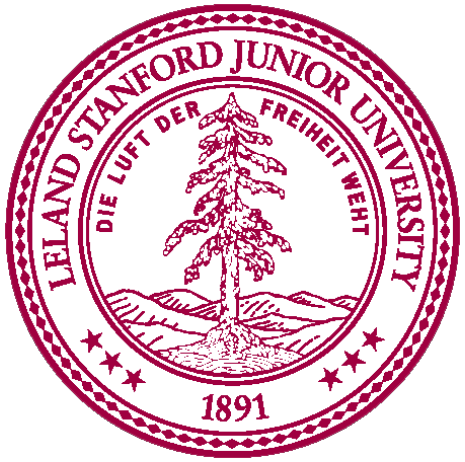


Interactors

Interactors

- **Interactors: graphical element that the user can interact with or view**
  - Presented by a GUI program
  - Also called widget

Interactors in graphics.py

- **Button - widget that the user can click to cause an action to take place**
  - When creating a button can specify:
    - Text to appear on the face of the button
    - Location of the button
- **Text Field - widget that the user can type in**
  - When creating a text field can specify:
    - Name of the text field
    - Text appear before the text field
    - Location of the text field

Interactors in graphics.py

- **Button**

```
  canvas.create_button(“Text and name of the button",
location of the button)

  e.g canvas.create_button(“Create Rectangle",
Canvas.TOP)
```

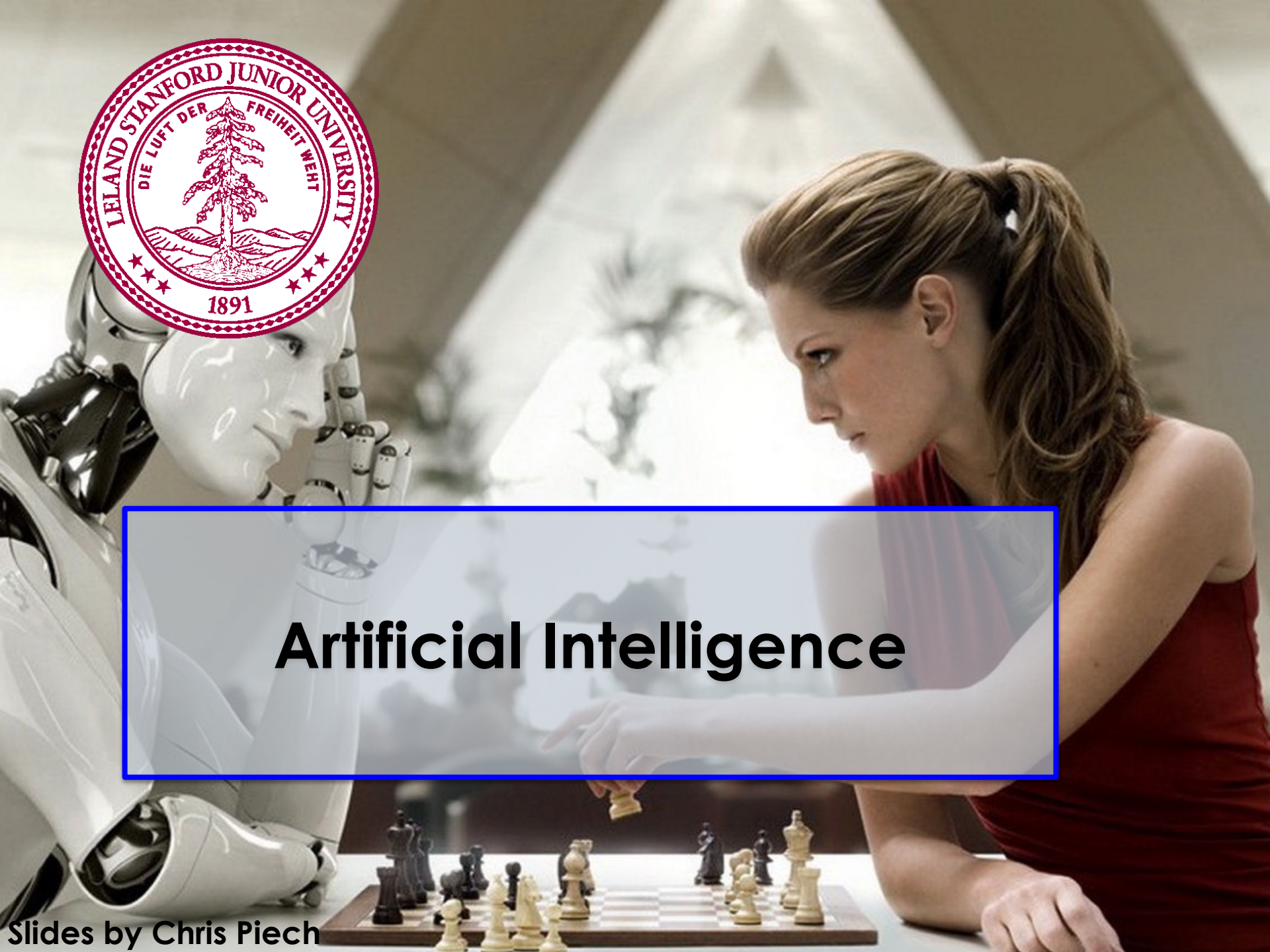
Interactors in graphics.py

- **Text Field**

```
canvas.create_text_field(“name and text of the
textfield", location of the textfield)
```

