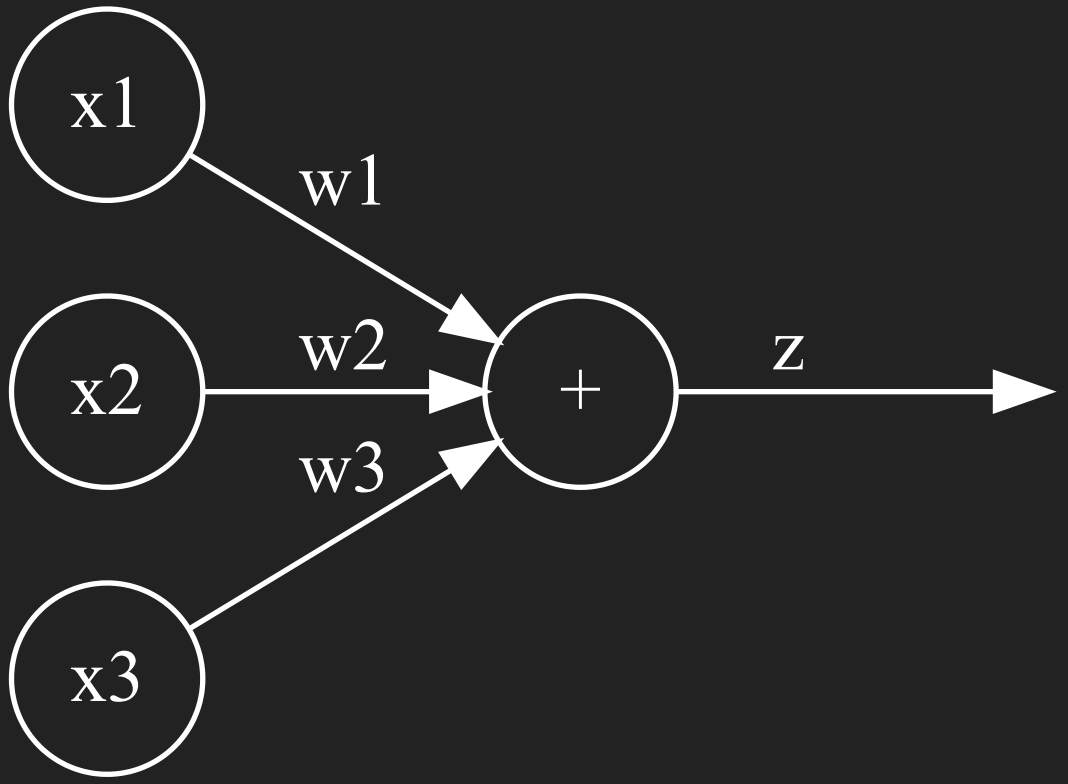
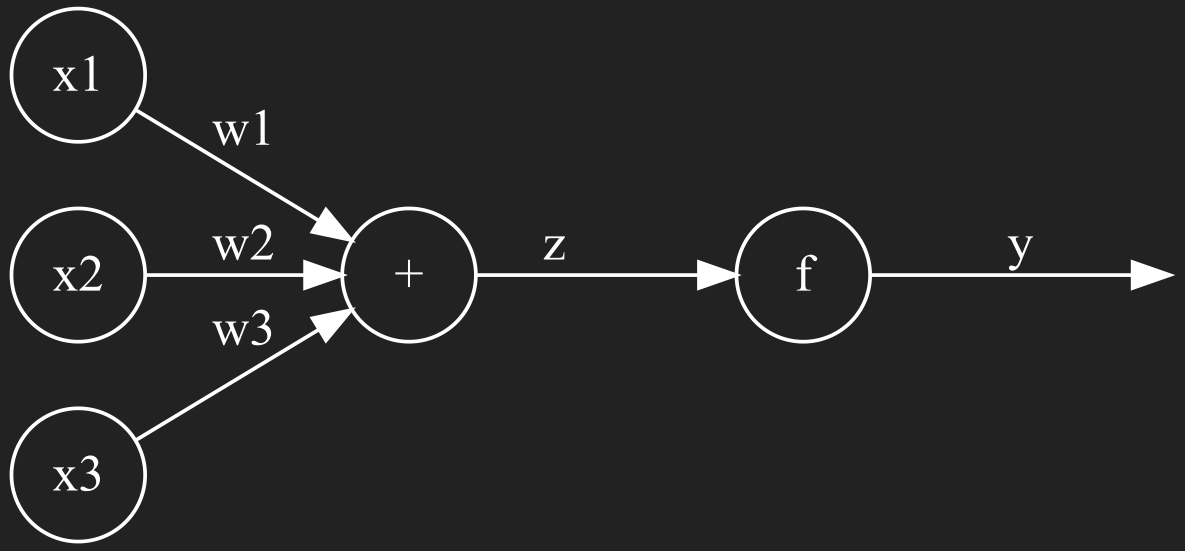
NEURONALES NETZWERK FROM SCRATCH

