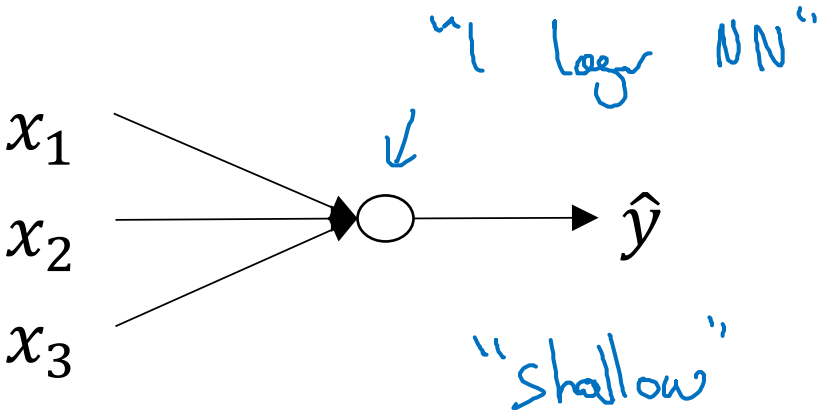deeplearning.ai

Deep Neural Networks

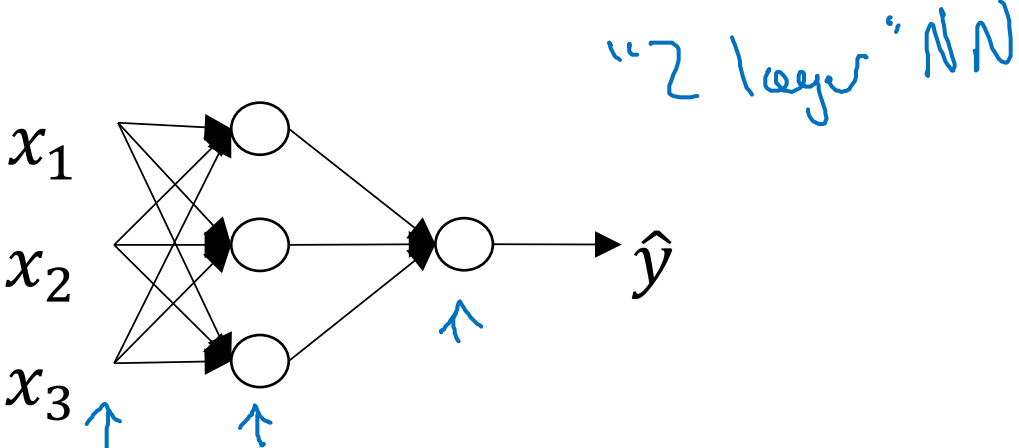Deep L-layer Neural network

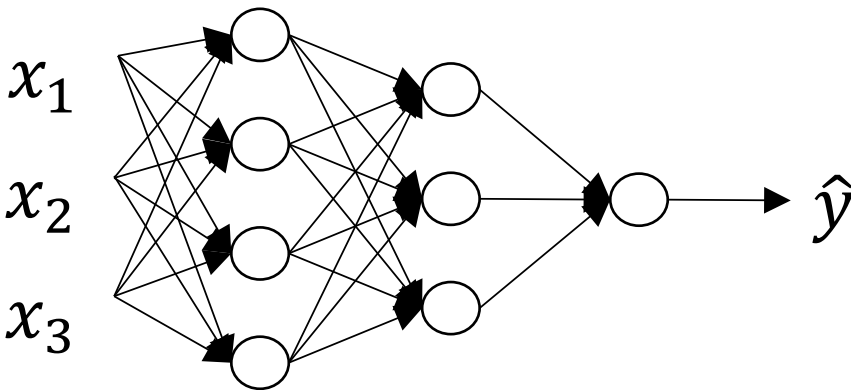# What is a deep neural network?

logistic regression

"1 layer NN"

"Shallow"

