ML LAB-2 REPORT

PROGRAM-6
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_))
```

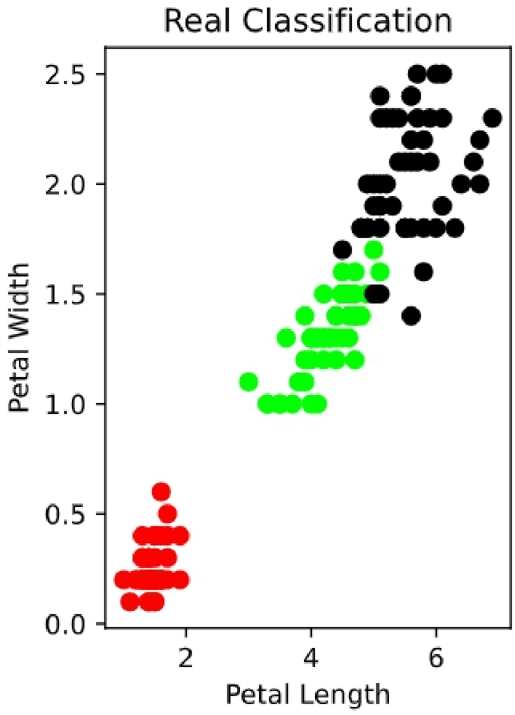
print('The Confusion matrixof K-Mean:\n ',sm.confusion_matrix(y, model.labels_))

SCREENSHOTS

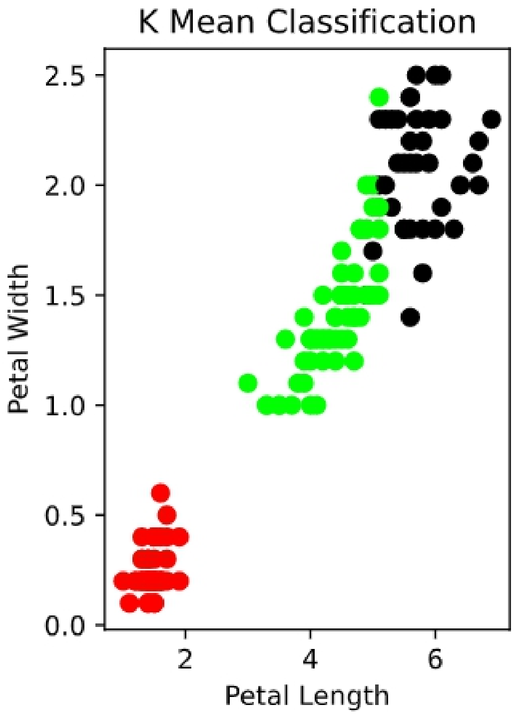
```
   Sepal_Length  Sepal_Width  Petal_Length  Petal_Width
0           5.1          3.5           1.4          0.2
1           4.9          3.0           1.4          0.2
2           4.7          3.2           1.3          0.2
3           4.6          3.1           1.5          0.2
4           5.0          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]
 [ 0 48  2]
 [ 0 14 36]]
```



PROGRAM-7
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-8
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-9
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

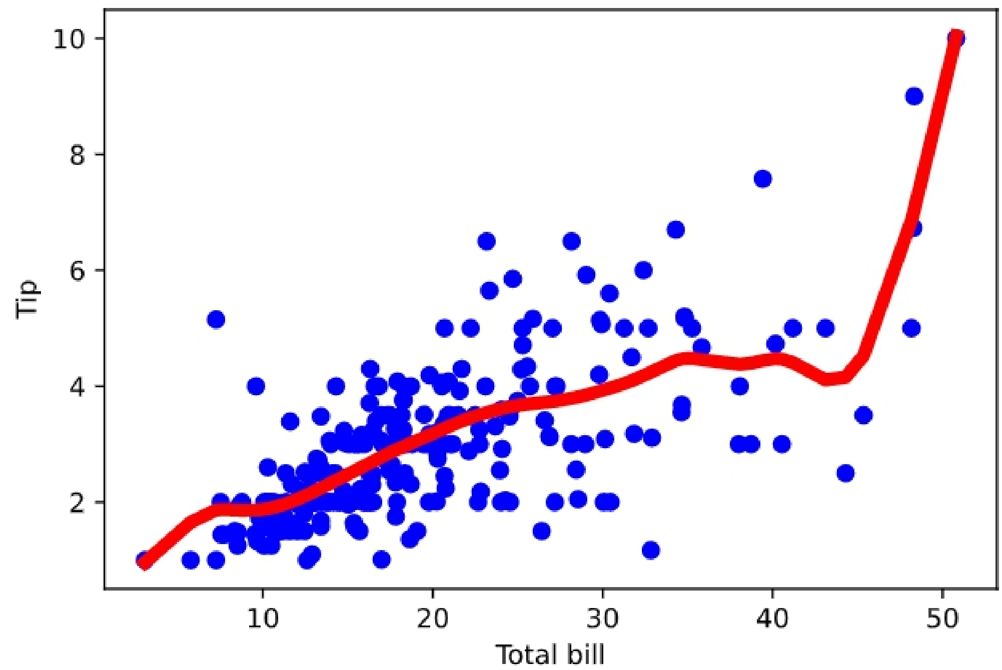
PROGRAM-10
Date-09/06/2021
Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