AI-SOMMER IN DER ITF

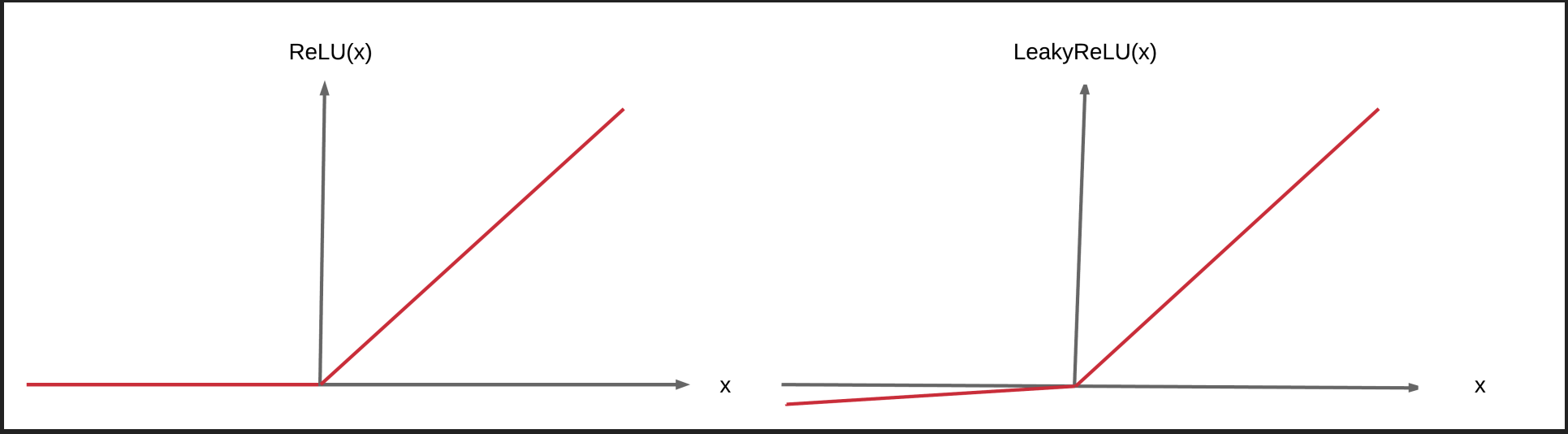
DAS NEURON



DAS NEURON MIT AKTIVIERUNGSFUNKTION



RELU UND LEAKY RELU



MATRIX TRANSPONIEREN

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} A^T = \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix}$$

MATRIZEN MULTIPLIZIEREN

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} B = \begin{pmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{pmatrix} A \times B = \begin{pmatrix} 14 \\ 32 \end{pmatrix}$$

