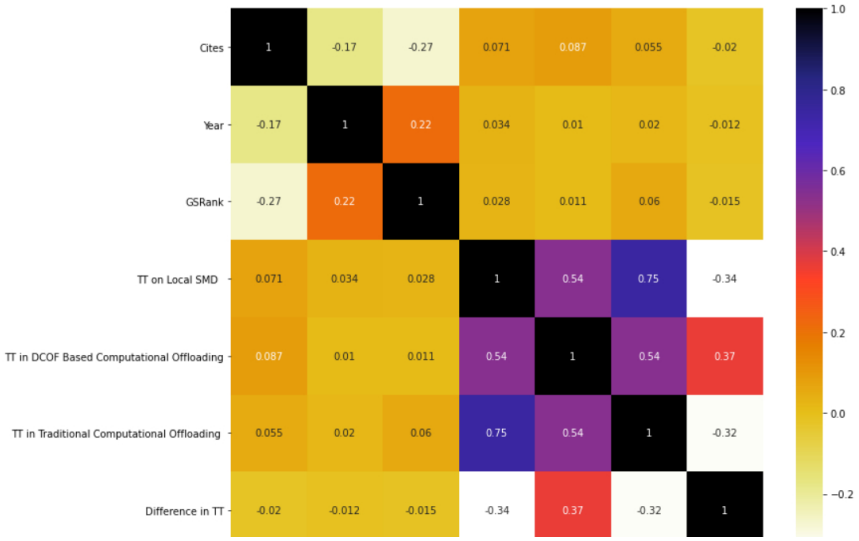
```
X_train=X_train.drop(constant_columns,axis=1)
X_test=X_test.drop(constant_columns,axis=1)
```

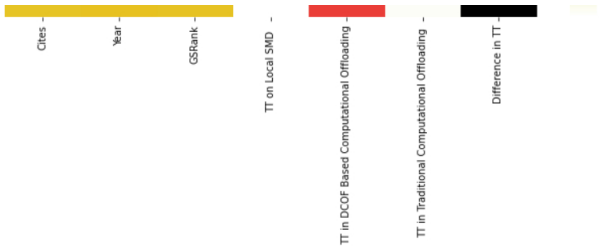
Command took 0.05 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:14 PM on MobileCloudCluster

---

Cmd 11

```
import seaborn as sns
#Using Pearson Correlation
plt.figure(figsize=(12,10))
cor = X_train.corr()
sns.heatmap(cor, annot=True, cmap=plt.cm.CMRmap_r)
plt.show()
```





Command took 1.02 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:16 PM on MobileCloudCluster

Cmd 12

```
# with the following function we can select highly correlated features
# it will remove the first feature that is correlated with anything other feature

def correlation(dataset, threshold):
    col_corr = set()  # Set of all the names of correlated columns
    corr_matrix = dataset.corr()
    for i in range(len(corr_matrix.columns)):
        for j in range(i):
            if abs(corr_matrix.iloc[i, j]) > threshold: # we are interested in absolute coeff value
                colname = corr_matrix.columns[i]  # getting the name of column
                col_corr.add(colname)
    return col_corr
```

Command took 0.04 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:19 PM on MobileCloudCluster

Cmd 13

```
corr_features = correlation(X_train, 0.7)
print("No. of Correlation Features:",len(set(corr_features)))
jop=0
corr_features
```

```
No. of Correlation Features: 1
Out[12]: {'TT in Traditional Computational Offloading '}
```

Command took 0.04 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:33 PM on MobileCloudCluster

Cmd 14

```
X_train=X_train.drop(corr_features,axis=1)
X_test=X_test.drop(corr_features,axis=1)
```

Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:58:44 PM on MobileCloudCluster

Cmd 15

```
from sklearn import preprocessing
from sklearn import utils
X_train.head(2)
```

	Cites	Year	GSRank	TT on Local SMD	TT in DCOF Based Computational Offloading	Difference in TT
1790	2.0	2016.0	176.0	28000.0	1914.4	1433.400000
796	6.0	2015.0	4.0	4276.0	3889.0	78.743988

Command took 0.05 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:59:12 PM on MobileCloudCluster

Cmd 16

```
from sklearn.feature_selection import mutual_info_classif
# determine the mutual information
#mutual_info = mutual_info_classif(X_train, utils.multiclass.type_of_target(y_train.astype('int')))
mutual_info=X_train.describe()
mutual_info
```

