Improving Deep Neural Networks

Video 2: The Solutions to Vanishing and Exploding Gradients - Part 1

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Vanishing and Exploding Gradients

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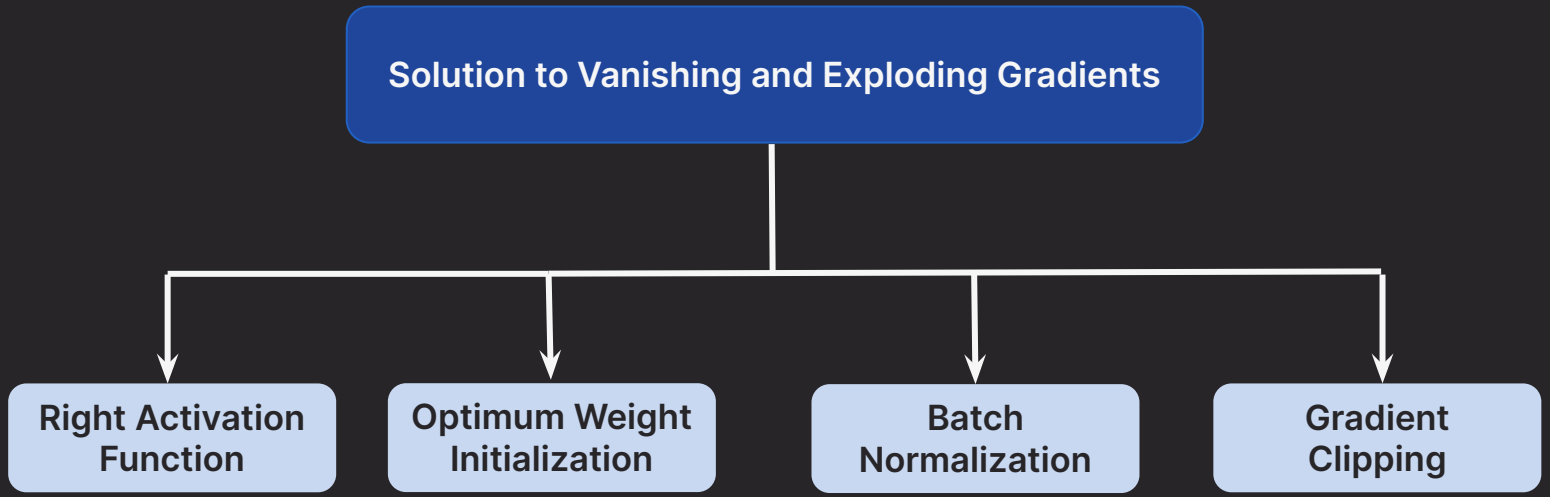
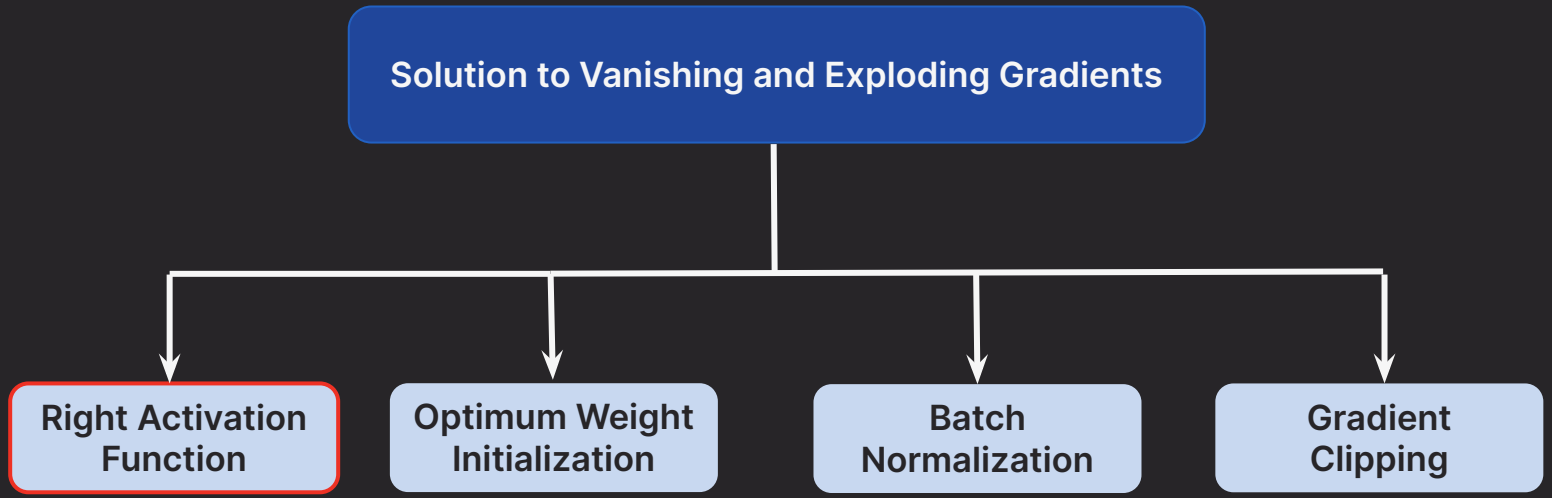
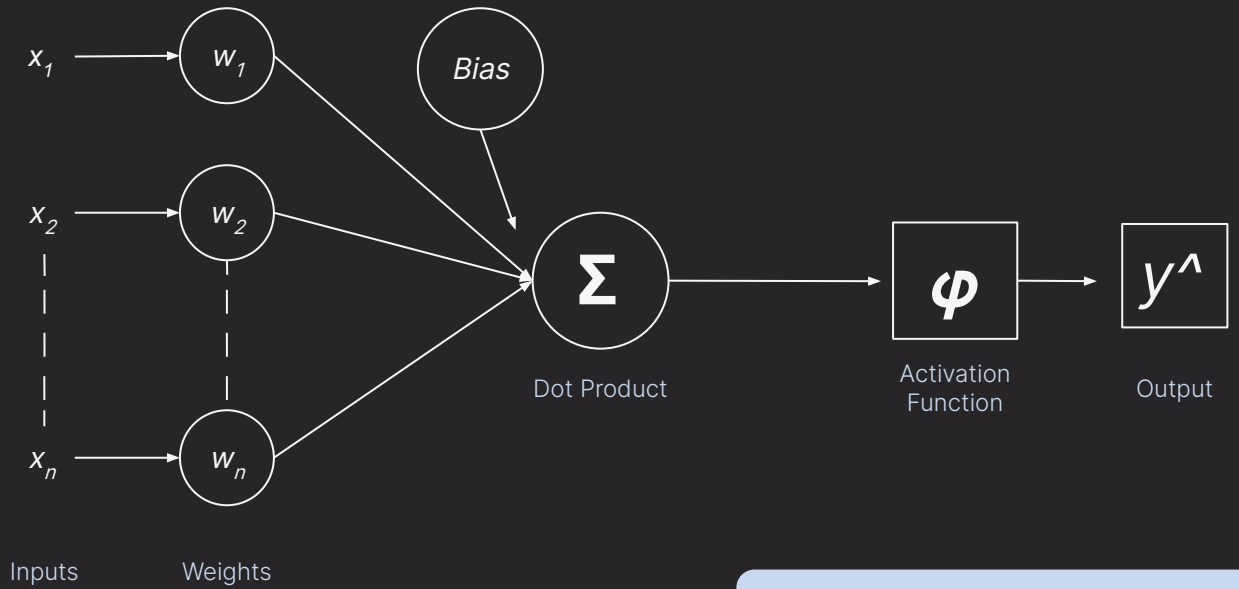
Vanishing and Exploding Gradients



