

Let us consider a sample dataset have one input x_i^a and one output y_i^a and number of samples n . Develop a simple linear regression model using RMS prop 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 samples

Step 1: $[x, y]$, $\eta = 0.1$, epochs = 2, $m = 1$, $c = -1$, $\beta = 0.9$, $E_m = E_c = 0$, $\epsilon = 10^{-8}$

Step 2: $\text{itr} = 1$

Step 3: $\text{sample} = 1$

Step 4: $g_m = -(3.4 - (1)(0.2) + 1)(0.2) = -0.84$
 $g_c = -(3.4 - (1)(0.2) + 1) = -4.2$

Step 5: $E_m = (0.9)(0) + (1 - 0.9)(-0.84)^2 = 0.07$
 $E_c = (0.9)(0) + (1 - 0.9)(-4.2)^2 = 1.764$

Step 6: $\Delta m = \frac{-0.1}{\sqrt{0.07 + 10^{-8}}} \times -0.84 = 0.31$

$\Delta c = \frac{-0.1}{\sqrt{1.764 + 10^{-8}}} \times -4.2 = 0.31$

Step 7: $m = m + \Delta m = 1 + 0.31 = 1.81$
 $c = c + \Delta c = -1 + 0.31 = -0.69$

Step 8: $\text{sample} = \text{sample} + 1 = 1 + 1 = 2$

Step 9: if (sample $>$ ns) goto step-10
 $3 > 2$

else
 goto step-4

$$\text{Step 4 :- } g_m = -(3.8 - (1.31)(0.4) + 0.69)(0.4) = -1.5$$

$$g_c = -(3.8 - (1.31)(0.4) + 0.69) = -3.9$$

$$\text{Step 5 :- } E_m = (0.9)(0.07) + (0.1)(-1.5)^2 = 0.28$$

$$E_c = (0.9)(1.76) + (0.1)(-3.9)^2 = 3.1$$

$$\text{step 6 :- } \Delta m = \frac{-0.1}{\sqrt{0.28 + 10^{-8}}} \times -1.5 = 0.28$$

$$\Delta c = \frac{-0.1}{\sqrt{3.1 + 10^{-8}}} \times -3.9 = 0.22$$

$$\text{step 7 :- } m = m + \Delta m = 1.31 + 0.28 = 1.59$$

$$c = c + \Delta c = -0.69 + 0.22 = -0.47$$

$$\text{Step 8 :- } \text{sample} = \text{sample} + 1 = 2 + 1 = 3$$

$$\text{step 9 :- } \text{if } (\text{sample} > ns) \text{ goto step-10}$$

$$3 > 2$$

else

step-4

$$\text{step-10 :- } ita = ita + 1$$

$$= 1 + 1 = 2$$

$$\text{step-11 :- } \text{if } (ita > \text{epochs})$$

goto step-12

else

goto step-3

$$\text{step-3 :- } \text{sample} = 1$$

$$\text{step 4 :- } g_m = -(3.4 - (1.59)(0.2) + 0.47)(0.2) = -0.7$$

$$g_c = -(3.4 - (1.59)(0.2) + 0.47) = -3.5$$

$$\text{step 5 :- } E_m = (0.9)(0.28) + (0.1)(-0.7)^2 = 0.3$$

$$E_c = (0.9)(3.1) + (0.1)(-3.5)^2 = 4.0$$

$$\text{step 6 :- } \Delta m = \frac{-0.1}{\sqrt{0.3 + 10^{-8}}} \times -0.7 = 0.12$$

$$\Delta c = \frac{-0.1}{\sqrt{4.0 + 10^{-8}}} \times -3.5 = 0.17$$

$$\text{step-7: } m = m + \Delta m = 1.59 + 0.12 = 1.71$$

$$c = c + \Delta c = -0.47 + 0.17 = -0.3$$

$$\text{step-8: } \text{sample} = \text{sample} + 1 \\ = 1 + 1 = 2$$

$$\text{step-9: } \text{if}(\text{sample} > \text{ns}) \\ \quad \gg \text{goto step-10} \\ \text{else} \\ \quad \text{goto step-4}$$

$$\text{step-4: } g_m = -(3.8 - (1.71)(0.4) + 0.3) \times 0.4 = -1.4 \\ g_c = -(3.8 - (1.71)(0.4) + 0.3) = -3.6$$

$$\text{step-5: } E_m = (0.9)(0.3) + (0.1)(-1.4)^2 = 0.46 \\ E_c = (0.9)(4.0) + (0.1)(-3.6)^2 = 4.89$$

$$\text{step-6: } \Delta m = \frac{-0.1}{\sqrt{0.46 + 10^{-8}}} \times -1.4 = 0.2$$

$$\Delta c = \frac{-0.1}{\sqrt{4.89 + 10^{-8}}} \times -3.6 = 0.16$$

$$\text{step-7: } m = m + \Delta m = 1.71 + 0.2 = 1.91 \\ c = c + \Delta c = -0.3 + 0.16 = -0.14$$

$$\text{step-8: } \text{sample} = \text{sample} + 1 \\ = 2 + 1 = 3$$

$$\text{step-9: } \text{if}(\text{sample} > \text{ns}) \\ \quad \gg \text{goto step-10}$$

$$\text{else} \\ \quad \text{goto step-4}$$

$$\text{step-10: } \text{itr} = \text{itr} + 1 \\ = 2 + 1 = 3$$

$$\text{step-11: } \text{if}(\text{itr} > \text{epochs}) \\ \quad \gg \text{goto step-12}$$

$$\text{else} \\ \quad \text{go to step-3}$$

$$\text{step-12: } m = 1.91 \\ c = -0.14$$