B.M.S. COLLEGE OF ENGINEERING BENGALURU
Autonomous Institute, Affiliated to VTU

Lab Record

MACHINE LEARNING

Submitted in partial fulfillment for the 6th Semester Laboratory

Bachelor of Technology
in
Computer Science and Engineering

Submitted by:

SAKSHI SRIVASTAVA
1BM18CS090

Department of Computer Science and Engineering
B.M.S. College of Engineering
Bull Temple Road, Basavanagudi, Bangalore 560 019
Mar-Jun 2021

B.M.S. COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the MACHINE LEARNING laboratory has been carried out by Sakshi Srivastava (1BM18CS090) during the 6^{th} Semester Mar-Jun-2021.

Signature of the Faculty In charge:

NAME OF THE FACULTY: Soumya V

Department of Computer Science and Engineering
B.M.S. College of Engineering, Bangalore

PROGRAM
Date-02/06/2021
Apply k-Means algorithm to cluster a set of data stored in a .CSV file.

```
import matplotlib.pyplot as plt
from sklearn import datasets
from sklearn.cluster import KMeans
import sklearn.metrics as sm
import pandas as pd
import numpy as np

iris = datasets.load_iris()
X = pd.DataFrame(iris.data)
X.columns = ['Sepal_Length','Sepal_Width','Petal_Length','Petal_Width']

y = pd.DataFrame(iris.target)
y.columns = ['Targets']

print(X.head())
print(y.head())

model = KMeans(n_clusters=3)
model.fit(X)

plt.figure(figsize=(14,7))
colormap = np.array(['red', 'lime', 'black'])

plt.subplot(1, 2, 1)
plt.scatter(X.Petal_Length, X.Petal_Width, c=colormap[y.Targets], s=40)
plt.title('Real Classification')
plt.xlabel('Petal Length')
plt.ylabel('Petal Width')

plt.subplot(1, 2, 2)
plt.scatter(X.Petal_Length, X.Petal_Width, c=colormap[model.labels_],
s=40)
plt.title('K Mean Classification')
plt.xlabel('Petal Length')
plt.ylabel('Petal Width')
print('The accuracy score of K-Mean: ',sm.accuracy_score(y,
model.labels_))
```

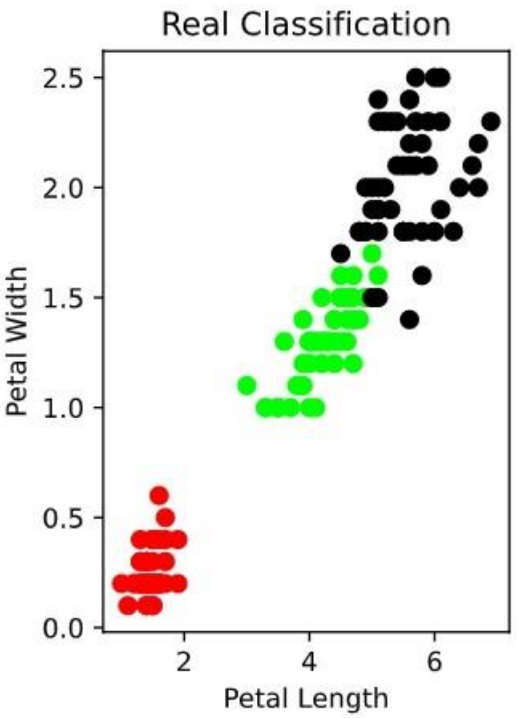
print('The Confusion matrixof K-Mean:\n ',sm.confusion_matrix(y, model.labels_))

SCREENSHOTS

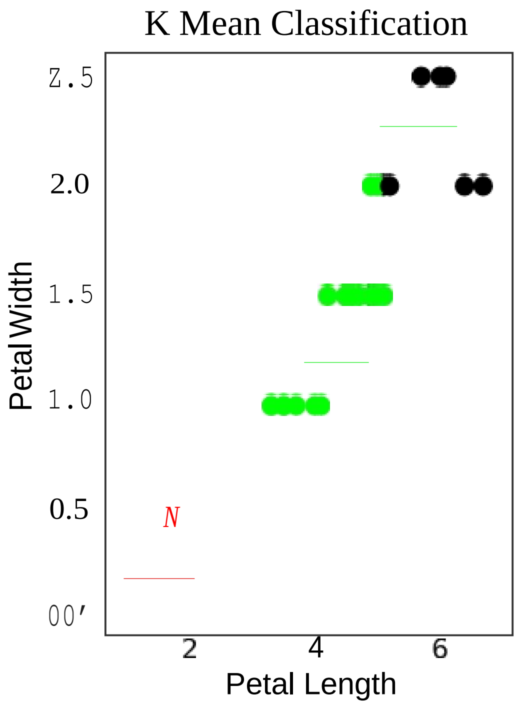
```
   Sepal_Length  Sepal_Width  Petal_Length  Petal_Width
0           5.1          3.5           1.4          0.2
1           4.9          3.0           1.4          0.2
2           4.7          3.2           1.3          0.2
3           4.6          3.1           1.5          0.2
4           5.0          3.6           1.4          0.2
   Targets
0        0
1        0
2        0
3        0
4        0
```

```
KMeans(n_clusters=3)
```

```
Text(0, 0.5, 'Petal Width')
```



```
The accuracy score of K-Mean:  0.8933333333333333
The Confusion matrixof K-Mean:
 [[50  0  0]
 [  8 48   2]
 [  8 14  36]]
```



