

Assignment-3

- * Let us consider sample dataset have one Input (x_{ia}) and one Output (y_{ia}) and number of samples. develop a sample regression model using stochastic gradient descent (SGD) Optimiser

sample (i)	x_{ia}	y_{ia}
1	0.2	3.4
2	0.4	3.8
3	0.6	4.2
4	0.8	4.6

→ do manual calculations for 2 iterations, 2 samples

Step 1 = $x, y, m = 1, c = -1, \eta = 0.1, \text{epochs} = 2, ns = 2$

Step 2 = $\text{iter} = 1$

Step 3 = $\text{sample} = 1$

Step 4 = $\frac{\partial e}{\partial m} = -(3.4 - (-1))(0.2) - (-1)0.2$
 $= -0.84$

$$\frac{\partial e}{\partial c} = -(3.4 - (-1))(0.2 + 1)$$
$$= -4.2$$

Step 5 = $\Delta m = -(0.1)(-0.84) = 0.084$

$$\Delta c = -(0.1)(-4.2)$$
$$= 0.42$$

Step 6 = $m = m + \Delta m$
 $= 1 + 0.084 = 1.084$

$$c = c + \Delta c$$
$$= -1 + 0.42 = -0.58$$

step 7 : sample += 1 $\Rightarrow 1+1=2$

step 8 : if (sample > ns)

$2 > 2$
goto step 9
else
goto step 4

step 4 : $\frac{\partial f}{\partial m} = -(3.8 - (1.084)(0.4) + 0.58) \cdot 0.4$
 $= -1.5785$

$$\frac{\partial E}{\partial c} = -(3.8 - (1.084)(0.4) + 0.58)$$
$$= -3.9464$$

step 5 : $\Delta m = -(0.1)(-1.5785) = 0.1578$

$$\Delta c = -(0.1)(-3.9464) = 0.3946$$

step 6 : $m = m + \Delta m = 1.084 + 0.1578 = 1.2418$

$$c = c + \Delta c = -0.58 + 0.3946 = -0.1854$$

step 7 : sample += 1 = 2+1 = 3

step 8 : if (sample > ns)

$3 > 2$
goto step 9
else
goto step 4

step 9 : iter = iter + 1

$$= 1+1 = 2$$

step 10 : if (iter > epochs)

$2 > 2$
goto step 11
else
goto step 3

step 3 : sample = 1

$$\begin{aligned}\text{step 4} \quad \frac{\partial E}{\partial m} &= -(3.4 - (1.2)(0.2) + (0.18))0.2 \\ &= -(3.34)0.2 \\ &= -0.668\end{aligned}$$

$$\begin{aligned}\frac{\partial E}{\partial c} &= -(3.4 - (1.2)(0.2) + 0.18) \\ &= -3.34\end{aligned}$$

$$\begin{aligned}\text{step 5} \quad \Delta m &= -(0.1)(-0.668) \\ &= 0.0668\end{aligned}$$

$$\begin{aligned}\text{step 6} \quad m &= m + \Delta m = 1.24 + 0.0668 \approx 1.3 \\ c &= c + \Delta c = 0.18 + 0.33 \approx 0.15\end{aligned}$$

$$\text{step 7} \quad \text{sample } t = 1$$

$$1 + 1 = 2$$

$$\text{step 8} \quad \text{if (sample} > \text{ns)}$$

$$\begin{aligned}&2 > 2 \\ &\text{goto step 9}\end{aligned}$$

$$\begin{aligned}&\text{else} \\ &\text{goto step 4}\end{aligned}$$

$$\text{step 4} \quad \frac{\partial E}{\partial m}$$

$$\begin{aligned}&= -(3.8 - (1.3)(0.4) - 0.15)0.4 \\ &= -1.25\end{aligned}$$

$$\begin{aligned}\frac{\partial E}{\partial c} &= -(3.8 - (1.3)(0.4) - 0.15) \\ &= -3.13\end{aligned}$$

$$\begin{aligned}\text{step 5} \quad \Delta m &= -(0.1)(-1.25) = 0.12 \\ \Delta c &= -(0.1)(-3.13) = 0.31\end{aligned}$$

$$\begin{aligned}\text{step 6} \quad m &= m + \Delta m = 1.3 + 0.12 \approx 1.42 \\ c &= c + \Delta c = 0.15 + 0.31 \approx 0.46\end{aligned}$$

step 7: sample = sample + 1

step 8: if (sample > ns)

goto step 9

else
goto step 4

step 9: iter = iter + 1
= 2 + 1 = 3

step 10: if (iter > epochs)

goto step 11
else
goto step 3

step 11: print m & c

$m = 1.42$, $c = 0.46$