Vanishing and Exploding Gradients

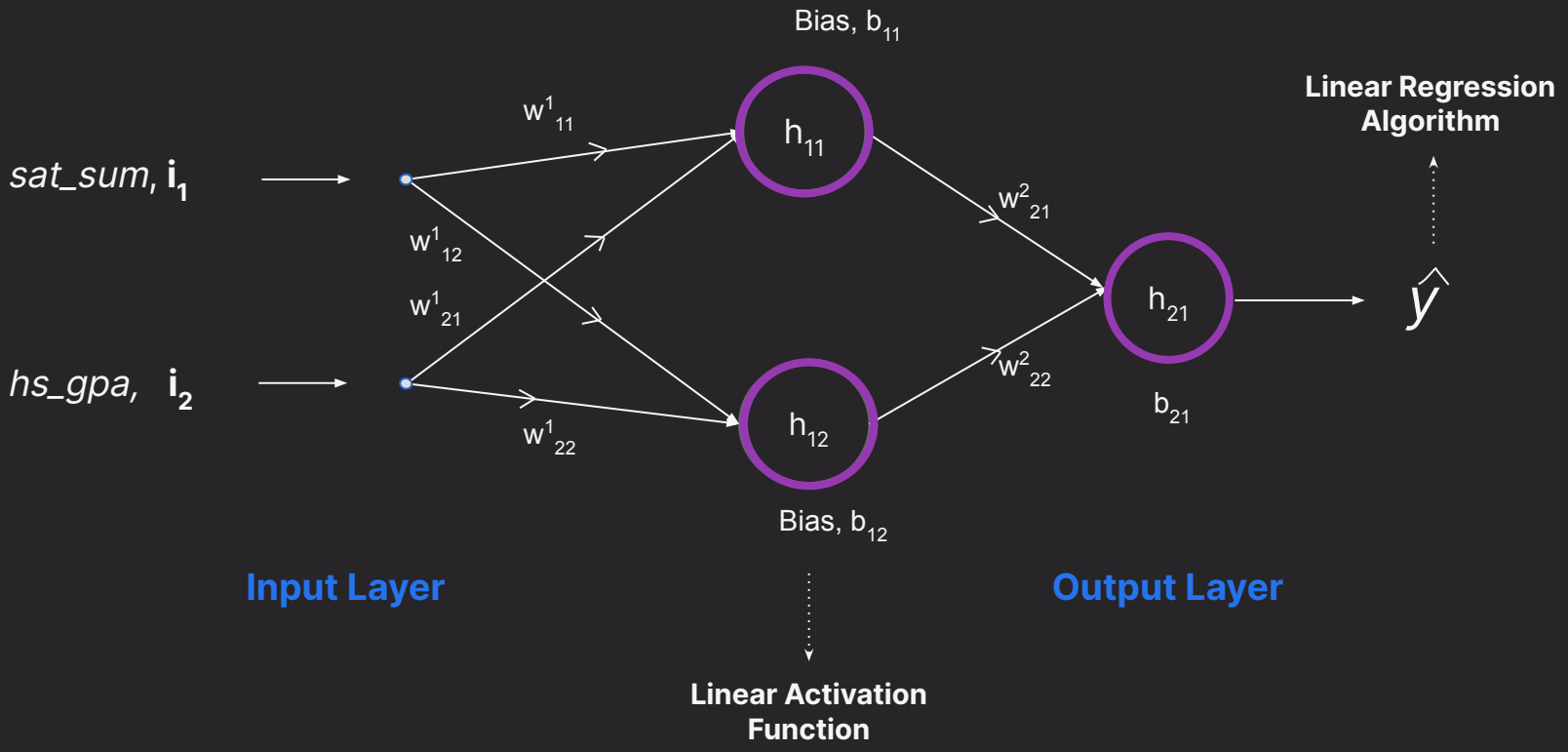


Recap



Linear Regression Model

Recap

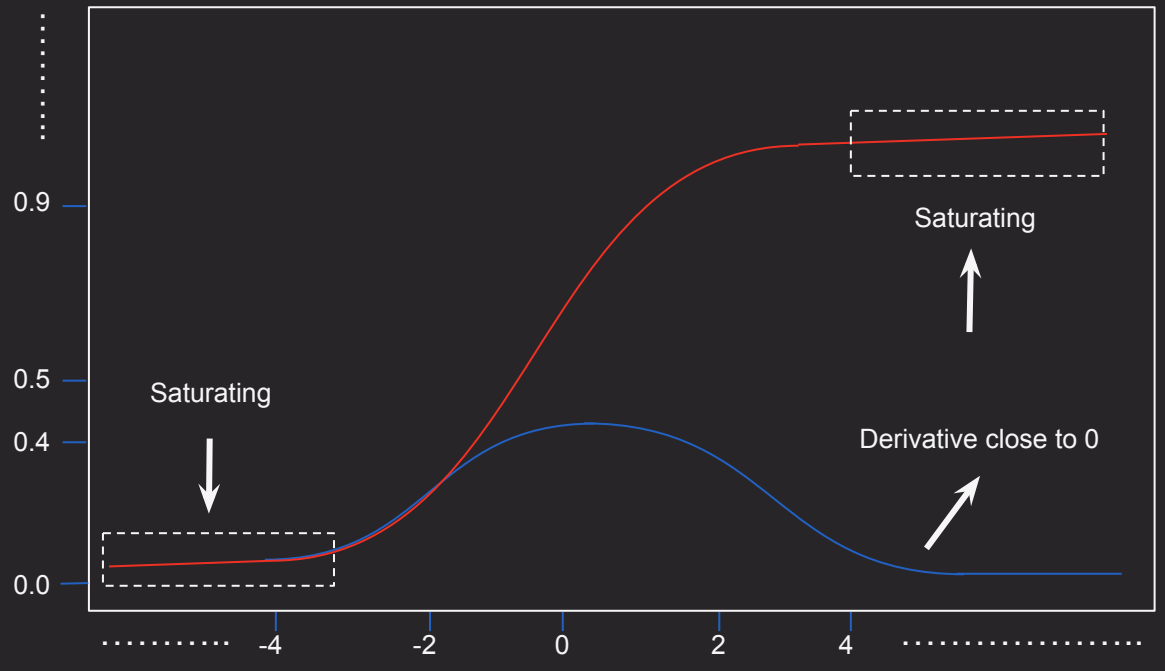

Bias, b_{11}
w^1_{11}
h_{11}
Linear Regression Algorithm
sat_sum, i_1
w^1_{12}
w^2_{21}
w^1_{21}
h_{21}
$\hat{y}$
hs_gpa, i_2
