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Let us consider a sample dataset have one input $(x_i{}^a)$ and one input $(y_i{}^a)$ and number of sample 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 2 iterations with first two examples.

Step-1: $[x, y]$, epoches $= 2$, $m=1$, $c=1$, $G_m=0$, $G_c=0$, $\eta=0.1$, $\varepsilon=10^{-6}$.

Step-2: itr = 1

Step-3: Sample = 1

Step-4: $g_m = -(3.4 - (1)(0.2)+1)0.2 = -0.24$

$\qquad g_c = -(3.4 - (1)(0.2)+1) = -4.2$

Step-5: $G_m = 0 + (-0.24)^2 = 0.7056$

$\qquad G_c = 0 + (-4.2)^2 = 17.64$

Step-6: $\quad \Delta m = \dfrac{-\eta}{\sqrt{G_m + \varepsilon}} \, g_m$

$\qquad = \dfrac{-(0.1)}{\sqrt{0.7056 + 10^{-3}}} \times -0.84$

$\qquad = 0.09$

$\qquad \Delta c = \dfrac{-(0.1)}{\sqrt{17.64 + 10^{-8}}} \times -4.2$

$\qquad = 0.09$

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

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

Step-8: Sample = Sample + 1

$\qquad = 1 + 1$

$\qquad = 2$

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

   $2 > 2$

   else

   step-4

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

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

Step-5: $G_m = 0.7056 + (-1.7)^2 = 3.59$

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

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

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

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 > n_s) goto step-10

   $3 > 2$

   else

   goto step-4

Step-10: itr = itr + 1

   $= 1 + 1 = 2$

Step-11: if (itr > epoches) goto step-12

   $2 > 2$

   else

   goto step-3

Step-3: Sample = 1

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: $\Delta m = \dfrac{-0.1}{\sqrt{4.23 + 10^{-8}}} \times -0.80 = 0.038$

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

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

$2 > 2$

else

goto step-4

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

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

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

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

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

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

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 = Sample + 1

$= 2 + 1 = 3$

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

$3 > 2$

else

goto step-4

step-10: itr = itr + 1

$= 2 + 1 = 3$

step-11: if (itr > epoches) goto step-12

$3 > 2$

else

goto step-3

step-12: $m = 1.26 \quad c = -0.75$