e.g

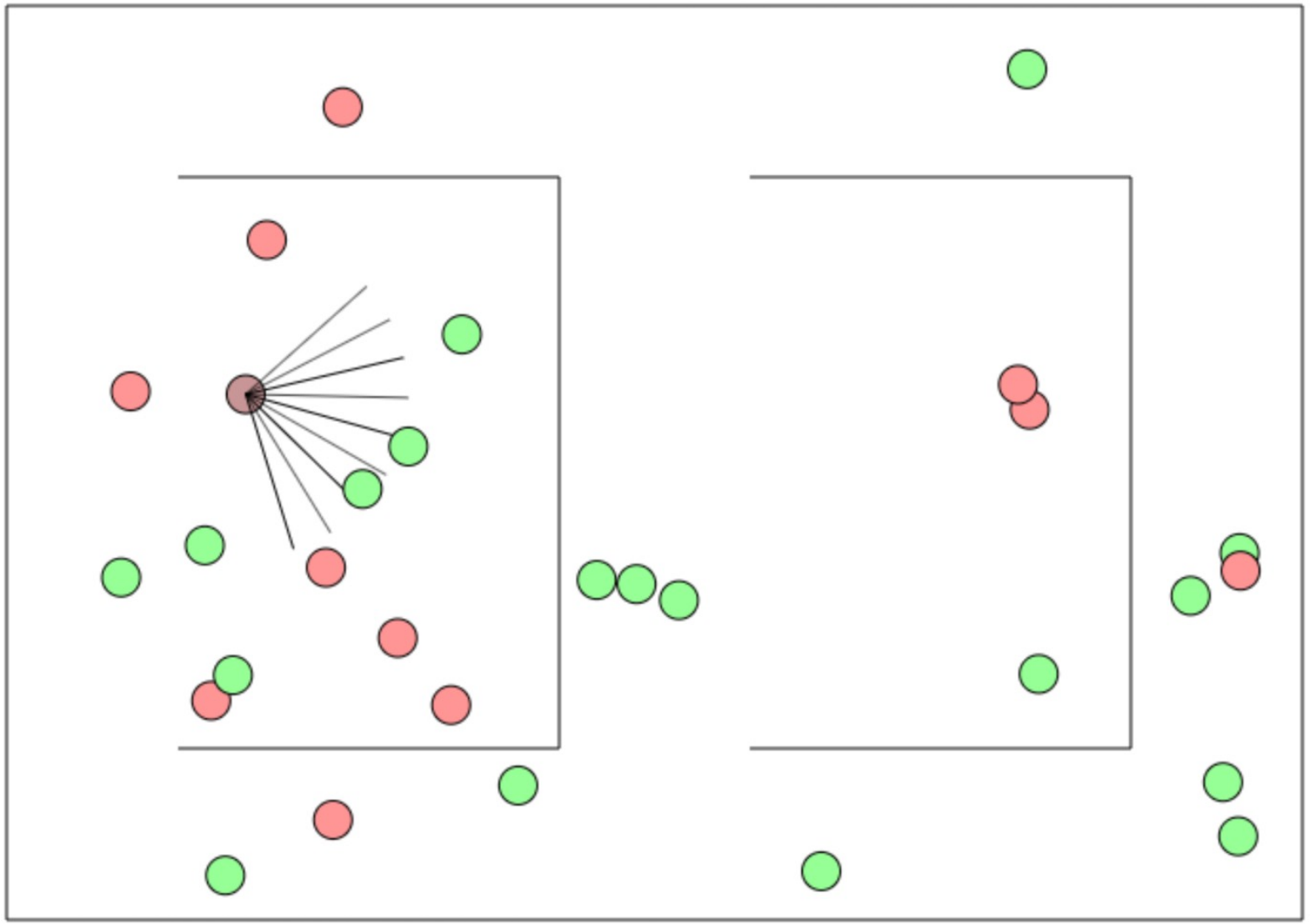
```
canvas.create_text_field("Color", Canvas.TOP)
```



