Assignment - 9

Let us consider a sample dataset have 1 input (x_i) & one output (y_i) & no of samples 4. Develop a simple linear regression 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.

Step-1: $[x, y]$ $m = 1$, $c = -1$, $\eta = 0.1$, epochs = 2, $\gamma = 0.9$

$v_m = v_c = 0$, $ns = 2$

Step-2: itr = 1

Step-3: sample = 1

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

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

$= -0.84$

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

$= -(3.4 - 0.2 + 1)$

$= -4.2$

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 + (-0.084)
= 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 : $g_m = \frac{\partial \epsilon}{\partial m}$ = -(3.8 - 10.916)(0.4) + 1.12)(0.4)
= - 1.941

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

↳ $v_m = \gamma v_m - \eta g_m$
= (0.9)(-0.084) - [-0.1 * -1.941]
= - 0.2697

$v_c = .8 v_c - \eta g_c$
= (0.9)(-0.42) - [-0.1 x -4.853]
= - 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 = 3
if (sample > ns)

goto step-9

else goto step-4

Step-9: itr += 1

1 + 1 = 2

Step-10: if (itr > epochs)

goto step-4

else goto step-3

step-3: sample = 1

step-4: $g_m = \frac{\partial t}{\partial m} = -(3.4 - (0.646)(0.2) + 2.283)(0.1)$

$= -1.110$

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

$= -5.553$

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: $m = m + v_m$

$= 0.6463 + (-0.353)$

$= 0.29$

$c = c + v_c$

$= -2.283 - 1.332$

$= -3.615$

Step-7: sample += 1

1 + 1 = 2

Step 8: if (sample > ns)

2 > 2 goto step-9

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: $v_m = (0.9)(-0.353) - [-0.1 * -2.919]$

$= -0.6096$

$v_c = (0.9)(-1.332) - [-0.1 * -7.297]$

$= -1.9285$

Step-6: $m_t = v_m$

$0.293 - 0.609 = -0.316$

$c_t = v_c$

$-3.615 - 1.928 = -5.543$

Step-7: Sample t = 1

2+1 = 3

Step-8: if (sample > n5)

go to step-9

else go to step-4

Step-9: itr t = 1

2+1 = 3

Step-10: if (itr > epochs)

go to step-11

else go to step-3

Step-11: print m, c

m = -0.316, c = -5.543

Assignment - 11

Let us consider a sample dataset have one input (x_i) & one output (y_i) & no. of samples 4. Develop a SLR model using nesterov accelerated gradient (NAG) 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 : $[x, y]$, $m = 1$, $c = -1$, $\eta = 0.1$, epochs = 2, $\gamma = 0.9$

$v_m = v_c = 0$, $ns = 2$

step-2 : itr = 1

step-3 : sample = 1

step-4 : $g_m = \frac{\partial \epsilon}{\partial m} = -(y_i - (m + \gamma v_m) x_i - (c + \gamma v_c)) x_i$

$= -(3.4 - (1 + (0.9)\,0)0.2 - (-1 + (0.9)0)$

$= -0.84$

$g_c = \frac{\partial \epsilon}{\partial c} = -(y_i - (m + \gamma v_m) x_i - (c + \gamma v_c))$

$= -(3.4 - (1 + 0.9) \times 0)\, 0.2$

$= -(-1 + (0.9))0)$

$= -4.2$

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

$= (0.9)\,0 - (-0.1) \times (-0.84)$

$= -0.084$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.42$

Step 6: $m_t = v_m$

$1 - 0.084 = 0.916$

$c_t = v_c = -1 - 0.42$

$= -1.42$

Step 7: sample += 1

$1 + 1 = 2$

Step 8: if (sample > ns)

else goto step-9

goto step-4

Step 4: $g_m = \frac{\partial E}{\partial m} = -(3.8 - (0.916 + (0.9 \times -0.089)))$

