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**Assignment 3 (written)**

***Task1 :***

1. Degree=1; Lambda=0

*Training Stage:*

w0=-6.3872

w1=0.0276

w2=0.0432

w3=0.0126

w4=0.0176

w5=0.0080

w6=-0.0058

w7=-0.0081

w8=0.0714

w9=-0.0153

w10=-0.0190

w11=0.0117

w12=0.0222

w13=-0.0018

w14=-0.0013

w15=0.0091

w16=0.0382

*Last line of Test Object:*

ID= 3498, output= 3.8514, target value = 4.0000, squared error = 0.0221

1. Degree=1; Lambda=1

*Training stage:*

w0=-6.2611

w1=0.0275

w2=0.0428

w3=0.0126

w4=0.0172

w5=0.0078

w6=-0.0059

w7=-0.0081

w8=0.0713

w9=-0.0154

w10=-0.0191

w11=0.0116

w12=0.0221

w13=-0.0018

w14=-0.0017

w15=0.0090

w16=0.0383

*Last line of test object:*

ID= 3498, output= 3.8528, target value = 4.0000, squared error = 0.0217

1. Degree=2; Lambda=0

*Training stage:*

w0=-7.5608

w1=0.0223

w2=0.0001

w3=0.0352

w4=0.0000

w5=0.0049

w6=-0.0000

w7=-0.0299

w8=0.0002

w9=0.0327

w10=-0.0001

w11=0.0694

w12=-0.0004

w13=0.0079

w14=-0.0002

w15=0.0596

w16=-0.0003

w17=-0.0184

w18=-0.0000

w19=0.0093

w20=0.0002

w21=0.0162

w22=-0.0000

w23=0.0398

w24=-0.0002

w25=-0.0041

w26=0.0001

w27=0.0538

w28=-0.0007

w29=-0.0149

w30=0.0002

w31=0.1215

w32=-0.0007

*Last line of test object:*

ID= 3498, output= 3.6074, target value = 4.0000, squared error = 0.1542

1. Degree=2; Lambda=1

*Training stage:*

w0=-7.0384

w1=0.0219

w2=0.0001

w3=0.0310

w4=0.0001

w5=0.0043

w6=-0.0000

w7=-0.0345

w8=0.0002

w9=0.0315

w10=-0.0001

w11=0.0678

w12=-0.0004

w13=0.0077

w14=-0.0002

w15=0.0574

w16=-0.0003

w17=-0.0192

w18=-0.0000

w19=0.0091

w20=0.0002

w21=0.0156

w22=-0.0000

w23=0.0401

w24=-0.0002

w25=-0.0050

w26=0.0001

w27=0.0536

w28=-0.0007

w29=-0.0155

w30=0.0002

w31=0.1208

w32=-0.0007

*Last line of test object:*

ID= 3498, output= 3.6001, target value = 4.0000, squared error = 0.1599

***Task2***

Given,

x1 = 5.3,   t1 = 9.6, x2 = 7.1,   t2 = 4.2, x3 = 6.4,   t3 = 2.2

Here we need to fit a line to this data and lambda is approaching positive infinity.

As, the lambda is reaching positive infinity the way to achieve minimum value is to minimize E(w). This can be done by removing lambda from the overall calculation which is multiplied with (wTw). So in order to minimize the EDw, wTw should be equal to zero. So, lambda is not involved in the calculation when w a 2D vector is zero Vector. *Therefore, w should be zero vector where lambda approaches infinity; to minimize EDw.*

***Task3***

Given values,

x1 = 5.3,   t1 = 9.6, x2 = 7.1,   t2 = 4.2, x3 = 6.4,   t3 = 2.2

Given functions,

* f(x) = 3.1x + 4.2
* f(x) = 2.4x - 1.5

To find the better functions we need to find the predicted value and find the squared errors and see the difference in total error.

Let T1, T2 and T3 be E1,E2 and E3 for respective cases in both functions.

For first function, f(x) = 3.1x + 4.2

Predicted values are:

T1=3.1\*5.3+4.2 = 20.63

T2=3.1\*7.1+4.2 = 26.21

T3=3.1\*6.4+4.2 = 24.04

Squared error values:

E1= (T1-t1)2 =(20.63-9.6)2 =121.661

E2= (T2-t2)2 =(26.21-4.2)2 =484.440

E3= (T3-t3)2 =(24.04-2.2)2 =476.986

Total error (TE1) = E1+E2+E3 =1083.887

For second function, f(x) = 2.4x - 1.5

Predicted values are:

T1=2.4\*5.3-1.5 =11.22

T2=2.4\*7.1-1.5 =15.54

T3=2.4\*6.4-1.5 =13.86

Squared error values:

E1= (T1-t1)2 =(11.22-9.6)2 =2.624

E2= (T2-t2)2 =(15.54-4.2)2 =197.122

E3= (T3-t3)2 =(13.86-2.2)2 =135.956

Total error (TE2) = E1+E2+E3 = 335.702

*Here, TE2<TE1 that is total sum of squared error for second function is less than first function so, function f(x) = 2.4x - 1.5 is better solution according to sum of squares criterion.*