SKILLPILLS
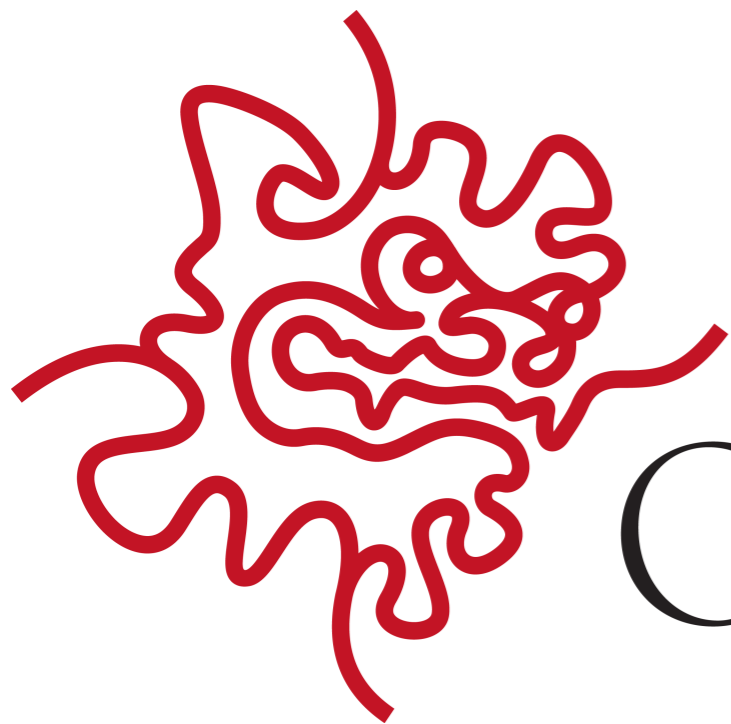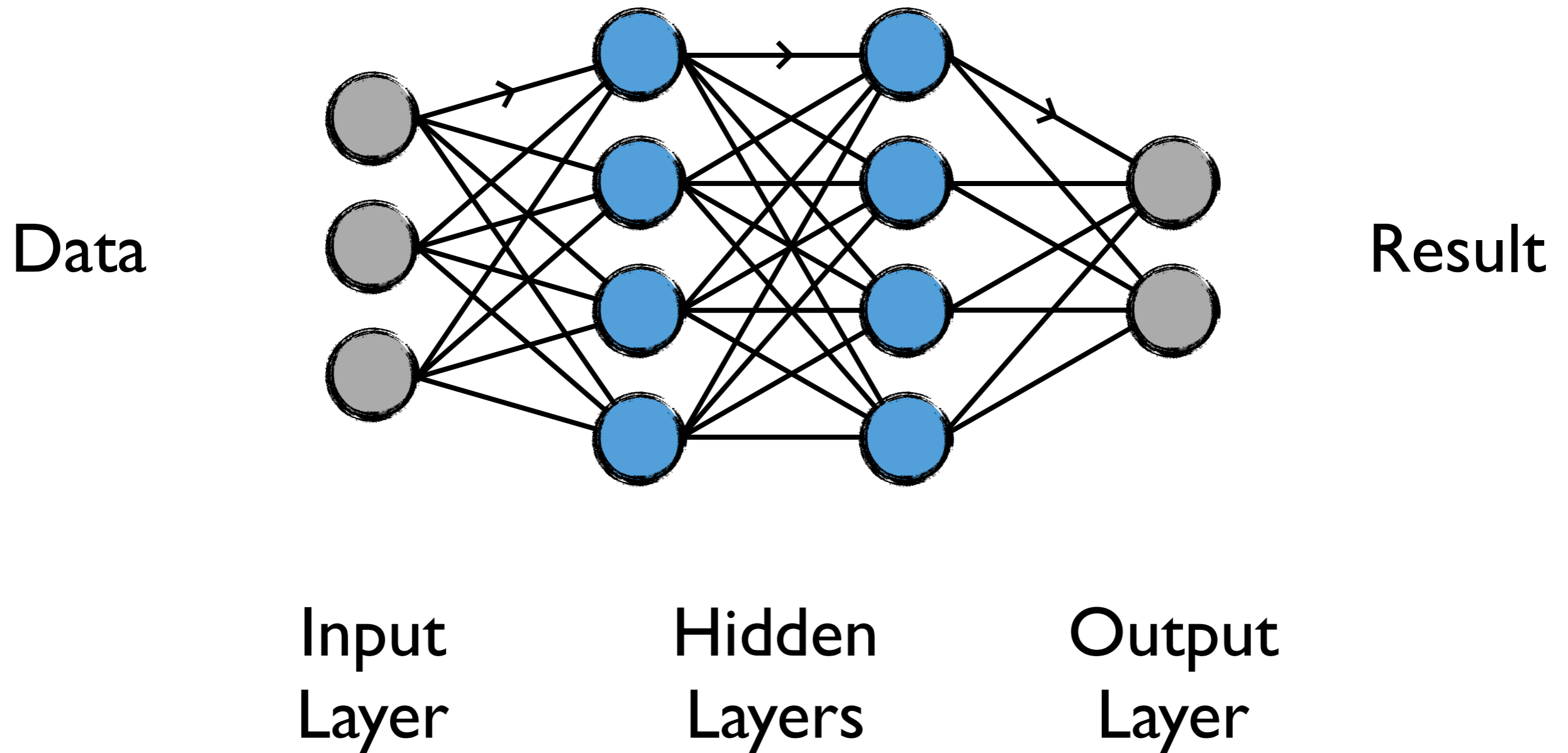
Neural Networks with MATLAB

