Nesterov Accelerated Gradient Descent

Step-1: read $[x,y]$; $m=1$, $c=-1$, $\eta=0.4$, $\gamma=0.9$, $V_m=0$.

$V_c=0$, epochs $=2$, no. of sample $=2$.

Step-2: iter $=1$ **Step-3:** sample $=1$

Step-4: $g_m = -(y_i - (m+\gamma V_m)x_i - (c+\gamma V_c))x_i$

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

$\div -(3.4 - 0.2+1)\times 0.2 = -(4.2\times 0.2) = -0.84$

$g_c = -4.2$.

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: $m = m + V_m = 1 + 0.084 = 1.084$

$c = c + V_c = -1 + 0.42 = -0.58$

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

Step-8 √ if sample > no. of samples = 2 > 2 = false
goto step 4

Step-9 √ $gm = -(3.8 - ((1.084 + (0.9) \times (0.0084)) \times 0.4) -$

$(-0.58 + 0.9) \times 0.42) \cdot 4)$

$\Rightarrow gm = -(3.8 - (1.1596 \times 0.4) + 0.958) \times 0.4$

$= -(4.29416) \times 0.4 = -1.7176.$

$gc = -4.2946.$

Step-10 √ $Vm = \gamma Vm - \eta gm = (0.9)(0.084) - (0.1)(-1.7176)$

$= 0.24736.$

$Vc = \gamma Vc - \eta gc = (0.9)(0.42) - (0.1)(-4.29416)$

$= 0.807416.$

Step-11 $m = m + Vm = 1.084 + 0.24736 = 1.33136$

$c = c + Vc = -0.58 + 0.8074 = 0.2274$

Step-12 √ . Sample = 2 + 1 = 3.

Step-13 √ if sample > no. of samples = 3 > 2 = true
goto next step.

Step : $q+u = 1+1 = 2$.

Step-15' if $q+u > epochs \Rightarrow 2 > 2 = false$

goto step3

Step-16' sample $= 1$

Step-17' $g_m = -(y_i - (m + \vartheta V_m)x_i - (C + \vartheta V_c))x_i$

$-(3.4 - (1.3313 + (0.9) \times (0.2473]) \times 0.2 -$

$(0.2274 + (0.9) \times 0.807416)$

$= -(3.4 - [1.5539] \times 0.2 - [0.95409]$

$= -(2.13511)$

$g_c = -(3.4 - 1.5539 - 0.9540) = -0.891926$.

Step-18' $V_m = \vartheta V_m - \eta g_m = (0.9) \times 0.24736 - (0.1) \times (-2.1351)$

$= 0.4361$

$V_c = \vartheta V_c - \eta g_c = (0.9) \times 0.80741 - (0.1) \times (-0.89192)$

$= 0.81586$.

Step-19'
$m = m + V_m = 1.3316 + 0.43614 = 1.76774$

$c = c + V_c = 0.227416 + 0.815867 = 1.043283$

Step 20: Sample = Sample+1 = 1+1=2

Step 21: if Sample > ns → 2 > 2 = False

$$\text{goto step 14}$$

Step 22: $gm = -(y?(m + \gamma vm) x? - (c + \gamma v_c)) x_i$

$$= -[3.8 - (1.767744 (0.9) \times 0.43614) \times 0.4 -$$

$$(1.043283 + (0.9) \times 0.815867) \times 0.4$$

$$-[3.8 - (2.160266) \times 0.4 - 1.777456] \times 0.4$$

$$= -0.4633$$

$$g_c = -[3.8 - (2.16026 \times 0.4) - 1.7775]$$

$$= -1.15833$$

Step 23:

$$Vm = \gamma Vm - \eta \frac{\partial E}{\partial m}$$

$$(0.9) \times 0.43614 - (0.1) \times (-0.4633)$$

$$= 0.43885$$

$$V_c = \gamma V_c - \eta \frac{\partial E}{\partial c}$$

$$= (0.9) \times 0.815867 - (0.1) \times (-1.15833)$$

$$= 0.85011$$

<u>step-24</u> $m = 1.767\overline{24} + 0.4\overline{388}$ $= 2.20659$

$c = 1.043283 + 1.15833 = 2.2016133$

<u>step-25</u> sample $= 2 + 1 = 3 > 2$. no.of samples

<u>step-26</u> Qters $= 2 + 1 = 3 >$ epochs.

goto step 2

Print m, c values

$= 2.20659 , 2.2016.$