Neural Networks

Seminar - Week 2

Igor Janos

Seminar - Week 2

Assignment 1 Goals

- Implement vectorized linear layer as Perceptron
- Implement Multi-Layer Perceptron & forward pass
- Implement and explore activation functions
    - Sigmoid
    - TanH
    - ReLU
    - LeakyReLU

Forward Pass

$$a^{[0]} = x$$

$$z^{[1]} = W^{[1]}a^{[0]} + b^{[1]}$$

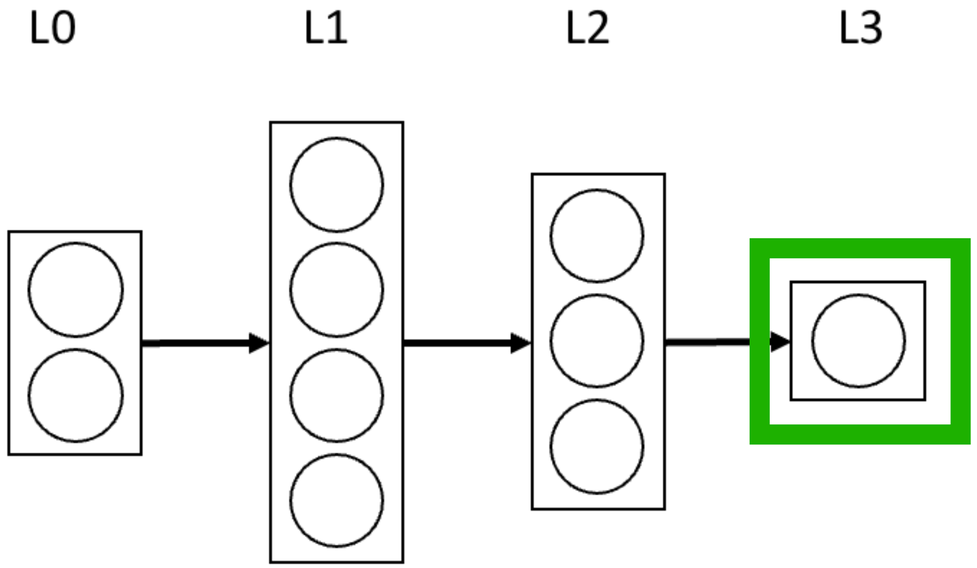
$$a^{[1]} = g^{[1]}(z^{[1]})$$

$$z^{[2]} = W^{[2]}a^{[1]} + b^{[2]}$$

$$a^{[2]} = g^{[2]}(z^{[2]})$$

$$z^{[3]} = W^{[3]}a^{[2]} + b^{[3]}$$

$$a^{[3]} = g^{[3]}(z^{[3]})$$

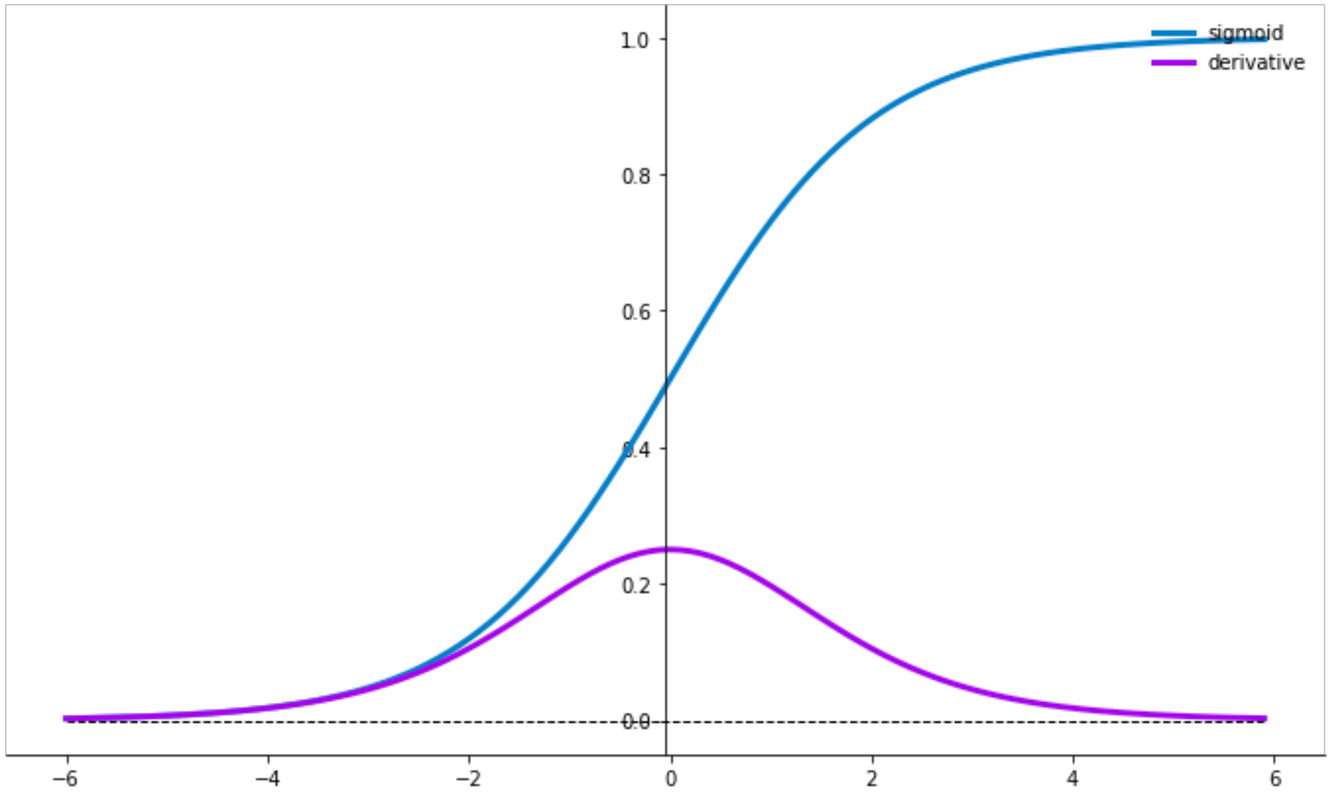


$$z^{[l]} = W^{[l]}a^{[l-1]} + b^{[l]}$$