1 hidden layer

"2 layer" NN
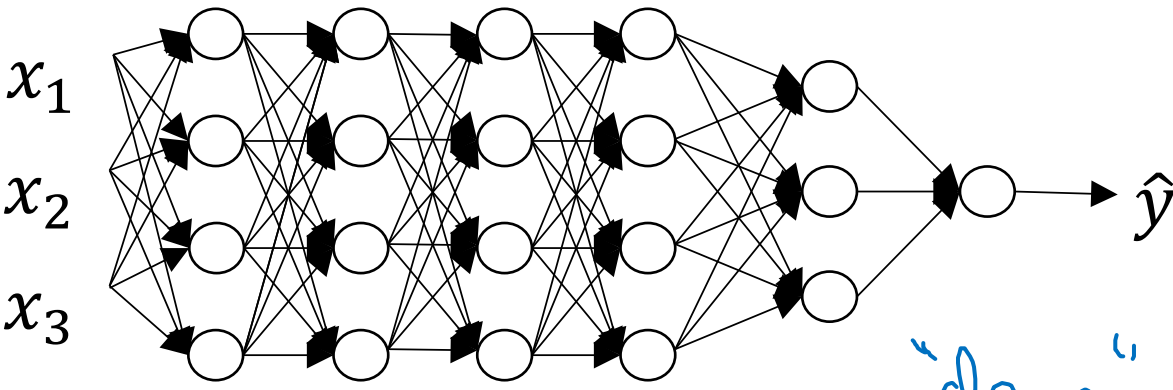
2 hidden layers

5 hidden layers

"deep"

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Deep neural network notation

4 layer NN

layer "0"

$\leftarrow 1$ $\leftarrow 2$ $\leftarrow 3$

4

x_1

x_2

x_3

$\hat{y} = a^{[L]}$

$X = a^{[0]}$

1

3

5

5
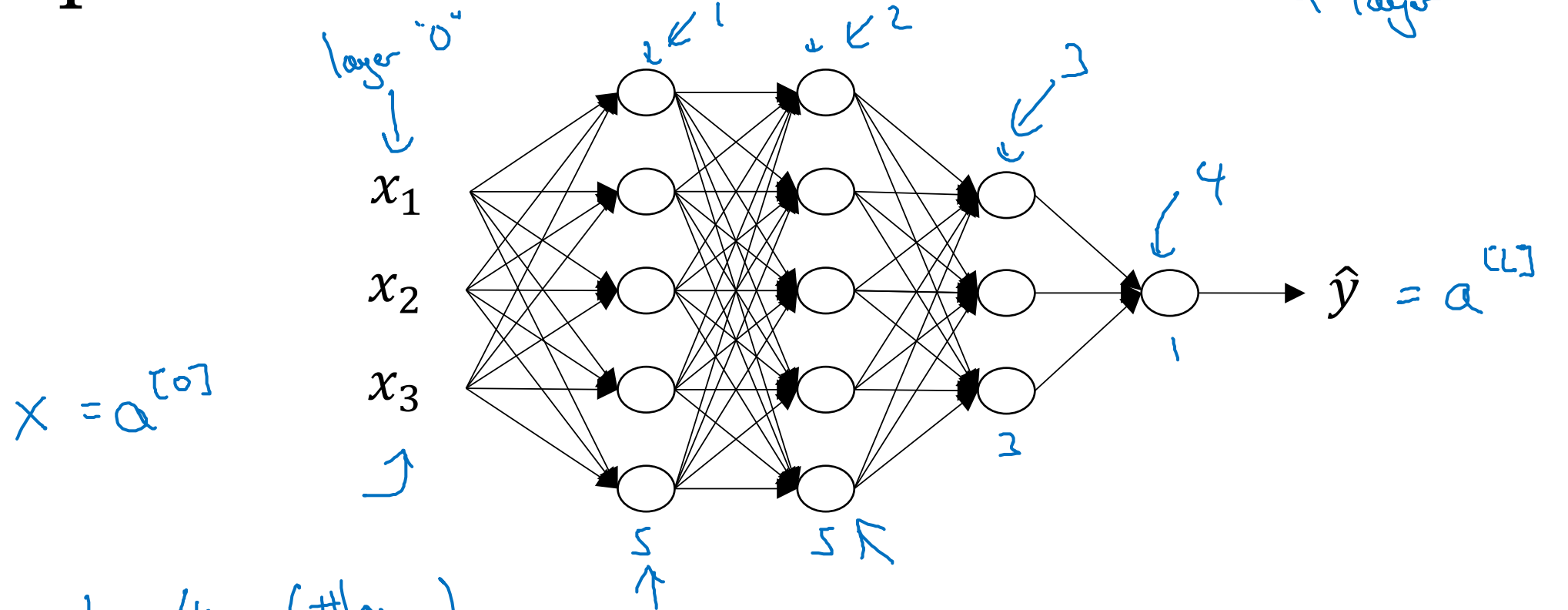
$L = 4$ (#layers)

