

Assignment - 15

Let us consider a sample dataset have one input (x_i^q) & one output (y_i^q) & no. of samples are 4.

Develop a simple linear regression model using RMS prop optimizer.

| Sample (i) | x_i^q | y_i^q |
|------------|---------|---------|
| 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, $m = 1$, $c = -1$, $\epsilon = 0$
 $E_m = E_c = 0$, $\epsilon = 10^{-8}$

Step-2: itr = 1

Step-3: 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: $\Delta m = \frac{-0.1}{\sqrt{0.07 + 10^{-8}}} * -0.84 = 0.31$

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

$$\text{step-7: } m = m + \Delta m = 1 + 0.31 = 1.31$$

$$c = c + \Delta c = -1 + 0.31 = -0.69$$

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

step-9: if (sample \geq ns) goto step-10
 else
 goto step-4

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

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

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

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

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

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

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

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

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

step-9: if (sample \geq ns) goto step-10
 else
 step-4

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

step-11: if (itr $>$ epochs)
 goto step-12
 else goto step-3

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

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

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

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

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

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

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

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

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

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

$$= 1 + 1 = 2$$

$$\text{Step-9: } \text{if}(\text{sample} > ns)$$

go to step-10

else

go to step-4

$$\text{Step-4: } g_m = -(3.8 - (1.71)(0.4) + 0.3) * 0.4 = -1.4$$

$$g_c = -(3.8 - (1.71)(0.4) + 0.3) = -3.6$$

$$\text{Step-5: } E_m = (0.9)(0.3) + (0.1)(-1.4)^2 = 0.46$$

$$E_c = (0.9)(4.0) + (0.1)(-3.6)^2 = 4.89$$

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

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

$$\text{Step-7: } m = m + \Delta m = 1.71 + 0.2 = 1.91$$

$$c = c + \Delta c = -0.3 + 0.16 = -0.14$$

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

step-9: if ($\text{sample} > \text{ns}$)
 $3 > 2$
go to step-10
else
go to step-4

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

step-11: if ($\text{itr} > \text{epoches}$)
 $3 > 2$ go to step-12
else
go to step-3

step-12: $m = 1.91$
 $c = -0.14$