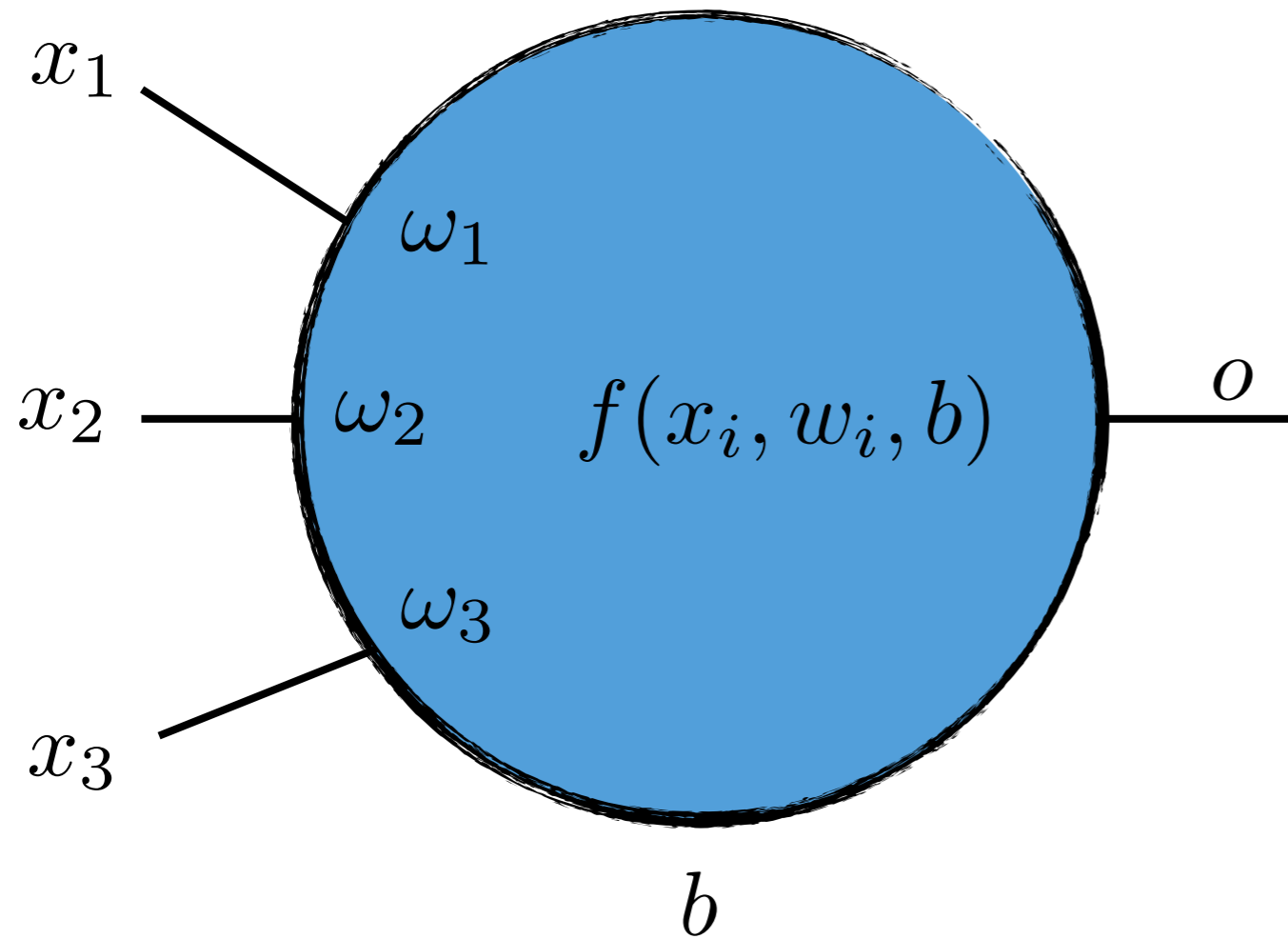Jérémie Gillet

OIST

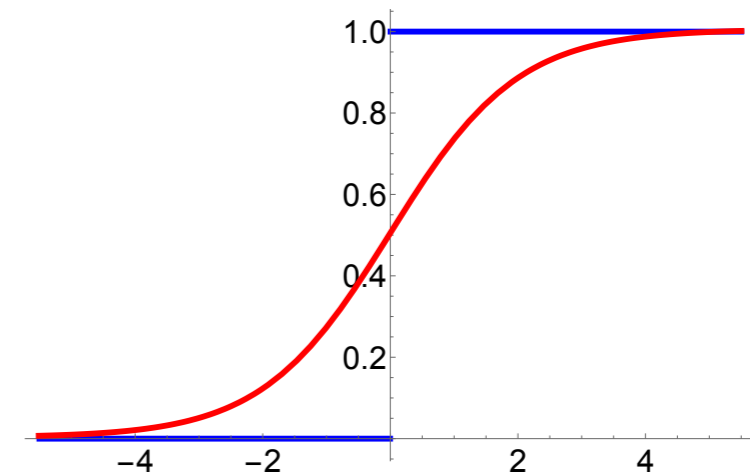# What is a Neural Network? SKILLPILLS

Data

Result

Input
Layer

Hidden
Layers

Output
Layer

Single neuron

