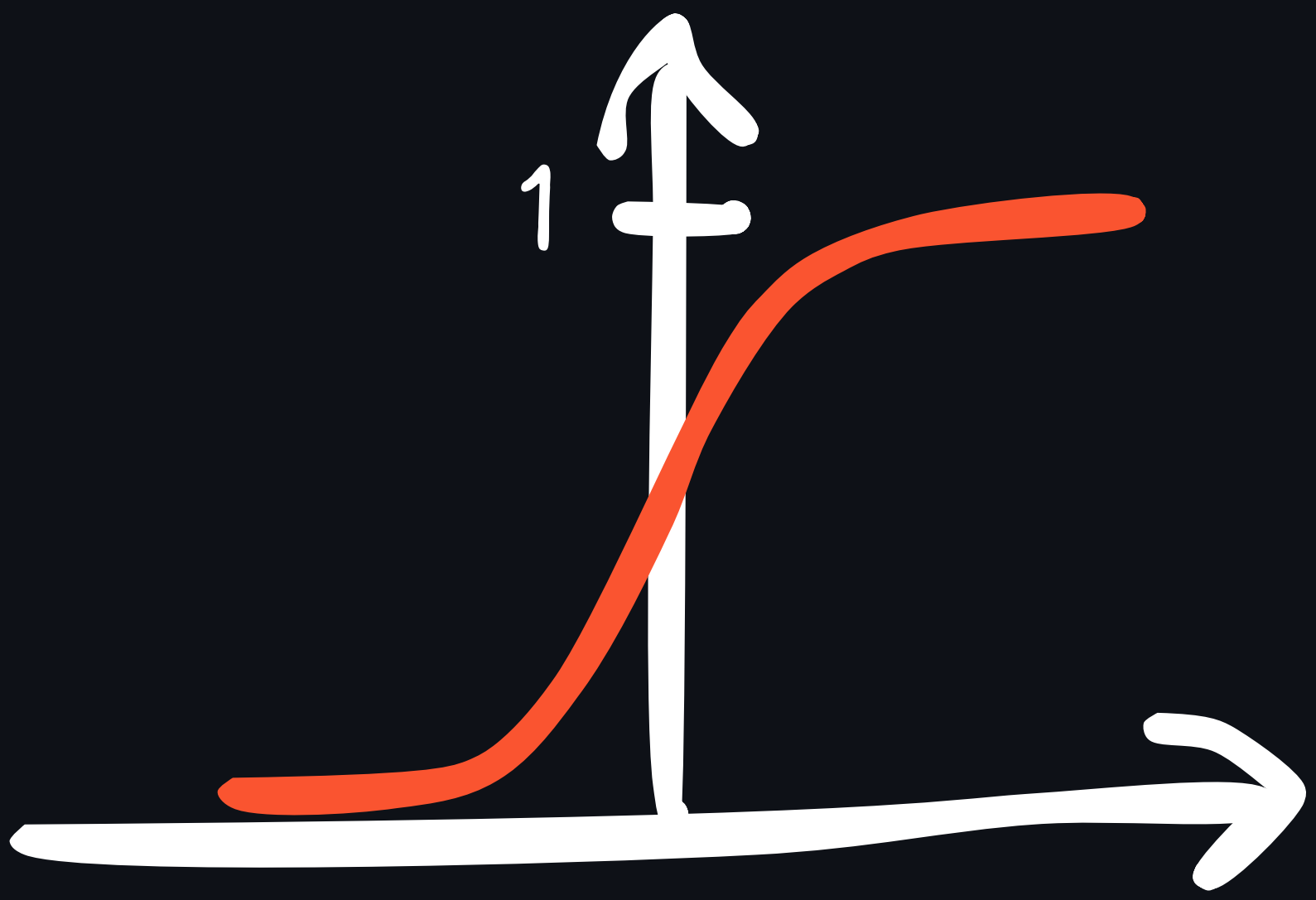
Activation Functions

The Sigmoid activation function.



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

- Perfect for classical binary classification where the output is either 0 or 1.
- Output the probability of belonging to a certain class.

Activation Functions

The Softmax activation function.