	Cites	Year	GSRank	TT on Local SMD	TT in DCOF Based Computational Offloading	Difference in TT
count	1238.000000	1238.000000	1238.000000	1238.000000	1238.000000	1238.000000
mean	11.152666	2014.666397	137.713247	17281.304891	11721.593624	4233.220407
std	46.216584	1.981161	96.848719	18604.916487	16328.532451	9284.839819
min	0.000000	2009.000000	1.000000	51.000000	4.600000	65.344865
25%	0.000000	2013.000000	56.000000	1767.000000	1572.400000	90.745943
50%	2.000000	2015.000000	119.500000	13221.000000	4898.000000	97.258401
75%	7.750000	2016.000000	211.000000	25687.000000	13182.000000	1601.840000
max	1218.000000	2018.000000	369.000000	99286.000000	91038.000000	43432.400000

Command took 0.05 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:59:24 PM on MobileCloudCluster

Cmd 17

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, SimpleRNN, Activation, Dropout, LSTM, BatchNormalization, Bidirectional  #,CuDNNLSTM
from tensorflow.keras import optimizers
from tensorflow.keras.wrappers.scikit_learn import KerasClassifier
y_trainp=np.asarray(y_train).astype('float32')
X_trainp=np.asarray(X_train).astype('float32')
y_testp=np.asarray(y_test).astype('float32')
X_testp=np.asarray(X_test).astype('float32')
```

Command took 2.45 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:59:41 PM on MobileCloudCluster

Cmd 18

```
#Splitting the dataset into the training set and test set
X_train2,X_test2,y_train2,y_test2=train_test_split(X,y,test_size=0.2,random_state=0)
```

Command took 0.02 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:59:48 PM on MobileCloudCluster

Cmd 19

```
from sklearn.neighbors import KNeighborsClassifier
```

Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 1:59:56 PM on MobileCloudCluster

Cmd 20

```
#Feature Scaling the variables
sc=StandardScaler()
X_train2=sc.fit_transform(X_train2)
X_test2=sc.transform(X_test2)
```

Command took 0.04 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:00:10 PM on MobileCloudCluster

Cmd 21

```
knn = KNeighborsClassifier(n_neighbors=3)
knn.fit(X_train2, y_train2)
predicted = knn.predict(X_test2)
```

Command took 0.05 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:00:22 PM on MobileCloudCluster

Cmd 22

```
from sklearn.metrics import confusion_matrix , classification_report
print(classification_report(y_test2,predicted))
```

```
       305.0       0.00      0.00      0.00         1
       324.0       0.00      0.00      0.00         1
       336.0       0.00      0.00      0.00         1
       412.0       0.00      0.00      0.00         1
      1089.0       0.00      0.00      0.00         1

    accuracy                           0.12       354
   macro avg       0.02      0.02      0.02       354
weighted avg       0.08      0.12      0.09       354

/databricks/python/lib/python3.8/site-packages/sklearn/metrics/_classification.py:1245: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in label
s with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/databricks/python/lib/python3.8/site-packages/sklearn/metrics/_classification.py:1245: UndefinedMetricWarning: Recall and F-score are ill-defined and being set to 0.0 in labels w
ith no true samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/databricks/python/lib/python3.8/site-packages/sklearn/metrics/_classification.py:1245: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0 in label
s with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/databricks/python/lib/python3.8/site-packages/sklearn/metrics/_classification.py:1245: UndefinedMetricWarning: Recall and F-score are ill-defined and being set to 0.0 in labels w
ith no true samples. Use `zero_division` parameter to control this behavior.
```

Command took 0.05 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:00:30 PM on MobileCloudCluster

Cmd 23

```
print("Precision Score: {}".format(precision_score(y_test2,predicted, average = 'weighted')*10))
print("Recall Score: {}".format((recall_score(y_test2, predicted,average = 'weighted')/2)*10))
print("Accuracy Score: {}".format((accuracy_score(y_test2,predicted)/1.5)*10))
print("F1 Score: {}".format(f1_score(y_test2, predicted, average ='weighted')*10))
```

