

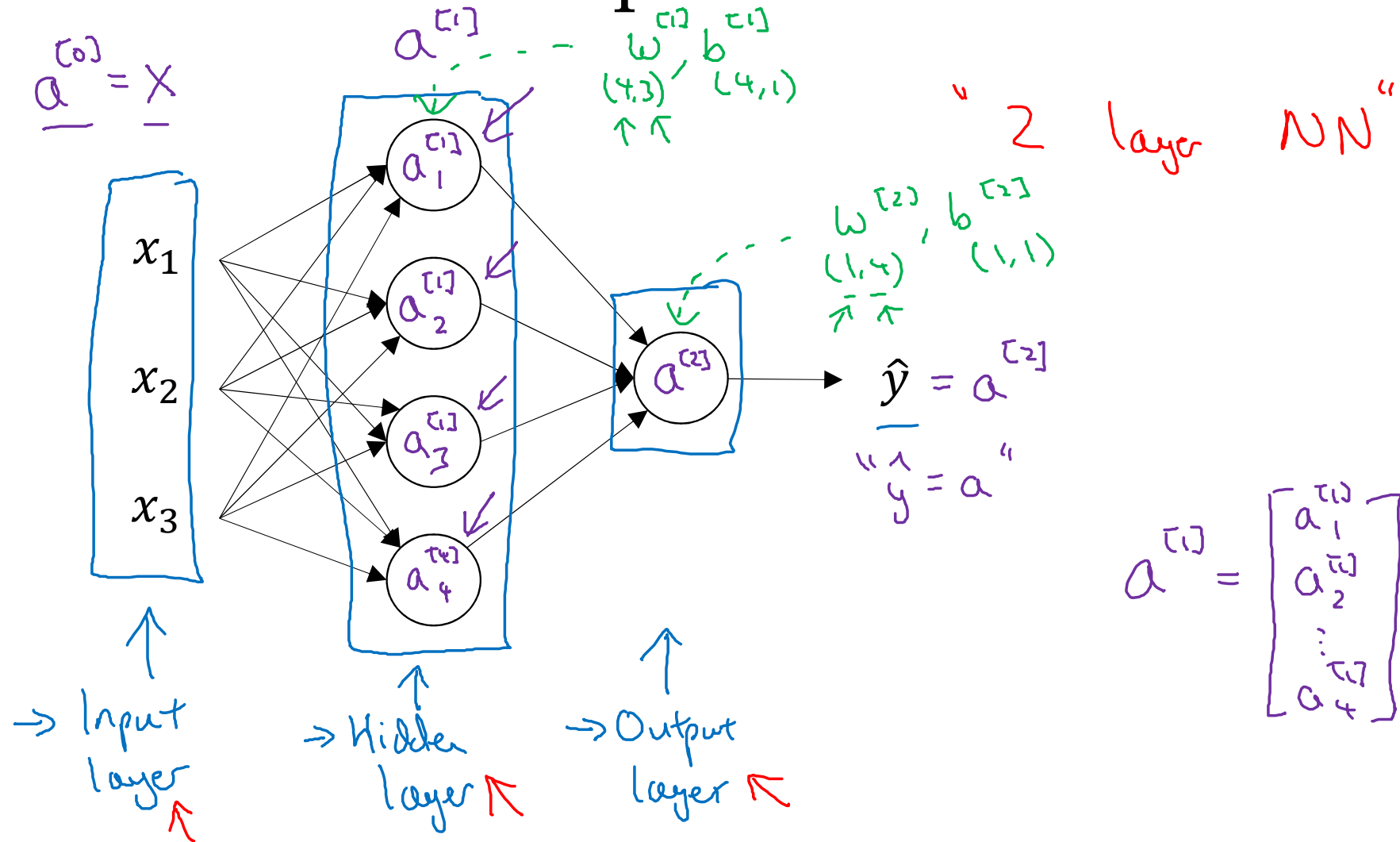


deeplearning.ai

One hidden layer
Neural Network

Neural Network
Representation

Neural Network Representation



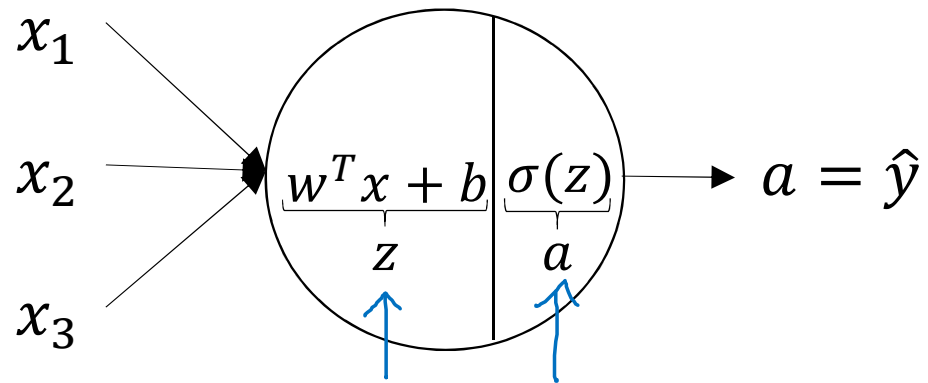


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One hidden layer Neural Network

