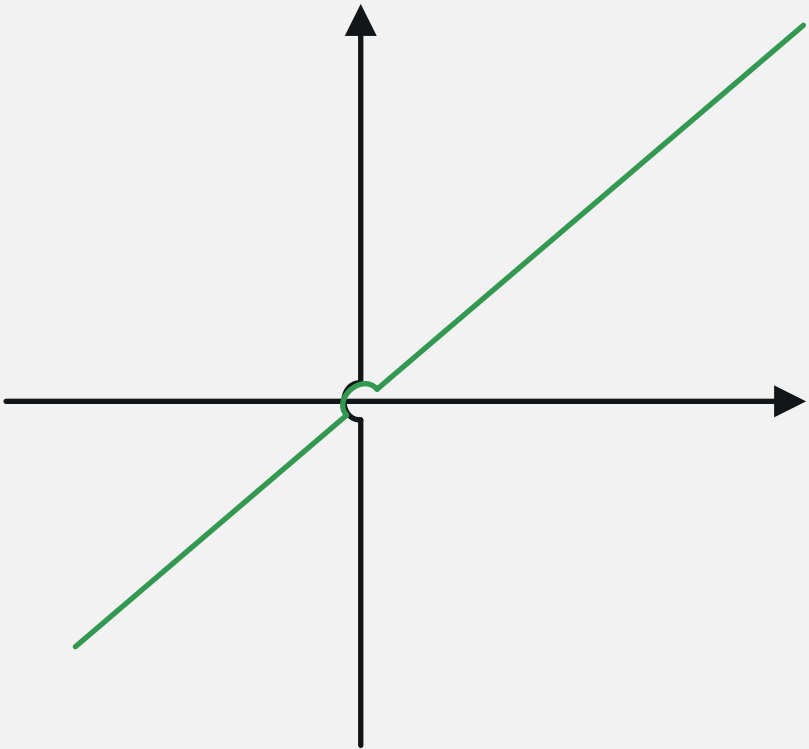# Activation Functions

They are essential components to ANN. They introduce non-linearity to the network, which enables to learn complex patterns and relationships in the data.

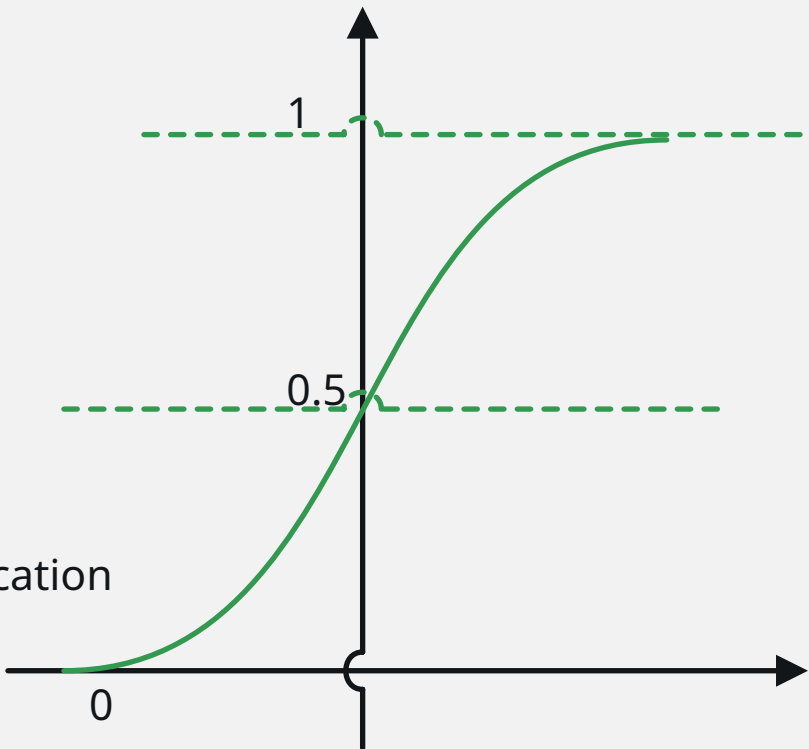**Standard Linear Function**

$$y = mx + c$$

Sigmoid Function

$$y = \frac{1}{1 + e^{-x}}$$
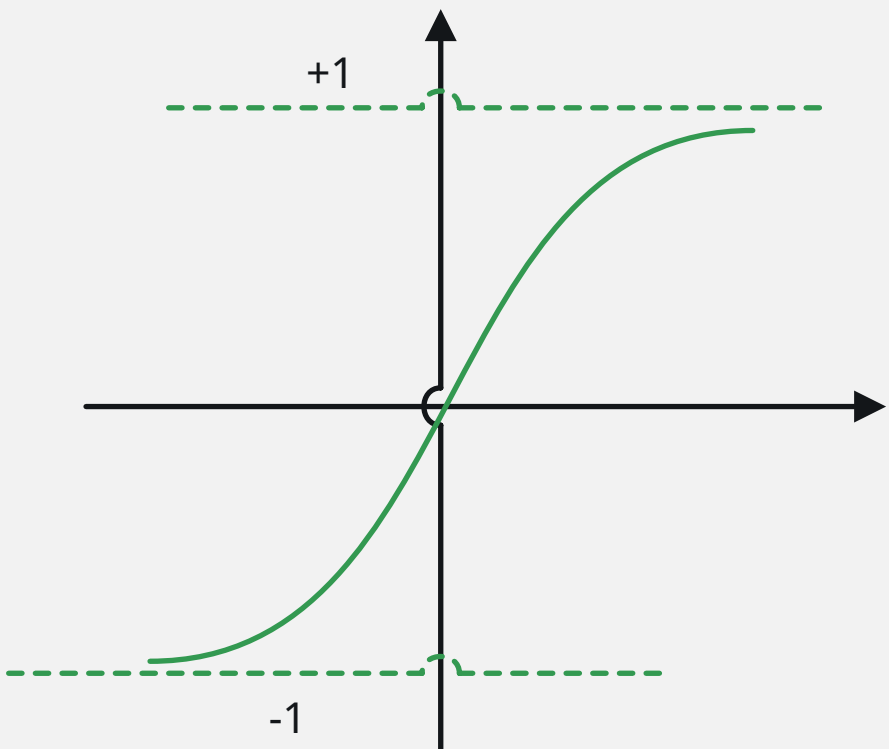
Output range: 0 to 1