w^2_{22}
w^1_{22}
h_{12}
b_{21}
Bias, b_{12}
Input Layer
Output Layer
Linear Activation Function

Sigmoid for Non-Linearity

Researchers preferred using a sigmoid activation function

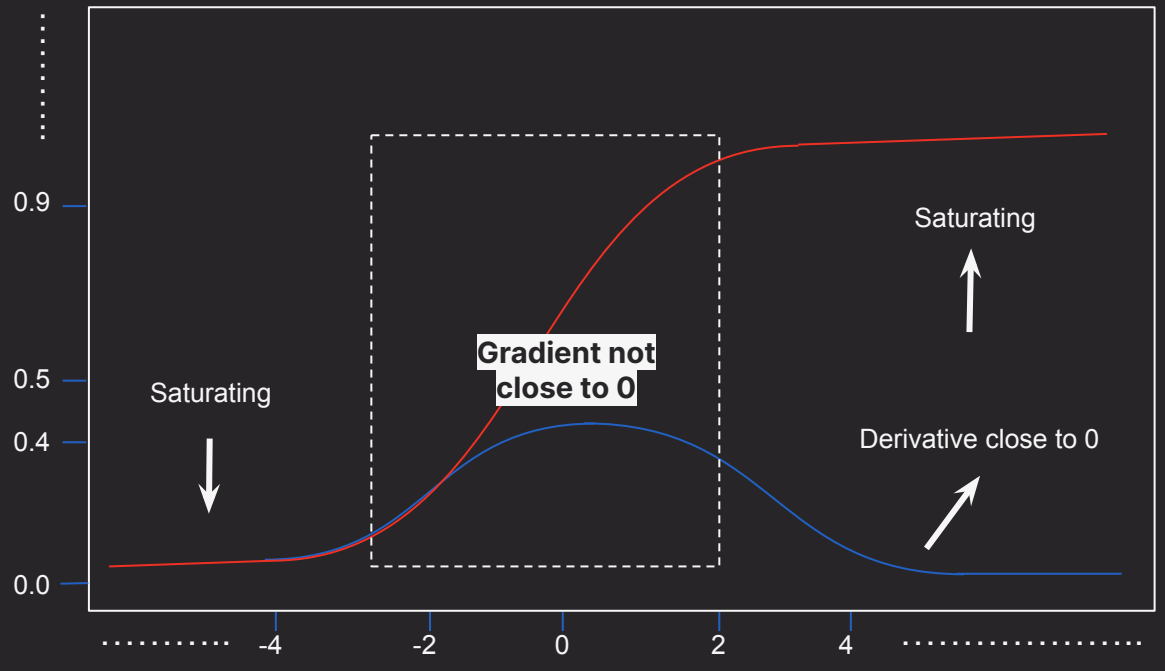
Sigmoid function narrows input ranges to 0-1 output

