Marcos Brito Devoto.

AMIA

Guía 4

4) $f = (x^2 \cos(x))^2 + x^2 \cos(x)$

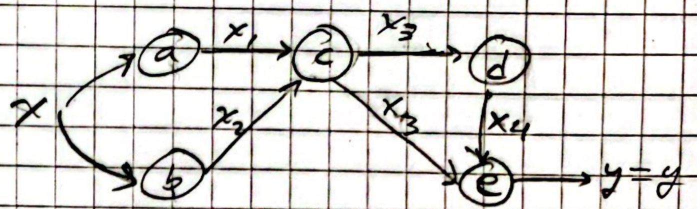
$x_1 = x^2$

$x_2 = \cos(x)$

$x_3 = x_1 \cdot x_2$

$x_4 = x_3^2$

$x_5 = x_3 + x_4 = y$



$$\frac{dy}{dx} = \frac{dy}{dx_4} \cdot \frac{dx_4}{dx} + \frac{dy}{dx_3} \cdot \frac{dx_3}{dx}$$

$$\frac{dx_4}{dx} = \frac{dx_4}{dx_3} \cdot \frac{dx_3}{dx}$$

$$\frac{dx_3}{dx} = \frac{dx_3}{dx_1} \cdot \frac{dx_1}{dx} + \frac{dx_3}{dx_2} \cdot \frac{dx_2}{dx}$$

$$\frac{dy}{dx_3} = 1 \qquad \frac{dy}{dx_4} = 1$$

$$\frac{dx_4}{dx_3} = 2x_3$$

$$\frac{dx_3}{dx_1} = x_2 \qquad \frac{dx_3}{dx_2} = x_1$$

$$\frac{dx_1}{dx} = 2x \qquad \frac{dx_2}{dx} = -\mathrm{sen}(x)$$

Luego, p/ un x dado, se puede calcular la derivada de f haciendo forward propagation y luego backward propagation

Ej:)

$x = \pi$ | $x_1 = \pi^2$, $x_2 = -1$ | $x_3 = -\pi^2$ | $x_4 = \pi^4$ | $y = \pi^4 - \pi^2 = 87{,}539$

$$\frac{dy}{dx}(x=\pi) = \overbrace{\frac{dy}{dx_4}}^{=1} \cdot \frac{dx_4}{dx} + \overbrace{\frac{dy}{dx_3}}^{=1} \cdot \frac{dx_3}{dx} = 4\pi^3 - 2\pi = 117{,}74$$

$$\overbrace{\frac{dx_4}{dx_3}}^{-2\pi^2} \cdot \frac{dx_3}{dx} = 4\pi^3$$

$$\overbrace{\frac{dx_3}{dx_1}}^{=-1} \cdot \underbrace{\frac{dx_1}{dx}}_{=2\pi} + \underbrace{\frac{dx_3}{dx_2}}_{=\pi^2} \cdot \underbrace{\frac{dx_2}{dx}}_{=0} = -2\pi$$

Scanned with CamScanner