Assignment-11

18K41A0588

Nesterov Accelerated Gradient Descent

manual calculations

step-1 :- read [X, Y], m=1, c=-1, η=0.1, γ=0.9,

v_m=0, v_c=0, epochs=2,

no of_samples=2

X	Y
0.2	3.4
0.4	3.8

step-2 :- iter=1

step-3 :- sample=1

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

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

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

$= -0.84$

$g_c = -4.2$

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 : $g_m = -(3.8 - (1.084 + (0.9) \times (0.084)) \times 0.4 - (-0.58 + (0.9) \times (0.42))) \times 0.4$

⇒ $g_m = -(3.8 - (1.1596 \times 0.4) + 0.958) \times 0.4$

$= -(4.29416) \times 0.4 = -1.717664$

$g_c = -4.29416$

Step-10 :- $V_m = \gamma V_m = \eta g_m = (0.9)(0.084) - (0.1)(-1.717664)$

$= 0.2473664$

$V_c = \gamma V_c - \eta g_c = (0.9)(0.42) - (0.1)(-4.29416)$

$= 0.807416$

Step-11 : $m = m + V_m = 1.084 + 0.24736$

$= 1.33136$

$C = C + V_c = -0.58 + 0.807416$

$= 0.227416$

step-12 :- sample = 2+1=3

step-13 :- if sample > no.of_samples = 3>2
= true
goto next step

step-14 :- iter = 1+1=2

step-15 :- if iter >= epochs ⇒ 2>2 = false
goto step 3

step-16 :- sample = 1

step-17 :- $g_m = -(y_i - (m+\gamma v_m)x_i - (c+\gamma v_c))x_i$

$= -(3.4 - [1.33136 + [(0.9) \times (0.24736)]]$
$\times 0.2 - (0.227416 + (0.9) \times 0.807416)$

$= -(3.4 - [1.553984] \times 0.2 - [0.95409])$

$= -(2.13511)$

$g_c = -(3.4 - 1.553984 - 0.95409)$

$= -0.891926$

step-18 :- $v_m = \gamma v_m - \eta g_m = (0.9) \times 0.2473664$
$- (0.1) \times (-2.13511)$

$= 0.436164$

$$V_c = \gamma v_c - \eta g_c = (0.9) \times 0.807416 - (0.1) \times (-0.891926)$$

$$= 0.815867$$

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 $\Rightarrow 2 > 2 \Rightarrow$ false

repeat step 4

Step-22 :- $g_m = -(y_i - (m + \gamma v_m) x_i - (c + \gamma v_c)) x_i$

$$= -[3.8 - (1.76774 + (0.9) \times 0.43614)) \times 0.4 - (1.043283 + (0.9) \times 0.815867] \times 0.4$$

$$= -[3.8 - (2.160266) \times 0.4 - 1.7775633] \times 0.4$$

$$= -0.463332$$

$$g_c = -[3.8 - (2.160266 \times 0.4) - 1.7775633]$$
$$= -1.1583303.$$

step-23 :- $v_m = \gamma v_m - \eta \frac{\partial E}{\partial m}$

$$= (0.9) \times 0.43614 - (0.1) \times (-0.463332)$$
$$= 0.43885792$$

$$v_c = \gamma v_c - \eta \frac{\partial E}{\partial c}$$
$$= (0.9) \times 0.815867 - (0.1) \times (-1.1583303)$$
$$= 0.8501133$$

step-24 :- $m = 1.767774 + 0.43885792$
$$= 2.2065992$$

$$c = 1.043283 + 1.1583303$$
$$= 2.2016133$$

step-25 :- sample = 2+1 = 3 > 2 ⇒ sample > epochs
goto step-26

step-26 :- iters = 2+1 = 3 ⇒ > epochs
step-27

step-27 :- print (m, c)
⇒ 2.2065992, 2.2016133

Step -28 :- Mean-squared Error

$$= \frac{(3.4 - (2.2065992 \times 0.2) - 2.206133)^2 + (3.8 - (2.2065992 \times 0.4) - 2.206133)^2}{2}$$

$$= \frac{(0.57315) + (0.512293)}{2}$$

$$= \frac{1.085443}{2} = 0.54271$$