

Assignment - 13:

Let us consider a sample dataset have one input (x_i) and one output (y_i) and number of samples 4. Develop a simple linear regression model using ADAGRAD optimize

Sample	x_i	y_i
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 2 samples

step 1:- (x, y) ; epochs = 2, $m = 1$, $c = -1$, $g_m = g_c = 0$, $\eta = 0.1$, $\epsilon = 10^{-8}$

step 2:- iter = 1

step 3:- sample = 1

$$\text{step 4:- } g_m = -(3.4 - (-1)(0.2) + 1)0.2 = -0.84$$

$$g_c = -(3.4 - (-1)(0.2) + 1) = -4.2$$

$$\text{step 5:- } G_m = 0 + (-0.84)^2 = 0.7086$$

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

$$\text{step 6:- } \Delta m = \frac{-\eta}{\sqrt{G_m + \epsilon}} g_m = \frac{-0.1}{\sqrt{0.7086 + 10^{-8}}} \times 0.8 = 0.09$$

$$\Delta c = \frac{-(0.1)}{\sqrt{17.64 + 10^{-8}}} \times -4.2$$

$$\Delta c = 0.09$$

$$7. m = m + \Delta m = 1 + 0.09 = 1.09$$

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

$$8. \text{Sample} = \text{sample} + 1$$

$$= 2$$

$$9. \text{if (sample} > n_s) \quad 2 > 2$$

goto next step 10

else

goto step 4

xi	xi^2	sign
+0.8	0.64	1
+0.8	0.64	1
+0.8	0.64	1
+0.8	0.64	1
+0.8	0.64	1

$$4. g_m = -(3.8 - (1.09)(0.4) + 0.91)(0.4) = -1.7$$

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

$$5. E_m = 0.70 + (-1.7)^2 = 3.59$$

$$E_c = 17.64 + (-4.27)^2 = 35.37$$

$$6. \Delta m = \frac{-0.1}{\sqrt{35.4 \times 10^8}} \times -1.7 = 0.08$$

$$\Delta c = \frac{-0.1}{\sqrt{35.8 \times 10^8}} \times -4.27 = 0.07$$

$$7. m = m + \Delta m = 1.09 + 0.08 = 1.17$$

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

$$8. \text{Sample} = \text{sample} + 1 = 3$$

$$9. \text{if (sample} > n_s) \quad 3 > 2$$

go to next step

else

goto step 2

10. iter + 1 = 2

11. if (iter > epochs)

goto step 12

else

goto step 3

3. sample = 1

$$4. g_m = -(3.4 - (1.17)(0.2) + 0.84)0.2 = -0.80$$

$$g_c = -(13.4 - (1.17)(0.2) + 0.84) = -4.0$$

$$5. G_m = 3.59 + (-0.80)^r = 4.23$$

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

$$6. \Delta m = \frac{-0.1}{\sqrt{4.23 + 10^8}} \times -0.80 = 0.038$$

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

$$7. m = m + \Delta m = 0.038 + 1.17 = 1.208$$

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

8. if (samples > ns)

goto step 9

else

goto step 4

$$4. q_m = -(3.8 - (1.20)(0.4) + 0.79)0.4 = -1.64$$

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

$$5. q_m = 4.23 + (-1.64)^2 = 6.9$$

$$q_c = 57.89 + (-4.11)^2 = 68.7$$

$$6. \Delta m = \frac{-0.1}{\sqrt{6.9 + 10^8}} \times -1.64 = 0.06$$

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

$$7. m = m + \Delta m = 1.708 + 0.06 = 1.26$$

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

$$8. \text{sample} = \text{sample} + 1 = 3$$

$$9. \text{if } (\text{sample} > \text{ns})$$

goto step 10

else

goto step 1

$$10. \text{iter} + 1 = 3$$

$$11. \text{if } (\text{iters} \geq \text{epochs})$$

goto next step

else

goto step 3

$$12. m = 1.76$$

$$c = -0.75$$