```
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]
```

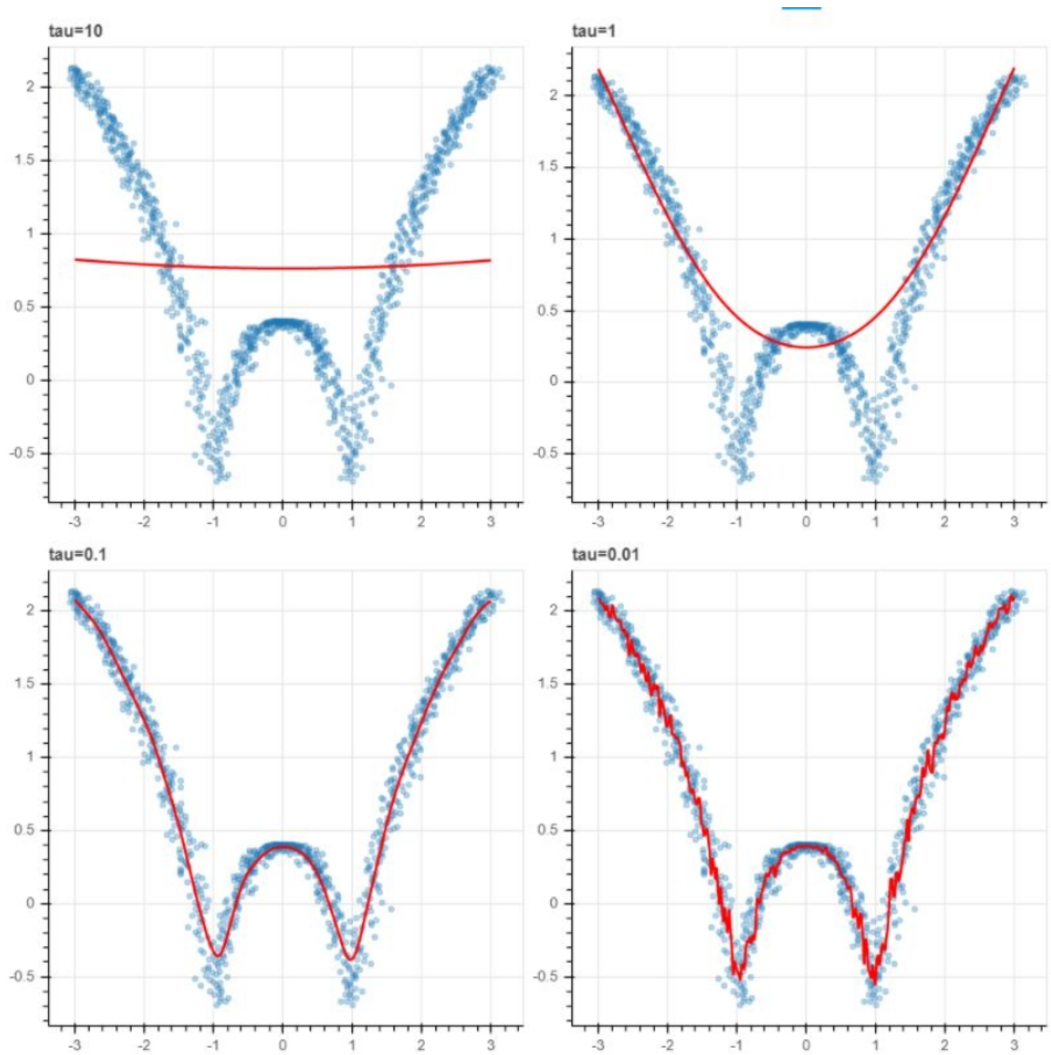
```
one = np1.mat(np1.ones(m))
X= np1.hstack((one.T,mbill.T)) # create a stack of bill from ONE

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