PROGRAM

Date-09/06/2021

Apply EM algorithm to cluster a set of data stored in a .CSV file. Compare the results of k-Means algorithm and EM algorithm.

```
from sklearn import datasets
from sklearn.cluster import KMeans
from sklearn.utils import shuffle
import numpy as np
import pandas as pd

iris=datasets.load_iris()
X=iris.data
Y=iris.target

X,Y = shuffle(X,Y)
model=KMeans(n_clusters=3,init='k-
means++',max_iter=10,n_init=1,random_state=3425)
model.fit(X)
Y_Pred=model.labels_

from sklearn.metrics import confusion_matrix
cm=confusion_matrix(Y,Y_Pred)
print(cm)
from sklearn.metrics import accuracy_score
print(accuracy_score(Y,Y_Pred))

from sklearn.mixture import GaussianMixture
model2=GaussianMixture(n_components=3,random_state=3425)
model2.fit(X)

Y_predict2= model2.predict(X)

from sklearn.metrics import confusion_matrix
cm=confusion_matrix(Y,Y_predict2)
print(cm)

from sklearn.metrics import accuracy_score
print(accuracy_score(Y,Y_predict2))
```

SCREENSHOTS

```
[[ 0 50  0]
 [48  0  2]
 [14  0 36]]
0.24
```

```
GaussianMixture(n_components=3, random_state=3425)
```

```
[[ 0 50  0]
 [45  0  5]
 [ 0  0 50]]
0.3333333333333333
```

PROGRAM
Date-09/06/2021

Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

```
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import classification_report, confusion_matrix
from sklearn import datasets

iris = datasets.load_iris()
X = iris.data
Y = iris.target

print('sepal-length','sepal-width','petal-length','petal-width')
print(X)
print('target')
print(Y)

x_train, x_test, y_train, y_test = train_test_split(X,Y,test_size=0.3)
classier = KNeighborsClassifier(n_neighbors=5)
classier.fit(x_train, y_train)
y_pred=classier.predict(x_test)

print('confusion matrix')
print(confusion_matrix(y_test,y_pred))
print('accuracy')
print(classification_report(y_test,y_pred))
```

SCREENSHOTS

```
confusion matrix
[[15  0  0]
 [ 0  7  2]
 [ 0  1 20]]

accuracy
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        15
           1       0.88      0.78      0.82         9
           2       0.91      0.95      0.93        21

    accuracy                           0.93        45
   macro avg       0.93      0.91      0.92        45
weighted avg       0.93      0.93      0.93        45
```

PROGRAM

Date-09/06/2021

Implement the Linear Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd

dataset = pd.read_csv('salary_data.csv')
X = dataset.iloc[:, :-1].values
y = dataset.iloc[:, 1].values

from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=1/3,
random_state=0)

from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
y_pred = regressor.predict(X_test)

viz_train = plt
viz_train.scatter(X_train, y_train, color='red')
viz_train.plot(X_train, regressor.predict(X_train), color='blue')
viz_train.title('Salary VS Experience (Training set)')
viz_train.xlabel('Year of Experience')
viz_train.ylabel('Salary')
viz_train.show()