x_1

x_2

x_3

ω_1

ω_2

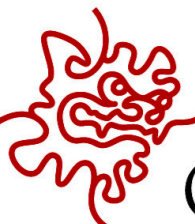ω_3

$f(x_i, w_i, b)$

o

b

Perceptron

$$o = \theta \left(\sum_i \omega_i x_i - b \right)$$

Sigmoid neuron
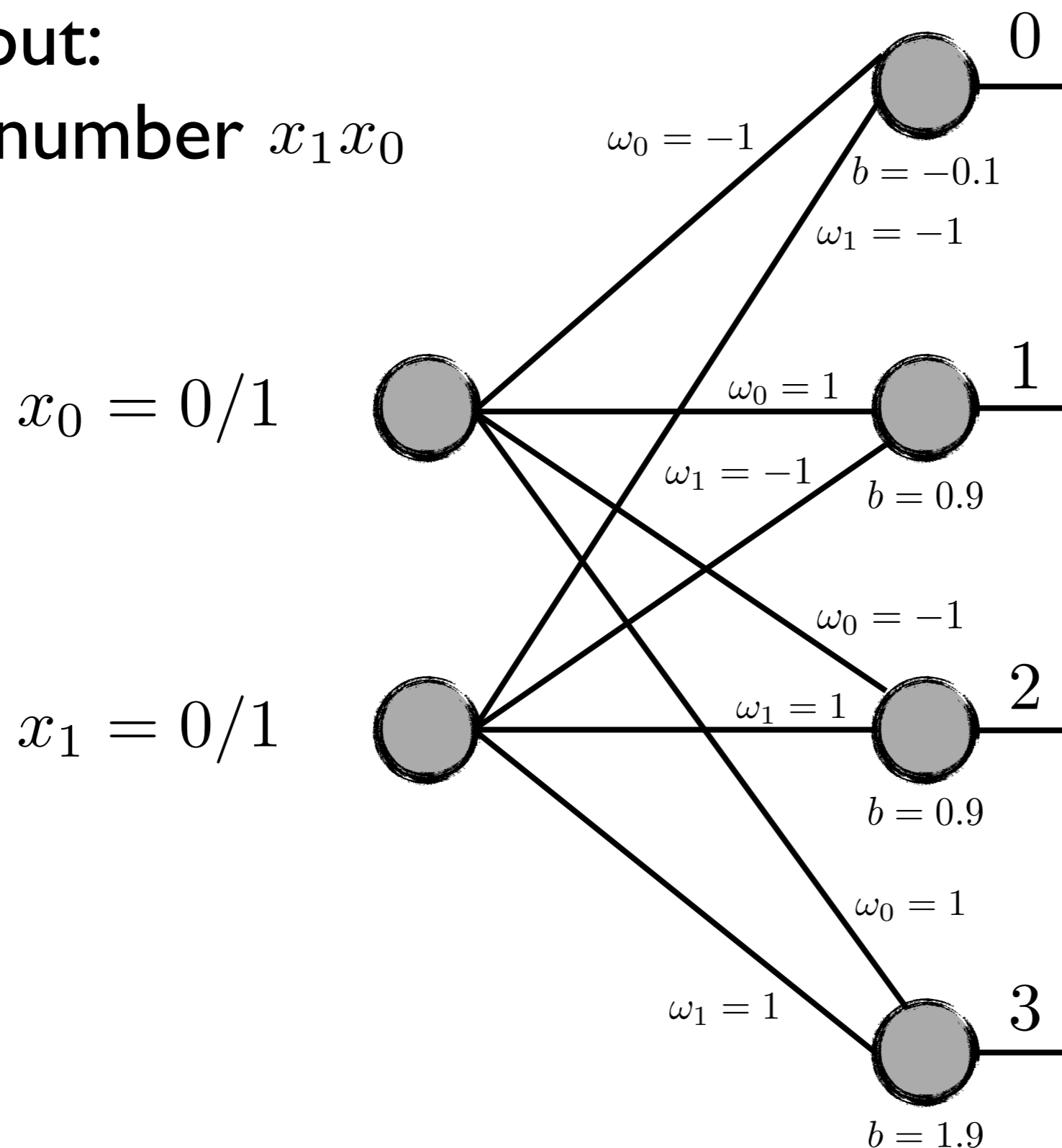
$$o = \sigma \left(\sum_i \omega_i x_i - b \right)$$

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

Example: binary conversion

Input:
binary number $x_1 x_0$

Output:
"0" to "3"

