ASSIGNMENT-9

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Let us consider a sample dataset have 1 input (x_i) and one output (y_i) and number of samples 4. Develop simple linear regression model 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, η = 0.1, epochs = 2, β = 0.9, $v_m = v_c = 0$, ns = 2

Step 2: itr = 1

Step 3: sample = 1

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

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

$= -0.84$

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

$= -(3.4 - 0.2 + 1)$

$= -4.2$

Step 5: $v_m = \beta v_m - \eta g_m$

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

$= 0 - 0.84$

$= -0.084$

$v_c = \beta v_c - \eta g_c$

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

$= -0.42$

Step 6: $m = m + v_m$

$= 1 + (-0.84)$

$= -0.916$

$c = c + v_c$

$= -1 - 0.42$

$= -1.42$

Step 7: sample $t = 1$

$1 + 1 = 2$

Step 8: if (sample > ns)

go to step-9

$2 > 2$

else

goto step-4

Step 4: $g_m = \frac{\partial E}{\partial m} = -(3.8 - 10.916)(0.4) + 1.12)(0.4)$

$= -1.941$

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

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

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

$= -0.2697$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.863$

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

Step 8: if (sample > ns)

go to step-9

else

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

= -1.110

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

= (0.9) (-0.2697) - [-0.1 x -4.110]

= - 0.353

$v_c = \gamma v_c - \eta g_c$

= (0.9)(-0.883) - [-0.1 x - 5.53]

= -1.332

step 6: $m = m + v_m$

= 0.6963 + (-0.353)

= 0.293

$c = c + v_c$

= -2.283 - 1.332

= -3.615

step 7: sample + = 1

1 + 1 = 2

Step 8: if (sample > ns)

2 > 2 goto step-9

else

goto step-4

Step 4: $q_m = -(3.8 - (0.293)(0.4) + 3.615)(0.4)$

$= -2.919$

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

$= -7.297$

Step 5: $v_m = (0.9)(-0.353) - [-0.1 \times -2.919]$

$= -0.6076$

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

$= -1.9285.$

Step 6: $m += t_m$

$0.293 - 0.609 = 0.316$

$c += v_c$

$-3.615 - 1.928 = -5.543$

Step 7: sample += 1

$2 + 1 = 3$

Step 8: if (sample > ns)

goto step-9

else

go to step-9

Step 9: itr += 1

$2 + 1 = 3$

step 10: if (itr > epochs)

go to step-11

else

goto step-3

step-11: print m, c

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