Assignment-13

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Q) Let consider a sample dataset have one input (X_i^2) and one output (Y_i^2) and number of samples 4. Develop a simple linear regression model using ADAGRAD optimizer

Sample (i)	x_i^a	y_i^a
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

Do manual calculations for two iterations with first two samples.

Sol) Step-1: epochs=2, m=1, c=-1, G_m=G_c=0, η=0.1, $\varepsilon=10^{-8}$

Step-2: iter=1

Step-3: sample=1

Step-4: $g_m = -(3.4-(1)(0.2)+1)0.2 = -0.84$

& $g_c = -(3.4-(1)(0.2)+1) = -4.2$

Step-5: $G_m = 0+(0.84)^2 = 0.7056$

$G_c = 0+(4.2)^2 = 17.64$

Step-6: $\Delta m = \frac{-0.1}{\sqrt{0.7056 + 10^{-8}}} \times 0.8 = 0.09$

$\Delta c = \frac{-0.1}{\sqrt{17.64 + 10^{-8}}} \times -4.2 = 0.09$

Step-7: $m = m + \Delta m = 1 + 0.09 = 1.09$

$c = c + \Delta c = -1 + 0.09 = -0.91$

Step-8: sample = 1+1 = 2

Step-9: if (sample > ns)

2 > 2

else goto step-4

Step-4: $gm = -(3.8 - (1.09)(0.4) + 0.91)\ 0.4 = -1.7$

$gc = -(3.8 - (1.09)(0.4) + 0.91) = -4.27$

Step-5: $Gm = 0.7056 + (1.7)^2 = 3.54$

$Gc = 17.64 + (4.27)^2 = 35.37$

Step-6: $\Delta m = \frac{-0.1}{\sqrt{3.59 + 10^{-8}}} \times -1.7 = 0.08$

$\Delta c = \frac{-0.1}{\sqrt{35.87 + 10^{-8}}} \times 4.27 = 0.07$

Step-7: $m = m + \Delta m = 1.09 + 0.03 = 1.17$

$c = c + \Delta c = -0.91 + 0.07 = -0.84$

Step-8: sample = 2+1 = 3

Step-9: if (sample > ns) goto step-10

3 > 2

Step-10: iter = 1+1 = 2

Step-11: if (iter > epochs) goto step-12

2 > 2

else goto step 3

Step-3: sample = 1

Step-4: $gm = (-3.4 - (1.17)(0.2) + 0.84)\,0.2 = -0.8$

$gc = -(3.4 - (1.17)(0.2) + 0.84) = -4$

Step-5: $G_m = 3.59 + (-0.8)^2 = 4.23$

$G_c = 35.89 + (-4)^2 = 51.89$

Step-6: $\Delta m = \frac{-0.1}{\sqrt{4.23 + 10^{-8}}} \times -0.8 = 0.038$

$\Delta c = \frac{-0.1}{\sqrt{51.84 + 10^{-8}}} \times -4 = 0.05$

Step-7: $m = m + \Delta m = 0.038 + 1.17 = 1.208$

$c = c + \Delta c = -0.84 + 0.05 = -0.79$

Step-8: Sample = 1+1 = 2

Step-9: if (sample > ns) goto step 10

2 > 2

else goto step-4

Step-4: $g_m = -(3.8 - (1.20)(0.4) + 0.79) \times 0.4 = -1.64$

$g_c = -(3.8 - (-1.2)(0.4) + 0.79) = -4.11$

Step-5: $G_m = 4.23 + (-1.64)^2 = 6.9$

$G_c = 51.89 + (-4.11)^2 = 68.7$

Step-6: $\Delta m = \frac{-0.1}{\sqrt{6.9 + 10^{-8}}} \times -1.64 = 0.06$

$\Delta c = \frac{-0.1}{\sqrt{68.7 + 10^{-8}}} \times -4.11 = 0.04$

Step-7: $m = m + \Delta m = 1.208 + 0.06 = 1.26$

$c = c + \Delta c = -0.79 + 0.04 = -0.75$

Step-8: sample = 2+1 = 3

Step-9: if (sample > ns) goto step-10

3 > 2

else goto step 4

Step-10: iter = 2+1 = 3

Step-11: if (iter > epochs) goto step-12

3 > 2

Step-12: m = 1.26

c = -0.75