Let us consider a sample dataset have one input (x_i^a) and one input (y_i^a) & no. 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 calculation for 2 iterations with first two samples.

Step-1 : [x, y], epoches = 2, m = 1, c = -1, $G_m = 0$, $G_c = 0$

$\eta = 0.1$, $\varepsilon = 10^{-8}$

Step-2 : itr = 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 : $\Delta m = \frac{-\eta}{\sqrt{G_m + \varepsilon}} g_m$

$= \frac{-(0.1)}{\sqrt{0.7056 + 10^{-8}}} * -0.84$

$= 0.09$

Scanned with CamScanner

$$\Delta c = \frac{\pi(0.1)}{\sqrt{17.6+10^{-8}}} * 4.2 = 0.09$$

step 7 : $m = m + \Delta m = 1 + 0.09 = 1.09$

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

step 8 : sample = sample + 1

$= 1 + 1$

$= 2$

step 9 : if (sample $\geq$ ns) goto step-10

$2 > 2$

else

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 : $gm = 0.7056 + (-1.7)^2 = 3.59$

$gc = 17.64 + (-4.22)^2 = 35.87$

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

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

step-7 : $m = m + \Delta m = 1.09 + 0.08 = 1.17$

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

step-8 : sample = sample + 1

$= 2 + 1 = 3$

step-9 : if (sample $\geq$ ns) goto step-10

$3 > 2$

else

goto step-4

step-10 ; itr = itr + 1

$= 1 + 1$

$= 2$

step-11 : if (itr $\geq$ epoches.) goto step-12

$2 > 2$

else

go to step-3

step-3 : sample = 1

Scanned with CamScanner

Step-4 : $g_m = -(3.4-(1.17)(0.2)+0.84)0.2 = -0.80$

$g_c = -((3.4)-(1.17)(0.2)+0.84) = -4.0$

Step-5 : $G_m = 3.59+(-0.80)^2 = 4.23$

$G_c = 35.89+(-4.0)^2 = 51.89$

Step-6 : $\Delta m = \frac{-0.1}{\sqrt{4.23+10^{-8}}} * -0.80 = 0.038$

$\Delta c = \frac{-0.1}{\sqrt{51.89+10^{-8}}} * -4.0 = 0.05$

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 = sample +1

$= 1+1 = 2$

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

else

goto step-4

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

$g_c = -(3.8-(1.20)(0.4)+0.79) = -4.11$

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

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

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

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

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 = sample+1

$= 2+1 = 3$

Scanned with CamScanner

step-9 : if (sample > ns)
3 > 2
go to step-10
else
go to step-4

step-10 : itr = itr+1
= 2+1 = 3

step-11 : if (itr > epoches)
3 > 2
goto step-12
else
go to step-3

step-12 : m = 1.26
c = -0.75
=

Scanned with CamScanner