

Assignment - 9: Momentum Gradient Descent

Manual Calculations

Step 1: Read $[x, y]$, $m = 1$, $c = -1$, $\eta = 0.1$, $\delta = 0.9$, epochs = 2,
 $V_m = 0$, $V_c = 0$

Step 2: iter = 1

Step 3: Sample = 1

Step 4: $E = \frac{1}{2} (y_i - mx_i - c)^2$

$$\frac{\partial E}{\partial m} = -(3.4 - (1)(0.2) + 1)(0.2) = -(4.2)(0.2) = -0.84$$

$$\frac{\partial E}{\partial c} = -(4.2) = -4.2$$

step 5: $V_m = \gamma V_m - \eta \frac{\delta E}{\delta m} = (0.9)(0.7) - (0.1)(-0.84)$
 $= 0.084$

$V_c = (0.9)(0.7) - (0.1)(4.2) = 0.42$

step 6: $m = 1 + 0.084 = \underline{1.084}$ | $c = -1 + 0.42 = \underline{-0.58}$

step 7: sample = 1 + 1 = 2

step 8: if sample > ns $\Rightarrow 2 > 2 \Rightarrow$ false
 goto step 8₁

step 9: $\frac{\delta E}{\delta m} = - (3.8 - (1.084 \times 0.4) + 0.58) \times 0.4$
 $= - (3.9464) \times 0.4 = 1.57856$

$\frac{\delta E}{\delta c} = -3.9464$

step 10: $V_m = (0.9)(0.084) - (0.1)(1.57856) = +0.08225$

$V_c = (0.9)(0.42) - (0.1)(-3.9464) = 0.77264$

step 11: $m = 1.084 + 0.08225 = \underline{1.16625}$

$c = -0.58 + 0.77264 = \underline{0.19264}$

step 12: sample = 2 + 1 = 3

step 13: if sample > ns = 3 > 2 = true
 goto step 14

step 14: iter = 1 + 1 = 2

step 15: if iter > epoch $\Rightarrow 2 > 2 \Rightarrow$ false
 goto step 3

Step 16: sample = 1

Step 17: $E = \frac{1}{2} (y - mx - c)^2$

$$\frac{\partial E}{\partial m} = - (3.4 - (1.16625 \times 0.2) - 0.19264) \times 0.2$$

$$= - (2.97411) \times 0.2 = -0.59482$$

$$\frac{\partial E}{\partial c} = -2.97411$$

Step 18: $V_m = (0.9) \times (0.08225) - (0.1) \times (-0.59482) = 0.133507$

$$V_c = (0.9) \times (0.77264) - (0.1) \times (-2.97411) = 0.992787$$

Step 19: $m = 1.16625 + 0.133507 = 1.299757$

$$c = 0.19264 + 0.992787 = 1.185427$$

Step 20: sample = 1 + 1 = 2

Step 21: if sample > $n_s = 2 > 2 = \text{false}$
goto step 24

Step 22: $\frac{\partial E}{\partial m} = - (3.8 - (1.299757) \times (0.4) - 1.185427) \times 0.4$

$$= - (2.094670) \times 0.4 = -0.83786$$

$$\frac{\partial E}{\partial c} = -2.09467$$

Step 23: $V_m = (0.9) (0.133507) - (0.1) (-0.83786)$

$$= 0.20394$$

$$V_c = (0.9) (0.992787) - (0.1) (-2.09467)$$

$$= 1.10297$$

Step 24: $m = 1.299757 + 0.20394 = 1.503697$

$$c = 1.10297 + 1.185427 = 2.288397$$

Step 25: $iter = 2 + 1 = 3$

Step 26: $if\ iter > epochs = 3 > 2 = \text{false}$
goto step 27

Step 27: $\text{Print}(m, c)$

$$= 1.503697, 2.288397$$

Step 28: calculating mean squared error.

$$mse = \frac{(2.5891364) + (2.889875)}{2}$$

$$= \frac{(5.4790122)}{2} = 2.7395061$$

$$mse = 2.7395061$$