$x_0 = 0/1$

$x_1 = 0/1$

$\omega_0 = -1$

$b = -0.1$

$\omega_1 = -1$

$\omega_0 = 1$

$\omega_1 = -1$

$b = 0.9$

$\omega_0 = -1$

$\omega_1 = 1$

$b = 0.9$

$\omega_0 = 1$

$\omega_1 = 1$

$b = 1.9$

0

1

2

3

Neuron fires when
$\omega_0 x_0 + \omega_1 x_1 > b$

$$\omega^l_{j,k} \quad b^l_j$$
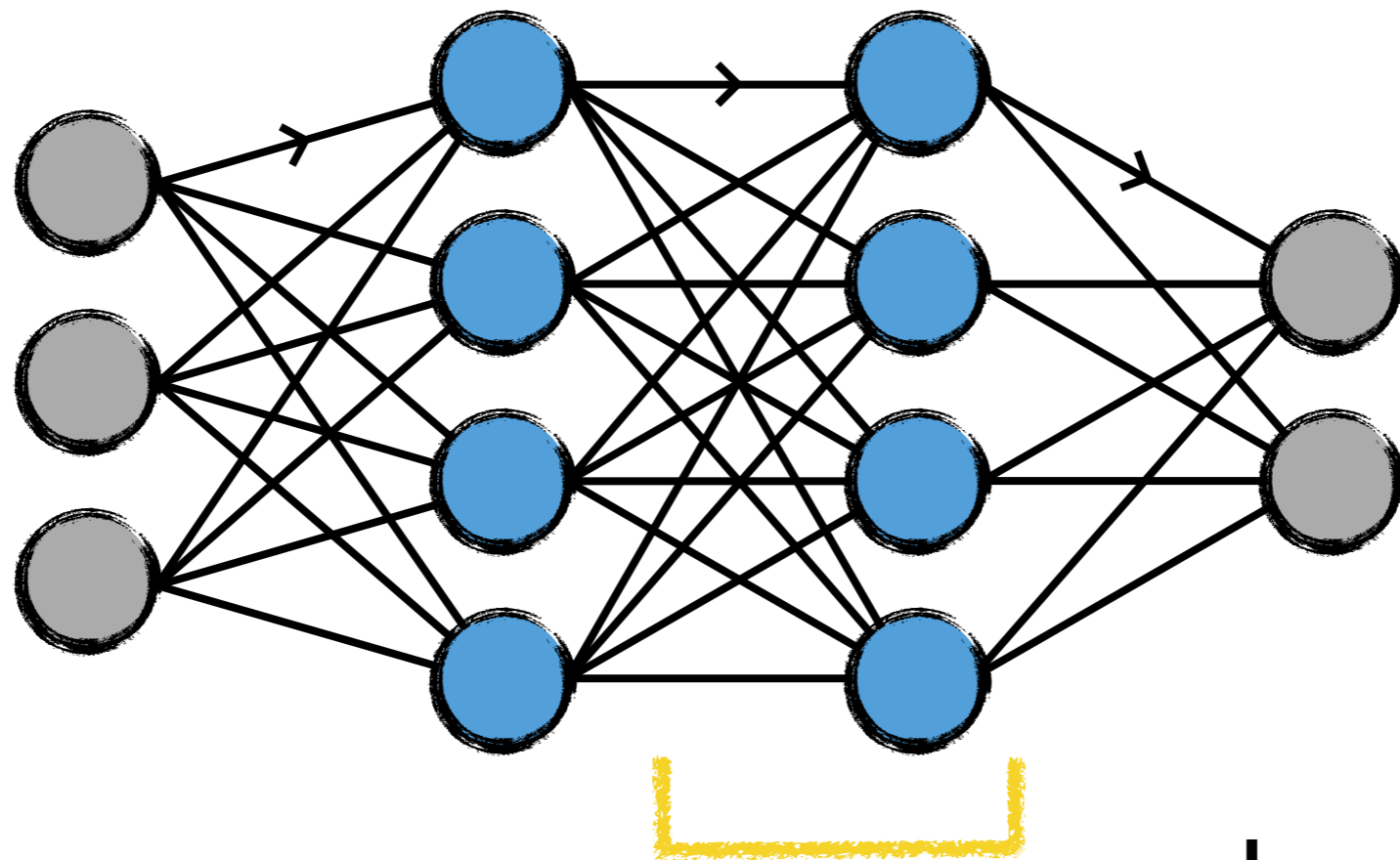
Layer number

Neuron number in previous layer

Neuron number in layer

Training a Neural Network

- Gather lots of training data (with solution)