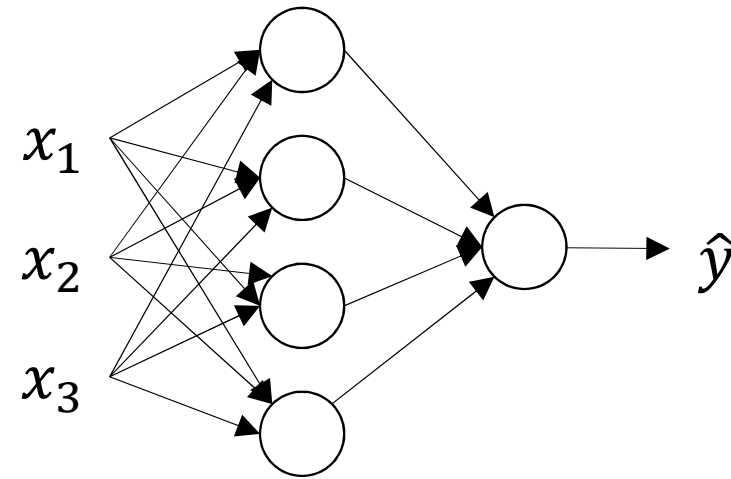
Computing a
Neural Network's
Output

Neural Network Representation

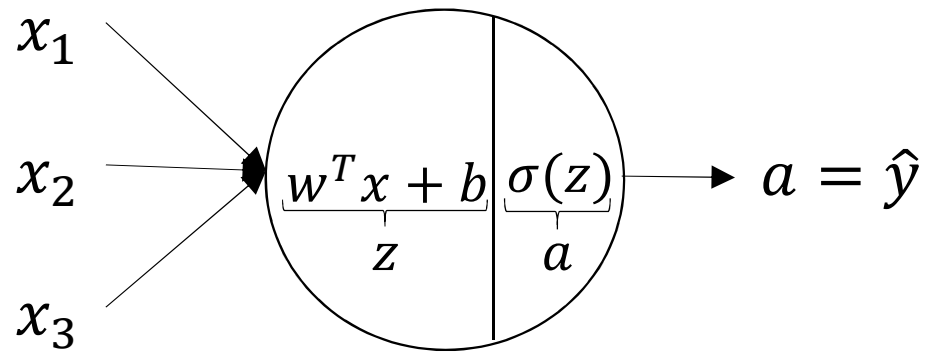


$$z = w^T x + b$$

$$a = \sigma(z)$$

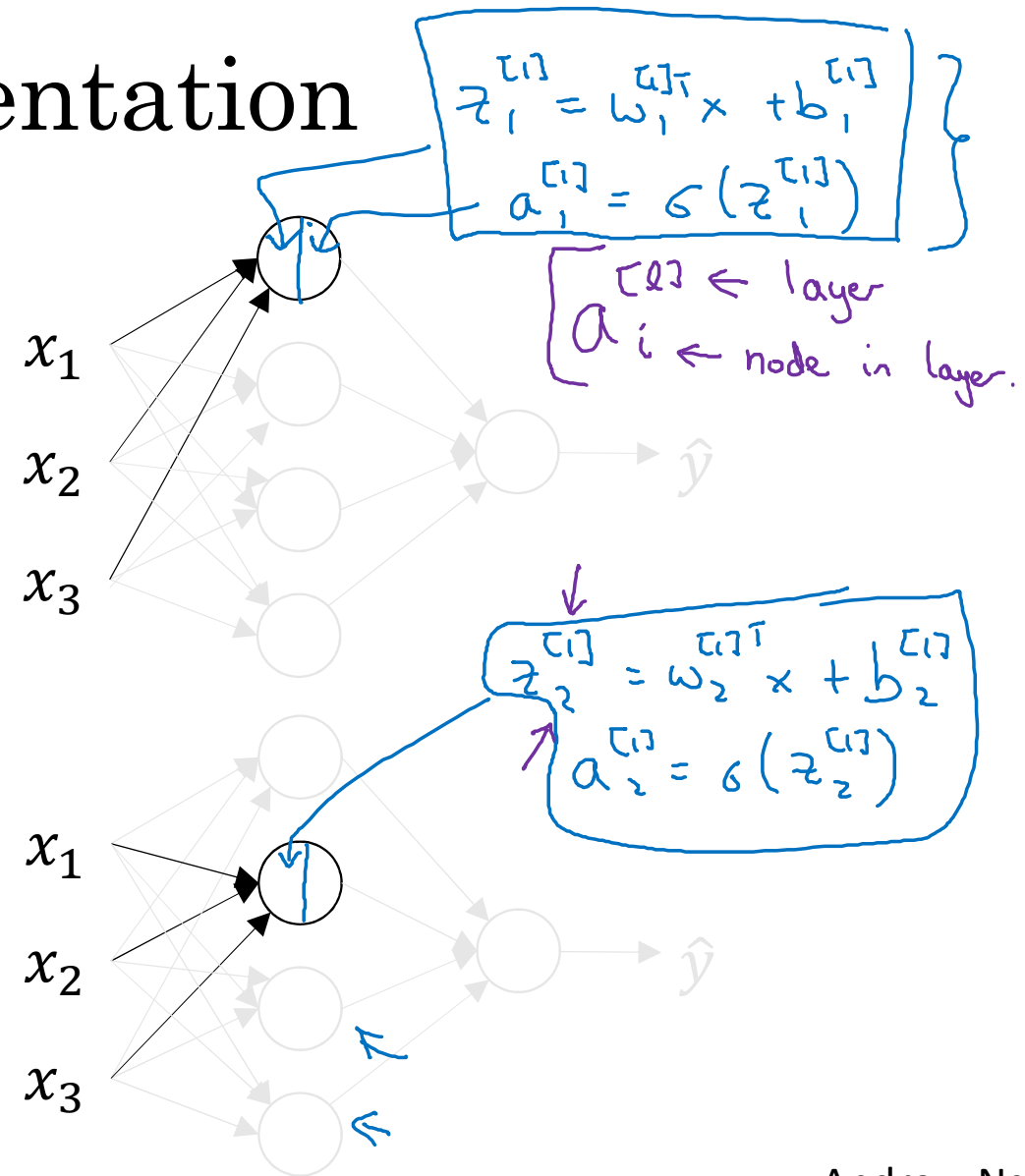


Neural Network Representation

