University of Michigan

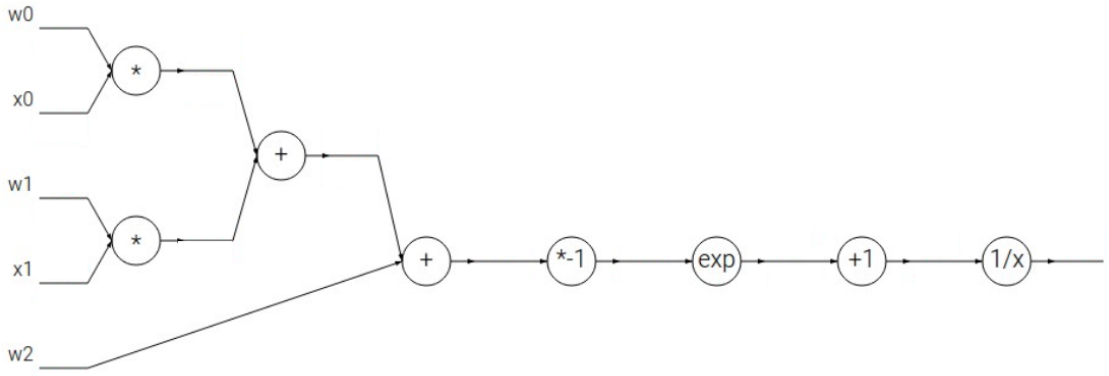
EECS 504: Foundations of Computer Vision

Winter 2020. Instructor: Andrew Owens.

Problem Set 4 Solution: Backpropagation

Problem 4.1 *Understanding backpropagation*

4.1(a) *Answer*:



4.1(b) *Answer*:

$$f(\vec{x}, \vec{w}) = \frac{1}{1 + e^{-27}}$$

4.1(c) *Answer*:

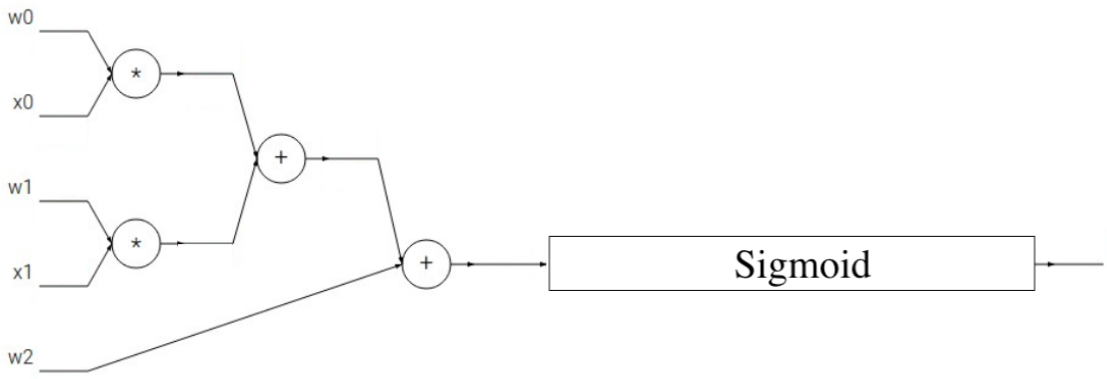
$$\frac{\partial f}{\partial \vec{w}} = [\frac{5e^{-27}}{(1+e^{-27})^2} \quad \frac{8e^{-27}}{(1+e^{-27})^2} \quad \frac{e^{-27}}{(1+e^{-27})^2}]$$

$$\frac{\partial f}{\partial \vec{x}} = [\frac{e^{-27}}{(1+e^{-27})^2} \quad \frac{3e^{-27}}{(1+e^{-27})^2}]$$

4.1(d) *Answer*:

$$\frac{\partial}{\partial x}[\sigma(x)] = \frac{e^{-x}}{(1+e^{-x})^2} = \left(\frac{1+e^{-x}-1}{1+e^{-x}}\right)\left(\frac{1}{1+e^{-x}}\right) = (1-\sigma(x))\sigma(x)$$

4.1(e) *Answer*:



$\frac{\partial f}{\partial \vec{w}}, \frac{\partial f}{\partial \vec{x}}$ are the as same as (c)