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SUBJECT :- NEURAL NETWORKS AND DEEP LEARNING

### Assignment - 2

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  $x=1$

$$\left(\frac{\partial f}{\partial x}\right)_{x=1} = (4x^3 + 6x)$$

$$= 4(1) + 6(1)$$

$$= 4 + 6$$

$$= 10$$

Step 3 :- Calculate change in  $x$  where  $\epsilon = 0.01$  if

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

$$= -(0.1)(10)$$

$$\Delta x = -1$$

Step 4 :- update variable  $x$

$$x = x + \Delta x$$

$$= 1 + (-1)$$

$$= 0$$

Step 5 :- Increment iterations

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



step-6: if (iterations > epochs) then go to step 7

else go to step-2

here, itr = 2, epochs = 2

$2 > 2 \rightarrow$  It is false

hence goto step 2

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

$x=0$

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

step 3:- calculate change in  $x$

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

$$= -(0.1)0 = 0$$

step 4: Update variable  $x$

$$x = x + \Delta x$$

$$= 0 + 0$$

$$= 0$$

step 5: Increment iterations

$$itr = itr + 1$$

step 6: if (itr > epochs) goto step 7

else goto step-2

here, itr = 3, epochs = 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

$$f(0) = 10$$