Artificial Intelligence

Slides by Chris Piech

A Little AI

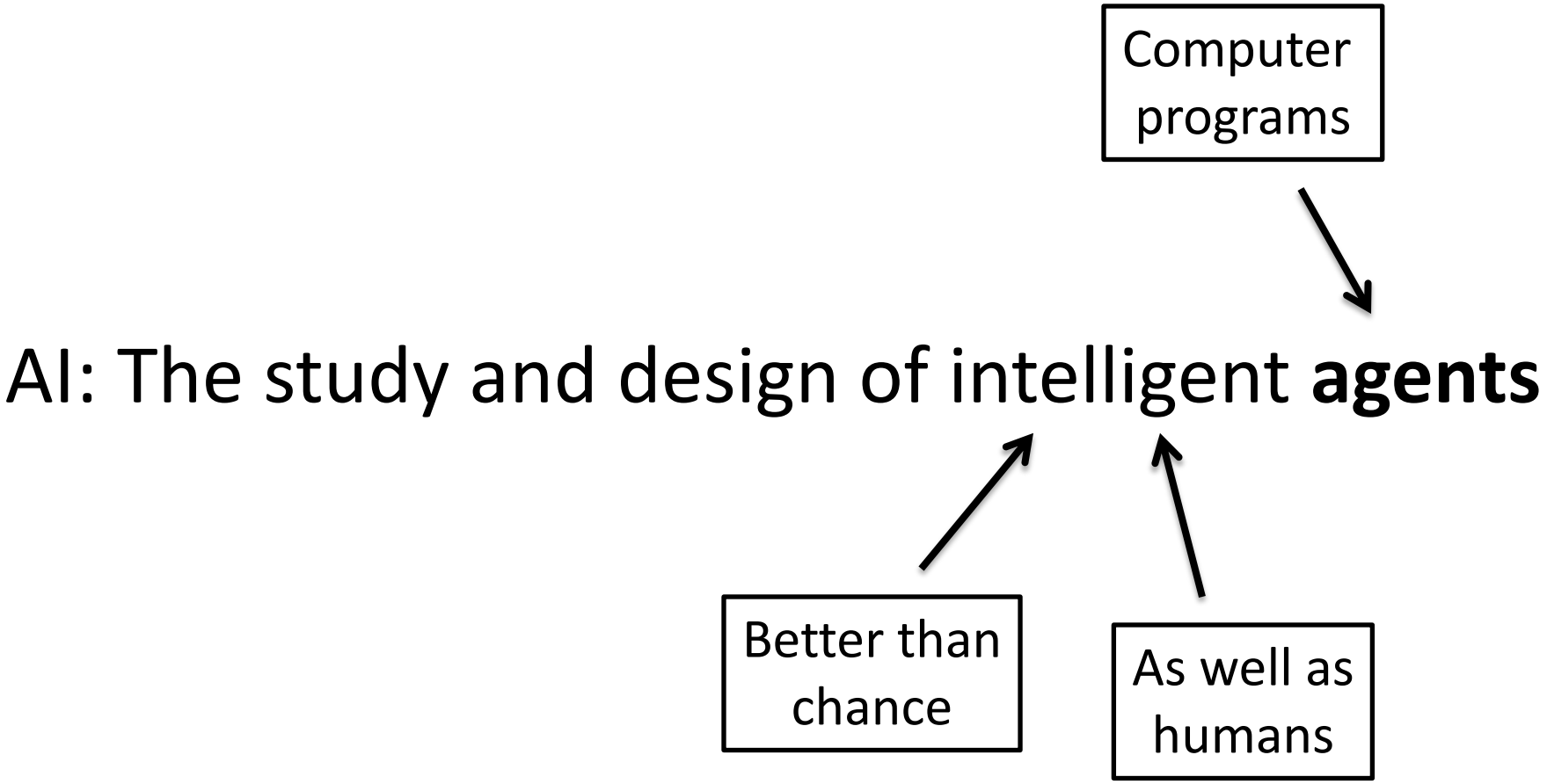


http://cs.stanford.edu/people/karpathy/convnetjs/demo/rldemo.html

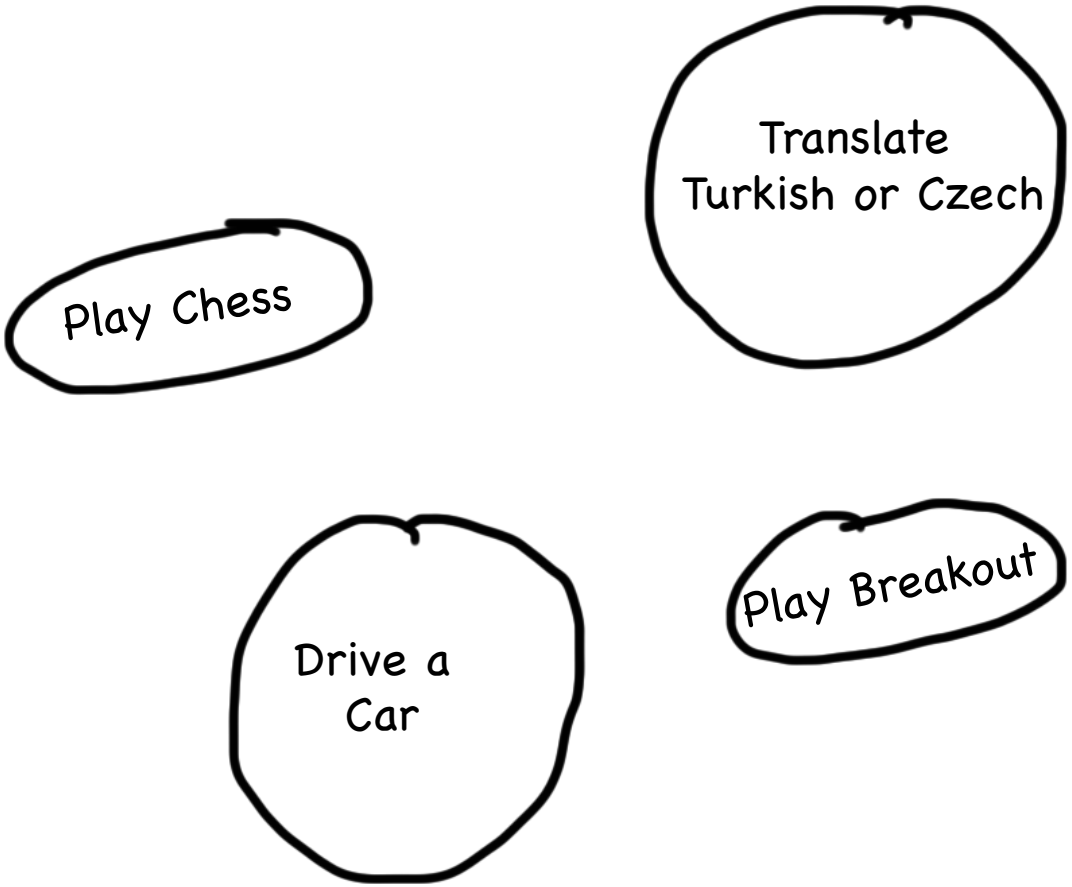
What is AI?

[suspense]

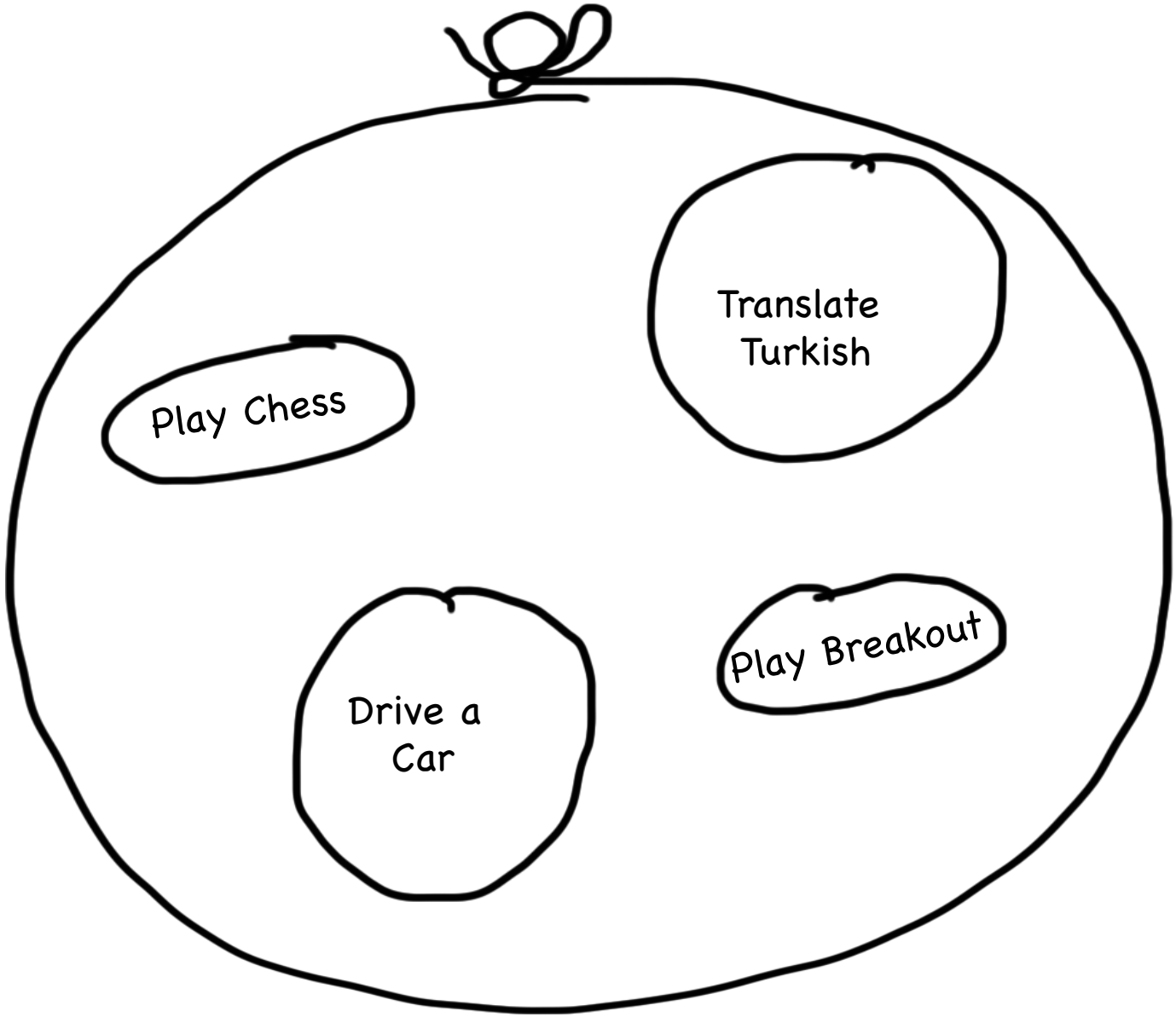
AI: The study and design of intelligent **agents**