Output Layer

Probabilities

$$\begin{pmatrix} 2.1 \\ 3 \\ 4.8 \\ 3.2 \\ 0.1 \end{pmatrix} \longrightarrow a(z)_j = \frac{e^{z_j}}{\sum_{k=1}^{K} e^{z_k}} \longrightarrow \begin{pmatrix} 0.8 \\ 0.11 \\ 0.03 \\ 0.04 \\ 0.02 \end{pmatrix}$$

$$a(z)_j = \frac{e^{z_j}}{\sum_{k=1}^{K} e^{z_k}} \text{ for } j = 1, \ldots, K \text{ and } \mathbf{z} = (z_1, \ldots, z_K)$$

- Generalization of sigmoid for multi-class classification tasks like image classification.
- Output probabilities for each class from 1 to K.

Activation Functions

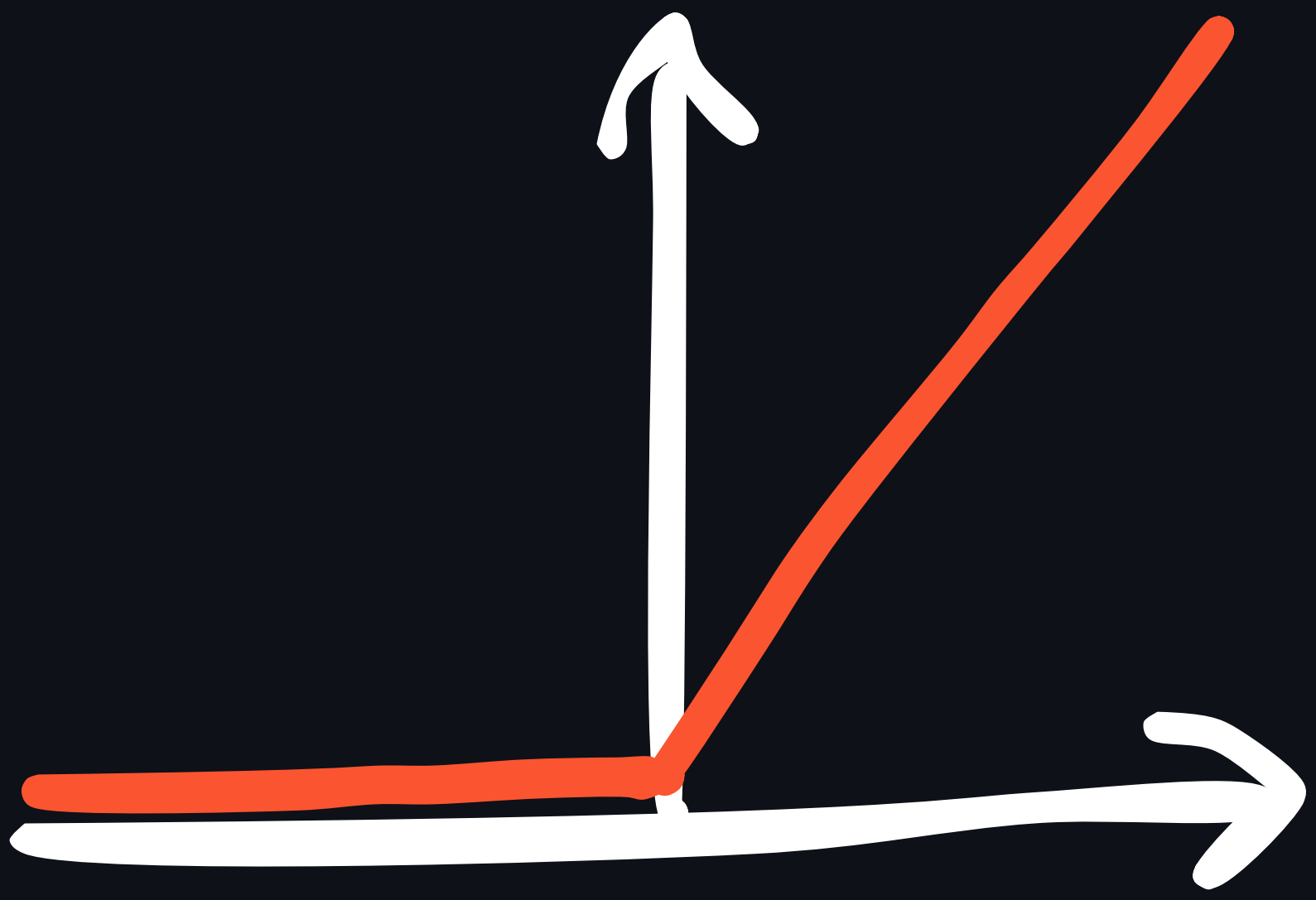
The TanH (Hyperbolic Tangent) activation function.