Used in the output layer of classification models for binary classes

Tanh (Hyperbolic Tangent)

$$y = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$
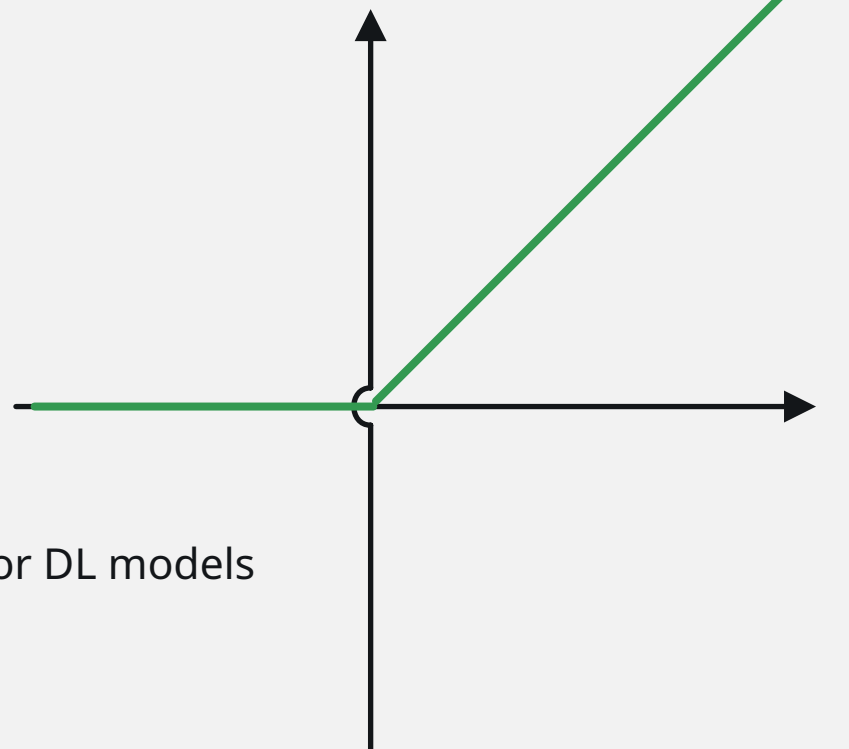
Output range: -1 to 1

**ReLU Function
(Rectified Linear Unit)**

$$y = max(0, x)$$

Output range: 0 to inf

Simple, computationally efficient.
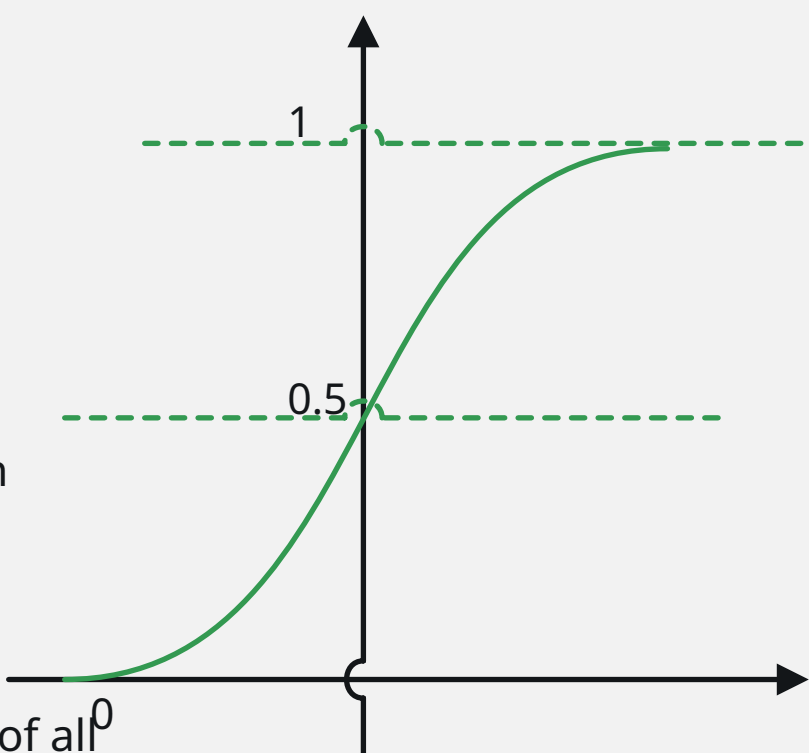It has become the default choice for DL models

Softmax Function

$$\sigma(\vec{z})_i = \frac{e^{z_i}}{\sum_{j=1}^{K} e^{z_j}}$$

Used in the output layer of classification models for multiple classes

Applied to a vector of outputs
Helpful to get a probability distribution of all classes

**ReLU Function
(Rectified Linear Unit)**

$$y : x, if\, x > 0$$
$$\alpha * x, if\, x \leq 0$$

Output range: -inf to inf

Use when ReLU is causing bad performance