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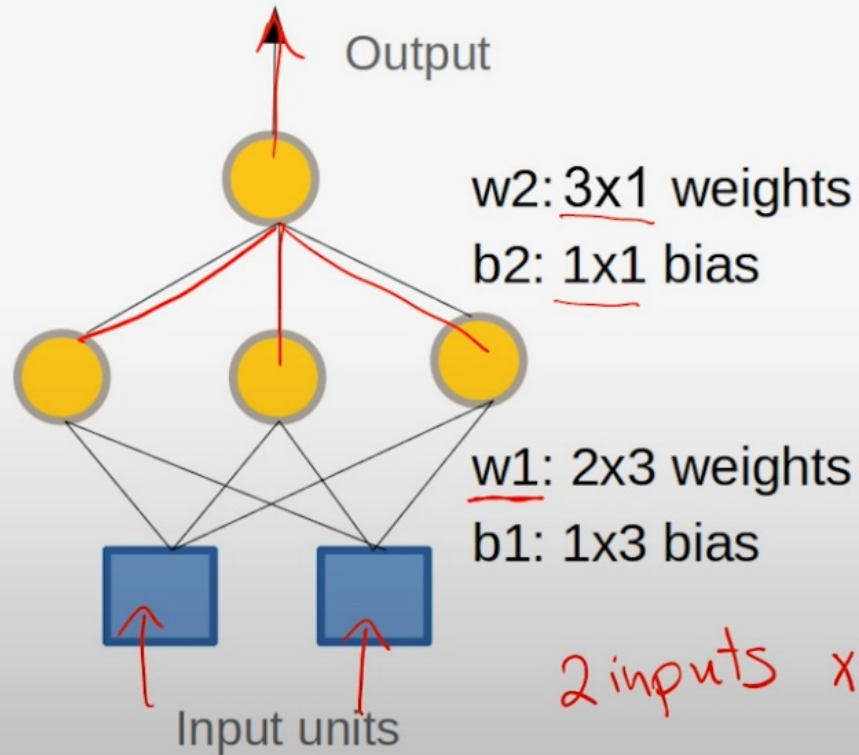
# Neural Network Example

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# Neural Network Example

## Neural Network for Logical **and** Operation



AND	0	1
0	0	0
1	0	1

2 inputs x 3 neurons

# Neural Network Parameters

Parameters for logical **and** network

Layer 1

matrix of hidden weights  
1st layer (hidden)

input

$$W_1 = \begin{bmatrix} -3.929 & -3.945 \\ 4.463 & 4.472 \\ -4.730 & -4.718 \end{bmatrix} \quad b_1 = \begin{bmatrix} 5.401 \\ -6.226 \\ 6.624 \end{bmatrix}$$

neuron 1  
neuron 2  
neuron 3

Layer 2

~~-8.092~~ ~~7.240~~ ~~-7.491~~

0 0 0

7.240

-7.491

2.883

$$W_2 = [-8.092, 7.240, -7.491] \quad b_2 = \underline{2.883}$$

# Neural Network Computations

Layer 1

$$W_1 \begin{bmatrix} -3.9 & -3.9 \\ 4.4 & 4.4 \\ -4.7 & -4.7 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} -7.8 \\ 8.8 \\ -9.4 \end{bmatrix} + \begin{bmatrix} 5.4 \\ -6.2 \\ 6.6 \end{bmatrix} = \begin{bmatrix} -2.4 \\ 2.6 \\ -2.8 \end{bmatrix}$$

$\downarrow$   
 $z_{L1}$

Element-wise sigmoid

$$\sigma(z_{L1}) = \begin{bmatrix} 0.08 \\ 0.93 \\ 0.06 \end{bmatrix} \rightarrow \underline{a_{L1}}$$

Layer 2

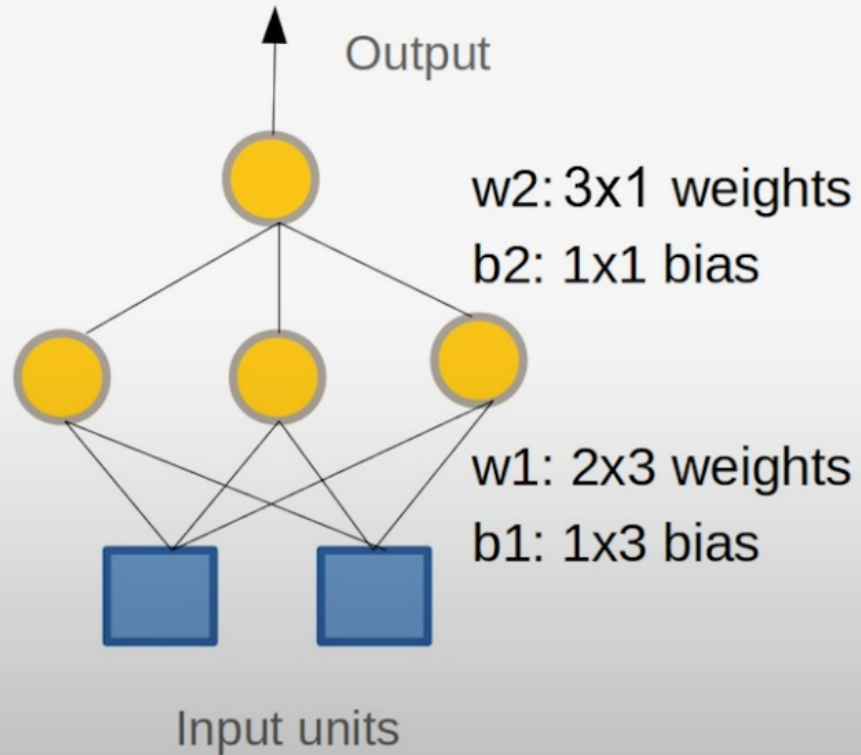
$$W_2 \begin{bmatrix} 8.1 & 7.2 & -7.4 \end{bmatrix} \begin{bmatrix} 0.08 \\ 0.93 \\ 0.06 \end{bmatrix} = 5.6 + 2.88 = \underline{8.48}$$

$\downarrow$   
 $z_{L2}$

$$\sigma(z_{L2}) = \underline{0.999} \text{ (1)}$$

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## Neural Network for Logical **and** Operation



AND	0	1
0	0	0
1	0	1