ASSIGNMENT-11

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Let us consider a sample dataset have one input (x_i^2) & one output (y_i^2) & number of samples 4. Develop a simple linear regression model using Nesterov accelerated gradient (NAG) optimizer.

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

Manual calculations:-

step 1:- [x,y], $m=1$, $c=-1$, $\eta=0.1$, $\gamma=0.9$, $v_m=v_c=0$

epochs=2, no of samples=2

x	y
0.2	3.4
0.4	3.8

step 2:- itr=1

step 3:- sample=1

step 4:- $g_m = -(y_i-(m+\gamma v_m)x_i - (c+\gamma v_c))x_i$

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

$= -0.84$

$g_c = -4.2$

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

$= (0.9)(0)-(0.1)(-0.84) = 0.084$

$v_c = \gamma v_c - \eta g_c$

$= (0)-(0.1)(-4.2) = 0.42$

step 6:- $m = m + vm$

$= 1 + 0.084 = 1.084$

$c = c + vc$

$= -1 + 0.42 = -0.58$

step 7:- sample = 1 + 1 = 2

step 8:- if (sample > no of samples)

2 > 2

goto step4

step 4:- $gm = -(3.8 - (1.084 + (0.9)(0.084))(0.4) - (-0.58 + (0.9)(0.42)))$ 0.7

$= -1.717664$

$gc = -4.29416$

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

$= (0.9)(0.084) - (0.1)(-1.717664)$

$= 0.247366$

$vc = \gamma vc - \eta gc$

$= (0.9)(0.42) - (0.1)(-4.29416)$

$= 0.807416$

step 6:- $m = m + vm$

$= 1.084 + 0.24736 = 1.33136$

$c = c + vc$

$= -0.58 + 0.807416 = 0.227416$

step 7:- sample = 2 + 1 = 3

step 8:- if (sample > no of samples)

3 > 2

goto next step

step 9:- $i_{tr} = i_{tr} + 1 = 1 + 1 = 2$

of approaches)

step 6:- $m = m + v_m$

$= 1 + 0.084 = 1.084$

$c = c + v_c$

$= -1 + 0.42 = -0.58$

step 7:- sample = 1 + 1 = 2

step 8:- if (sample > no of samples)

2 > 2

goto step4

step 4:- $g_m = -(2.8 - (1.084 + (0.9)(0.084))(0.4) - (-0.58 + (0.9)(0.42))$

$= -1.7176644$

$g_c = -4.29416$

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

$= (0.9)(0.084) - (0.1)(-1.7176644)$

$= 0.247364$

$v_c = \gamma v_c - \eta g_c$

$= (0.9)(0.42) - (0.1)(-4.29416)$

$= 0.807416$

step 6:- $m = m + v_m$

$= 1.084 + 0.247364 = 1.331364$

$c = c + v_c$

$= -0.58 + 0.807416 = 0.227416$

step 7:- sample = 2 + 1 = 3

step 8:- if (sample > no of samples)

3 > 2

goto next step

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

step 10:- if (itr > epochs)

stop

false goto step 3

step 3:- sample = 1

step 4:- $gm = -(3.4 - (1.33136 + ((0.9)(0.24736))0.2 - (0.227416 + (0.9)(0.807416)$

$= -2.13571$

$gc = -0.891926$

step 5:- $vm = \gamma vm - \eta gm$

$= (0.9)(0.247364) - (0.1)(2.1371)$

$= 0.43614$

$vc = \gamma vc - \eta gc$

$= (0.9)(0.807416) - (0.1)(0.891786)$

$= 0.815867$

step 6:- $m = m + vm$

$= 1.3316 + 0.43614 = 1.76774$

$c = c + vc$

$= 0.227416 + 0.815867 = 1.043283$

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

step 8:- if (sample > no of samples) 2 > 2

false go to step 4.

step 4:- $gm = -(3.8 - (1.76774 + (0.9)(0.43614))0.4 -$

$(1.043283 + (0.9)(0.815))0.4$

$= -0.46332$

$gc = -1.1583303$

Step 5:- $v_m = \gamma v_m - \eta \frac{\partial \epsilon}{\partial m}$

$= (0.9)(0.43614) - (0.1)(-0.46332)$

$= 0.43885992$

$v_c = \gamma v_c - \eta \frac{\partial c}{\partial \epsilon}$

$= (0.9)(0.815867) - (0.1)(-1.1583303)$

$= 0.8501133$

Step 6:- $m = 1.76774 + 0.438592 = 2.206592$

$c = 1.043283 + 1.1583303 = 2.201613$

Step 7:- sample = 2+1 = 3

Step 8:- if (sample > no of samples)

3 > 2

true → goto next step

Step 9:- itr = 2+1 = 3

Step 10:- if (itr > epochs)

3 > 2

true → next step

Step 11:- print m, c

$m = 2.206592$

$c = 2.201613$

Step 12:- MSE

$= \frac{(34 - (2.2065 \times 0.2) - 2.01613)^2 + (38 - (2.2065 \times 0.4) - 2.201613)^2}{2}$

$= 0.54271$