Assignment 9

Let us consider a sample dataset have 1 input (x_i) and 1 output (y_i) and number of samples 4. Develop a simple linear regression model using momentum optimiser

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 a 2 iterations with first 2 samples.

step 1 :- [x, y], m = 1, c = -1, epochs = 2, $\gamma = 0.9$, $v_m = v_c = 0$, $n_s = 2$

step 2 : iter = 1

step 3 : sample = 1

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

$= -(2.4 - (1)(0.2) + 1)(0.2)$

$= -0.84$

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

$= -(2.4 - 1(0.2) + 1)$

$= -4.2$

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 : $m = m + v_m = 1 + (-0.84) = -0.916$

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

step 7 : sample = sample + 1

$= 1 + 1 = 2$

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

else : goto step 4

$2 > 4$

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

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

$= -0.2697$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.863$

step 6 : $m = m + v_m = 0.916 + (-0.2697) = 0.1 \times -4.85$

$= 0.6463$

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

step 7 : sample = sample + 1

$= 2 + 1$

$= 3$

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

else : goto step 4

step 9 : iter = iter + 1

= 1 + 1 = 2

step 10 : if (itr > epochs) goto step 4

else goto step 3

step 3 : sample = 1

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

$= -1.110$

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

$= -5.553$

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

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

$= -0.353$

$v_c = \gamma v_c - \eta g_c$

$= (0.9)(-0.863) - [-0.1 \times -5.53]$

$= -1.332$

step 6 : $m = m + v_m \Rightarrow 0.6463 + (-0.353) = 0.293$

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

step 7 : sample = sample + 1

= 1 + 1

= 2

step 8 : if (sample > ns) goto step 9
2 > 2
else goto step 4

step 4 : $gm = -(3.8 - (0.293)(0.4) + 3.615)(0.4)$

$= -2.919$

$gc = -(3.8 - (0.293)(0.4) + 3.615)$

$= -7.297$

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 : $m = m + v_m \Rightarrow 0.293 - 0.609 = -0.316$

$c = c + v_c \Rightarrow -3.615 - 1.928 = -5.543$

step 7 : sample = sample + 1

$= 2 + 1$

$= 3$

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

else goto step 4

step 9 : iter = iter + 1

$= 2 + 1 = 3$

step 10: if (iter > epochs) . goto step 11

else goto step 3

step 11: print m, c

m = -0.316 , c = -5.543