ASSIGNMENT-9

Let consider a sample dataset have one input ($x_i^{\vec{a}}$) and one output ($Y_i^{\vec{a}}$) and number of samples 4. Develop a simple linear regression model using momentum optimizer.

Sample(i)	$x_i^{\vec{a}}$	$y_i^{\vec{a}}$
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

→ Do Manual calculations for two iterations with first two samples

Step 1:- [x, Y], m=1, c=-1, epochs=100,
$\eta=0.1$, $\gamma=0.9$, $V_m=V_c=0$

Step 2: iter = 1

Step 3: sample = 1

[Note: considering stochastic Gradient descent]

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

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

$= 0 - 0.084$

$\boxed{v_m = -0.084}$

$v_c = \gamma v_c - \eta g_c = 0.9 \times 0 - (-0.1)(-4.2)$

$\boxed{v_c = -0.42}$

step 6: $m = m + v_m = 1 + (-0.84) = -0.916$

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

step 7: sample + = 1

$= 1 + 1 = 2$

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

else: goto step 4.

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

$= -1.04$

step 5 : $g_c = \frac{\partial E}{\partial c} = -4.853$

step 6 : $V_m = \gamma v_m - \eta g_m$

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

$= -0.2697$

$V_c = \gamma v_m - \eta g_m$

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

$V_c = -0.863$

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

$= 0.6463$

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

$= -2.283$

step 7 : sample = sample + 1

$= 2 + 1 \Rightarrow 3$

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

else : goto step 4

step 9 : iter + = 1

$1 + 1 = 2$

step10 : if (itr > epochs)
goto step 4
else :
goto step 3

step3 : sample = 1

step4 : $g_m = \frac{\partial E}{\partial m} = -(3.4 - (0.646)(0.2) + 2.283)(0.2)$

$= -1.110$

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

$= -5.553$

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

$= (0.9)(-0.2647) - [0.1 \times -1.110]$

$= -0.353$

$V_c = \gamma V_c - \eta g_c$

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

$= -1.332$

step6 : $m = m + V_m \Rightarrow 0.6 + 63 + (-0.353)$

$= 0.293$

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

step 7: sample+1 = 1

$\Rightarrow 1+1=2$

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

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

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

step 7: sample += 1

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

else goto step 4

step 9: iter += 1

$\Rightarrow 2+1=3$

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

else goto step 3

step 11: print m, c

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