$$a^{[l]} = g^{[l]}(z^{[l]})$$

Activation Functions

Sigmoid

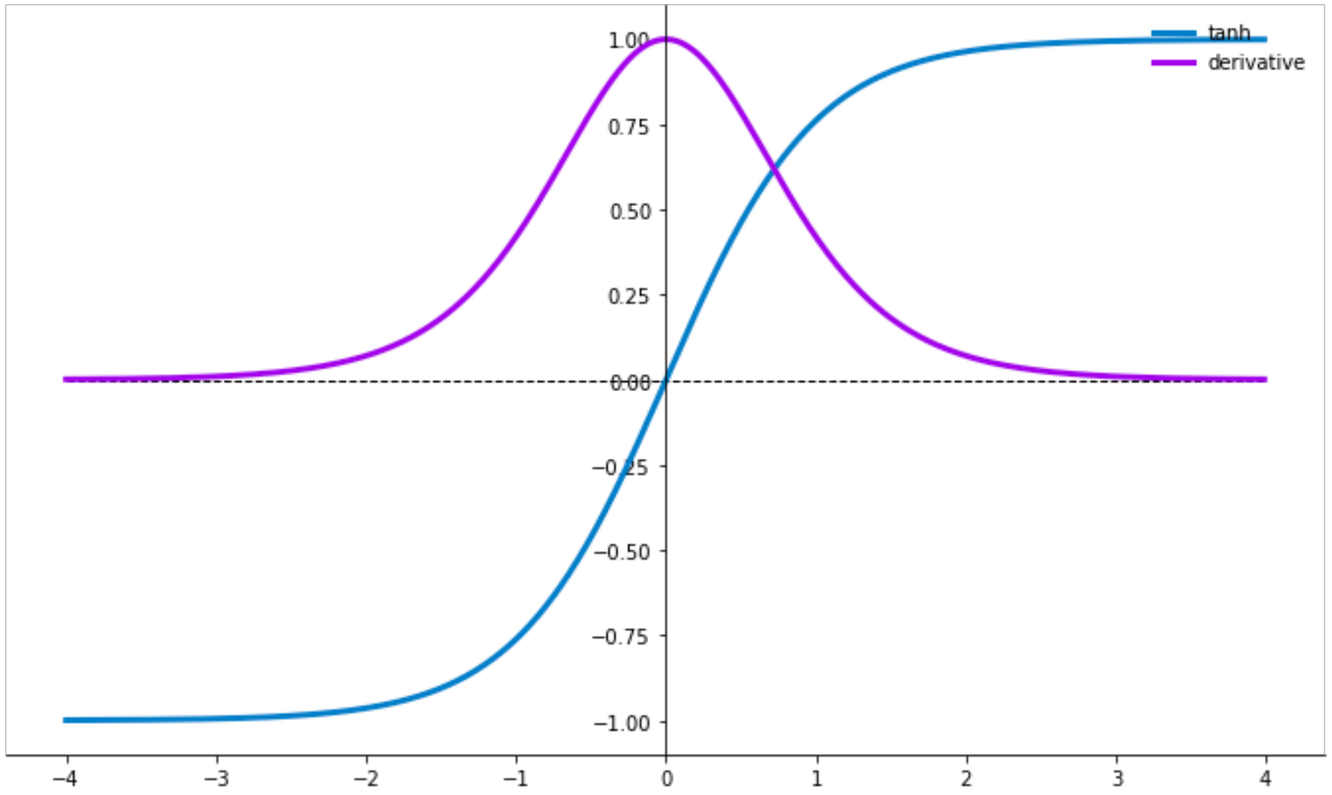


$$\sigma(z) = \frac{1}{1 + e^{-z}}$$

$$\sigma'(z) = \sigma(z)(1 - \sigma(z))$$

Activation Functions

TanH

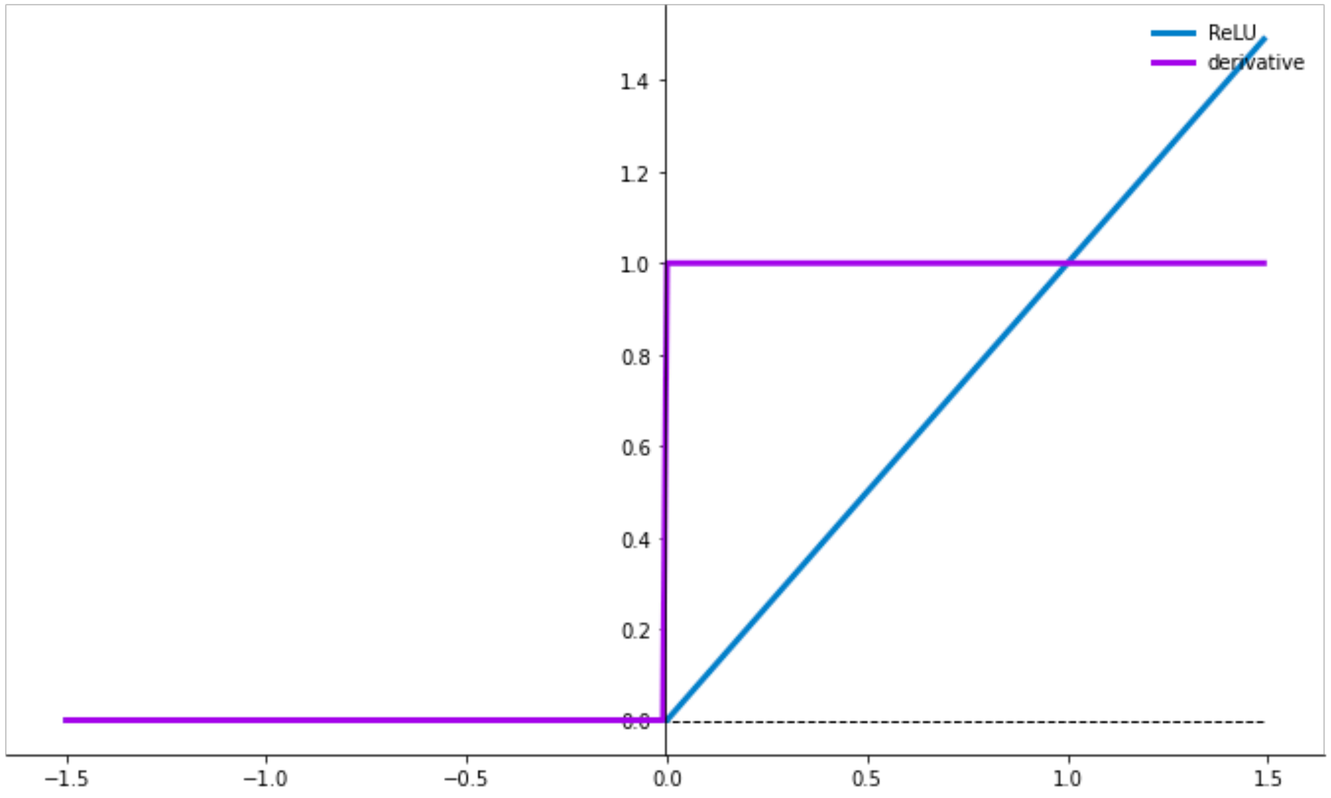


$$\tanh(z) = \frac{e^z - e^{-z}}{e^z + e^{-z}}$$

$$\tanh'(z) = 1 - \tanh^2(z)$$