$n^{[l]} = $ #units in layer l

$n^{[1]} = 5, \; n^{[2]} = 5, \; n^{[3]} = 3, \; n^{[4]} = n^{[L]} = 1$

$n^{[0]} = n_x = 3$

$a^{[l]} = $ activations in layer l

$a^{[l]} = g^{[l]}(z^{[l]})$, $W^{[l]} = $ weights for $z^{[l]}$

$b^{[l]}$

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Deep Neural
Networks

deeplearning.ai

Forward Propagation
in a Deep Network

Forward propagation in a deep network

x_1

x_2

x_3

$\hat{y}$

$a^{[0]}$
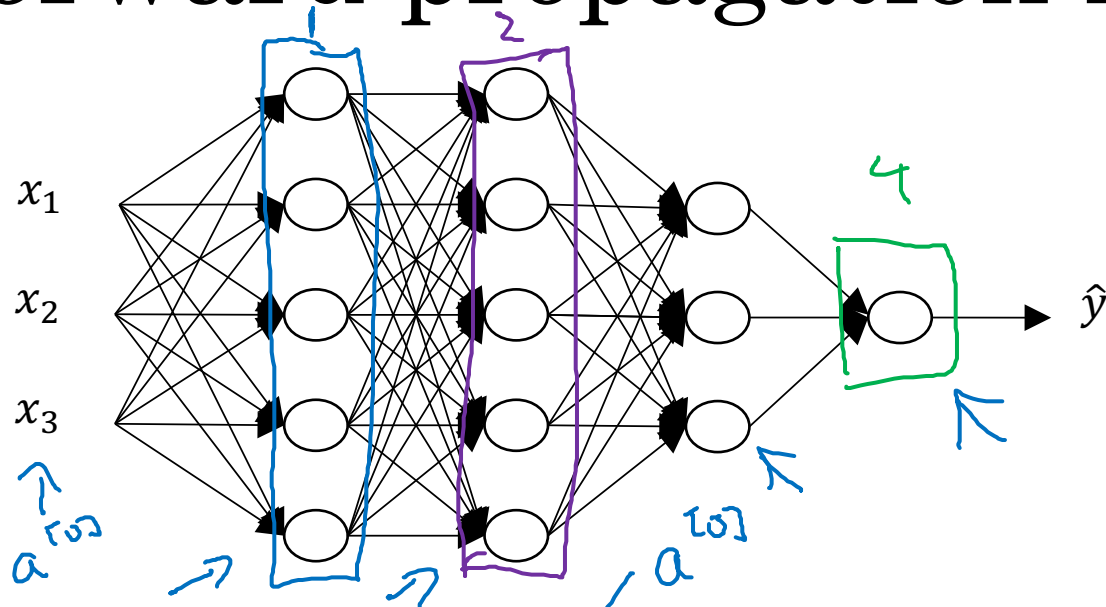
$X: \quad z^{[1]} = w^{[1]} a^{[0]} + b^{[1]}$

$a^{[1]} = g^{[1]}(z^{[1]})$

$z^{[2]} = w^{[2]} a^{[1]} + b^{[2]}$

$a^{[2]} = g^{[2]}(z^{[2]})$

$z^{[4]} = w^{[4]} a^{[3]} + b^{[4]}, \quad a^{[4]} = g^{[4]}(z^{[4]}) = \hat{y}$

$A^{[0]} = X$

$$z^{[l]} = w^{[l]} A^{[l-1]} + b^{[l]}$$

$$A^{[l]} = g^{[l]}(z^{[l]})$$

Vectorized:

$\left[z^{[2](1)} \mid z^{[2](2)} \cdots z^{[2](m)} \right]$

$\rightarrow X = A^{[0]}$

$z^{[1]} = w^{[1]} A^{[0]} + b^{[1]}$

$A^{[1]} = g^{[1]}(z^{[1]})$

$\rightarrow z^{[2]} = w^{[2]} A^{[1]} + b^{[2]}$

$\rightarrow A^{[2]} = g^{[2]}(z^{[2]})$

$\hat{Y} = g(z^{[4]}) = A^{[4]}$

for $l = 1 \ldots 4$

Andrew Ng