Assignment-9

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

Sample (i)	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 1st 2 samples

Step 1 : [x, y], $m = 1$, $c = -1$, $\eta = 0.1$, epoches = 2, $\gamma = 0.9$, $v_m = v_c = 0$

$n_s = 2$

Step 2 : iter = 1

Step 3 : sample = 1

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

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

$= -0.84$

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

$= -(3.4 - 0.2 + 1)$

$= -4.2$

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

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

Step 7 :- sample += 1 $\Rightarrow 1+1 = 2$

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

$2 > 2$

else : go to step 4

Step 4 : $g_m = \frac{\partial E}{\partial m} = (3.8 - (0.916)(0.4) + 0.42)(0.4)$

$= -1.941$

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

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 : $m = m + v_m = -0.916 + (-2697) = 0.6463$

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

Step 7 : sample += 1

$= 2 + 1 = 3$

Step 8 : if (sample > ns) : go to step 9

else goto step 4

Step 9 : iter = iter + 1

$1+1 = 2$

Step 10 : if (iter > epoches) goto step 9

else : go to step 3

Step 3 = sample = 1

Step 4 = $g_m = \frac{\partial E}{\partial c} = -(3.4 - (0.646)(0.2)(2.283)(0.2)$

$= -1.110$

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

$= -5.553$

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

$= (0.9)(-2697) - [-0.1 \times -1.110]$

$= -0.353$

$v_c = \gamma v_c - \eta g_c$

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

$= -1.332$

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 = Sample + 1

$= 1 + 1 = 2$

Step 8 : if (sample > ns) : go to step 4

$2 > 2$

else : go to 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 : $v_m = (0.9)(-0.353) - [-0.1 \times -2.919] = 0.6096$

$v_c = (0.9)(-1.332) - [-0.1 \times -7.297] = -1.9255$

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

$c + = v_c = -3.615 - 1.928 = -5543$

step 7 = sample = sample + 1

2 + 1 = 3

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

else : goto step 4

Step 9: 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 = 5543