Activation Functions

ReLU

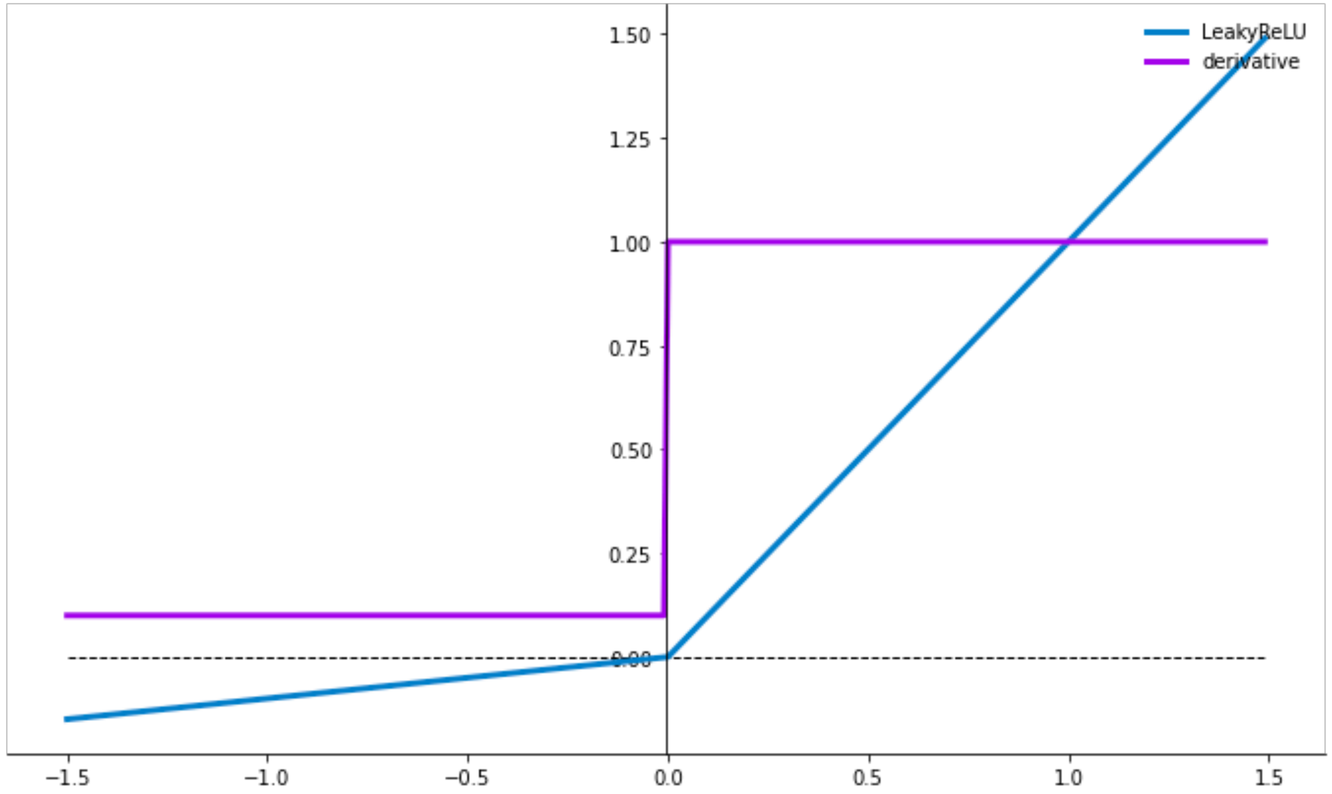


$$ReLU(z) = \max(0, z)$$

$$ReLU'(z) = \begin{cases} 1 & if\ z > 0 \\ 0 & else \end{cases}$$

Activation Functions

LeakyReLU



$$\alpha = 0.1$$

$$lReLU(z) = \max(\alpha z, z)$$

$$lReLU'(z) = \begin{cases} 1 & if\ z > 0 \\ \alpha & else \end{cases}$$