TITANIC-DATENSET

PId	TC	Sex	SibSp	ParCh	Survived
1	3	male	1	0	0
2	1	female	1	0	1

Netzarchitektur: 5 x 32 x 1

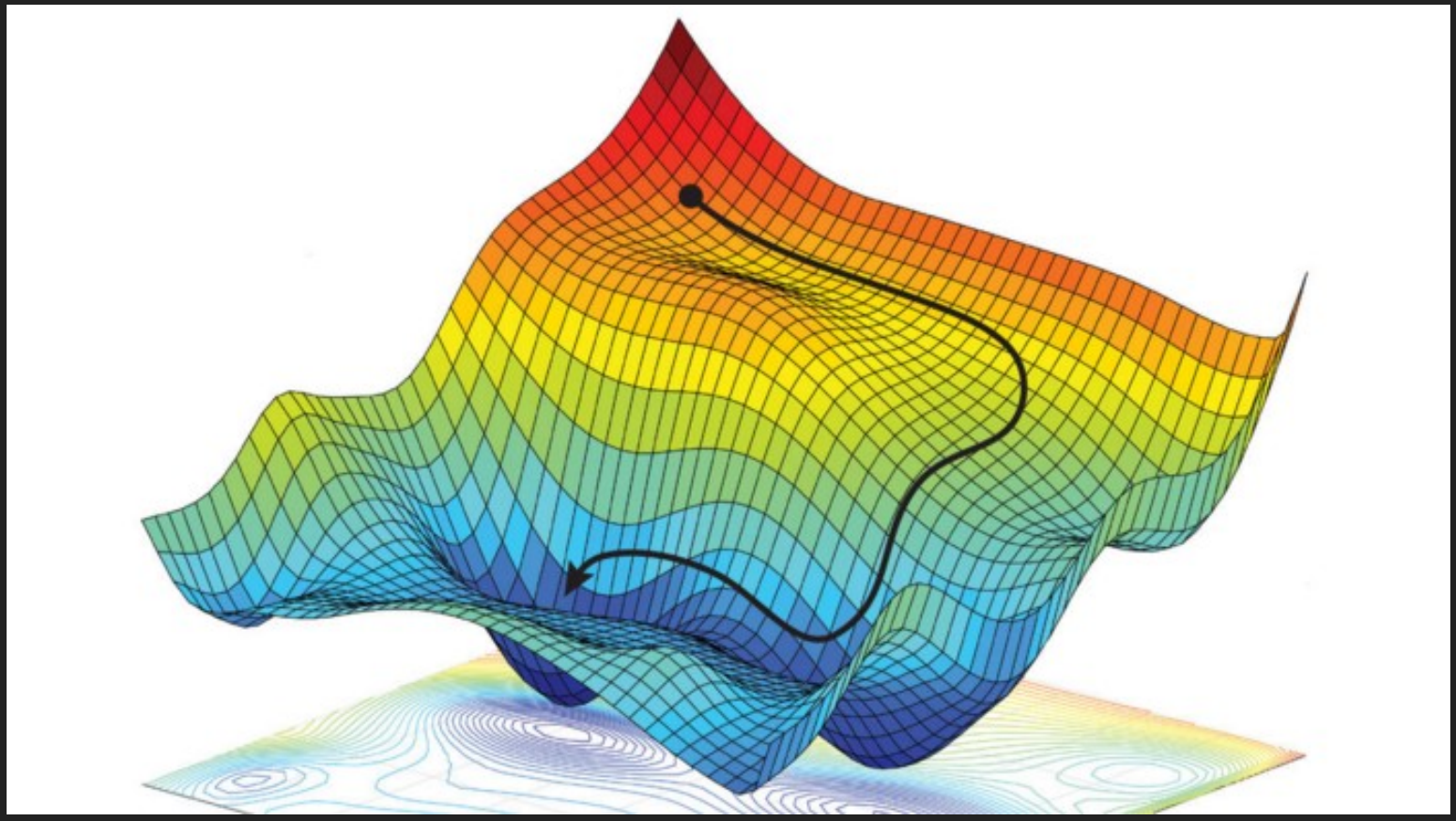
FEHLERFUNKTION

$$E = \frac{1}{2}(y - x)^2$$

$\hat{y} =$ Berechneter Output

$x =$ Echter Output

GRADIENTENABSTIEGSVERFAHREN



BACKPROPAGATION GEWICHTE OUTPUT-LAYER

$$\frac{\partial E}{\partial W^l} = \frac{\partial E}{\partial Y^l} \times \frac{\partial Y^l}{\partial Z^l} \times \frac{\partial Z^l}{\partial W^l}$$

ABLEITUNG I

$$
\begin{aligned}
\frac{\partial E}{\partial Y^l} &= \frac{\partial}{\partial Y^l} \frac{1}{2} (Y^l - X^l)^2 \\
&= \frac{\partial}{\partial Y^l} 2 * \frac{1}{2} (Y^l - X^l) \\
&= Y^l - X^l
\end{aligned}
$$

ABLEITUNG II

$$\frac{\partial Y^l}{\partial Z^l} = \frac{\partial}{\partial Y^l} lrelu(Z^l)$$

$$= \begin{cases} 1 & x > 0 \\ 0.01 & x < 0 \end{cases}$$

ABLEITUNG III

$$
\begin{aligned}
\frac{\partial Z^l}{\partial W^l} &= \frac{\partial}{\partial W^l} W^l \times X^l + B^l \\
&= \frac{\partial}{\partial W^l} W^l \times X^l + 0 \\
&= \frac{\partial}{\partial W^l} 1 \times X^l + 0 \\
&= X^l
\end{aligned}
$$

BACKPROPAGATION GEWICHTE HIDDEN-LAYER

$$\frac{\partial E}{\partial W^{l-1}} = \frac{\partial E}{\partial Y^{l}} \times \frac{\partial Y^{l}}{\partial Z^{l}} \times \frac{\partial Z^{l}}{\partial X^{l}} \times \frac{\partial X^{l}}{\partial Z^{l-1}} \times \frac{\partial Z}{\partial W}$$

ABLEITUNG IV

$$
\begin{aligned}
\frac{\partial Z^l}{\partial X^l} &= \frac{\partial}{\partial X^l} W^l \times X^l + B^l \\
&= \frac{\partial}{\partial X^l} W^l \times X^l + 0 \\
&= \frac{\partial}{\partial W^l} W^l \times 1 + 0 \\
&= W^l
\end{aligned}
$$

ABLEITUNG V

$$\frac{\partial X^l}{\partial Z^{l-1}} = \frac{\partial}{\partial Z^{l-1}} lrelu(X^l)$$

$$= \begin{cases} 1 & x > 0 \\ 0.01 & x < 0 \end{cases}$$