Sigmoid for Non-Linearity



Sigmoid Function and its derivatives

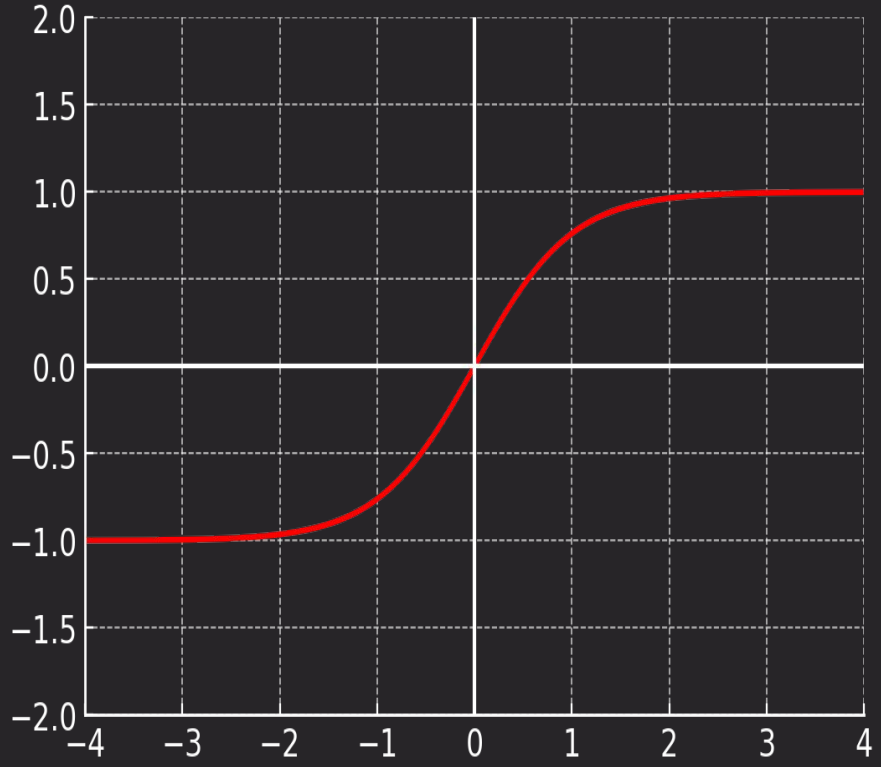
Sigmoid for Non-Linearity



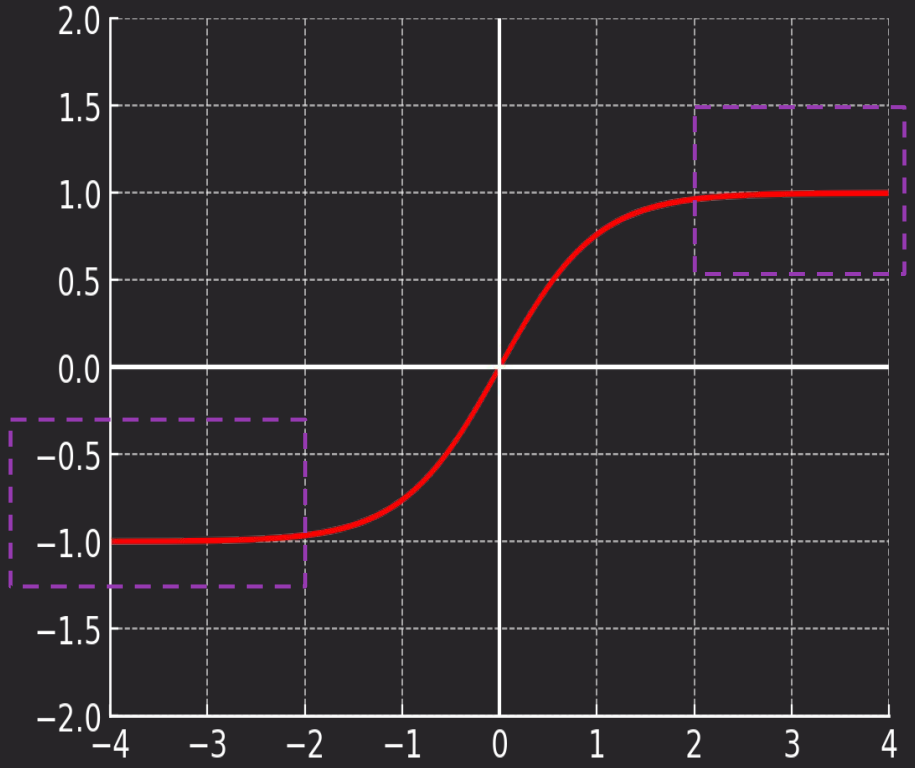
Sigmoid Function and its derivatives

Other activation function: TanH

TanH Function

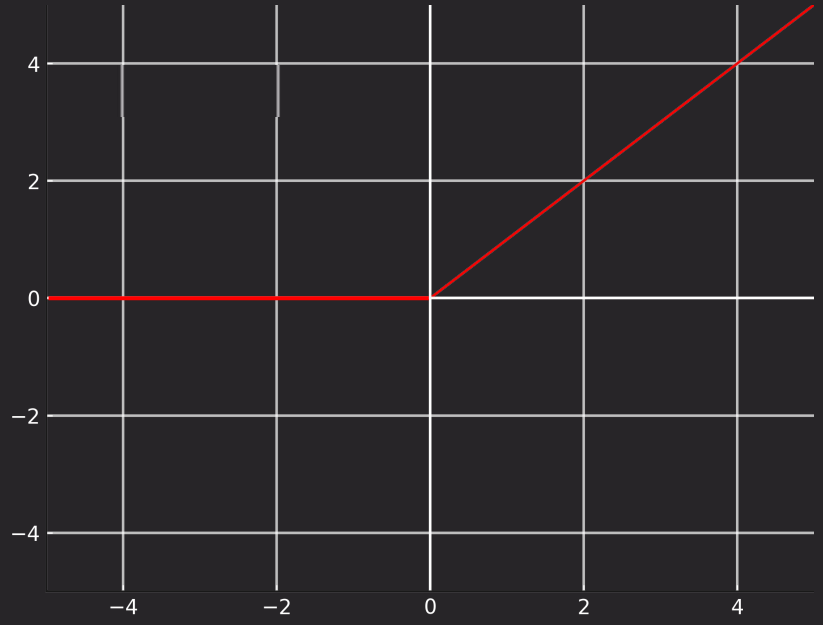


TanH Function



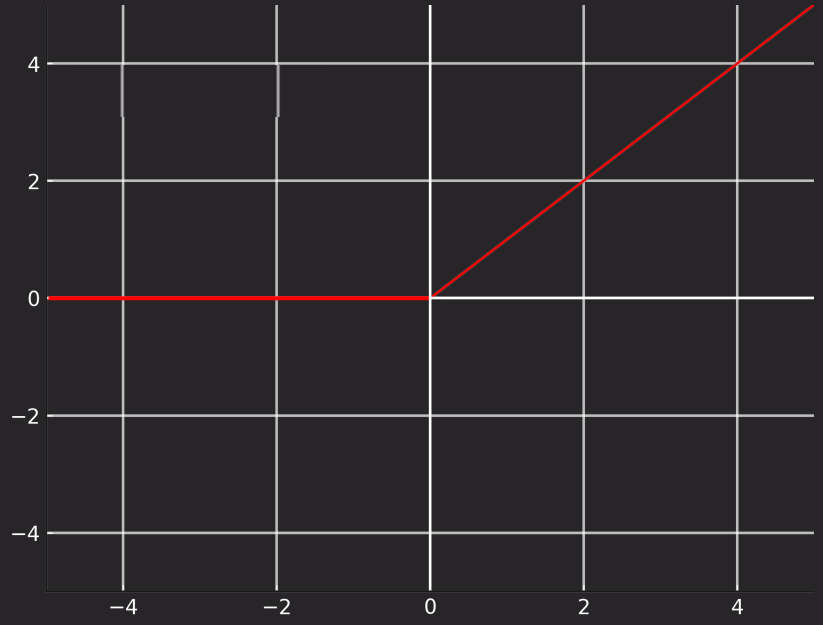
