Assignment-9

Sample (i)	x_i^a	y_i^a
1	0.2	3.4
2	0.4	3.8

Do manual calculations for two iterations for first 2 samples using momentum optimizer.

Step.1: Read dataset, $\eta = 0.1$, epochs = 2, $m = 1$, $c = -1$, $\gamma = 0.9$, $v_m = 0$ and $v_c = 0$

Step.2: Set iter = 1

Step.3: set sample = 1

Step.4: $y = mx_i + c$

$y = (1)(0.2) - 1$

$= -0.8$

Step.5: $e = \frac{1}{2}(3.4 - (-0.8))^2$

$= 8.82$

Step. 6 $\frac{\partial e}{\partial m} = -(y_i^a - mx_i^a - c)x_i^a$

$= -(3.4 + 0.8)(0.2)$

$= -0.84$

$\frac{\partial e}{\partial c} = -(y_i^a - mx_i^a - c)$

$= -(3.4 + 0.8)$

$= -4.2$

Step. 7: $v_m^t = \gamma * v_m^{t-1} - \eta \frac{de}{dm}$

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

$= 0.084$

$v_c^t = \gamma * v_c^{t-1} - \eta \frac{de}{dc}$

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

$= 0.42$

Step. 8: $m = m + v_m^t$

$= 1 + 0.084$

$= 1.084$

$c = c + v_c^t$

$= -1 + 0.42$

$= -0.58$

Step.9: Sample = Sample+1 = 2 and $2 < n_s = 4$

Step.10:

$$y_i = mx_i + c$$

$$y_2 = (1.084)(0.4) - 0.58$$

$$= -0.1464$$

Step 11:

$$e = \frac{1}{2}(3.8 + 0.1464)^2$$

$$= 7.79$$

Step.12:

$$\frac{de}{dm} = -(3.8 + 0.1464)(0.4)$$

$$= -1.58$$

$$\frac{de}{dc} = -(3.8 + 0.1464)$$

$$= -3.94$$

Step.13:

$$V_m = 0.9 * 0.084 + 0.1 * (1.58)$$

$$= 0.2336$$

$$V_c = 0.9 * 0.42 + 0.1 * (3.94)$$

$$= 0.772$$

Step.14:

$$m = 1.084 + 0.2336 \qquad C = -0.58 + 0.772$$

$$= 1.3176 \qquad = 0.192$$

Step. 15: Sample = sample + 1 = 2 and 2 not < n_s = 2

Step. 16: iter = iter + 1 = 2 and iter < epochs = 2

Step 17: set sample = 1

step. 18: $y = m x_i + c$

$y_1 = (1.3176)(0.2) + 0.192$

$= 0.45552$

Step. 19: $e = \frac{1}{2}(3.4 - 0.45552)^2$

$= 4.33498124$

Step. 20: $\frac{\partial e}{\partial m} = -(3.4 - 0.45552)(0.2)$

$= -0.588896$

$\frac{\partial e}{\partial c} = -(3.4 - 0.45552)$

$= -2.94448$

step. 21: $v_m = 0.9 * 0.2336 + 0.1 * (0.588896)$

$= 0.2691296$

$v_c = 0.9 * 0.772 + 0.1 * (2.94448)$

$= 0.989248$

Step 23: $m = m + V_m^t$ $\quad c = c + V_c^t$

$= 1.3176 + 0.2691296$ $\quad = 0.1982 + 0.989248$

$= 1.586726$ $\quad = 1.181248$

Step 23: sample = sample + 1 = 2 $\leq n_s = 2$

Step 24: $y_2 = mx_2 + c$

$= (1.586726)(0.4) + 1.181248$

$= 1.8159384$

Step 25: $e = \frac{1}{2}(3.8 - 1.8159384)^2$

$= \frac{1}{2}(1.9840616)^2$

$= 1.968250228.$

Step 26: $\frac{de}{dm} = -(3.8 - 1.8159384)(0.4)$

$= -0.7873300088$ ~~0.7873300088~~ 0.79362464

$\frac{de}{dc} = -(3.8 - 1.8159384)$

~~$= 1.968250228$~~

$= -1.9840616$

Step 27: $v_m = 0.9^* 0.2691296 + 0.1^* (0.7936246)$

$= 0.9564788816$

0.3215791104

$v_c = 0.9^* 0.989248 + 0.1^* (1.9840616)$

$= 1.08872936$

Step 28: $m = m + v_m t$ $\quad c = c + v_c t$

$= 1.586726$ $\quad = 1.181248 +$

$+ 0.3215791104$ $\quad 1.08872936$

$= 1.9083051$ $\quad = 2.26997736$

Step 29: Sample = Sample + 1 = 3 ≠ n_s = 2

Step 30: iter = iter + 1 = 3 ≠ epochs

$$MSE = \frac{1}{2} \sum (y_i - mx_i - c)^2$$

$$= \frac{1}{2} \left((3.4 - (1.9083051)(0.2) - 2.26997736)^2 + (3.8 - (1.9083051)(0.4) - 2.26997736)^2 \right)$$

$$= \frac{1}{2} (0.560045114 + 0.58782981)$$

$$= 0.573937746$$