Assignment - 13

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Develop a simple linear regression model using ADAGRAD optimizer for the adjacent dataset

- Do manual calculations for two iterations with the 1st two samples

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

ADAGRAD optimizer.

step 1) $[x, y]$, epochs = 2, $m=1$, $c=1$,

$G_m = G_c = 0$, $\eta = 0.1$ $\epsilon = 10^{-8}$

step 2 :- itr = 1

step 3 :- sample = 1

step 4 :- $g_m = -(y_i - mx_i - c)x_i = -0.44$

$g_c = -(y_i - mx_i - c) = -(3.4 - (1)(0.2)(-1)$

$= -2.2$

step 5 :- $G_m = G_m + (g_m)^2 = 0 + (-0.44)^2 = 0.1936$

$G_c = G_c + (g_c)^2 = 0 + (-2.2)^2 = 4.84$

step-6 :-

$$\Delta m = \frac{-\eta}{\sqrt{G_m + \epsilon}} g_m = \frac{-0.1}{\sqrt{0.1936 + 10^{-8}}} \times (-0.44)$$

$$\Delta c = \frac{-\eta}{\sqrt{G_c + \epsilon}} g_c = \frac{-0.1}{\sqrt{4.84 + 10^{-8}}} (-2.2)$$

step-7 :- $m = m + \Delta m = 1 + 0.1 = 1.1$

$c = c + \Delta c = 1 + 0.1 = 1.1$

$= 1+1 = 2$

step-9: If (sample > ns) false

$\therefore$ goto step4

step4: $gm = -(yi - mxi - c)xi$

$= -(3.8 - (1.1)(0.4) - 1.1)(0.4)$

$= -0.904$

$gc = -(yi - mxi - c)$

$= -(3.8 - (1.1)(0.4) - 1.1)$

$= -2.26.$

step-5: $Gm = Gm + (gm)^2 = 0.1936 + (-0.904)^2$

$= 1.010816$

$Gc = Gc + (gc)^2 = 4.84 + (-2.26)^2$

$= 9.9476001$

step-6: $\Delta m = \frac{-\eta}{\sqrt{Gm + \epsilon}} gm = \frac{-0.1}{\sqrt{1.010516 + 10^{-8}}} (-0.904)$

$= -0.08991509.$

$\Delta c = \frac{-\eta}{\sqrt{Gc + \epsilon}} gc = \frac{-0.1}{\sqrt{-2.26 + 10^{-8}}} (-2.26)$

$= 0.07165546$

step-7: $m = m + \Delta m = 1.1 + 0.08991505 = 1.18991504.$

$c = c + \Delta c = 1.1 + 0.07165546 = 1.17165546.$

step 8: sample $= 2+1 = 3$

step 10 iter = iter+1 = 1+1 = 2

step-11 if (iter > epochs) false
else goto step-3.

step 3:- sample = 1

step 4 $gm = -(yi - mxi - c)xi$

$= -(3.4 - (1.1899)(0.2) - 1.17165)(0.2)$

$= -0.398072.$

step 4 $gc = -(yi - mxi - c)$

$= -(3.4 - (1.899)(0.2) - 1.17165)$

$= -1.9903615$

step 5 $Gm = Gm + (gm)^2 = 1.010816 + (-0.39807)^2$

$= 1.16927756.$

$Gc = Gc + (gc)^2 = 9.946001 + (-1.99036153)^2.$

$= 13.90913903.$

step-6 $\Delta m = \frac{-\eta}{\sqrt{Gm + E}} gm = \frac{-0.1}{\sqrt{1.169 + 10^{-8}}}(-0.39807)$

$= 0.03681316$

$\Delta c = \frac{-\eta}{\sqrt{Gc + E}} gc = \frac{-0.1}{\sqrt{13.909 + 10^{-8}}}(-1.9903)$

$= 0.0533681$

Step-7 $m = m + \Delta m = 1.18991504 + 0.03681316 = 1.226786$

$c = c + \Delta c = 1.17165546 + 0.053368 = 1.225022$

Step-8 sample = 1+1 = 2.

Step-9 if (sample > n_s) no else goto step 4.

Step 4

$g_m = -(y_i - m x_i - c) x_i$

$= -(3.8 - (1.2267)(0.4) - 1.2250)(0.4)$

$= -0.83371406.$

$g_c = -(y_i - m x_i - c)$

$= -(3.8 - (1.2267)(0.4) - 1.2250$

$= -2.08428514.$

Step-5 $G_m = G_m + (g_m)^2 = 1.1692 + (-0.8337)^2$

$= 1.85435689.$

$G_c = G_c + (g_c)^2 = 18.2533836.$

Step-6

$\Delta m = \frac{-\eta}{\sqrt{G_m + \epsilon}} g_m = \frac{-0.1}{\sqrt{1.8543 + 10^{-8}}} (-0.833714)$

$= 0.06105941$

$\Delta c = \frac{-\eta}{\sqrt{G_c + \epsilon}} g_c = \frac{-0.1}{\sqrt{18.2533 + 10^{-8}}} (-2.0842)$

$= 0.04878.$

Step 7

$m = m + \Delta m = 1.226728 + 0.06105941 = 1.28778876$

$c = c + \Delta c = 1.2250235 + 0.0487849 = 1.2738084.$

Step 8 sample $2+1=3$.

Step-9 if (sample > n_s) yes, goto next step.

Step-10 iter $= 2+1=3$.

Step-11 if (iter > epochs) goto next step.

Step-12 Print (m, c)

$m = 1.28778762 \qquad c = 1.2738097.$