Other activation function: ReLU

ReLU Function



$$f(x) = \max(0, x)$$
$$f(x) = x, x \geq 0$$
$$f(x) = 0, x < 0$$

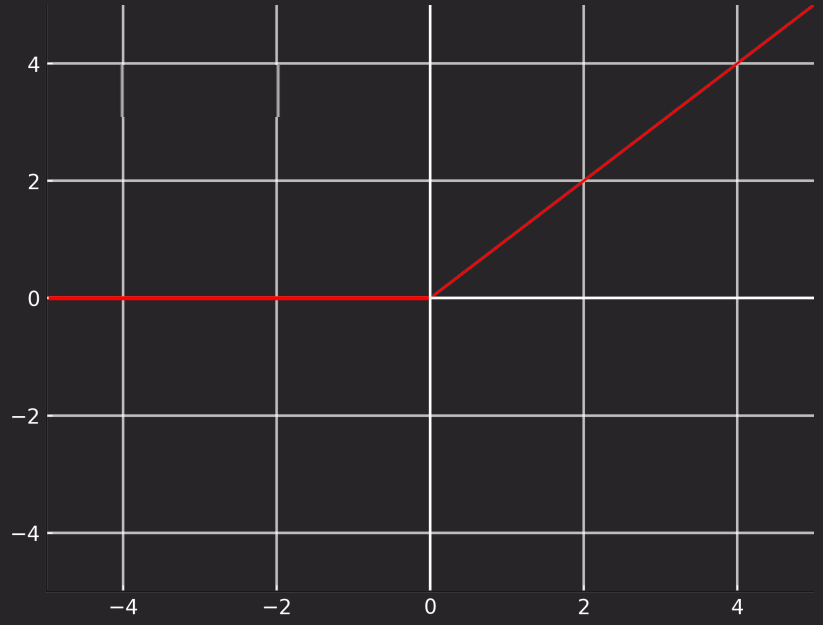
ReLU Function



$$f(x) = \max(0, x)$$
$$f(x) = x, x \geq 0$$
$$f(x) = 0, x < 0$$

ReLU is faster and more effective.

ReLU Function



$$f(x) = \max(0, x)$$
$$f(x) = x, x \geq 0$$