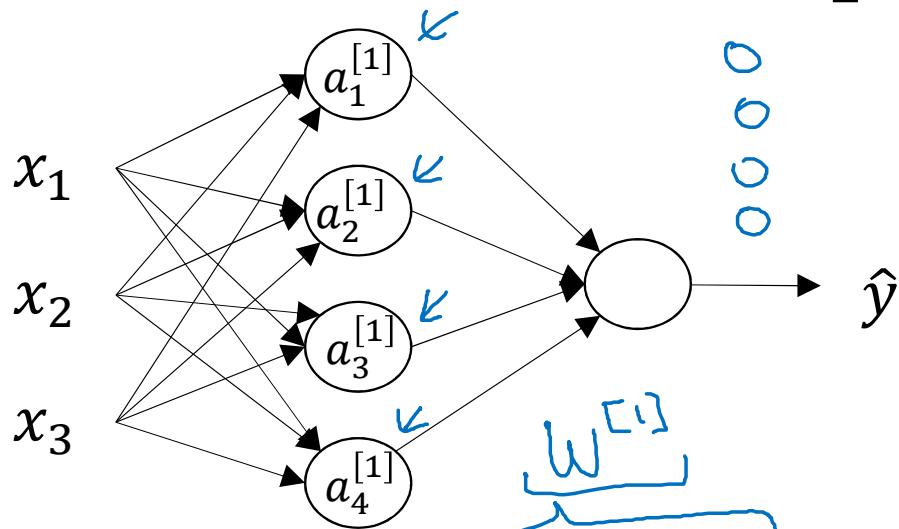


$$z = w^T x + b$$

$$a = \sigma(z)$$



Neural Network Representation



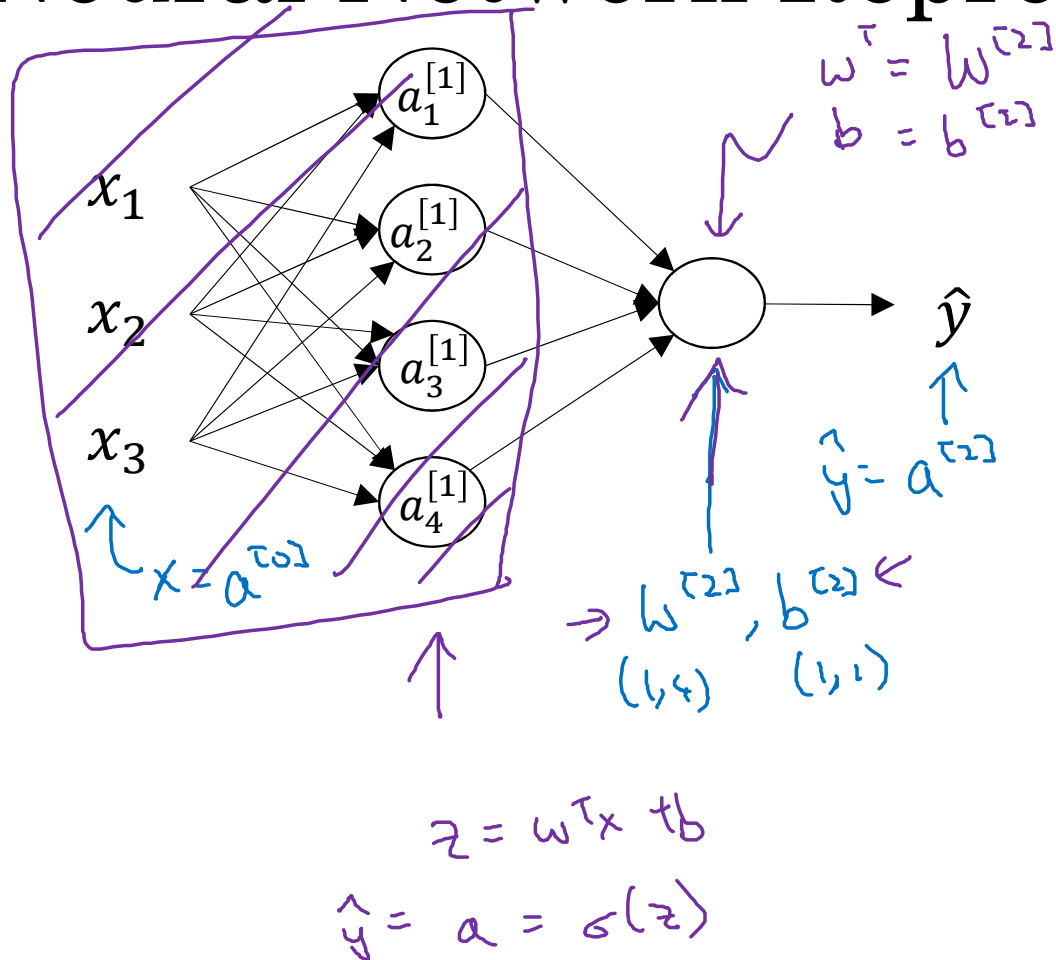
$$\begin{aligned}
 z_1^{[1]} &= w_1^{[1]T} x + b_1^{[1]}, & a_1^{[1]} &= \sigma(z_1^{[1]}) \\
 z_2^{[1]} &= w_2^{[1]T} x + b_2^{[1]}, & a_2^{[1]} &= \sigma(z_2^{[1]}) \\
 z_3^{[1]} &= w_3^{[1]T} x + b_3^{[1]}, & a_3^{[1]} &= \sigma(z_3^{[1]}) \\
 z_4^{[1]} &= w_4^{[1]T} x + b_4^{[1]}, & a_4^{[1]} &= \sigma(z_4^{[1]})
 \end{aligned}$$