Computer programs
AI: The study and design of intelligent **agents**
Better than chance
As well as humans

Narrow Intelligence

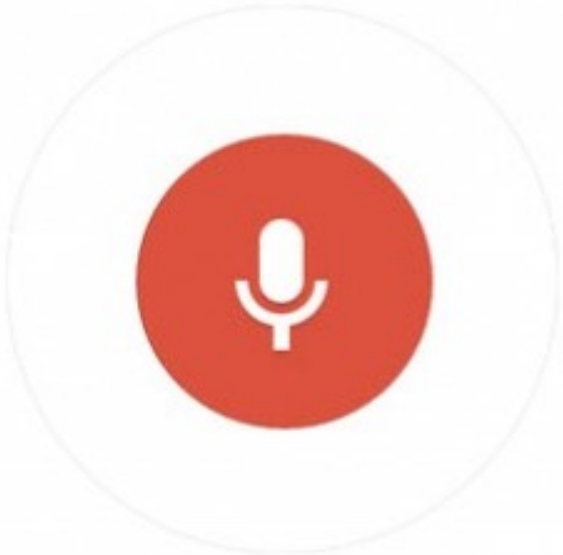


General Intelligence



Big Milestones

Told Speech Was 30 Years Out



Almost perfect…

The Last Remaining Board Game

Computers Making Art

Self Driving Cars

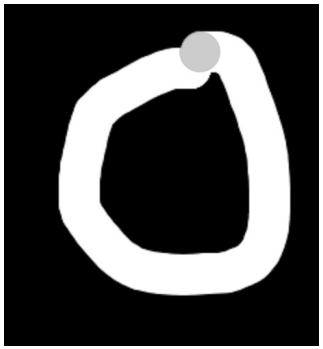
Make a Harry Potter Sorting Hat

Classification

That is a picture of a **one**

Classification

That is a picture of a **zero**



Classification

That is a picture of an **zero**

* It doesn't have to be correct all of the time

Can you do it?

How about now?

What a computer sees

0	0	1	0	1	0	1	0	0	0	1	1	1	0	1
1	0	0	1	0	1	1	1	0	1	0	0	0	0	0
1	1	1	0	1	0	0	1	1	0	0	1	0	1	0
1	1	1	1	1	0	0	0	0	0	1	1	0	1	1
0	0	0	1	1	0	0	1	0	0					
1	0	0	1	1	0	0	0	1	0					
1	1	0	1	1	0	0	1	1	0					
1	0	1	0	0	1	0	0	1	0					
0	0	0	0	1	0	1	0	1	1					
0	1	1	0	0	0	0	0	1	1					
0	0	1	0	1	1	1	0	0	0					
0	1	1	1	0	1	0	0	1	0					
1	1	0	0	0	0	0	0	0	0					
0	0	0	0	0	0	0	0	1	1					
0	0	1	1	1	0	1	0	1	1					

What a human sees

Why is it easy for Humans?

About 30% of your cortex is used for vision
3% is used to process hearing

Very hard to Program


```
def main():
    print("Todo: Write program")
```

Perhaps there is an insight?