viz_test = plt
viz_test.scatter(X_test, y_test, color='red')
viz_test.plot(X_train, regressor.predict(X_train), color='blue')
viz_test.title('Salary VS Experience (Test set)')
viz_test.xlabel('Year of Experience')
viz_test.ylabel('Salary')
viz_test.show()
```

SCREENSHOTS

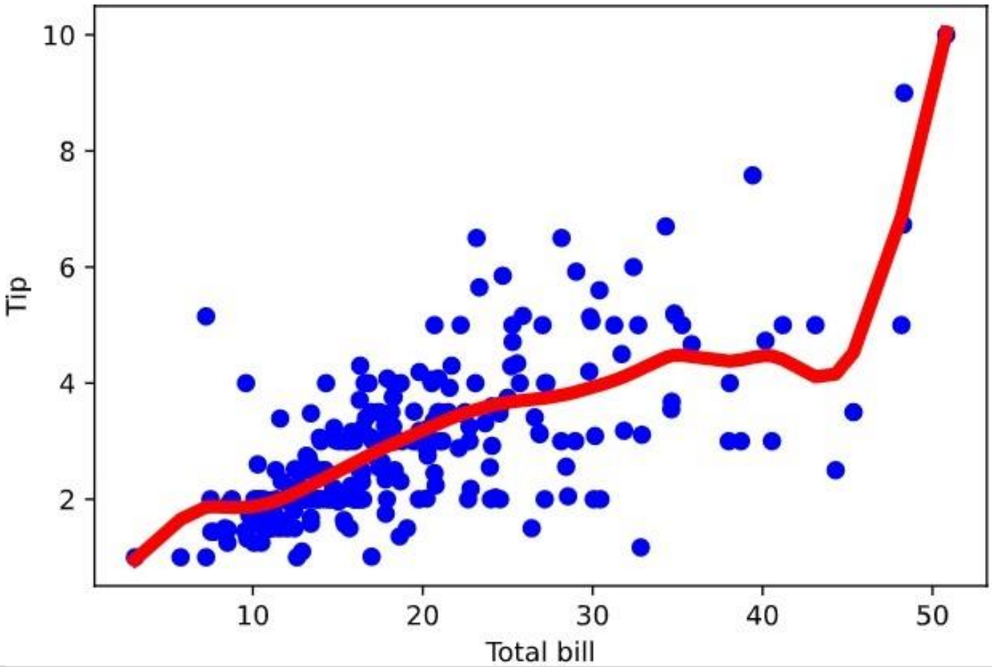
PROGRAM
Date-09/06/2021
Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

```
from numpy import *
from os import listdir
import matplotlib
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np1
import numpy.linalg as np
from scipy.stats.stats import pearsonr

def kernel(point,xmat, k):
 m,n = np1.shape(xmat)
 weights = np1.mat(np1.eye((m)))
 for j in range(m):
    diff = point - X[j]
    weights[j,j] = np1.exp(diff*diff.T/(-2.0*k**2))
 return weights

def localWeight(point,xmat,ymat,k):
 wei = kernel(point,xmat,k)
 W = (X.T*(wei*X)).I*(X.T*(wei*ymat.T))
 return W

def localWeightRegression(xmat,ymat,k):
 m,n = np1.shape(xmat)
 ypred = np1.zeros(m)
 for i in range(m):
    ypred[i] = xmat[i]*localWeight(xmat[i],xmat,ymat,k)
 return ypred

data = pd.read_csv('tips.csv')
bill = np1.array(data.total_bill)
tip = np1.array(data.tip)

mbill = np1.mat(bill)
mtip = np1.mat(tip) # mat is used to convert to n dimesiona to 2
dimensional array form
m= np1.shape(mbill)[1]
```

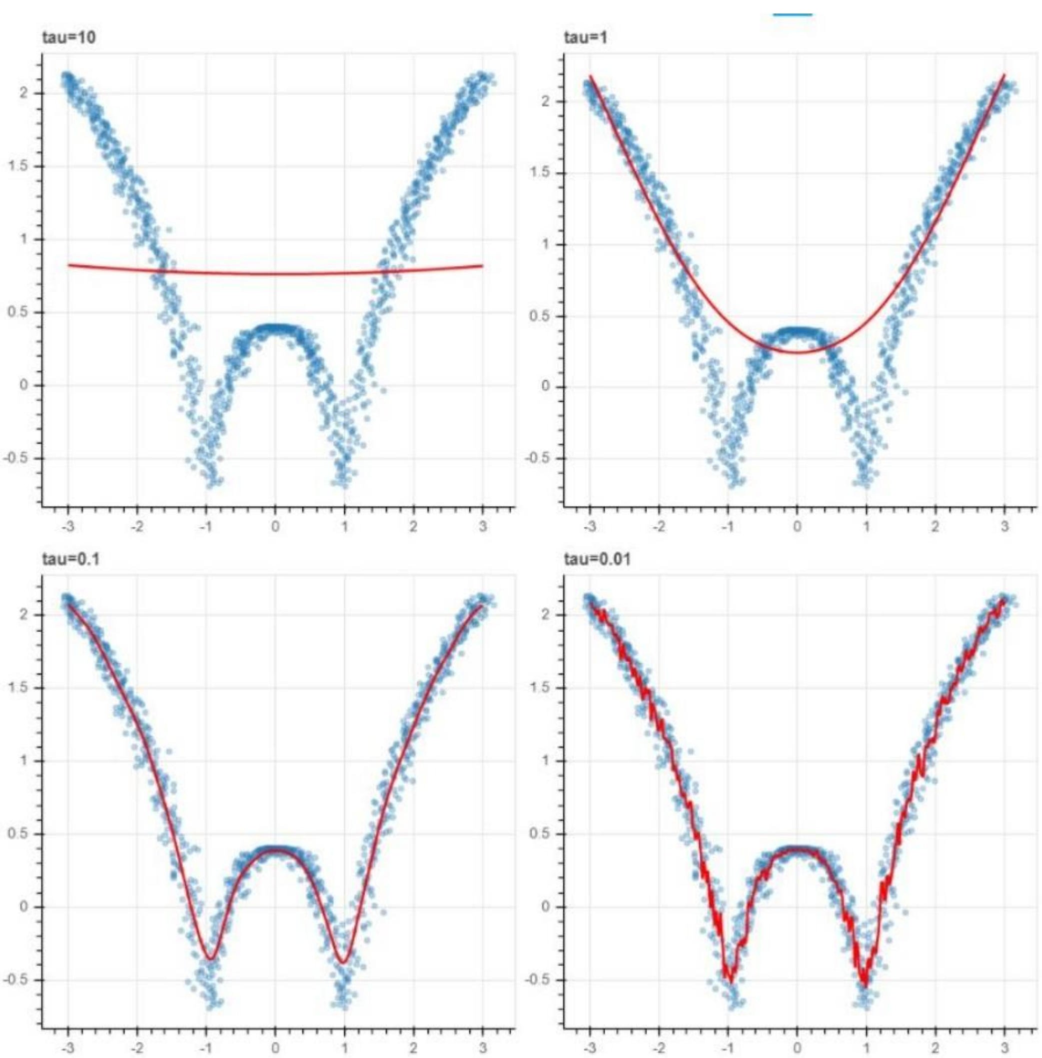
```
one = np1.mat(np1.ones(m))
X= np1.hstack((one.T,mbill.T)) # create a stack of bill from ONE

