Assignment - 9

let consider a sample dataset have 1 input (X_i^a) and 1 output (y_i^a) and number of samples 4. Develop a simple linear regression model using momentum 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 2 iterations with first 2 samples

Step1 :- [x, y], m=1, c=-1, η=0.1, epoches = 2, γ=0.9

$v_m = v_c = 0$; ns = 2.

Step 2 :- iter = 1

Step 3 :- sample = 1

Step 4:- $g_m = \frac{\partial E}{\partial m} = -(y_i - mx_i - c)x_i$

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

$= -0.84$

$g_c = \frac{\partial E}{\partial c} = -(y_i - mx_i - c)$

$= -(3.4 - 0.2 + 1)$

$= -4.2$

Step 5 :- $v_m = \gamma v_m - \eta g_m$

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

$= 0 - 0.084$

$= -0.084$

$v_c = \gamma v_c - \eta g_c$

$= 0.9 \times 0 - (-0.1)(-4.2)$

$= -0.42$

Step 6 :- $m = m + v_m = 1 + (-0.084) = 0.916$

$c = c + v_c = -1 - 0.42 = -1.42$

Step 7:- sample = sample + 1

= 1 + 1 = 2.

Step 8 :- if (sample > ns) goto step 9
2 > 2

else step 4

Step 4 :- $g_m = \frac{\partial E}{\partial m} = -(3.8 - (0.916)(0.4) + 1.42)(0.4)$

$= -1.941.$

$g_c = \frac{\partial E}{\partial c} = -4.853$

Step 5 :- $v_m = \gamma v_m - \eta g_m$

$= (0.9)(-0.084) - [-0.1 \times -1.941]$

$= -0.0756 - 0.1941$

$= -0.2697$

$v_c = \gamma v_c - \eta g_c$

$= (0.9)(-0.42) - [-0.1 \times -4.853]$

$= -0.378 - 0.485$

$= -0.863$

Step 6 :- $m = m + v_m = 0.916 + (-0.2697) = 0.6463$

$c = c + v_c = -1.42 - 0.863 = -2.283$

Step7 :- sample = sample+1

= 2+1=3

Step8 :- if (sample > ns) goto step 9
3 >2

else goto step 4

step9 :- iter = iter+1

= 1+1 = 2

step10 :- if (iter > epoches) goto step 11

else goto step 3

step3 :- sample = 1

step 4 :- $g_m = \frac{\partial E}{\partial m} = -(3.4 - (0.646)(0.2) + 2.283)(0.2)$

$= -1.110$

$g_c = \frac{\partial E}{\partial c} = -(3.4 - (0.646)(0.2) + 2.283)$

$= -5.553$

step5 :- $v_m = \gamma v_m - \eta g_m$

$= (0.9)(-0.2697) - [-0.1 \times -1.110]$

$= -0.353$

Step 5 $v_c = \gamma v_c - \eta g_c$

$= (0.9)(-0.863) - [-0.1 \times -5.553]$

$= -1.332$

Step 6 :- $m = m + v_m = 0.6463 + (-0.353) = 0.293$

$c = c + v_c = -2.283 - 1.332 = -3.615$

Step 7 :- Sample = sample + 1

$= 1 + 1 = 2$

Step 8 :- if (sample > ns) goto step 9

$2 > 2$

else goto step 4

Step 4 : $g_m = -(3.8 - (0.293)(0.4) + 3.615)(0.4)$

$= -2.919$

$g_c = -(3.8 - [0.293)(0.4) + 3.615)$

$= -7.297$

Step 5 :- $v_m = (0.9)(-0.353) - [-0.1 \times -2.919]$

$= -0.6096$

$v_c = (0.9)(-1.332) - [-0.1 \times -7.297]$

$= -1.9285$

Step 6 :- $m = m + \nabla m = 0.293 - 0.609 = -0.316$

$c = c + \nabla c = -3.615 - 1.928 = -5.543$

Step 7 :- Sample = Sample + 1

$= 2 + 1 = 3$

Step 8 :- if (Sample > ns) goto step 9

$3 > 2$

else : goto step 4

Step 9 :- iter = iter + 1

$= 2 + 1 = 3$

Step 10 :- if (iter > epoches) goto step 11

$3 > 2$

else goto step 3

Step 11 :- print m, c

$m = -0.316$, $c = -5.543$.