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

- Often used in hidden layers of a neural network. It centers the data, improving the learning for subsequent layers.

Activation Functions

The ReLU (Rectified Linear Unit) activation function.

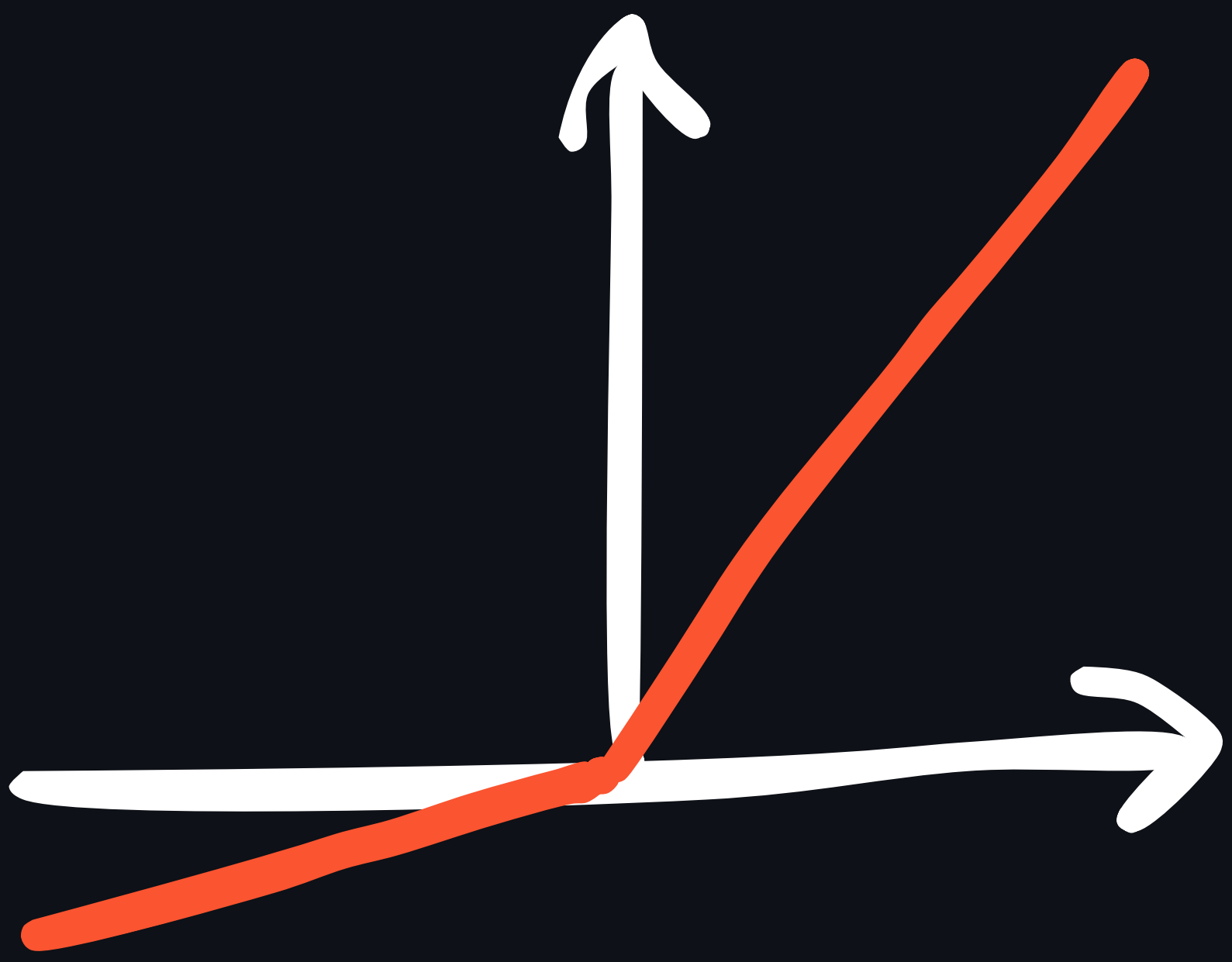


$$a(z) = max(0, x)$$

- Widely used in CNNs for tasks like image recognition due to its computational efficiency.

