Assignment 11

Let us consider a sample dataset have one input (x_i) and one output (y_i) and number of samples 4. Develop a SLR model using nestrov Accelerated gradient (NAG) 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 first 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: iter = 1

step 3: sample = 1

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

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

$= 0.34$

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

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

$= -4.2$

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

$= (0.9)\,0 - (-0.1) \times (-0.34)$

$= -0.034$

$v_c = \partial v_c - \eta g_c$

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

$= -0.42$

step 6 $m = m + v_m = 1 - 0.084 = 0.916$

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

step 7 Sample = sample + 1

$= 1 + 1 = 2$

step 8 if (sample > n_s) goto step 9

else goto step 4

step 4 : $g_m = \frac{\partial E}{\partial m} = -(3-8-(0.416+0.48-0.84)0.4 - [-1+2+(0.98$

$- 0.041 \times 0.4)$

$= -1.983$

$g_c = \frac{\partial E}{\partial c} = -4.859$

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

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

$= -0.2739$

$v_c = (0.9 \times -0.42) - (-0.1 \times -4.059)$

$= -0.8739$

Step 6 :- $m = m + \Delta m = 0.916 - 0.2939 = 0.6421$

$c = c + v_c = -1.42 - 0.8739 = -2.2939$

Step 7: Sample = sample + 1

$= 2 + 1$

$= 3$

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

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

step 10: if (iter > epochs) goto step 11
2 > 2
else goto step 3

step 3: sample = 1

step 4: $\frac{\partial E}{\partial m}$ = -(3.4 - (0.642 + (0.9 * 0.273)) * 0.2 - (-2.293 + (0.9 * -0.273) * 0.2)

gm = -1.171

gc = -5.859

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

= [(0.9) * (0.273)] - (-0.1 * -1.081)

= -0.3627

$v_c = v_c \gamma - \eta g_c$

= (0.9)(-0.873) - (-0.1)(-5.859)

= -1.3707

step 6: m = m + v_m => 0.6421 + (-0.3827) = 0.2794

c = c + v_c => -2.2939 + (1.3707) = -3.6646

step 7: sample = sample + 1

= 1 + 1

= 2

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

else goto step 4

Step 4 : $gm = \frac{\partial E}{\partial m} = -(3.8 - (0.279 + (0.9 * 0.3622)) * 0.4$

$- (-3.6646 + (0.9)$

$= -2.985$

$gc = \frac{\partial E}{\partial c} = -7.4645$

step 5 : $v_m = [0.9 \times -0.3627] - [-0.1 \times -2.985] = -0.6249$

$v_c = [0.9 \times -1.3707] - [-0.1 \times -7.4645] = -1.9800$

step 6 : $m = m + v_m = 0.2974 + (-0.6249) = -0.3275$

$c = c + v_c = -3.6646 - 1.9800 = -4.6446$

step 7 : sample = sample + 1

$= 2 + 1$

$= 3$

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

else goto step 4

step 9 : iter = iter + 1

$= 2 + 1 = 3$

step 10 : if (iter > epochs) : goto step 4

else goto step 3

step 11 : print m, c

$m = 0.3275$

$c = -4.8446$