Assignment - 9

18K41A0420.

Let us consider a sample dataset have 1 input(x_i) and one output (y_i) and number of samples 4. Develop a sample linear regression model using momentum optimiser.

sample (i)	x_i^a	y_i^a
1	0.2	3.4
2	.04	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, $\gamma=0.9$,
$v_m = v_c = 0$, $\eta g = 2$.

step 2: iter = 1

step 3: sample = 1

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

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

$= -0.84$

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

$= -(3.4 - 0.2 + 1)$

$= -4.2$

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

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

$= 0 - 0.084$

$= -0.084$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.42$

step5: $m = m + v_m = 1 + (-0.84) = -0.916$

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

step7: sample += 1

$= 1+1 \Rightarrow 2$

step8: if (sample > ns) : goto step9

$2 > 2$

else: go to step 4

step4: $g_m = \frac{\partial \epsilon}{\partial m} = -(13.8 - (0.916)(0.4) + 1.12)(0.4)$

$= -1.841$

step5: $g_c = \frac{\partial \epsilon}{\partial c} = -4.853$

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

$= (0.9)(-0.084) - [-0.1 \times -1.841]$

$= -0.2697$

$v_c = \gamma v_c - \eta g_c$

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

$= -0.863$

step6: $m = m + v_m = 0.916 + (-0.2697) = 0.6463$

$c = c + v_c = -1.42 - 0.863 = -2.283$

step7: sample = sample + 1

$= 2+1 \Rightarrow 3$

step8: if (sample > ns) ; goto step9

else: goto step 4

step9: iter += 1

$\Rightarrow 1+1 = 2$

step10: if (iter > epochs) goto step4
else: goto step3

step3: sample = 1

step4: $g_m = \frac{\partial \epsilon}{\partial m} = -(3.4 - (0.646)(0.2) + 2.283)(0.2)$
$= -1.110$
$g_c = \frac{\partial \epsilon}{\partial c} = -(3.4 - (0.646)(0.2) + 2.283)$
$= -5.553$

step5: $v_m = \gamma v_m - \eta g_m$
$= (0.9)(-0.2697) - [-0.1 \times -1.110]$
$= -0.353$
$v_c = \gamma v_c - \eta g_c$
$= (0.9)(-0.863) - [-0.1 \times -5.53]$
$= -1.832$

step6: $m = m + v_m \Rightarrow 0.6463 + (-0.353) = 0.293$
$c = c + v_c \Rightarrow -2.283 - 1.332 = -3.615$

step7: sample += 1
$\Rightarrow 1+1 = 2$

step8: if (sample > ns) goto step9
$2 > 2$
else: goto step4.

step4: $g_m = -(3.8 - (0.293)(0.4) + 3.615)(0.4) \Rightarrow -2.912$
$g_c = -(3.8 - (0.293)(0.4) + 3.615) \Rightarrow -7.297$

step5: $v_m = (0.9)(-0.353) - [-0.1 \times -2.919] \Rightarrow -0.6096$
$v_c = (0.9)(-1.332) - [-0.1 \times -7.297] \Rightarrow -1.9285$

step6: $m += v_m \Rightarrow 0.293 - 0.609 = -0.316$
$c += v_c \Rightarrow -3.615 - 1.928 = -5.543$

step7: sample+=1 ⇒ 2+1=3

step8: if (sample > ns) : goto step9
else: goto step4

step9: iter+=1
⇒ 2+1=3

step10: if (iter > epochs) : goto step11
3>2
else: goto step3.

step11: print m, c
m=-0.316, c=-5.543.