Neural Networks and deep learning

18K41A0564

Assignment - 1

→ find the global minimum point and value for the following function

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

→ Calculations:-

manual calculations for two iterations respectively

- Step 1 :- $f(x) = x^4 + 3x^2 + 10$ (given equation)

  variable initialization

  $x = 2$; $\eta = 0.04$; epoches = 132 (in code)
  = 2 (manual)

  itr = 1 (initial)

- step 2 :- 1st Order derivative for $f(x)$ at $x=1$

$$\left(\frac{df}{dx}\right)_{\substack{at \\ x=1}} = (4x^3 + 6x)_{at\ x=1} = 4(1)^3 + 6(1) = 44$$

- step 3:- Calculating change in x

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

$$= (-0.04) \cdot (44)$$

$$= \boxed{\Delta x = -1.76}$$

- Step 4 :- Update the value of x

$$x = x + \Delta x$$

$$x = 2 + (-1.76)$$

$$x = 0.24$$

Step 5 :- Increment the Iter value

iter = iter + 1

ie iter = 2 (current)

Step 6 :- if (iter > epoches)

then go to step 7

else

go to step 2

Here iter = 2 & epoches = 2

if (2 > 2) → false

else → True

So, go to step 2

Step 2 :- 1st order derivative for f(x) at x = 0.24

$$\left(\frac{df}{dx}\right)_{at\ x=0.24} = (4x^3 + 6x)_{at\ 0.24} \Rightarrow 4(0.24)^3 + 6(0.24)$$

$$\Rightarrow 0.013824$$

Step 3 :- Calculating change in x

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

$$= -(0.04)(0.013824)$$

$$\Rightarrow \Delta x = -0.00055296$$

Step 4 :- Update the value of x

$$x = \Delta x$$

$$= 0.94 + (-0.00055296)$$

$$x = 0.23944704$$

Step 5 : Increment the iter value

iter = iter + 1

i.e iter = 3 (now)

Step 6 : if (iter > epoches) then

go to step 7

else

go to step 2

Here, iter = 3 & epoches = 2

if (3>2) → True

So, go to step 7

Step 7 : print x value = 0.23944704

minimum value of function f(x) at x = 0.23944704 is f(0.23944704).

→ Here we taken only 2 iterations, by increasing iterations we can reduce the value to min which is x = 0 respectively.