$$f(x) = 0, x < 0$$

ReLU is faster and more effective.

ReLU is computationally efficient.

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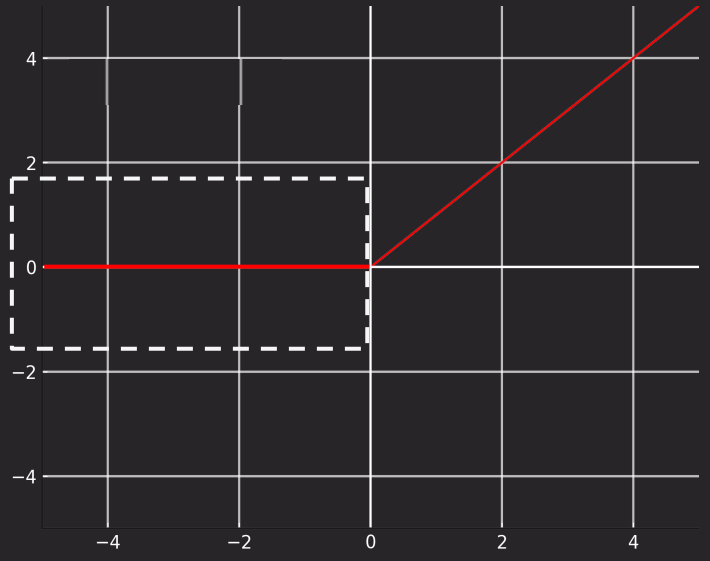
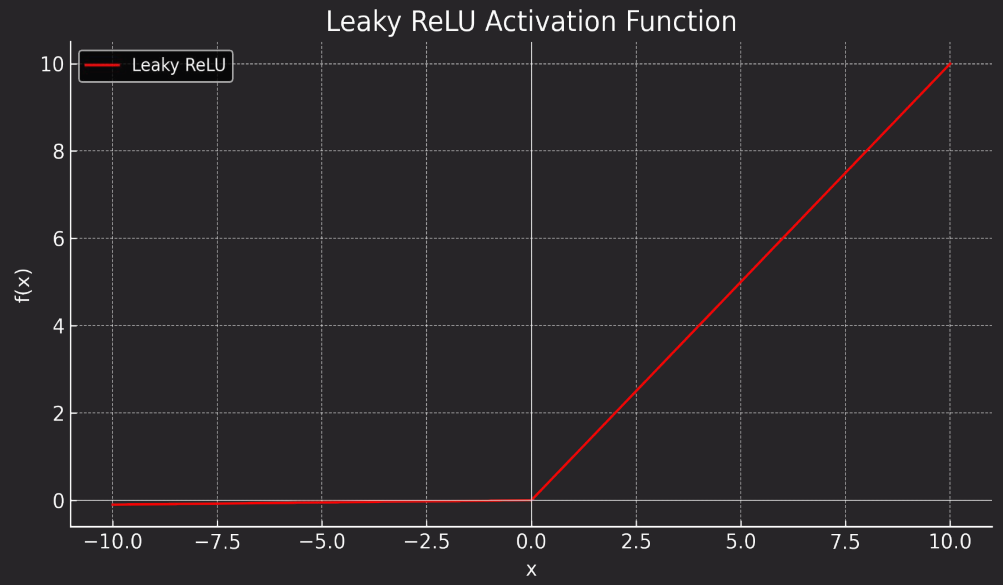
ReLU Function



During backpropagation process, the weights and biases for some neurons may not be updated.

