

Manual Calculations:

step 1: $[x, y], \eta = 0.1, \gamma = 0.9, \text{epochs} = 1, m = 1, c = -1, \epsilon = 10^{-8},$

$$E_m = E_c = 0$$

step 2: $\text{iter} = 1$

step 3: sample = 1

step 4: $g_m = -(3.4 - (1)(0.2) + 1)(0.2) = -0.84$

$$g_c = -4.2$$

step 5: $E_m = (0.9)(0) + (0.1)(-0.84)^2 = 0.0705$

$$E_c = (0.9)(0) + (0.1)(-4.2)^2 = 1.764$$

step 6: $\Delta m = \frac{-0.1}{\sqrt{0.07 + 10^{-8}}} (-0.84) = 0.317$

$$\Delta c = \frac{-0.1}{\sqrt{1.76 + 10^{-8}}} (-4.2) = 0.322$$

step 7:

$$m = m + \Delta m = 1 + (-0.314) = 0.686$$

$$c = c + \Delta c = -1 - 0.322 = -1.322$$

step 8: sample = sample + 1

$$= 1 + 1 = 2$$

step 9: if (sample > n_s) $\Rightarrow (2 > 2)$ goto step 4

$$\text{step-10: } g_m = -(3.8 - (0.686) \times (0.4) + 1.322) \times (0.4) \\ = -1.93904$$

$$g_c = -4.8476$$

$$\text{step-11: } E_m = (0.9) \times (0.0705) + (0.1) \times (-1.93904)^2 \\ = 0.4394$$

$$E_c = (0.9) \times (1.764) + 0.1 \times (-4.8476)^2 \\ = 3.9375$$

$$\text{step-12: } \Delta m = \frac{-0.1}{\sqrt{0.4394 + 10^{-8}}} \times (-1.93904) = 0.2925$$

$$\Delta c = \frac{-0.1}{\sqrt{3.9375 + 10^{-8}}} \times (-4.8476) = 0.2442$$

$$\text{step-13: } m = m + \Delta m = 0.9785$$

$$c = c + \Delta c = -1.0778$$

$$\text{step-14: } \text{sample} = \text{sample} + 1 = 2 + 1 = 3 \text{ no-of-samples}$$

$$\text{step-15: } \text{iters} = 1 + 1 = 2 < \text{epochs}$$

$$\text{step-16: } \text{sample} = 1$$

$$\text{p-7: } g_m = -(3.4 - (0.9785 \times 0.2) + 1.0778) \times 0.2 \\ = -0.85642$$

$$g_c = -4.2821$$

$$\text{step-18: } E_m = (0.9) \times (0.4394) + (0.1) \times (-0.85642)^2 \\ = 0.46957$$

$$E_c = (0.9 \times 3.9375) + (0.1) \times \frac{-4.2821}{(-0.85642)^2}$$

$$= 5.3773$$

step-19: $\Delta m = -0.1$

$$\frac{-0.1}{\sqrt{0.46957 + 10^{-8}}} \times (-0.85642) = 0.05868$$

$$\Delta c = \frac{-0.1}{\sqrt{5.3773 + 10^{-8}}} \times (-4.2821) = 0.18466$$

step-20: $m = m + \Delta m = 0.9785 + 0.0586 = 1.0371$

$$c = c + \Delta c = -1.0778 + 0.18466 = -0.89314$$

step-21: $\text{sample} = \text{sample} + 1$

step-22: $g_m = -(3.8 - (1.0371 \times 0.4) + 0.89314) \times 0.4$

$$= -1.71132$$

$$g_c = -4.2783$$

step-23: $E_m = (0.9) \times (0.46957) + (0.1) \times (-1.71132)^2$

$$= 0.71547$$

$$E_c = (0.9) \times (5.3773) + (0.1) \times (-4.2783)^2$$

$$= 6.6699$$

$$\text{step-24: } \Delta m = \frac{-0.1}{\sqrt{0.71547 + 10^{-8}}} \times (-1.71132) = 0.20231$$

$$\Delta c = \frac{-0.1}{\sqrt{6.6699 + 10^{-8}}} \times (-4.27883) = 0.16565$$

$$\text{step-25: } m = m + \Delta m = 1.0371 + 0.20231 = 1.23941$$

$$c = c + \Delta c = -0.89314 + 0.16565 = -0.72749$$

$$\text{step-26: } \text{sample} = 2 + 1 = 3 > \text{no-of-samples}$$

$$\text{step-27: } \text{iter} = \text{iter} + 1 = 3 > \text{no-of-epochs}$$

$$\text{step-28: } \text{print}(m, c) \Rightarrow (1.23941, -0.72749)$$

$$\text{step-29: } \text{calculating mean-squared error}$$

$$\text{mse} = \frac{1}{2 \times 2} \left[(3.4 - (1.23941 \times 0.2 + 0.72749))^2 + (3.8 - (1.23941 \times 0.4 + 0.72749))^2 \right]$$

$$= \frac{1}{4} [15.05135 + 16.25481]$$

$$\text{mse} = 7.82654$$