Assignment-9.

Let us consider a sample data set have i/p (x_i) & o/p (y_i) & no. 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 1st 2 samples.

step 1: $[x, y]$, $m = 1$, $c = -1$, $\eta = 0.1$, epochs $= 2$,

$\gamma = 0.9$, $V_m = V_c = 0$, $n_s = 2$

step 2: iter = 1

step 3: sample = 1

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

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

$= -0.84$

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

$= -(3.4 - 0.2 + 1)$

$= -4.2$

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

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

$= -0.084$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.42$

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

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

step7: sample = sample + 1

= 1+1 = 2

step8: if(sample > ns)

True go to next step

False, go to step 4.

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

$= -1.941$

$g_c = +\frac{\partial E}{\partial c} = -((3.8 - (0.916)(0.4) + 1.42)$

$= -4.85$

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

$= (0.9)(-0.084) - [(-0.1)(-1.94)]$

$= -0.0756 - 0.194$

$= -0.27$

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$V_c = \gamma V_c - \eta g_c$

$= (0.9)(-0.42) - [(-0.1)(-4.85)]$

$= -0.378 - 0.48$

$= -0.86$

step 6: $m = m + V_m = 0.916 + (-0.269) = 0.646$

$c = c + \cancel{0.6} V_c = -1.42 - 0.86 = -2.28$

step 7: sample = sample + 1 = 2 + 1 = 3

step 8: if(sample > ns) True go to next step
False go to step 4

step 9: iter = iter + 1
1 + 1 = 2

step 10: if(iter > epochs) True go to next step
else step 3.

step 3: sample = 1

step 4: $g_m = \frac{\partial E}{\partial m} = -[3.4 - (0.64)(0.2) + 2.28)(0.2)]$

$= -1.11$

$g_c = \frac{\partial E}{\partial c} = -(3.4 - (0.64)(0.2) + 2.28)$

$= -5.55$

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

$= (-0.9)(-0.269) - [0.1 \times -1.11]$

$= 0.35$

$V_c = \gamma V_c - \eta g_c$

$= (0.9)(-0.83) - (0.1)(-5.53)$

$= -1.332$

step6: $m = m + V_m = 0.646 + (-0.353) = 0.293$

$c = c + V_c = -2.28 - 1.33 = -3.615$

step7: sample = sample + 1

$= 1 + 1 = 2$

step8: if (sample > n_s)

True goto next step

else goto step 4.

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

$= -2.919$

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

$= -7.29$

step5: $V_m = (0.9)(-0.353) - (0.1)(-2.919)$

$= -0.609$

$V_c = (0.9)(-1.332) - (0.1)(-7.29)$

$= -1.928$

step6: $m = m + V_m = 0.293 - 0.609 = -0.316$

$c = c + V_c = -3.615 - 1.928 = -5.54$

step7: sample = sample + 1

= 2+1 = 3

step8: if(sample > ns)

3 > 2 goto step 9

False go to step 4.

step9: iter = iter + 1

2+1 = 3

step10: if (iter > epcohs)

True go to step 11

else goto step 3.

step11: print m & c values

m = -0.316, c = -5.54