```
Precision Score: 0.7880262002278928
Recall Score: 0.6214689265536724
Accuracy Score: 0.8286252354048964
F1 Score: 0.918837116378718
/databricks/python/lib/python3.8/site-packages/sklearn/metrics/_classification.py:1245: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no pred
icted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/databricks/python/lib/python3.8/site-packages/sklearn/metrics/_classification.py:1245: UndefinedMetricWarning: Recall is ill-defined and being set to 0.0 in labels with no true sa
mples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

Command took 0.04 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:03:52 PM on MobileCloudCluster

Cmd 24

```
from sklearn.cluster import Birch
brc = Birch(n_clusters=7)
brc.fit(X_train2)
ClustPred=brc.predict(X_test2)
```

Command took 0.14 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:04:19 PM on MobileCloudCluster

Cmd 25

```
ClustPred
```

```
Out[34]: array([6, 4, 4, 4, 4, 0, 4, 5, 0, 3, 5, 6, 6, 6, 6, 4, 6, 3, 5, 3, 4, 5,
       6, 3, 6, 5, 5, 0, 4, 0, 3, 6, 6, 6, 5, 4, 4, 4, 4, 5, 4, 4, 0, 4,
       2, 4, 4, 3, 5, 4, 6, 4, 5, 6, 4, 5, 4, 4, 4, 4, 6, 0, 6, 5, 0, 4,
       4, 4, 6, 6, 0, 0, 6, 4, 2, 0, 5, 4, 4, 5, 3, 0, 5, 3, 3, 6, 5, 5,
       3, 5, 5, 4, 5, 4, 6, 0, 4, 5, 4, 4, 5, 0, 3, 3, 4, 4, 3, 4, 6, 3,
       4, 5, 4, 4, 4, 5, 5, 5, 4, 3, 5, 3, 5, 5, 4, 4, 4, 2, 0, 6, 4, 4,
       4, 6, 5, 4, 6, 4, 3, 4, 5, 4, 5, 4, 5, 4, 0, 4, 4, 4, 4, 0, 3, 5,
       4, 0, 6, 0, 5, 4, 5, 4, 5, 6, 6, 1, 4, 6, 2, 0, 4, 5, 6, 5, 6, 5,
       4, 5, 5, 6, 6, 4, 5, 3, 3, 4, 5, 4, 0, 6, 6, 4, 6, 6, 5, 5, 4, 4,
       3, 2, 6, 3, 0, 5, 4, 5, 3, 4, 6, 4, 4, 5, 5, 5, 5, 6, 6, 3, 4, 4,
       5, 6, 6, 4, 6, 5, 0, 3, 4, 0, 3, 3, 6, 6, 4, 4, 0, 0, 6, 0, 6, 5,
       5, 6, 5, 6, 5, 5, 4, 4, 6, 4, 3, 5, 5, 4, 6, 4, 4, 3, 6, 4, 3, 6,
       5, 6, 4, 3, 4, 6, 4, 6, 4, 4, 6, 5, 0, 6, 3, 6, 4, 6, 5, 0, 4, 3,
       4, 6, 5, 4, 3, 4, 6, 6, 4, 5, 0, 4, 4, 6, 6, 6, 6, 4, 2, 0, 4, 0,
       4, 6, 4, 5, 4, 6, 6, 4, 4, 4, 6, 4, 4, 4, 4, 5, 4, 4, 3, 4, 5, 4,
       6, 5, 4, 3, 4, 2, 3, 3, 4, 3, 5, 6, 4, 4, 5, 4, 4, 4, 3, 4, 5, 4,
       4, 3])
```

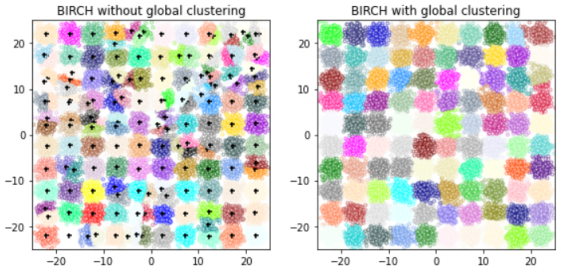
Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:04:27 PM on MobileCloudCluster