Activation Functions

The leaky ReLU activation function.

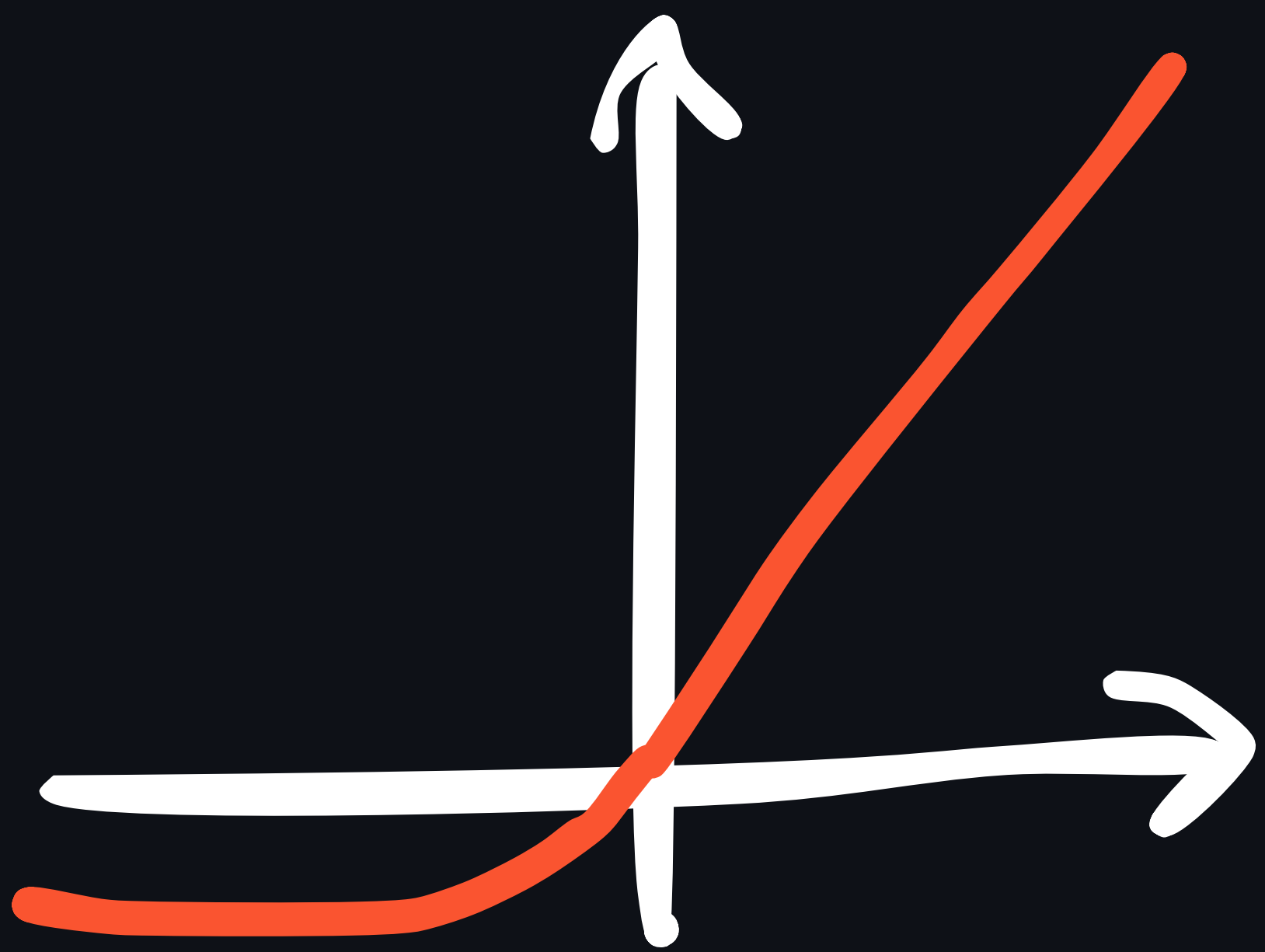


$$a(z) = \begin{cases} z & \text{if z} > 0, \\ \alpha z & \text{otherwise.} \end{cases}$$

- Helps prevent dead neurons in ReLU. Useful in deep learning models where avoiding the dying ReLU problem is critical.

Activation Functions

The ELU (Exponential Linear Unit) activation function.

