

ASSIGNMENT-9

12/11/2021

Let consider a sample dataset have one input (x_i^a) and one output (y_i^a), and number of samples 4, develop a simple linear regression model using Momentum optimizer.

Samples (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

Manual calculations:

step 1: $[x, y]$, $m=1$, $c=-1$, $\eta=0.1$, $\beta=0.9$, epochs=2.
 $v_m = v_c = 0$

step 2: $itr = 1$

step 3: samples = 1

step 4: $E = \frac{1}{2} (y_i - mx_i - c)^2$

$$\frac{\partial E}{\partial m} = -(3.4 - (1)(0.2) + 1)(0.2) = -0.84$$

$$\frac{\partial E}{\partial c} = -(3.4 - (1)(0.2) + 1) = -4.2$$

Step 5: $\Delta m = \gamma \Delta m - \gamma \frac{\partial E}{\partial m}$

$$= (0.9)(0) - (0.1)(-0.84) = 0.084$$

$$\Delta c = (0.9)(0) - (0.1)(4.2) = -0.42$$

Step 6: $m = 1 + 0.084 = 1.084$

$$c = -1 + 0.42 = -0.58$$

Step 7: Sample = 1+1 = 2

Step 8: If (sample > n_s)

$$2 > 2$$

goto step 4

Step 4: $\frac{\partial E}{\partial m} = -(3.8 - (1.084)(0.4) + 0.58)(0.4) = -1.57856$

$$\frac{\partial E}{\partial c} = -3.9464$$

Step 5: $\Delta m = (0.9)(0.084) - (0.1)(1.57856)$

$$= 0.08225$$

$$\Delta c = (0.9)(0.42) - (0.1)(-3.9464)$$

$$= 0.77264$$

Step 6: $m = 1.084 + 0.08225$

$$= 1.16625$$

$$c = -0.58 + 0.77264$$

$$= 0.19264$$

step 7: sample = 2 + 1 = 3

step 8: if sample > n
3 > 2

goto next step

step 9: $it = it + 1$
 $= 1 + 1 = 2$

step 10: if $(it > epochs)$
 $2 > 2$

false \rightarrow goto step 3

step 3: sample = 1

step 4:
$$\frac{\partial E}{\partial m} = -(3.4 - (1.16625)(0.2) - 0.19264)(0.2)$$
$$= (-2.97411)(0.2) = -0.59482$$

$$\frac{\partial E}{\partial c} = -2.97411$$

step 5:
$$\Delta m = (0.9)(0.08225) - (0.1)(-0.59482)$$
$$= 0.133507$$

$$\Delta c = (0.9)(0.77264) - (0.1)(-2.97411)$$
$$= 0.992787$$

step 6:
$$m = 1.16625 + 0.133507 = 1.299757$$

$$c = 0.19264 + 0.992787 = 1.185427$$

step 7: sample = 1 + 1 = 2

step 8: if (sample > ns)

$$2 > 2$$

goto step 4

step 4: $\frac{\partial E}{\partial m} = -(3.8 - (1.299757)(0.4) - 1.185427)(0.4)$
 $= -0.83786$

$$\frac{\partial E}{\partial c} = -2.09467$$

step 5: $\Delta m = (0.9)(0.133507) - (0.1)(-0.83786)$
 $= 0.20394$

$$\Delta c = (0.9)(0.992787) - (0.1)(-2.09467)$$

 $= 1.10297$

step 6: $m = 1.299757 + 0.20394$
 $= 1.503697$

$$c = 1.10297 + 1.185427$$

 $= 2.288397$

step 7: ^{sample}
 $\frac{\partial E}{\partial x} = 2 + 1 = 3$

step 8: if sample > ns
 $3 > 2$

goto next step

step 9: $\frac{\partial E}{\partial h} = 2 + 1 = 3$

step 10: if (ih > goch) $3 > 2$
goto next step

step 11: print m, c
 $m = 1.503697$
 $c = 2.288397$

step 12: MSE

$$= \frac{(2.5891364) + (2.889875)}{2}$$
$$= 2.7395061$$