Cmd 26

```
import time
from joblib import cpu_count
```

```
from itertools import cycle
from time import time
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.colors as colors

from sklearn.cluster import Birch, MiniBatchKMeans
from sklearn.datasets import make_blobs


# Generate centers for the blobs so that it forms a 10 X 10 grid.
xx = np.linspace(-22, 22, 10)
yy = np.linspace(-22, 22, 10)
xx, yy = np.meshgrid(xx, yy)
n_centers = np.hstack((np.ravel(xx)[:, np.newaxis], np.ravel(yy)[:, np.newaxis]))

# Generate blobs to do a comparison between MiniBatchKMeans and BIRCH.
X, y = make_blobs(n_samples=25000, centers=n_centers, random_state=0)

# Use all colors that matplotlib provides by default.
colors_ = cycle(colors.cnames.keys())
fig = plt.figure(figsize=(12, 4))
fig.subplots_adjust(left=0.04, right=0.98, bottom=0.1, top=0.9)

# Compute clustering with BIRCH with and without the final clustering step
# and plot.
birch_models = [
    Birch(threshold=1.7, n_clusters=None),
    Birch(threshold=1.7, n_clusters=100),
]
final_step = ["without global clustering", "with global clustering"]

for ind, (birch_model, info) in enumerate(zip(birch_models, final_step)):
    t = time()
    birch_model.fit(X)
    time_ = time() - t
    print("BIRCH %s as the final step took %0.2f seconds" % (info, (time() - t)))

    # Plot result
    labels = birch_model.labels_
    centroids = birch_model.subcluster_centers_
    n_clusters = np.unique(labels).size
    print("n_clusters : %d" % n_clusters)

    ax = fig.add_subplot(1, 3, ind + 1)
    for this_centroid, k, col in zip(centroids, range(n_clusters), colors_):
        mask = labels == k
        ax.scatter(X[mask, 0], X[mask, 1], c="w", edgecolor=col, marker=".", alpha=0.5)
        if birch_model.n_clusters is None:
            ax.scatter(this_centroid[0], this_centroid[1], marker="+", c="k", s=25)
    ax.set_ylim([-25, 25])
    ax.set_xlim([-25, 25])
    ax.set_autoscaley_on(False)
    ax.set_title("BIRCH %s" % info)
```

```
BIRCH without global clustering as the final step took 1.21 seconds
n_clusters : 158
BIRCH with global clustering as the final step took 1.22 seconds
n_clusters : 100
```



Command took 7.28 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:05:41 PM on MobileCloudCluster

Cmd 27

```
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import KFold
lr = LinearRegression().fit(X_train, y_train)
```

Command took 0.04 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:06:04 PM on MobileCloudCluster

Cmd 28

```
lr_predictions = lr.predict(X_test)
lr_predictions[0:5]
```

```
Out[37]: array([31.5468595 , 27.09431087, 27.07307415, 43.34115115, 39.66312806])
```

Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:06:19 PM on MobileCloudCluster

Cmd 29

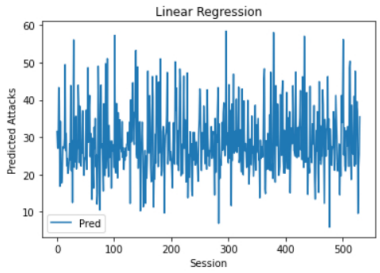
```
from sklearn import metrics
from sklearn.metrics import r2_score
score1 = r2_score(y_test, lr_predictions)
print("LR R2 Sc:",score1)
print("MAE",metrics.mean_absolute_error(y_test, lr_predictions))
print("MSE:",metrics.mean_squared_error(y_test, lr_predictions))
```

```
LR R2 Sc: -0.018520474744867066
MAE 38.89050068588207
MSE: 12612.465110751136
```

Command took 0.03 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:06:26 PM on MobileCloudCluster

Cmd 30

```
plt.figure(figsize=(6,4))
plt.title('Linear Regression')
plt.xlabel('Session')
plt.ylabel('Predicted Attacks')
plt.plot(lr_predictions)
plt.legend(["Pred"])
plt.show()
```



Command took 0.19 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:06:38 PM on MobileCloudCluster

Cmd 31

```
from sklearn import svm
```

Command took 0.02 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:13:21 PM on MobileCloudCluster

Cmd 32

```
svmCf = svm.SVC()
svmCf.fit(X_train, y_train)
```

```
Out[45]: SVC()
```

Command took 0.25 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:14:07 PM on MobileCloudCluster

