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SUBJECT: NEURAL NETWORKS AND DEEP LEARNING

ASSIGNMENT-1

Find Global minimum point and value for function

$$f(x) = x^4 + 3x^2 + 10$$

Sol:- Manual calculations for two iterations:-

$$\text{Given } f(x) = x^4 + 3x^2 + 10$$

Step-1: Initialize Variables

$$x = 1$$

$$\eta = 0.1$$

$$\text{epochs} = 2$$

Step-2: First order derivative of $f(x)$ at $x=1$

$$\begin{aligned} \left(\frac{\partial f}{\partial x} \right)_{x=1} &= (4x^3 + 6x)_1 \\ &= 4(1) + 6(1) \\ &= 4 + 6 \\ &= 10 \end{aligned}$$

Step-3: Calculate change in x

$$\begin{aligned} \Delta x &= -\eta \frac{df}{dx} \\ &= -(0.1)(10) \end{aligned}$$

$$\Delta x = -1$$

Step-4: Update variable x

$$x = x + \Delta x$$

$$= 1 + (-1)$$

$$x = 0$$

Step-5: Increment iterations

$$\text{itr} = \text{itr} + 1$$

Step-6: if (iterations > epochs) then goto step-7

else, go to step-2

here, $\text{itr} = 2$, $\text{epochs} = 2$

$$2 > 2 \rightarrow \text{It is false.}$$

Hence goto step-2.

Step-2: Calculate first order derivative of $f(x)$

at $x = 0$

$$\left(\frac{\partial f}{\partial x} \right)_{x=0} = (4x^3 + 6x)_0$$

$$= 0$$

Step-3: Calculate change in x .

$$\Delta x = -\eta \frac{df}{dx}$$

$$= -(0.1) 0$$

$$= 0$$

Step-4: Update variable x

$$x = x + \Delta x$$

$$= 0 + 4(0)$$

$$= 0$$

Step-5: Increment iterations

$$\text{itr} = \text{itr} + 1$$

Step-6 : if (itr > epoches) goto step-7
else, goto step-2
Here, itr = 3, epoches = 2
 $3 > 2 \rightarrow$ It is True.
Hence goto step-7

Step-7: Print variable x

$\Rightarrow x = 0$

At $x = 0$

We find minimum value of function $f(x)$,
that minimum value

$$f(0) = 10.$$