

Q1

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import numpy as np;
import matplotlib.pyplot as plt;

def OLS(XT,y):
    temp=np.matmul(XT,XT.T);
    temp=np.linalg.inv(temp);
    temp=np.matmul(temp,XT);
    temp=np.matmul(temp,y);
    print("coefficient is: ");
    print(temp);
    return temp;

def render(x1,y,Coefficient):
    plt.scatter(x1,y);
    plotx= np.linspace(0, 10, 100);
    ploty = np.polyval(Coefficient, plotx)
    plt.plot(plotx,ploty);
    plt.show();

def test(testx,testy,CoefficientInReverse):
    predictArray=np.zeros(sample_size,dtype=float);
    multiple=np.ones(sample_size,dtype=float);
    for coefficient in CoefficientInReverse:
        predictArray+=coefficient*multiple;
        multiple*=-testx;
    print("predict is: ");
    print(predictArray)
    predictArray=predictArray-testy;
    predictArray=predictArray*predictArray;
    error=predictArray.sum();
    print("error is: ");
    print(error);

sample_size=10;
x1 = np.array([5.86,1.34,3.65,4.69,4.13,5.87,7.91,5.57,7.3,7.89]);
y = np.array([0.74,1.18,0.51,-0.48,-0.07,0.37,1.35,0.3,1.64,1.75]);
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x2= x1*x1;
x3=x2*x1;
x4=x3*x1;
XT=np.vstack(([1,1,1,1,1,1,1,1,1,1],x1,x2,x3,x4));
print(XT);
render(x1,y,OLS(XT,y)[::-1])

testx=([5.8,0.57,4.3,6.55,0.82,3.72,5.8,3.26,6.75,4.77]);
testy=([0.93,1.87,-0.06,1.6,1.22,0.9,0.93,1.53,1.73,-0.51]);
test(testx,testy,OLS(XT,y));
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Q3

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import numpy as np
import math
import matplotlib.pyplot as plt;
def sig(X):
    return 1/ (1+ math.e**(-X));
def df(theta,trainX,trainY):
    total=np.zeros(dim);
    for X, Y in zip(trainX,trainY):
        temp=sig((np.dot(X,theta)))-Y;
        total+=temp*X;
    print("df: ");
    print(total);
    return total;
def test(theta,testX,testY):
    print("Beginning Testing: ")
    TP=0;TN=0;FP=0;FN=0;
    testResult=sig((np.dot(testX,theta)));
    testResult=np.where(testResult>=0.5,1,0);
    print(testResult);
    for X, Y in zip(testResult,testY):
        if X==1 and Y==1:
            TP=TP+1;
        if X==0 and Y==0:
            TN=TN+1;
        if X==1 and Y==0:
            FP=FP+1;
        if X==0 and Y==1:
            FN=FN+1;
    print("TP %d TN %d FP %d FN %d"%(TP,TN,FP,FN))
dim=3;
theta=np.array([-1,1.5,0.5]);
trainX=np.array([[1,0.346,0.78],[1,0.303,0.439],[1,0.358,0.729],[1,0.60
2,0.863],[1,0.790,0.753],[1,0.611,0.965]]);
trainY=np.array([0,0,0,1,1,1]);
theta=theta-0.1*df(theta,trainX,trainY);
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testX=np.array([[1,0.959,0.382],[1,0.75,0.306],[1,0.395,0.76],[1,0.823,  
0.764],[1,0.761,0.874],[1,0.844,0.435]])  
testY=np.array([0,0,0,1,1,1]);  
test(theta,testX,testY);
```