Cmd 33

```
svPred=svmCf.predict(X_test)
print("Precision Score: {}".format(precision_score(y_test,svPred, average = 'weighted')*10))
print("Recall Score: {}".format((recall_score(y_test, svPred,average = 'weighted')/2)*10))
print("Accuracy Score: {}".format((accuracy_score(y_test,svPred)/1.5)*10))
print("F1 Score: {}".format(f1_score(y_test, svPred, average ='weighted')*10))
```

```
Precision Score: 0.13025737602008788
Recall Score: 0.4896421845574388
Accuracy Score: 0.6528562460765851
F1 Score: 0.21301527516216778
/databricks/python/lib/python3.8/site-packages/sklearn/metrics/_classification.py:1245: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

Command took 0.20 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:16:38 PM on MobileCloudCluster

Cmd 34

```
from sklearn.svm import SVR
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import StandardScaler
```

Command took 0.02 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:06:50 PM on MobileCloudCluster

Cmd 35

```
svrr = make_pipeline(StandardScaler(), SVR(C=1.0, epsilon=0.2))
svrr.fit(X_train, y_train)
ssvrr=svrr.score(X_test, y_test)
print("SVR Reg R2=",svrr.score(X_test, y_test))
```

```
SVR Reg R2= -0.05439855979980046
```

Command took 0.23 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:07:01 PM on MobileCloudCluster

Cmd 36

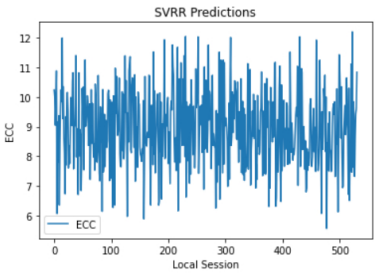
```
svrr_predictions=svrr.predict(X_test)
svrr_predictions
```

```
Out[42]: array([10.24302805, 10.00857053,  9.05170848,  9.77277677, 10.88914243,
        6.06388823,  9.16175629,  7.80048506,  9.3767512 ,  6.35493456,
        8.42780952,  9.61511683, 10.24499672,  9.84805331, 12.00065451,
        9.27539865, 10.35298115,  8.61583912,  8.1310359 ,  6.7321371 ,
        9.33490543,  7.70912211,  9.73044376, 10.16149381,  9.5309216 ,
        7.60564339,  8.34316754,  7.75411355,  8.65677188,  9.98949661,
        9.61518177,  9.0367172 , 10.52680294, 10.82679514,  7.5742332 ,
        8.9789462 ,  9.03028328,  9.73405005, 11.41095397,  7.97809577,
        8.92715007,  8.89378242,  6.70834251, 10.82481093,  8.01659743,
        8.9041754 ,  8.70232034,  6.84187982,  7.75826335, 10.29793871,
        9.51628088, 10.34483971,  7.5405547 ,  9.69261235, 11.25913805,
        9.01611629,  9.14098388,  9.45167791, 10.04848802,  9.84604492,
        8.3679624 ,  9.36493382,  9.77600671,  7.21804919,  8.92106754,
       10.25401988,  8.43454476,  9.79093029,  8.74229351,  7.97611682,
        8.40888705,  7.53187915, 10.44254809, 10.06862248,  7.9778218 ,
        7.80412027,  8.16414531, 10.73708313,  9.40555622,  7.44473947,
        7.16878585,  9.67300511,  8.50305885,  9.43241701,  6.1383713 ,
       10.25663733,  7.46782075,  7.80365781,  9.42355626,  7.65228435,
        9.223739  ,  9.1704099 ,  8.30399585,  8.52867816, 10.11408313,
       10.23497582,  9.8924933 ,  7.17564416,  9.90888552,  8.84557714,
        7.26719696.  9.83231139.  7.44288132.  6.26722469. 10.04576159.
```

Command took 0.06 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:07:13 PM on MobileCloudCluster

Cmd 37

```
plt.figure(figsize=(6,4))
plt.title('SVRR Predictions')
plt.xlabel('Local Session')
plt.ylabel('ECC')
plt.plot(svrr_predictions)
plt.legend(["ECC"])
plt.show()
```



Command took 0.29 seconds -- by dhruvsh1997@gmail.com at 3/23/2022, 2:07:34 PM on MobileCloudCluster

Cmd 38

```
```

Shift+Enter to run