Assignment-15

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Develop a simple linear regression model using Rmsprop optimizer by using given dataset.

* Do manual calculations for two iterations with two samples

Sample	Xi	Yi
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

Rmsprop

step-1: [x, y], epochs=2,

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

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

step-2: for i=1. step 3: sample=1

step-4: $gm = -(yi - mxi - c)xi = -(3.4 - (1)(0.2) + 1)(0.2)$

$= -0.84.$

$gc = -(yi - mxi - c) = (-3.4 - (1)(0.2) + 1)$

$= -4.2$

step-5: $Em = \gamma Em + (1-\gamma)(gm)^2 = (0.9)(0) + (-0.9)(-0.84)^2$

$= 0.705611$

$Ec = \gamma Ec + (1-\gamma)(gc)^2 = (0.9)(0) + 0.1(-4.2)^2$

$= 1.764.$

step-6 $\Delta m = \frac{-\eta}{\sqrt{Em+\epsilon}} gm = \frac{-0.0001}{\sqrt{0.7056+10^{-8}}} (-0.84)$

$= 0.00031623.$

$\Delta c = \frac{-\eta}{\sqrt{Ec+\epsilon}} gc = \frac{-0.0001}{\sqrt{1.764+10^{-8}}} (-4.2)$

$= 0.00031623.$

step-7 $m = m + \Delta m = 1.0031623$

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

step-8 sample = 1+1=2.

step-9 If (sample > ns) NO

else goto step 4.

step-4 $gm = -(yi - mxi - c)xi = -(3.8 - (1.0003162)$

$(0.4) + 0.99968377)(0.4)$

$= -1.75982291$

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

$= -(3.8 - (1.00031623)(0.4) + 0.999683$

$= -4.39955728.$

step-5 $Em = \gamma Em + (1-\gamma)(gm)^2$

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

$= 0.37320167$

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

$$= (0.9)(1.764) + (0.1)(-4.399)^2$$

$$= 3.5232104.$$

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

$$= 0.00028807$$

$$\Delta c = \frac{-\eta}{\sqrt{E_m + \varepsilon}} g_c = \frac{-0.0001}{\sqrt{0.3732 + 10^{-8}}} (-4.399)$$

$$= 0.00023439.$$

Step-7: $m = m + \Delta m = 1.00031623 + 0.00028807.$

$$= 1.000604.$$

$$c = c + \Delta c = -0.99968337 + 0.00023439.$$

$$= -0.99944938$$

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

Step-9: If (sample > n_s)

goto step10.

Step-10: Epoch = 1+1 = 2.

Step-11: If (Epoch > epochs) no

else goto step3.

step-3rd Sample = 1

step-4th $gm = -(y_i - mx_i - c)x_i$

$= -(3.8 - (1.0006043)(0.4) + 0.999444)(0.4)$

$= -0.8398657$

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

$= -(3.8 - (1.0006043)(0.4) + 0.999444)$

$= -4.19932852$

step-5th $Em = \gamma Em + (1-\gamma)(gm)^2$

$= (0.9)(0.343) + (0.1)(-0.8398)^2$

$= 0.4064189$

$Ec = \gamma Ec + (1-\gamma)(gc)^2$

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

$= 4.93432539$

step-6th $\Delta m = \frac{-\eta}{\sqrt{Em + \epsilon}} gm = \frac{-0.0001}{\sqrt{0.4064 + 10^{-8}}}(-0.839)$

$= 0.00013714$

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

$= 0.00018905$

Step 7: $m = m + \Delta m = 1.00060453 + 0.00013714$

$= 1.00073604$

$c = c + \Delta c = -0.99914449 + 0.00018905$

$= -0.99926034$.

Step 8: sample = 1 + 1 = 2

Step-9: If (sample > n_s) no

else goto step 4

Step 10: $gm = -(y_i - mx_i - c)x_i$

$= -(3.8 - (1.00073604)(0.4) + 0.99926$
$(0.4$

$= -1.75958637$

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

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

$= -4.39896592$.

Step 5: $Em = 0.9Em + (1-0.9)(gm)^2$

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

$= 0.67539147$.

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

$$= (0.9)(4.9343) + (0.1)(-4.3989)^2$$

$$= 6.37598297$$

step-6 $\Delta m = \frac{-\eta}{\sqrt{E_m + \varepsilon}} g_m = \frac{-0.0001}{\sqrt{0.6753914 + 10^{-8}}} (-1.75863)$

$$= 0.0002144$$

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

$$= 0.0001742$$

step-7 $m = m + \Delta m = 1.00073604 + 0.0002144$

$$= 1.0009504$$

$$c = c + \Delta c = -0.99926034 + 0.0001742$$

$$= -0.99908612$$

step-8 sample = 2+1 = 3

step-9 if (sample > n) yes ⇒ goto step 6.

step-10 epoch = 2+1 = 3

step-11 if (epoch > epochs) goto next step

print (m, c)

$m = 1.00095015$

$c = -0.99908612$