Two Great Ideas

1. Artificial Neurons

2. Learn by Example

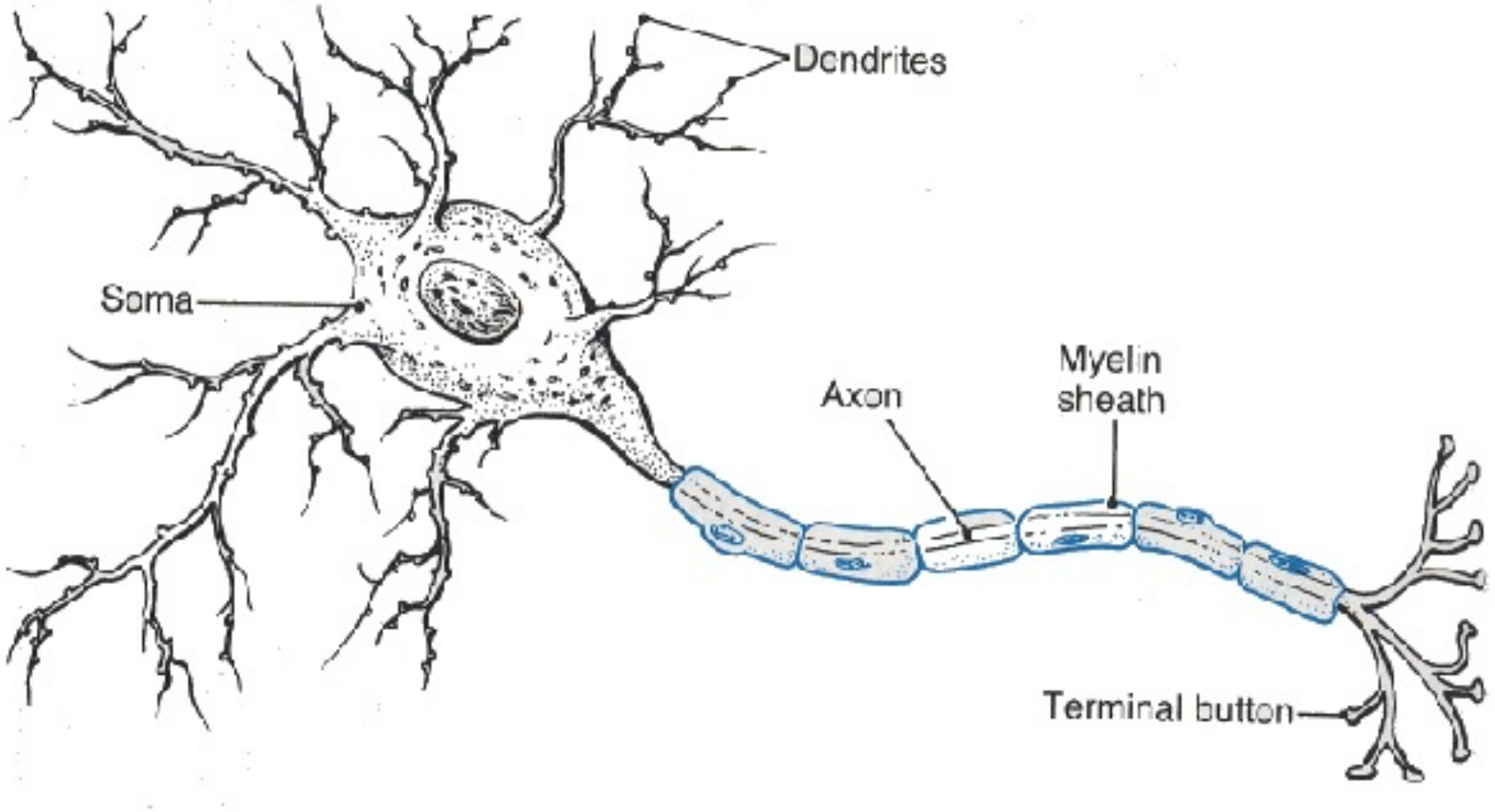
Two Great Ideas

1. Artificial Neurons

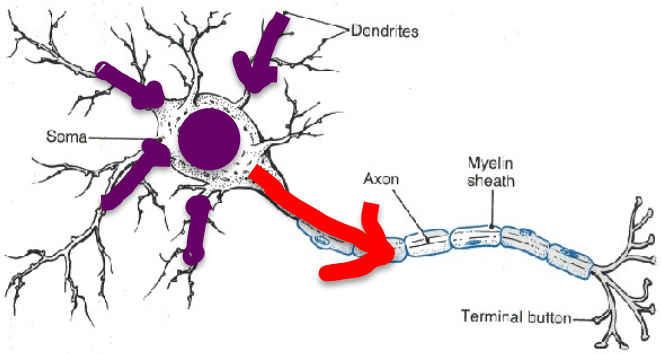
2. Learn by Example