Handwritten notes: $(w_1^{[1]})^T x$ and $a^{[1]}$ are written in red above the equations. A blue arrow points from the output of the hidden layer to the output node.

$$\begin{aligned}
 \rightarrow z^{[1]} &= \begin{bmatrix} w_1^{[1]T} \\ w_2^{[1]T} \\ w_3^{[1]T} \\ w_4^{[1]T} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} b_1^{[1]} \\ b_2^{[1]} \\ b_3^{[1]} \\ b_4^{[1]} \end{bmatrix} = \begin{bmatrix} \rightarrow w_1^{[1]T} x + b_1^{[1]} \\ \rightarrow w_2^{[1]T} x + b_2^{[1]} \\ \rightarrow w_3^{[1]T} x + b_3^{[1]} \\ \rightarrow w_4^{[1]T} x + b_4^{[1]} \end{bmatrix} = \begin{bmatrix} z_1^{[1]} \\ z_2^{[1]} \\ z_3^{[1]} \\ z_4^{[1]} \end{bmatrix} \\
 \rightarrow a^{[1]} &= \begin{bmatrix} a_1^{[1]} \\ \vdots \\ a_4^{[1]} \end{bmatrix} = \sigma(z^{[1]})
 \end{aligned}$$

Handwritten notes: $(4, 3)$ is written below the weight matrix, and $(4, 1)$ is written below the bias vector. A blue arrow points from the output of the hidden layer to the output node.

Neural Network Representation learning



Given input x :

$$\begin{aligned} \rightarrow z^{[1]} &= W^{[1]} x + b^{[1]} \\ &\quad \begin{matrix} (4,1) & (4,3) & (3,1) & (4,1) \end{matrix} \\ \rightarrow a^{[1]} &= \sigma(z^{[1]}) \\ &\quad \begin{matrix} (4,1) & (4,1) \end{matrix} \\ \rightarrow z^{[2]} &= W^{[2]} a^{[1]} + b^{[2]} \\ &\quad \begin{matrix} (1,1) & (1,4) & (4,1) & (1,1) \end{matrix} \\ \rightarrow a^{[2]} &= \sigma(z^{[2]}) \\ &\quad \begin{matrix} (1,1) & (1,1) \end{matrix} \end{aligned}$$