

Manual Calculation for two iterations of ADAGRAD optimizer

x	y
0.2	3.4
0.4	3.8
0.6	4.2
0.8	4.6

$$\eta^i = \frac{\eta}{\sqrt{(g_m)^2 + \epsilon}}$$

Step-1: $[x, y]$, $\eta = 0.1$, epochs = 2, $m = 1$, $c = -1$, $G_m = G_c = 0$, $\epsilon = 10^{-8}$

Step-2: $itr = 1$

Step-3: Sample = 1

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

$g_c = -(3.4 - (1)(0.2) + 1) = 4.2$

Step-5: $G_m = 0 + (0.84)^2 = 0.7056$

$G_c = 0 + (4.2)^2 = 17.64$

Step-6: $\Delta m = \frac{-(0.1)}{\sqrt{0.7056 + 10^{-8}}} \times (0.84) = 0.2$

$\Delta c = \frac{-(0.1)}{\sqrt{17.64 + 10^{-8}}} \times 4.2 = -0.3$

Step-7: $m = m + \Delta m = 1 - 0.2 = 0.8$

$c = c + \Delta c = -1 - 0.3 = -1.3$

Step-8: $\text{Sample} = \text{Sample} + 1 = 1 + 1 = 2$

Step-9: if ($\text{Sample} \geq n_s$)

Go to next step

else

Go to step-4

Step-4: $G_m = -(2.8 - (0.8)(0.4) - 1.3)0.4 = -0.87$

$G_c = -(2.8 - (0.8)(0.4) - 1.3) = -2.18$

Step-5: $G_m = 0.705 + (-0.872) = -0.167$

$G_c = 17.64 + (-2.18) = 15.46$

Step-6: $\Delta m = \frac{-(0.1) \times -0.872}{\sqrt{(-0.167)^2 + 10^{-8}}} = 0.0625$

$\Delta c = \frac{-(0.1) \times -2.18}{\sqrt{15.46 + 10^{-8}}} = 0.055$

Step-7: $m = m + \Delta m = 0.8 + 0.062 = 0.862$

$c = c + \Delta c = -1.3 + 0.055 = -1.245$

Step-8: $\text{Sample} = \text{Sample} + 1 = 2 + 1 = 3$

Step-9: if ($\text{Sample} \geq n_s$)

Go to next step

Step-10: $\text{its} = \text{its} + 1 = 1 + 1 = 2$

Step-11: if ($\text{its} \geq \text{epochs}$)

Go to next step

else

Go to step-3

Step-3: Sample = 1

$$\text{Step-4: } g_m = -(3.4 + (0.862)(0.2) - (-1.245)(0.2)) = -0.396$$
$$g_c = -(3.4 - (0.862)(0.2) + (-1.245)) = -1.982$$

$$\text{Step-5: } G_m = -0.167 + (-0.396) = -0.563$$
$$G_c = 15.46 + (-1.982) = 13.48$$

$$\text{Step-6: } \Delta m = \frac{-(0.1)}{\sqrt{-0.56 \times 10^{-8}}} \times (-0.39) = 0.055$$

$$\Delta c = \frac{-(0.1)}{\sqrt{13.48 \times 10^{-8}}} \times (-1.98) = 0.053$$

$$\text{Step-7: } m = m + \Delta m = 0.862 + 0.05 = 0.912$$
$$c = c + \Delta c = -1.245 + 0.05 = -1.195$$

$$\text{Step-8: } \text{Sample} = \text{Sample} + 1 = 1 + 1 = 2$$

Step-9: if (Sample > ns) (x).

goto step-4

$$\text{Step-4: } g_m = -(3.8 - (0.912)(0.4) - 1.195)(0.4) = -0.89$$

$$g_c = -(3.8 - (0.912)(0.4) - 1.195) = -2.24$$

$$\text{Step-5: } G_m = -0.56 + (-0.89) = -1.45$$

$$G_c = 13.48 + (-2.24) = 11.24$$

$$\text{Step-6: } \Delta m = \frac{-(0.1)}{\sqrt{-1.43 \times 10^{-8}}} \times (-0.89) = 0.074$$

$$\Delta c = \frac{-(0.1)}{\sqrt{11.24 \times 10^{-8}}} \times (-2.24) = 0.066$$

Step-7: $m = m + \Delta m = 0.912 + 0.074 = 0.986$

$c = c + \Delta c = -1.195 + 0.066 = -1.129$

Step-8: $\text{Sample} = \text{Sample} + 1 = 2 + 1 = 3$

Step-9: $\text{if } (\text{Sample}^3 > 2)$

Go to next step

Step-10: $\text{itr} = \text{itr} + 1 = 2 + 1 = 3$

Step-11: $\text{if } (\text{itr}^3 > \text{epochs})$

Go to next step

Step-12: $m = 0.98 \quad c = -1.12$