DL ASSIGNMENT - 1

CS898BD

Question - 1: Draw a computational graph for the following function and calculate values for the forward pass and backward pass

$$f(x) = (x_1 w_1 + x_2 w_2) * (x_3 w_3 + x_4 w_4)$$

where $x_1 = 0.7, w_1 = -1.5, x_2 = 0.34, w_2 = -0.35,$
$x_3 = 0.2, w_3 = -0.25, x_4 = -0.9, w_4 = 0.2$

Solution:

Forward Pass

Step-1:

Let $a_1 = x_1 w_1, a_2 = x_2 w_2, b_1 = x_3 w_3, b_2 = x_4 w_4$

$a_1 = x_1 w_1 = 0.7 \times -1.5 = -1.05$

$a_2 = x_2 w_2 = 0.34 \times -0.35 = -0.119$

$b_1 = x_3 w_3 = -0.2 \times 0.25 = -0.05$

$b_2 = x_4 w_4 = -0.9 \times 0.2 = -0.18$

Step-2: Let $A = a_1 + a_2, B = b_1 + b_2$

$A = x_1 w_1 + x_2 w_2 = (-1.05) + (-0.119) = -1.169$

$B = x_3 w_3 + x_4 w_4 = (-0.05) + (-0.18) = -0.23$

Step-3:

$f(x) = A \times B$

$(-1.169) \times (-0.23) = 0.26887$

Backward pass:

Gradients $\frac{\partial f}{\partial A} = B, \frac{\partial f}{\partial B} = A$

Gradients of A & B

$$\frac{\partial f}{\partial A} = -0.23$$

$$\frac{\partial f}{\partial B} = -1.169$$

Gradients of x_1, w_1, x_2, w_2

$$\frac{\partial f}{\partial x_1} = \frac{\partial f}{\partial A} \times \frac{\partial A}{\partial x_1} = (-0.23) \times (0.7) = -0.161$$

$$\frac{\partial f}{\partial w_1} = \frac{\partial f}{\partial A} \times \frac{\partial A}{\partial w_1} = (-0.23) \times (-1.5) = 0.345$$

$$\frac{\partial f}{\partial x_2} = \frac{\partial f}{\partial A} \times \frac{\partial A}{\partial x_2} = (-0.23) \times (0.34) = -0.0782$$

$$\frac{\partial f}{\partial w_2} = \frac{\partial f}{\partial A} \times \frac{\partial A}{\partial w_2} = (-0.23) \times (-0.35) = 0.0805$$

Gradients of x_3, w_3, x_4, w_4

$$\frac{\partial f}{\partial x_3} = \frac{\partial f}{\partial B} \times \frac{\partial B}{\partial x_3} = (-1.169) \times (0.2) = -0.2338$$

$$\frac{\partial f}{\partial w_3} = \frac{\partial f}{\partial B} \times \frac{\partial B}{\partial w_3} = (-1.169) \times (-0.25) = 0.2922$$

$$\frac{\partial t}{\partial x_4} = \frac{\partial t}{\partial B} \times \frac{\partial B}{\partial x_4} = (-1.169) \times (-0.9) = 1.0521$$

$$\frac{\partial t}{\partial w_4} = \frac{\partial t}{\partial B} \times \frac{\partial B}{\partial w_4} = (-1.169) \times (0.2) = -0.2338$$

Graph: