Assignment - 9

let us consider a sample dataset Have 1 input (x_i) and one 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 2 Iterations with 1st 2 samples

step1 : [x, y] $m=1, c=-1, \eta=0.1$, epochs = 2, $\gamma=0.9$, $v_m = v_c = 0$, $n_{samples}$

step2 : iter = 1

step3 : sample = 1

step4 : $g_m = \frac{\partial E}{\partial m} = -(y_i - mx_i - c)x_i$

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

$= -0.84$

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

$= -(3.4 - 0.2 + 1)$

$= -4.2$

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

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

$= 0 - 0.084$

$= -0.084$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.42$

step6: $m = m + v_m = 1 + (-0.84) = 0.916$

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

step7: sample $+= 1$

$= 1 + 1 \Rightarrow 2$

step8: if (sample $>$ ns) : goto step9

$2 > 2$

else : goto step4

step4: $g_m = \frac{\partial E}{\partial m} = -(3.8 - (0.916)(0.4) + 1.42)(0.4)$

$= -1.941$

step5: $g_c = \frac{\partial E}{\partial c} = -4.853$

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

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

$= -0.2697$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.863$

step6: $m = m + v_m = 0.916 + (-0.2697) = 0.6463$

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

step7: sample = sample + 1

$= 2 + 1 \Rightarrow 3$

step8: if (sample $>$ ns) : goto step9

else : goto step4

step9: iter $+= 1$

$\Rightarrow 1 + 1 = 2$

step10: if (iter $>$ epochs) goto step4

else : goto step3

step 3: sample = 1

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

$= -1.110$

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

$= -5.553$

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

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

$= -0.353$

$v_c = \gamma v_c - \eta g_c$

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

$= -1.332$

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 += 1

$\Rightarrow 1 + 1 = 2$

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

step 4: $g_m = -(3.8 - (0.293)(0.4) + 3.615)(0.4) \Rightarrow -2.919$

$g_c = -(3.8 - (0.293)(0.4) + 3.615) \Rightarrow -7.297$

step 5: $v_m = (0.9)(-0.353) - [-0.1 \times -2.919] \Rightarrow -0.6096$

$v_c = (0.9)(-1.332) - [-0.1 \times -7.297] \Rightarrow -1.9285$

step 6: $m += v_m \Rightarrow 0.293 - 0.609 = -0.316$

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

step 7: sample += 1 $\Rightarrow 2 + 1 = 3$

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

else: goto step 4

step9 : iter += 1

$\Rightarrow 2+1=3$

step10 : if (iter > epochs) : goto step11

$3 > 2$

else : goto step3.

step11 : print m, c

$m = -0.316, \quad c = -5.543$