- Set number of hidden layers and neurons

- Start with random parameters

- Apply the network, tweak the parameters

- Repeat step above until you are satisfied

- Apply neural network to new data

Neural Net and MATLAB
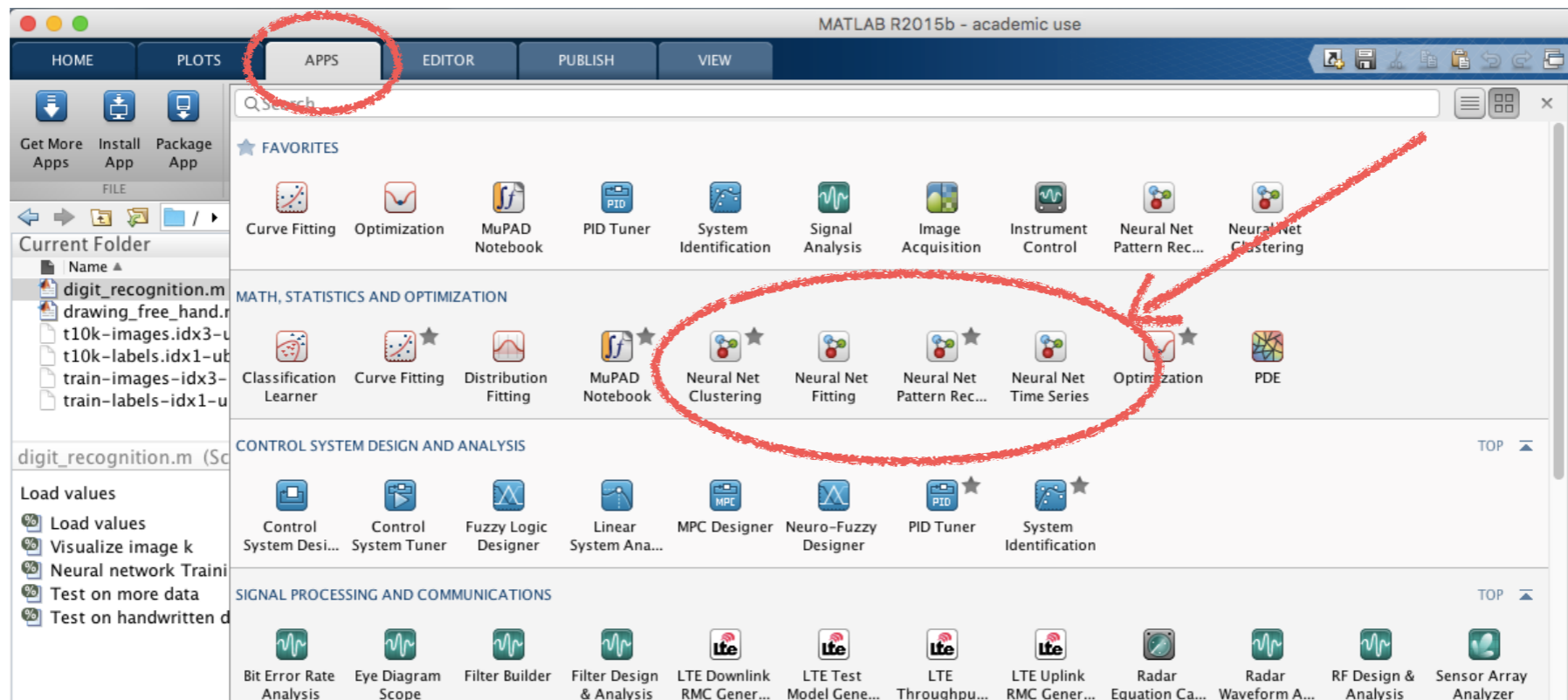
- Several tools exist and are being developed

- Basic understanding of the tool is required

- Pushes the GUI, but stick with the code

- MNIST database

- 60,000 examples in training set

- 10,000 examples in test set

- 28x28=784 pixel images

- Our network: single hidden layer, 100 neurons