Date _____

Expt. No. 10 Page No. 49

Program 10

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

```
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) + 0.5)
print("The Fitting Curve Data Set (10 samples) Y :\n",
                                Y[1:10])
```

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```
xt = np.random.normal(scale=0.1, size=n)
print("Normalised (10 samples) x: \n", x[1:10])
domain = np.linspace(-3, 3, num=300)
print("\nDomain 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=0.3)
    plot.line(domain, prediction, line_width=2, color='red')
    return plot

show(gridplot([[plot_lwr(10.0), plot_lwr(1.0)], [plot_lwr(0.1), plot_lwr(0.01)]]))
```

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Output

The Data set (10 samples) x:

[-2.99399399, -2.89798799 -2.98198198, -2.97597598
-2.96996997 -2.96396396 -2.95795796 -2.95195195
-2.94594595]

The fitting curve dataset (10 samples) y:

[2.13582188 2.13156806 2.12730467 2.12303166 2.11874898
2.11445659 2.11015444 2.10584249 2.10152068]

Normalized (10 samples) x:

[-2.98570318 -3.02850034 -2.94500019 -2.90051121 -2.96781
-2.94366518 -3.10168986 -2.91344219 -2.94338611]

Xo Domain Space (10 samples):

[-2.979931 -2.95986622 -2.93979933 -2.91973244
2.89966555 -2.87959866 -2. 85953177 -2.83946488
-2.81939799]