Assignment - 11 :- (18K41A04D0)

Let consider a Sample dataset have one i/p (x_i^a) and one o/p (y_i^a), and no.of samples 4. Develop a simple linear regression model using nesterov Accelerated gradient (NAG) 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 first two Samples.

step 1) [x, y], m = 1, c = -1, η = 0.1, epochs = 2, γ = 0.9, $v_m = v_c = 0$, ns = 2.

2) iters = 1 3) sample = 1

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

$= -[3.4 - (1 + (0.9)(0))(0.2) - (-1 + (0.9)(0))](0.2)$

$= -[3.2 + 1](0.2) = -0.84$

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

$= -[3.4 - (1 + (0.9)(0))(0.2) - (-1 + (0.9)(0))]$

$= -4.2$

5) $v_m = \gamma v_m - \eta g_m = (0.9)(0) - (-0.1)(-0.84)$

$= -0.084$

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

$= -0.42$

6) $m = m + v_m = 1 + (-0.084) = 0.9116$

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

7) Sample = Sample + 1 = 1 + 1 = 2

8) if (sample > ns)

2 > 2 false

goto step 4

4) $g_m = \frac{\partial E}{\partial m} = -(3.8 - (0.916) + (0.9)(-0.084))(0.4)$

$- (-1.42 + (0.9)(-0.42)))(0.4)$

$= -(3.463 + 1.798)(0.4) = -2.104$

$g_c = \frac{\partial E}{\partial c} = -(3.8 - (0.916 + (0.9)(-0.084)(0.4)$

$- (-1.42 + (0.9)(-0.42)))$

$= -(2.914 + 1.798) = -4.712$

5) $v_m = \gamma v_m - \eta g_m = (0.9)(-0.084) - (-0.1)(-2.104)$

$= -0.286$

$v_c = \gamma v_c - \eta g_c = (0.9)(-0.42) - (-0.1)(-4.712)$

$= -0.849$

6) $m = m + v_m = 0.916 - 0.286 = 0.63$

$c = c + v_c = -1.42 - 0.849 = -2.269$

7) Sample = Sample + 1 = 2 + 1 = 3

8) if (Sample > ns)

3 > 2

true

goto next step.

9) iter = iter + 1 = 1 + 1 = 2

10) if (iter > epochs).

2 > 2

false

goto step 3.

3) sample = 1

4) $g_m = \frac{\partial E}{\partial m} = -(3.4 - (0.63 + (0.9)(-0.286)))(0.2) - (-2.269 + (0.9)(-0.849)))(0.2)$

$= -(3.325 - (-3.0331))(0.2)$

$= -1.271$

$g_c = \frac{\partial E}{\partial c} = -(3.4 - (0.63 + (0.9)(-0.286)))(0.2) - (-2.269 + (0.9)(-0.849)))$

$= -6.3581$

5) $v_m = \delta v_m - \eta g_m = (0.9)(-0.286) - (-0.1)(-1.271)$

$= -0.384$

$v_c = \delta v_c - \eta g_c = (0.9)(-0.849) - (-0.1)(-6.3581)$

$= -1.399$

6) $m = m + v_m = 0.63 - 0.384 = 0.246$

$c = c + v_c = -2.269 - 1.399 = -3.668$

7) sample = sample + 1 = 1 + 1 = 2

if (sample > ns)

2 > 2 False

goto step 4 ~

4) $g_m = \frac{\partial E}{\partial m} = -(3.8 - (0.246 + (0.9)(-0.384))(0.4) - (-3.668 + (0.9)(-1.399)))(0.4)$

$= -[3.839 - (-4.927)](0.4) = -3.506$

$g_c = \frac{\partial E}{\partial c} = -[3.8 - (0.246 + (0.9)(-0.384))(0.4) - [-3.668 + (0.9)(-1.399)]]$

$= -8.766$

5) $v_m = \delta v_m - \eta g_m = (0.9)(-0.384) - (-0.1)(-3$

$= -0.696$

$v_c = \delta v_c - \eta g_c = (0.9)(-1.399) - (-0.1)(-8.7$

$= -2.1357$

6) $m = m + v_m = 0.246 + (-0.696) = -0.45$

$c = c + v_c = -3.668 + (-2.1357) = -5.803$

7) sample = sample + 1 = 2 + 1 = 3

8) if (sample > ns)

3 > 2 true

goto next step.

9) iter = iter + 1 = 2 + 1 = 3.

10) if (iter > epochs)

3 > 2 true.

goto next step.

11) print m, c values

m = -0.45

c = -5.803.