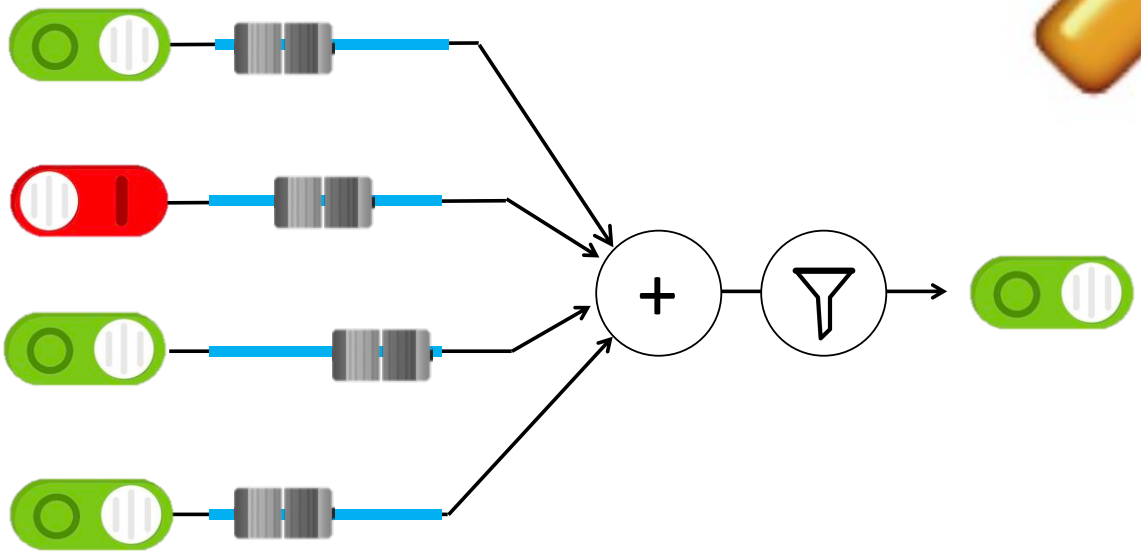
1. Artificial Neurons

Neuron

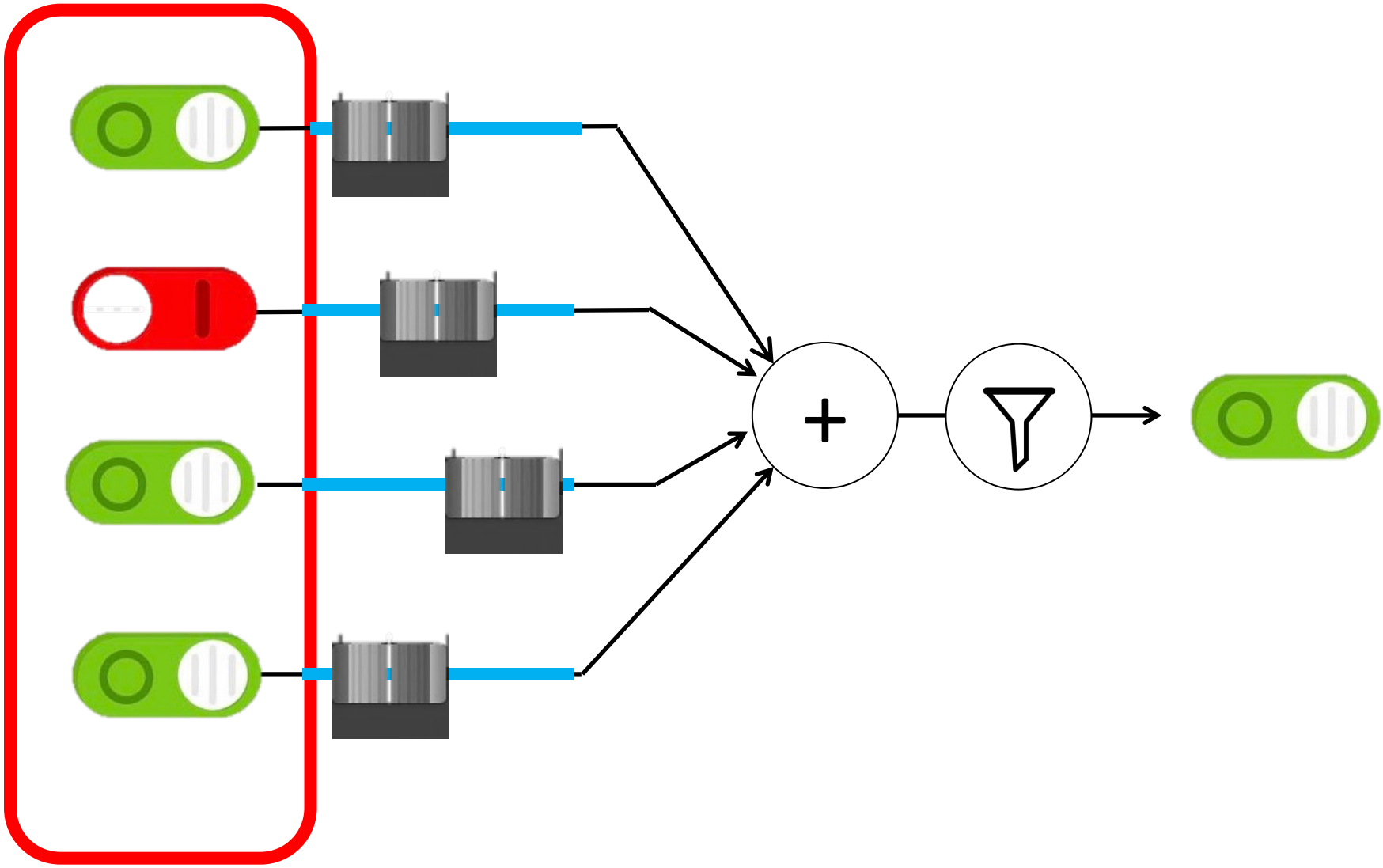


Artificial Neuron

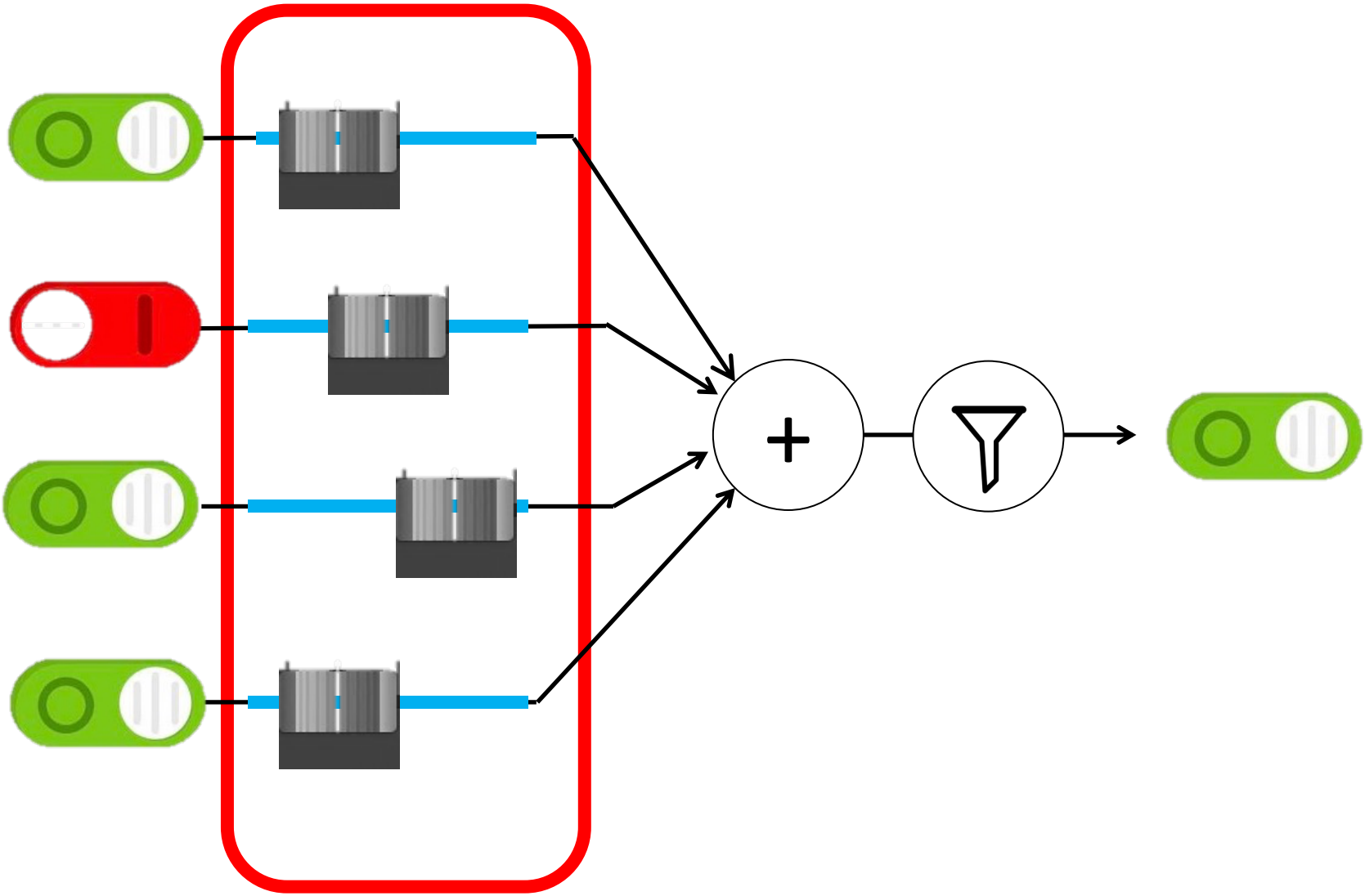




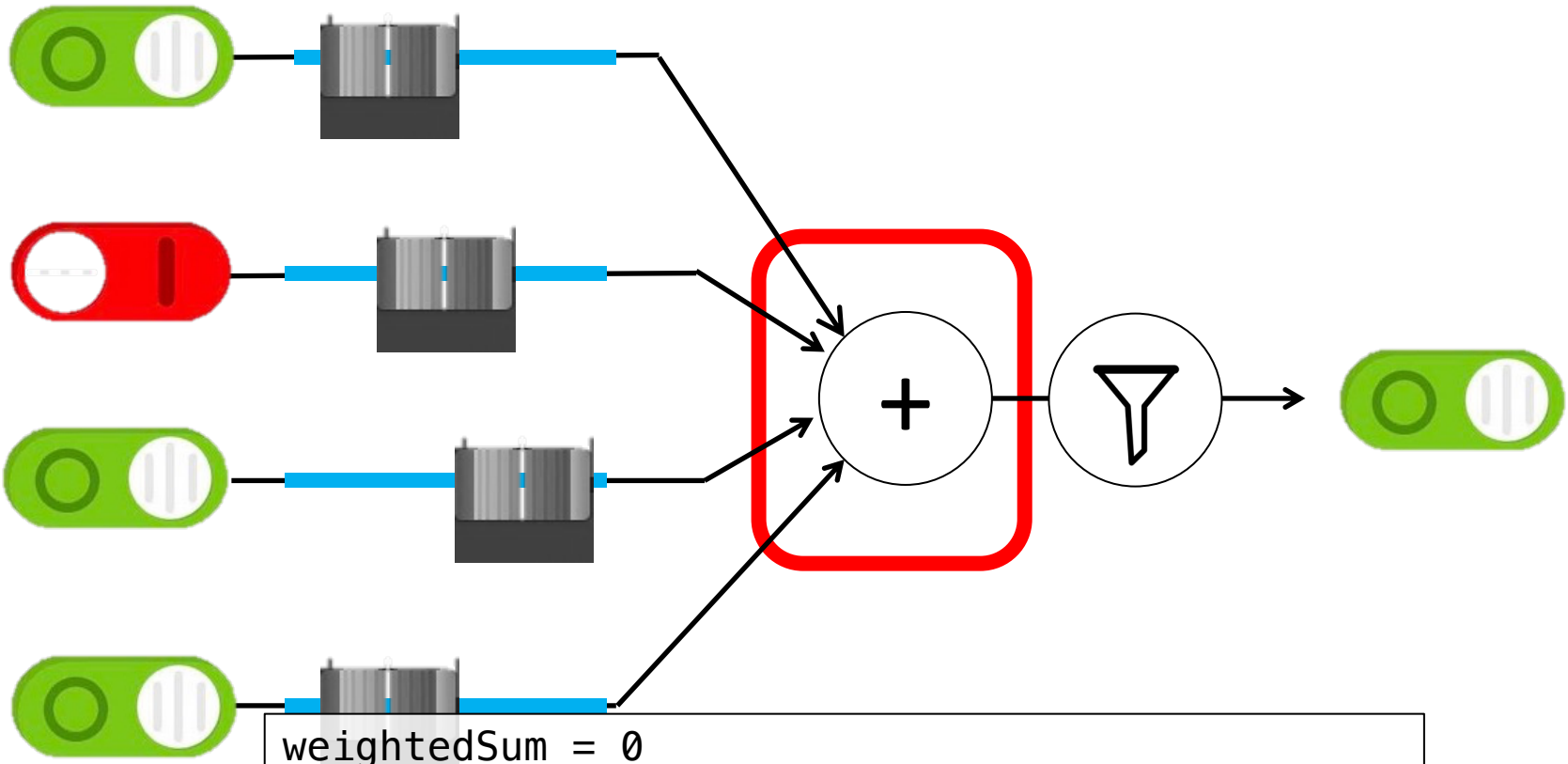
Inputs



Weights