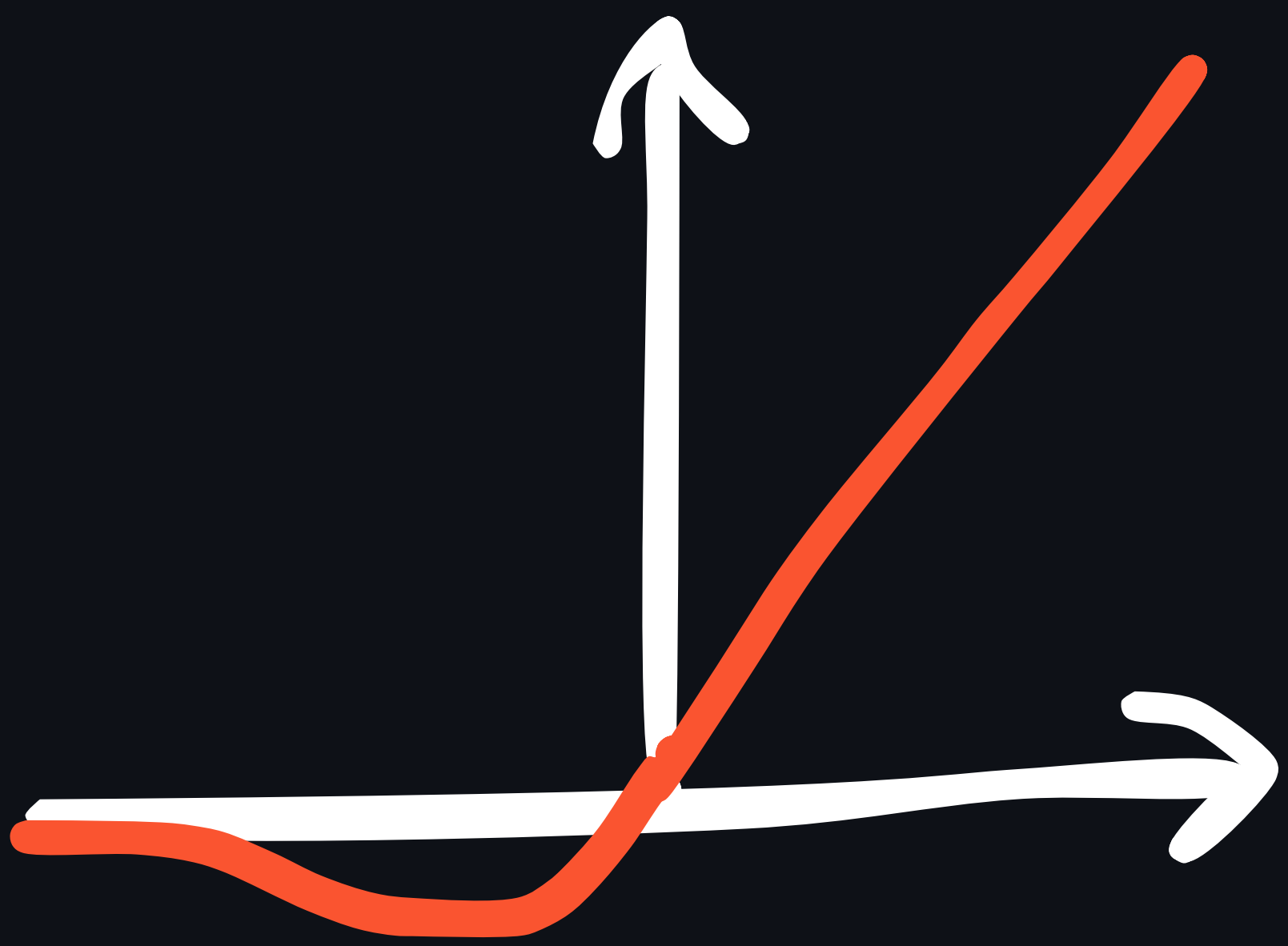


$$a(z) = \begin{cases} z & \text{if z} > 0, \\ \alpha(e^z - 1) & \text{if z} \leq 0. \end{cases}$$

- ELU improves accuracy for deep neural networks by allowing negative values for activations.

Activation Functions

The GeLU (Gaussian Error Linear Unit) activation function.



$$a(z) = zP(Z \leq z)$$

- Non-linear activation function that approximates the expectation of a Gaussian distribution.

Thanks for Reading

I hope this helps!