Assignment-11

18KU1A0423

Let us consider a sample dataset have i/p (x_i^0) and o/p (y_i^0) and number of samples 4. Develop a simple linear regression model using Nesterov Accelerated Gradient (NAG)

Sample(i)	x_i^0	y_i^0
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

→ Do manual calculation for 2 iteration with first 2 samples

Step 1: [x, y], m=1, c=-1, η=0.1, epochs=2, γ=0.9, v_m=v_c=0, i=2

Step 2: iter=1

Step 3: sample=1

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

$= -(3.4 - (1 + (0.9)(0))\,0.2 - (-1 + (0.9)(0)))\,(0.2)$

$g_m = -0.84$

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

$= -(3.4 - (1+(0.9)(0))\,0.2 - (-1+(0.9)(0)))$

$g_c = -4.2$

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

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

$v_m = -0.084$

$v_c = \gamma v_c - \eta g_c$

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

$v_c = -0.42$

Step 6: $m = m + v_m = 1 + (-0.084) = 0.916$

$c = c + v_c = -1 - 0.142 = -1.42$

Step 7: sample = sample+1 $= 1+1 = 2$

Step 8: if (sample > ng)

$2 > 2 \rightarrow$ false

goto step 4

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

$- (-1.42 + (0.9)(-0.142))) 0.4$

$g_m = -2.104$

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

$- (1.42 + (0.9)(-0.142)))$

$= -(2.914 + 1.798)$

$g_c = -4.712$

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

$= (0.9)(-0.084) - (-0.1)(-2.104)$

$v_m = -0.286$

$v_c = \gamma v_c - \eta g_c$

$(0.9)(-0.142) - (-0.1)(-4.712)$

$v_c = -0.849$

Step 6: $m = m + v_m = 0.916 - 0.286 = 0.63$

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

Step 7: sample = sample+1 $= 2+1 = 3$

Step 8: if (sample > ng)

$3 > 2$ True

goto next step

Step 9: ite = ite + 1 = 1+1 = 2

Step 10: if (ite > epochs)

2 > 2 false

goto step 3

Step 3: sample = 1

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

$-(-2.269 + (0.9)(-0.849))\,0.2$

$g_m = -1.271$

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

$-(-2.269 + (0.9)(-0.849)))$

$g_c = -6.3581$

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

$= (0.9)(-0.286) - (-0.1)(-1.271)$

$v_m = -0.8384$

$v_c = \gamma v_c - \eta g_c$

$= (0.9)(-0.849) - (-0.1)(-6.3581)$

$v_c = -1.399$

Step 6: $m = m + v_m = 0.63 - 0.384 = 0.246$

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

Step 7: sample = sample + 1 = 1+1 = 2

if (sample > 3)

2 > 2 false

goto step 4.

Step 4: $g_m = \frac{\partial E}{\partial m} = -[3.8 - (0.246 + (0.9)(-0.384))\,(0.4)$

$-(-3.668 + (0.9)(-1.399)))\,(0.4)$

$g_m = -3.506$

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

$$g_c = -8.766$$

steps: $v_m = \gamma v_m - \eta g_m = (0.9)(-0.384) - (-0.1)(-3.366)$

$$v_m = -0.696$$

$$v_c = \gamma v_c - \eta g_c = (0.9)(-1.399) - (0.1)(-8.766)$$

$$v_c = -2.1357$$

Step 6: $m + v_m = 0.246 + (-0.696)$

$$m = -0.45$$

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

$$c = -5.803$$

Step 7: Sample = Sample + 1

$= 2 + 1 = 3$

Step 8: if (Sample > ns)

$3 > 2 \rightarrow$ True

goto next step

Step 9: iter = iter + 1

$= 2 + 1 = 3$

Step 10: if (iter > epochs)

$3 > 2 \rightarrow$ True

goto next step

Step 11: print m, c values

$m = -0.45$

$c = -5.803$ //