Assignment - 15.

Develop a Simple Linear Regression Model using RMSProp Optimizer by using given dataset.

* Do manual calculations for two iterations with 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

RMSprop:

Step1: [x, y], epochs = 2,

m = 1, c = -1, Em = Ec = 0,

$\eta = 0.0001$, $\gamma = 0.9$, $e = 10^{-8}$.

Sample:

x	y
0.2	3.4
0.4	3.8

Step 2: iter = 0

Step 3: Sample = 1.

Step4: $g_m = -(y_i - mx_i - c)x_i = -(3.4 - (1)(0.2) + 1)(0.2$

$= -0.84$

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

$= -4.2$

Step 5: $Em = \gamma Em + (1-\gamma)(g_m)^2 = (0.9)(0) + (1-0.7)(-0.84)^2$

$= 0.70564$.

$E_c = \gamma E_c + (1-\gamma)(g_c)^2 = (0.9)(6) + (0.1)(-4.2)^2$

$= 1.764$ //

Step 6: $\Delta m = \frac{-\eta}{\sqrt{E_m + e}} g_m = \frac{-0.0001}{\sqrt{0.7056 + 10^{-8}}} (-0.84)$

$= 0.00031623.$

$\Delta c = \frac{-\eta}{\sqrt{E_c + e}} g_c = \frac{-0.0001}{\sqrt{1.764 + 10^{-8}}} (-4.2)$

$= 0.00031623.$

Step 7: ~~Sample = 1 + 1 = 2.~~ $m = m + \Delta m = 1.00031623$

$c = c + \Delta c = -0.99968377.$

Step 8: Sample = 1 + 1 = 2.

Step 9: if (sample $\overset{2 \to 2}{>}$ ns) no.

else go to step 4.

Step 4: $g_m = -(y_i - mx_i - c)x_i = -(3.8 - (1.00031623)(0.4) + 0.99968377)(0.4)$

$= -1.75982291$ //

$g_c = -(y_i - mx_i - c) = -(3.8 - (1.00031623)(0.4) + 0.99968377)$

$= -4.31955728$ //

Step 5: $E_m = \gamma E_m + (1-\gamma)(g_m)^2$

$= (0.9)(0.7056) + (0.1)(-1.7589)^2$

$= 0.3732017.$

$E_c = \gamma E_c + (1-\gamma)(g_c)^2$

$= (0.9)(1.764) + (0.1)(-4.379)^2$

$= 3.523271043$

Step 6: $\Delta m = \frac{-\eta}{\sqrt{E_m + \epsilon}} g_m = \frac{-0.0001}{\sqrt{0.3732 + 10^{-8}}}(-1.7598)$

$= 0.00028807.$

$\Delta c = \frac{-\eta}{\sqrt{E_m + \epsilon}} g_c = \frac{-0.0001}{\sqrt{0.3732 + 10^{-8}}}(-4.379)$

$= 0.00028439$

Step 7: $m = m + \Delta m = 1.00031623 + 0.00028807 = 1.0006043$

$c = c + \Delta c = -0.99968377 + 0.00028439 =$

$= -0.99944938$

Step 8: Sample = 2+1 = 3.

Step 9: if (sample > n_s) $3 > 2$ → go to step 10.

Step 10: iter = 1+1 = 2.

Step 11: if (iter > epochs) $2 > 2$ no

else goto step 3.

Step 3: Sample = 1

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

$= -(3.8 - (1.0006043)(0.4) + 0.99944)(0.4)$

$= -0.8398657$

$g_c = -(y_i - mx_i - c) =$

$= -(3.8 - (1.0006043)(0.4) + 0.99944)$

$= -4.19932852$

Step 5: $E_m = \gamma E_m + (1-\gamma)(g_m)^2$

$= (0.9)(0.373) + (0.1)(-0.8398)^2$

$= 0.40641894$

$E_c = \gamma E_c + (1-\gamma)(g_c)^2$

$= (0.9)(3.5232) + (0.1)(-4.1993)^2$

$= 4.93432539$

Step 6: $\Delta m = \frac{-\eta}{\sqrt{E_m + \epsilon}} g_m = \frac{-0.0001}{\sqrt{0.40641 + 10^{-8}}}(-0.839)$

$= 0.00013714$

$\Delta c = \frac{-\eta}{\sqrt{E_c + \epsilon}} g_c = \frac{-0.0001}{\sqrt{3.5232 + 10^{-8}}}(-4.1993)$

$= 0.00013714$ // 0.00018905 //

Step 7: $m = m + \Delta m = 1.0006043 + 0.00013714$

$= 1.00073604$

$c = c + \Delta c = -0.9994449 + 0.00018905$

$= -0.99926034$

Step 8: Sample = 1+1 = 2.

Step 9: if (sample > 2) no

else goto step 4.

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

$= -(3.8 - (1.00073604)(0.4) + 0.99926034)$

(0.4)

$= -1.75958637$

$g_c = -(y_i - mx_i - c)$

$= -(3.8 - (1.00073604)(0.4) +$

$0.99926034)$

$= -4.39896592$

Step 5: $E_m = \gamma E_m + (1-\gamma)(g_m)^2$

$= (0.9)(0.40064) + (0.1)(-1.7595)^2$

$= 0.67539147$ //

$E_c = \gamma E_z + (1-\gamma)(g_c)^2$

$= (0.9)(4.9343) + (0.1)(-4.3984)^2$

$= 6.37598297.$

Step 6: $\Delta m = \frac{-\eta}{\sqrt{\epsilon_m + \epsilon}} g_m = \frac{-0.0001}{\sqrt{0.67539147 + 10^{-8}}} (-1.7595\ 8637)$

$= 0.00021441$ //

$\Delta c = \frac{-\eta}{\sqrt{E_c + \epsilon}} g_c = \frac{-0.0001}{\sqrt{6.37598 + 10^{-8}}} (-4.3989)$

$= 0.00017421$ //

Step 7: $m = m + \Delta m = 1.00073604 + 0.00021441$

$= 1.00095045$

$c = c + \Delta c = -0.99926034 + 0.00017421$

$= -0.99908612$ //.

Step 8: Sample $= 2 + 1 = 3.$

Step 9: if $(\text{sample}^{3} > n_s^{2})$ yes $\Rightarrow$ goto step 10.

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

Step 11: if $(\text{iter}^{3} > \text{epochs}^{2})$ go to next step

step 12 : print(m, c)

m = 1.00095015

c = -0.99908612