Leaky ReLU and ELU Activation Functions

Leaky ReLU Function



$$f(x)=\max(\text{alpha}*x\ ,\ x)$$

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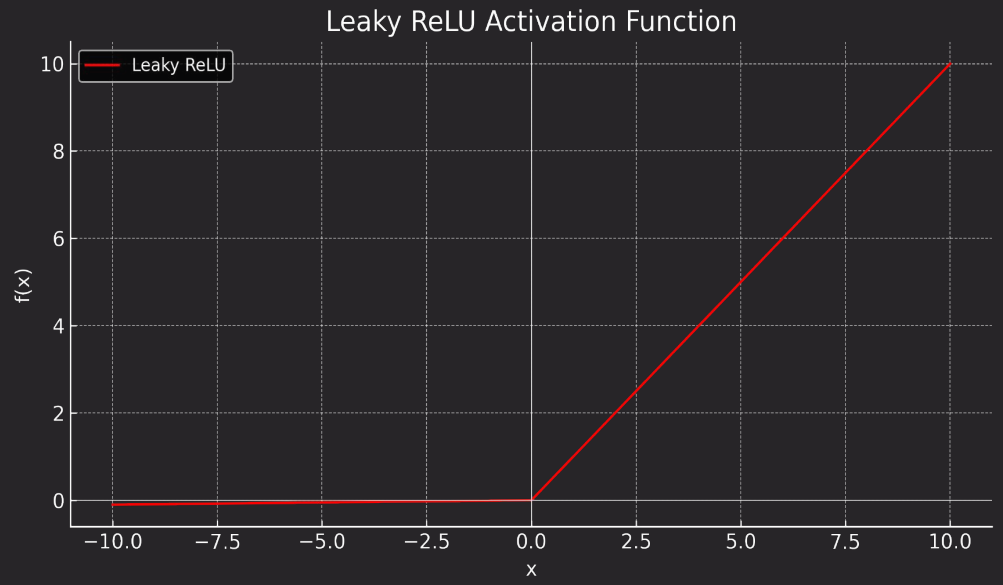
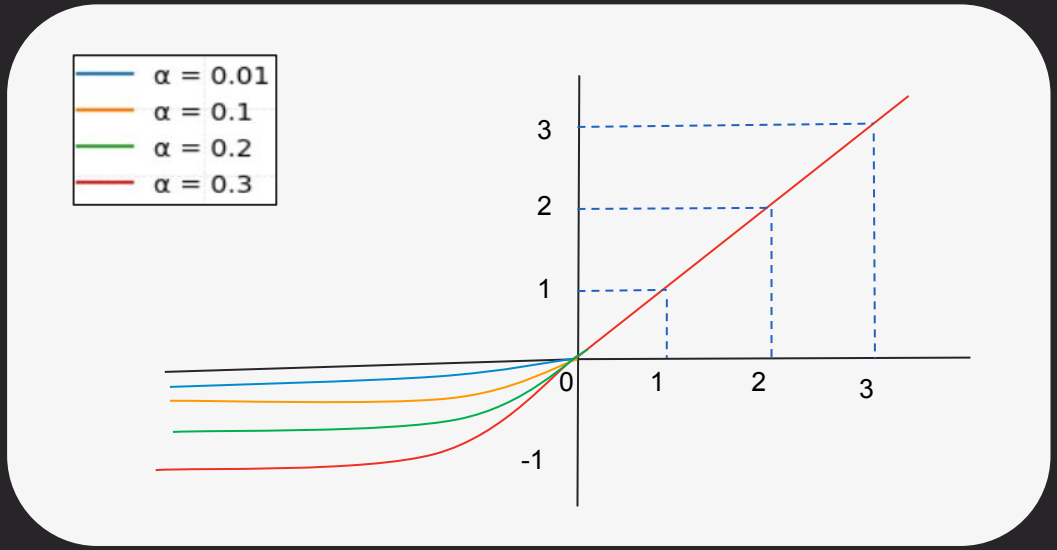
Leaky ReLU Function



$$\text{Leaky ReLU} = \begin{cases} x, & if\ x > 0 \\ a \times x, & if\ x \leq 0 \end{cases}$$

Exponential Linear Unit



$$f(x) = \begin{cases} x, & x \geq 0 \\ \alpha(e^x - 1), & x \geq 0 \end{cases}$$

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The Current Approach

- ReLU is used to reduce the problem of vanishing gradient
- The sigmoid activation function is used in the last layer of the binary classification problems.
- TanH and sigmoid are used in the hidden layers of some complex neural architectures.

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Up-Next: Optimum Weight Initialization Techniques