ASSIGNMENT-9

-18K41A0530

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, $\gamma=0.9$, $v_m = v_c = 0$, 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 : $v_m = \gamma v_m - \eta g_m$

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

$= 0 - 0.084$

$= -0.084$

$v_c = \gamma v_c = \eta g_c$

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

$= -0.42$

step-6: $m = m + \vartheta m$

$= 1 + (-0.84)$

$= -0.916$

$c = c + \vartheta c$

$= -1 - 0.42$

$= -1.42$

step-7: sample += 1

$1 + 1 = 2$

step-8: if (sample > ns)

goto step-9

$2 > 2$

else goto step-4.

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

$= -1.941$

step-5: $gc = \frac{\partial E}{\partial c} = -4.853$

↳ $\vartheta m = \gamma \vartheta m - \eta gm$

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

$= -0.2697$

$\vartheta c = \gamma \vartheta c - \eta gc$

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

$= -0.863$

step-6: $m = m + \vartheta m$

$= 0.916 + (-0.2697)$

$= 0.6463$

$c = c + \vartheta c$

$= -1.42 - 0.863$

$= -2.283$

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: $\nabla m = (0.9)(-0.353) - [-0.1 \times -2.919]$
$= -0.6096$
$\nabla c = (0.9)(-1.332) - [-0.1 \times -7.297]$
$= -1.9285$

step-6: $m+ = \nabla m$
$0.293 - 0.609 = -0.316$
$c+ = \nabla c$
$-3.615 - 1.928 = -5.543$

step-7: sample+ = 1
2+1 = 3

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

step-9: itr+ = 1
2+1 = 3

step-10: if (itr > epochs)
goto step-11
else goto step-3

Step-11: print m, c
$m = -0.316, \quad c = -5.543$