

Assignment-13

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Let us consider a sample dataset have one input (x_i^a) and one output (y_i^a) & no. of samples. Develop a simple linear regression model using ADAGRAD 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 calculation for 2 iterations with first two samples.

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

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: $G_m = 0 + (-0.84)^2 = 0.7056$

$$G_c = 0 + (-4.2)^2 = 17.64$$

Step-6: $\Delta m = \frac{-\eta}{\sqrt{G_m + \epsilon}} g_m$

$$= \frac{-(0.1)}{\sqrt{0.7056 + 10^{-3}}} * -0.84$$

$$= 0.09$$

$$\Delta C = \frac{-(0.1)}{\sqrt{17.6 + 10^{-8}}} * 4.2 = 0.09$$

$$\text{step-7: } m = m + \Delta m = 1 + 0.09 = 1.09$$

$$c = c + \Delta C = -1 + 0.09 = -0.91$$

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

$$= 1 + 1$$

$$= 2$$

step-9: if (sample \geq ns)
 $\frac{2}{2} \geq 2$ goto step-10
 else
 step-4

$$\text{step-4: } g_m = -(3.8 - (1.09)(0.4) + 0.91)0.4 = -1.7$$

$$g_c = -(3.8 - (1.09)(0.4) + 0.91) = -4.27$$

$$\text{step-5: } q_m = 0.7056 + (-1.7)^2 = 3.59$$

$$q_c = 17.64 + (-4.27)^2 = 35.87$$

$$\text{step-6: } \Delta m = \frac{-0.1}{\sqrt{3.59 + 10^{-8}}} * -1.7 = 0.08$$

$$\Delta C = \frac{-0.1}{\sqrt{35.87 + 10^{-8}}} * -4.27 = 0.07$$

$$\text{step-7: } m = m + \Delta m = 1.09 + 0.08 = 1.17$$

$$c = c + \Delta C = -0.91 + 0.07 = -0.84$$

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

$$= 2 + 1 = 3$$

step-9: if (sample \geq ns)
 $\frac{3}{2} \geq 2$ goto step-10
 else
 goto step-4

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

$$= 1 + 1$$

$$= 2$$

step-11: if (itr \geq epochs)
 $\frac{2}{2} \geq 2$ goto step-12
 else
 goto step-3

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

$$\text{Step-4: } g_m = -(3.4 - (1.17)(0.2) + 0.84)0.2 = -0.80$$

$$g_c = -(3.4 - (1.17)(0.2) + 0.84) = -4.0$$

$$\text{Step-5: } G_m = 3.59 + (-0.80)^2 = 4.23$$

$$G_c = 35.89 + (-4.0)^2 = 51.89$$

$$\text{Step-6: } \Delta m = \frac{-0.1}{\sqrt{4.23 + 10^{-8}}} * -0.80 = 0.038$$

$$\Delta c = \frac{-0.1}{\sqrt{51.89 + 10^{-8}}} * -4.0 = 0.05$$

$$\text{Step-7: } m = m + \Delta m = 0.038 + 1.17 = 1.208$$

$$c = c + \Delta c = -0.84 + 0.05 = -0.79$$

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

$$= 1 + 1 = 2$$

$$\text{Step-9: } \text{if (sample} \geq \frac{n}{2}) \text{ goto step-10}$$

$$\text{else}$$

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

$$\text{Step-4: } g_m = -(3.8 - (1.20)(0.4) + 0.79) * 0.4 = -1.64$$

$$g_c = -(3.8 - (1.20)(0.4) + 0.79) = -4.11$$

$$\text{Step-5: } G_m = 4.23 + (-1.64)^2 = 6.9$$

$$G_c = 51.89 + (-4.11)^2 = 68.7$$

$$\text{Step-6: } \Delta m = \frac{-0.1}{\sqrt{6.9 + 10^{-8}}} * -1.64 = 0.06$$

$$\Delta c = \frac{-0.1}{\sqrt{68.7 + 10^{-8}}} * -4.11 = 0.04$$

$$\text{Step-7: } m = m + \Delta m = 1.208 + 0.06 = 1.26$$

$$c = c + \Delta c = -0.79 + 0.04 = -0.75$$

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

$$= 2 + 1 = 3$$

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

step-10 : itr = itr + 1
= 2 + 1 = 3

step-11 : if (itr > epochs)
3 > 2
go to step-12
else go to step-3

step-12 : m = 1.26
c = -0.75
= 0