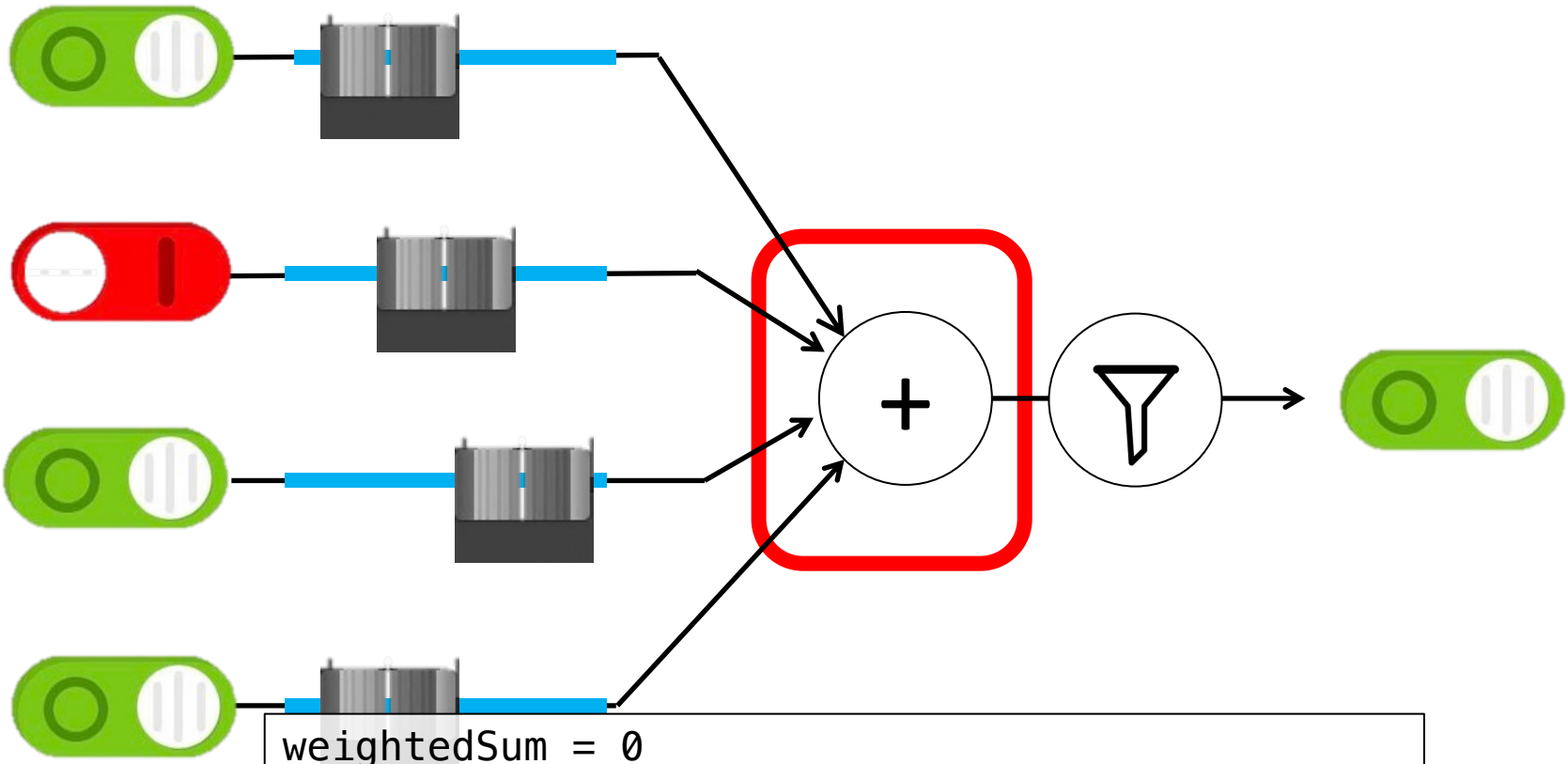


Weighted Sum



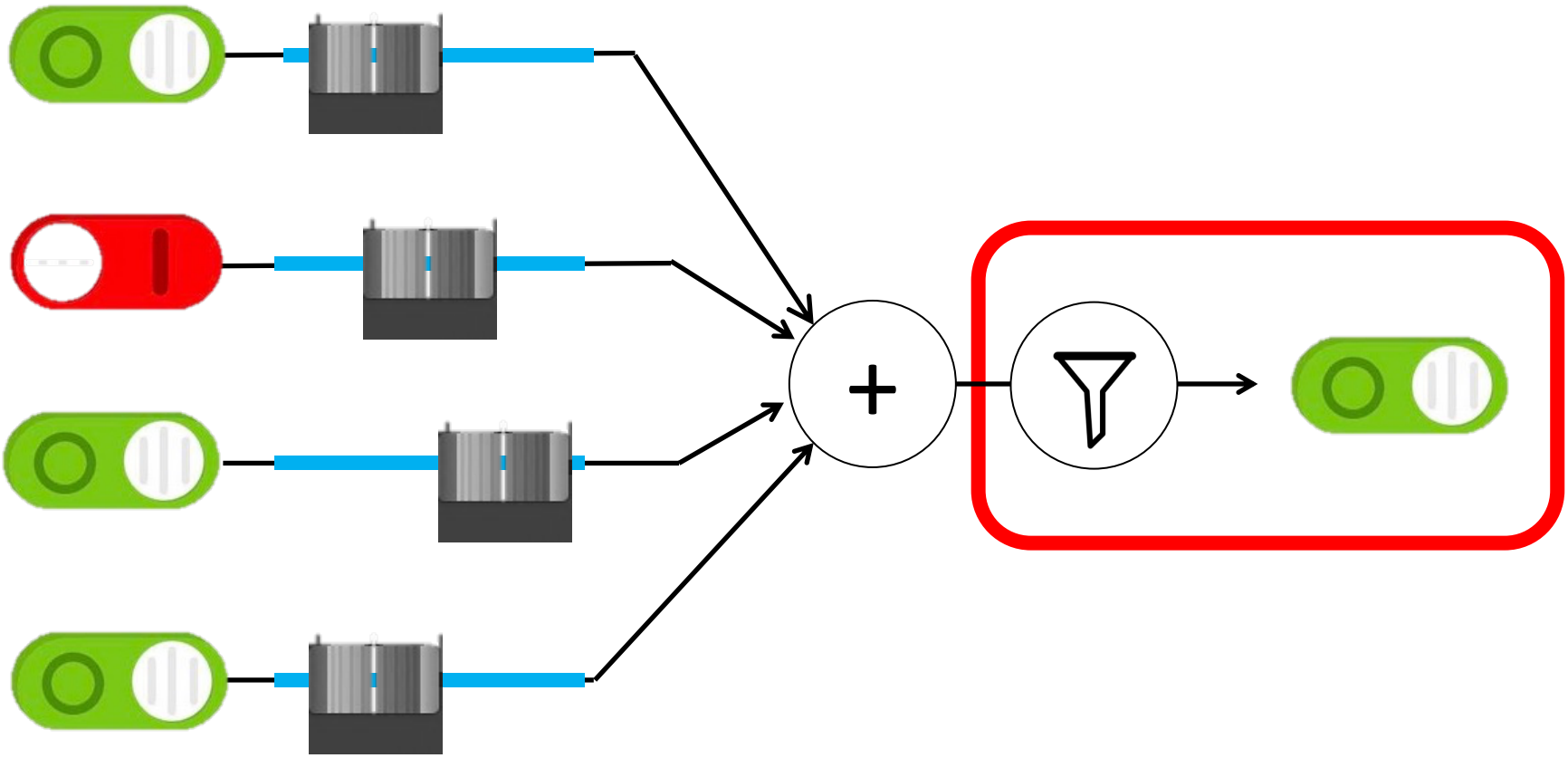
```
weightedSum = 0
weightedSum = weightedSum  + input0 * weight0
weightedSum = weightedSum  + input1 * weight1