$= 0.4 - (-1.42 + (0.98 - 0.034) \times 0.4)$

$= -1.983$

$g_c = \frac{\partial E}{\partial c} = -4.958$

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

$= (0.9 \times -0.084) - (-0.1 \times -1.983)$

$= -0.2739$

$v_c = (0.9 \times -0.42) - (-0.1 \times -4.959)$

$= 0.8739$

step-6: $m_t = v_m$

$= 0.916 - 0.2739 = 0.6421$

$c_t = v_c$

$= -1.42 - 0.8739 = -2.2939$

step-7: sample += 1

$1 + 1 = 3$

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

$2 > 2$

else
go to step 3

Step 3 : Sample = 1

Step 4 : $\frac{\partial E}{\partial m} = -(3.4 - (0.6421 + (0.9 \times 0.773))) \times 0.2 - (-2.2939 + (0.9 \times -0.773))$ [illegible]

$g_m = 1.191$

$g_c = \frac{\partial E}{\partial c} = -5.859$

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

$= [(0.9) \times (-0.273)] - (0.1 \times 1.81)$

$= -0.3627$

$V_c = V_c \gamma - \eta g_c$

$(0.9)(-0.873) - (-0.1)(-5.859)$

$= -1.37007$

Step - 6 : $m + = V_m$

$0.6421 + (-0.3627)$

0.2794

$c + = V_c$

$= -2.2939 - 1.37007$

$= -3.6646$

Step - 7 : Sample + = 1

$1 + 1 = 2$

Step - 8 : if (sample > ns)

go to step - 9

else go to step - 4

Step 4 : $g_m = \frac{\partial E}{\partial m} = -(3.8 - (0.279 + (0.9 \times -0.3627)) \times 0.4 - (-3.6646 + (0.9)$

$= -2.985$

else go to step 3

step 3: sample = 1

step 4: $\frac{\partial E}{\partial m}$ = -(3.4-(0.6421+(0.9×0.2733))×

×0.2-(-2.2993+(0.9×-0.2733)×0

g_m = -1.191

$g_c = \frac{\partial E}{\partial c}$ = -5.859

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

= [(0.9)×(-0.2733)]-(-0.1×1.81)

= -0.3627

$V_c = V_c \delta - \eta g_c$

(0.9)(-0.8733)-(-0.1)(-5.859)

= -1.3707

step 6: $m_t = V_m$

0.64217 (-0.3627)

0.2794

$c_t = V_c$

= -2.2939-1.3707

= -3.6646

step 7: sample + 0 = 1

1+1=2

step 8: if (sample > ns)

go to step 9

else go to step 4

step 4: $g_m = \frac{\partial E}{\partial m}$ = -(3.8-(0.279+(0.9×-0.3627))

×0.4-(-3.6646+0.9)

= -2.985

$g_c = \frac{\partial E}{\partial c} = -3.4645$

step 5. $V_m = [0.9 \times -0.3627] - [-0.1 \times -3.981]$

$= -0.6249$

$V_c = [0.9 \times -1.3302] - [-0.1 \times 3.4645]$

$= -1.9800$

step-6 : $m_{t+1} = V_m$

$= 0.2934 + [-0.6249]$

$= -0.3275$

$c_{t+1} = V_c$

$= -3.6646 - 1.9800$

$= -4.6446$

step-7 : sample t = 1

2 + 1 = 3

step-8 : if (sample > n5)

go to step-9

else go to step-4

Step 9 : itr t = 1

2 + 1 = 3

Step 10 : if (itr > epochs)

go to step-4

else go to step-3

step-11 : print m, c

$m = 0.3275$

$c = -4.6466$.

$g_c = \frac{\partial L}{\partial c} = -3.4645$

step 5: $V_m = [0.9 \times -0.3627] - [-0.1 \times 2.985]$

$= -0.6249$

$V_c = [0.9 \times -1.3707] - [-0.1 \times 3.4645]$

$= -1.9800$

step-6: $m_t = V_m$

$= 0.2974 + [-0.6249]$

$= -0.3275$

$c_t = V_c$

$= -3.6646 - 1.9800$

$= -4.6446$

step-7: sample t = 1

2 + 1 = 3

step-8: if (sample > n5)

go to step-9

else go to step-4

Step 9: itr t = 1

2 + 1 = 3

Step 10: if (itr > epochs)

go to step-4

else go to step-3

step-11: print m, c

m = 0.3275

c = -4.6446.