# Assignment-15

18K41A0574

Let us consider a simple dataset have one input ($x_i^2$) and one output ($y_i^2$) and number of samples 4. Develop a simple linear regression model using RMSprop 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.

Sol) Step-1: $x, y$, $\eta = 0.1$, epochs = 2, $m=1$, $c=-1$, $\gamma=0.9$,

$E_m = E_c = 0$, $\varepsilon = 10^{-8}$

Step-2: iter = 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: $\Delta m = \frac{-0.1}{\sqrt{0.07+10^{-8}}} \times -0.84 = 0.31$

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

Step-7: $m = m + \Delta m = 1 + 0.31 = 1.31$

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

Step-8: sample = 1+1 = 2

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

2 > 2

else goto step-4

Step-4: $gm = -(3.8 - (1.31)(0.4) + 0.69)\,0.4 = -1.5$

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

Step-5: $Em = (0.9)(0.07) + (0.1)(-1.5)^2 = 0.28$

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

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

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

Step-7: $m = m + \Delta m = 1.31 + 0.28 = 1.59$

$c = c + \Delta c = -0.69 + 0.22 = -0.97$

step-8: Sample = 2+1 = 3

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

step 10: iter = 1+1 = 2

step-11: if (iter < epochs) goto step 12
else goto step 3

step-3: Sample = 1

step-4: $g_m = -(3.4 - (1.59)(0.2) + 0.49)(0.2) = -0.7$

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

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

$E_c = (0.9)(3.1) + (0.1)(-3.5)^2 = 4$

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

$\Delta c = \frac{-0.1}{\sqrt{4 + 10^{-8}}} \times -3.5 = 0.17$

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

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

step-8: sample = 1+1 = 2

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

else goto step-4

Step-4: $gm = -(3.8 - (1.71)(0.4) + 0.3) \times 0.4 = -1.4$

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

Step-5: $Em = (0.9)(0.3) + (0.1)(-1.4)^2 = 0.46$

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

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

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

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

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

Step-8: sample = 2+1 = 3

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

3 > 2

Step-10: iter = 2+1 = 3

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

3 > 2

Step-12: $m = 1.91$

$c = -0.14$