NNDL 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 a 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] $m=1$, $c=-1$, $\eta=0.1$, epochs = 2, $\gamma=0.9$, $v_m = v_c = 0$, $n_s = 2$

Step-2: if = 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: $v_m = \gamma v_m - \eta g_m$

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

$= 0 - 0.084$

$= -0.084$

$v_c = \gamma v_c = \eta g_c$

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

$= -0.42$

Step-6: $m = m + v_m$

$= 1 + (-0.84)$

$= -0.916$

$c = c + v_c$

$= -1 - 0.42$

$= -1.42$

Step-7: Sample += 1
1+1 = 2

Step-8: if(sample > ns)
goto step-9
2 ≥ 2
else
goto step-4

Step-4: $g_m = \frac{\partial E}{\partial m} = -(3.8 - 10.916)(0.4) + 1.12)(0.4)$
$= -1.941$

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

Step-5: $v_m = \delta v_m - \eta g_m$
$= (0.9)(-0.084) - [-0.1 \times -1.941]$
$= -0.2697$
$v_c = \delta v_c - \eta g_c$
$= (0.9)(-0.42) - [-0.1 \times -4.853]$
$= -0.863$

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

$= -1.110$

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

$= -5.553$

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: $m = m + v_m$

$= 0.6463 + (-0.353)$

$= 0.293$

$c = c + v_c$

$= -2.283 - 1.332$

$= -3.615$

step-7: sample += 1

$1 + 1 = 2$

step-8: if (sample > ns)

$2 > 2$

goto step-9

else

goto step-4

step-4: $g_m = -(3.8 - (0.293)(0.4) + 3.615)(0.4)$

$= -2.919$

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

$= -7.297$

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

$= -0.6096$

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

$= -1.9285$

Step- 6: $m_t = \nabla m$

$0.293 - 0.609 = -0.316$

$c_t = \nabla c$

$-3.615 - 1.928 = -5.543$

Step-7: sample += 1

$2 + 1 = 3$

Step-8: if(sample > ns)

goto step-9

else

goto step-4

Step-9: its += 1

$2 + 1 = 3$

Step-10: if(its > epochs)

goto step-11

else

goto step-3

Step-11: print m, c

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