ypred = localWeightRegression(X,mtip,2)
SortIndex = X[:,1].argsort(0)
xsort = X[SortIndex][:,0]

fig = plt.figure()
ax = fig.add_subplot(1,1,1)
ax.scatter(bill,tip, color='blue')
ax.plot(xsort[:,1],ypred[SortIndex], color = 'red', linewidth=5)
plt.xlabel('Total bill')
plt.ylabel('Tip')
plt.show()


import numpy as np
from bokeh.plotting import figure, show, output_notebook
from bokeh.layouts import gridplot
from bokeh.io import push_notebook

def local_regression(x0, X, Y, tau):
    x0 = np.r_[1, x0]
    X = np.c_[np.ones(len(X)), X]

    xw = X.T * radial_kernel(x0, X, tau)
    beta = np.linalg.pinv(xw @ X) @ xw @ Y
    return x0 @ beta

def radial_kernel(x0, X, tau):
    return np.exp(np.sum((X - x0) ** 2, axis=1) / (-2 * tau * tau))


n = 1000
X = np.linspace(-3, 3, num=n)
print("The Data Set ( 10 Samples) X :\n",X[1:10])
Y = np.log(np.abs(X ** 2 - 1) + .5)
print("The Fitting Curve Data Set (10 Samples) Y :\n",Y[1:10])
X += np.random.normal(scale=.1, size=n)
print("Normalised (10 Samples) X :\n",X[1:10])
domain = np.linspace(-3, 3, num=300)
print(" Xo Domain Space(10 Samples) :\n",domain[1:10])
```

```
def plot_lwr(tau):

    prediction = [local_regression(x0, X, Y, tau) for x0 in domain]
    plot = figure(plot_width=400, plot_height=400)
    plot.title.text='tau=%g' % tau
    plot.scatter(X, Y, alpha=.3)
    plot.line(domain, prediction, line_width=2, color='red')
    return plot


show(gridplot([
[plot_lwr(10.), plot_lwr(1.)],
[plot_lwr(0.1), plot_lwr(0.01)]]))
```

SCREENSHOTS




```
The Data Set ( 10 Samples) X :
 [-2.99399399 -2.98798799 -2.98198198 -2.97597598 -2.96996997 -2.96396396
 -2.95795796 -2.95195195 -2.94594595]
The Fitting Curve Data Set (10 Samples) Y :
 [2.13582188 2.13156806 2.12730467 2.12303166 2.11874898 2.11445659
 2.11015444 2.10584249 2.10152068]
Normalised (10 Samples) X :
 [-3.02807273 -2.87202266 -3.09630094 -3.18308318 -3.07358118 -3.01668872
 -3.03421482 -2.78784604 -2.99243688]
 Xo Domain Space(10 Samples) :
 [-2.97993311 -2.95986622 -2.93979933 -2.91973244 -2.89966555 -2.87959866
 -2.85953177 -2.83946488 -2.81939799]
```


tau=10
tau=1
tau=0.1
tau=0.01