

Quiz 3

Let's assume we have a function. $(x,y,z)=(x^2+y) \cdot z - \sin(x)$

- Draw the computational graph.
- Evaluate the function at $x=3$, $y=2$, and $z=4$ using forward propagation.
- Then use backward propagation to get $\partial f/\partial a$, $\partial f/\partial b$, $\partial f/\partial d$, $\partial f/\partial g$

a) Draw by yourself

Handwritten solution for Quiz 3:

(b) Forward propagation

$x=3, y=2, z=4$

- $x^2 = 9$
- $y = 2$
- $x^2 + y = 9 + 2 = 11$
- $(11) * z = 44$
- $f(3, 2, 4) = 44 - \sin(3) = 43.85$

(c) back propagation

$\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}, \frac{\partial f}{\partial z}$

- $\frac{\partial f}{\partial z} = x^2 + y = 9 + 2 = 11$
- $\frac{\partial f}{\partial y} = z = 4$
- $\frac{\partial f}{\partial x} = \frac{\partial f}{\partial (x^2+y)} \cdot \frac{\partial (x^2+y)}{\partial x} - \frac{\partial \sin(x)}{\partial x}$

5 Friday
FEBRUARY
23 Jumada-II 1442 H

7 am

30 $\frac{\partial f}{\partial (x^2+y)} = z = 4$

8

30 $\frac{\partial (x^2+y)}{\partial x} = \frac{\partial (x^2)}{\partial x} = 2x = 2 \times 3 = 6$

9

30 $\frac{\partial \sin(x)}{\partial x} = \cos(x)$

10

30

11

30

12

30

1 pm

الجمعة
شباط. فبراير
٢٣ جماد آخر ١٤٤٢ هـ

6 Saturday
FEBRUARY
24 Jumada-II 1442 H

7 am

30 $\frac{\partial f}{\partial x} = 4 \times 6 - \cos(x) = 24 - \cos(3)$

8

30 using $\cos(3) \approx -0.989$

9

30 $\frac{\partial f}{\partial x} = 24 - (-0.989) = 24.989$

10

30 $\frac{\partial f}{\partial x} \approx 24.989$

11

30 $\frac{\partial f}{\partial y} = 4$

12

30 $\frac{\partial f}{\partial z} = 11$

1 pm

2- Apply gradient descent where the true $y=1$

(positive) Two features:

$$x_1 = 4 \quad x_2 = 5 \quad w_1 = 0.5 \quad w_2 = 0.75$$

10 Wednesday
FEBRUARY ... 2021 ...
28 Jumada-II 1442 H ... شباط، فبراير ٢٨ جماد آخر ١٤٤٢ هـ

7 am

30 $z = w \cdot x + b = w_1 x_1 + w_2 x_2 + b$

8

30

9 - one step of gradient descent

30

10

30 - Where the True $y=1$ (Positive)

11

30 and

12 Two Features :-

30

1 pm $x_1 = 4 \quad x_2 = 5$

30

2 - Assume 3 parameters

30

3 $w_1 = 0.5 \quad w_2 = 0.75 \quad b = 0.1$

30

4 $\eta = 0.1$

30

5 - update step for update Θ is :-

30

6 $\Theta^{t+1} = \Theta^t - \eta \nabla_{\Theta} L(f(x^{(i)}; \Theta), y^{(i)})$

7

30 where

8 $\frac{\partial L_{CE}(\hat{y}, y)}{\partial w_j} = [\sigma(w \cdot x + b) - y] x_j$

30

9

30

Tuesday
FEBRUARY
27 Jumada-II 1442 H ... 2021 ...
الثلاثاء
شباط، فبراير
٩
٢٧ جماد آخر ١٤٤٢ هـ

- Gradient vector has 3 dimensions.

$$\nabla_{w,b} = \begin{bmatrix} \sigma(w \cdot x + b) - y \\ \sigma(w \cdot x + b) - y \\ \sigma(w \cdot x + b) - y \end{bmatrix}$$

$$= \begin{bmatrix} (0.9971 - 1) \times 4 \\ (0.9971 - 1) \times 5 \\ (0.9971 - 1) \end{bmatrix}$$

$$\Rightarrow \hat{y} = \sigma(z) = \frac{1}{1 + e^{-z}}$$

$$\eta = 0.1$$

$$= \begin{bmatrix} -0.0464 \\ -0.058 \\ -0.0029 \end{bmatrix} \Rightarrow \Theta = \begin{bmatrix} w_1 \\ w_2 \\ b \end{bmatrix} - \eta \begin{bmatrix} -0.0464 \\ -0.058 \\ -0.0029 \end{bmatrix}$$

$$= \begin{bmatrix} 0.504 \\ 0.755 \\ 0.10029 \end{bmatrix}$$