18K41A04C8

Assignment-13:

Let consider a sample dataset have one input (x_i^a) and one output (y_i^a), 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.

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

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

Step 2: iter $= 1$

Step 3: sample $= 1$

Step 4: $g_m = -(y_i - mx_i - c)x_i = -(3.4 - (1)(0.2) + 1)(0.2)$

$g_m = -0.84$

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

$g_c = -4.2$

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

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

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

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

$\Delta m = 0.09$

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

$\Delta c = 0.09$

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 > ns)

2 > 2

goto step 10

else

goto step 4.

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

$g_m = -1.709$

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

$g_c = -4.274$

Step 5 : $G_m = 0.7056 + (-1.709)^2$

$G_m = 3.626$

$G_c = 17.64 + (-4.274)^2$

$G_c = \cancel{35.8}\ 35.9$

Step 6 : $\Delta m = \dfrac{-0.1}{\sqrt{3.626 + 10^{-8}}} \times (-1.709)$

$\Delta m = 0.08$

Scanned with CamScanner

$$\Delta c = \frac{-0.1}{\sqrt{35.9 + 10^{-8}}} \times (-4.274)$$

$$\Delta c = 0.07$$

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 > ns) goto step 10

$3 > 2$

else

goto step 4

Step 10 : iter = iter + 1 = 1 + 1 = 2

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

$2 > 2$

else

goto step 3

Step 3 : sample = 1

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

$g_m = -0.80$

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

$g_c = -4.0$

Step 5 : $G_m = G_m + (g_m)^2 = 3.626 + (-0.80)^2$

$G_m = 4.266$

$G_c = G_c + (g_c)^2 = 35.9 + (-4.0)^2$

$G_c = 51.9$

Step 6 : $\Delta m = \frac{-0.1}{\sqrt{4.266+10^{-8}}} \times (-0.80)$

$\Delta m = 0.038$

$\Delta c = \frac{-0.1}{\sqrt{51.9+10^{-8}}} \times (-4.0)$

$\Delta c = 0.05$

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

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

Step 8 : sample = sample + 1 = 1 + 1 = 2

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

2 > 2

else

goto step 4

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

$g_m = -1.64$

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

$g_c = -4.11$

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

$G_c = 51.9 + (-4.11)^2 = 68.7$

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

$\Delta m = 0.06$

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

$\Delta c = 0.04$

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

$m = 1.268$

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

$c = -0.75$

Step 8: sample = sample + 1 = 2 + 1 = 3

Step 9: if (sample > ns)

3 > 2 True

goto step 10

Step 10: iter = iter + 1 = 2 + 1 = 3

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

3 > 2 True

Step 12: print m, c

$m = 1.268$

$c = -0.75$