weightedSum = weightedSum  + input2 * weight2
weightedSum = weightedSum  + input3 * weight3
```

Weighted Sum

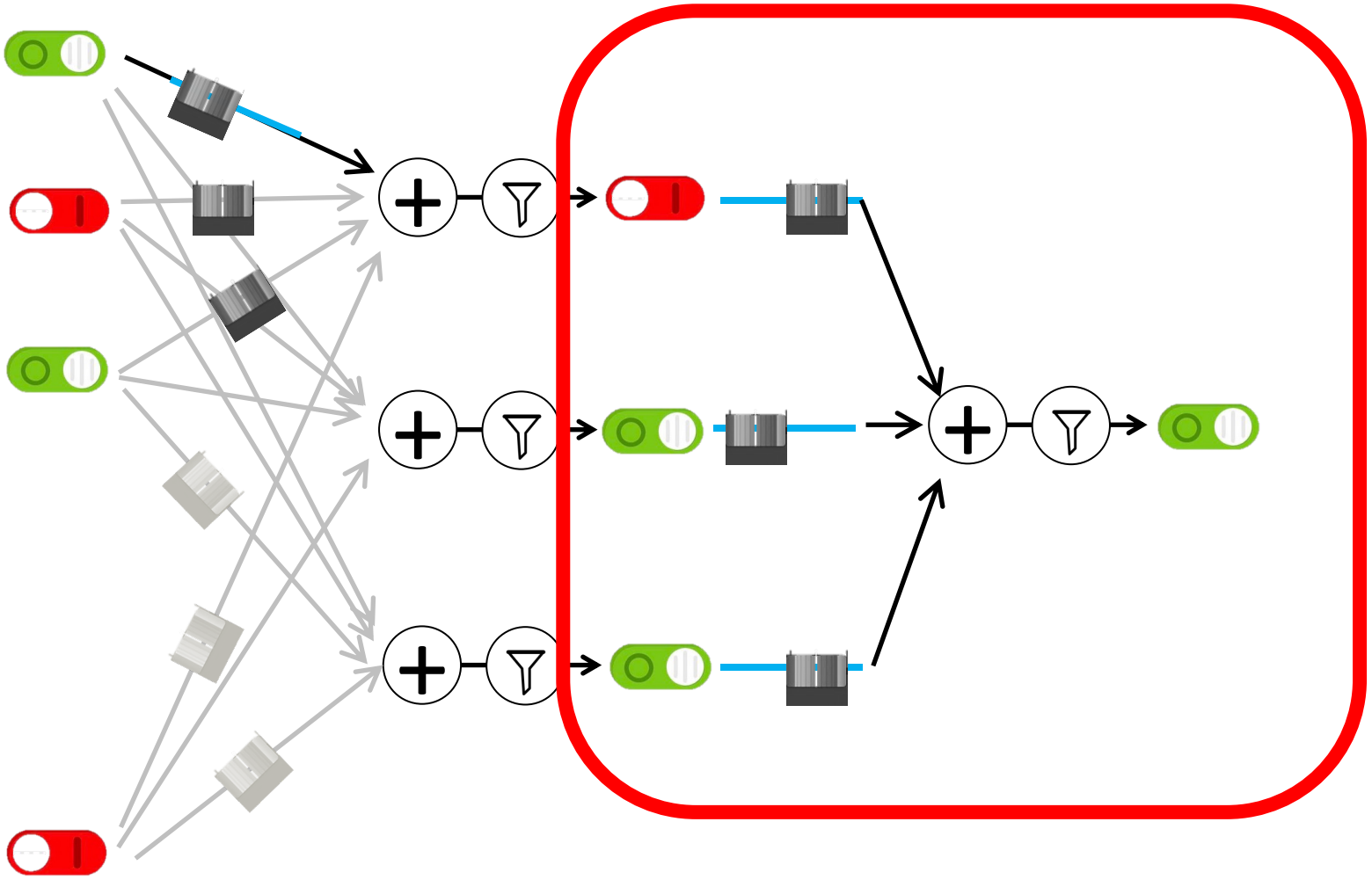


```
weightedSum = 0
for i in range(4):
   weightedSum += weight[i] * input[i]
```

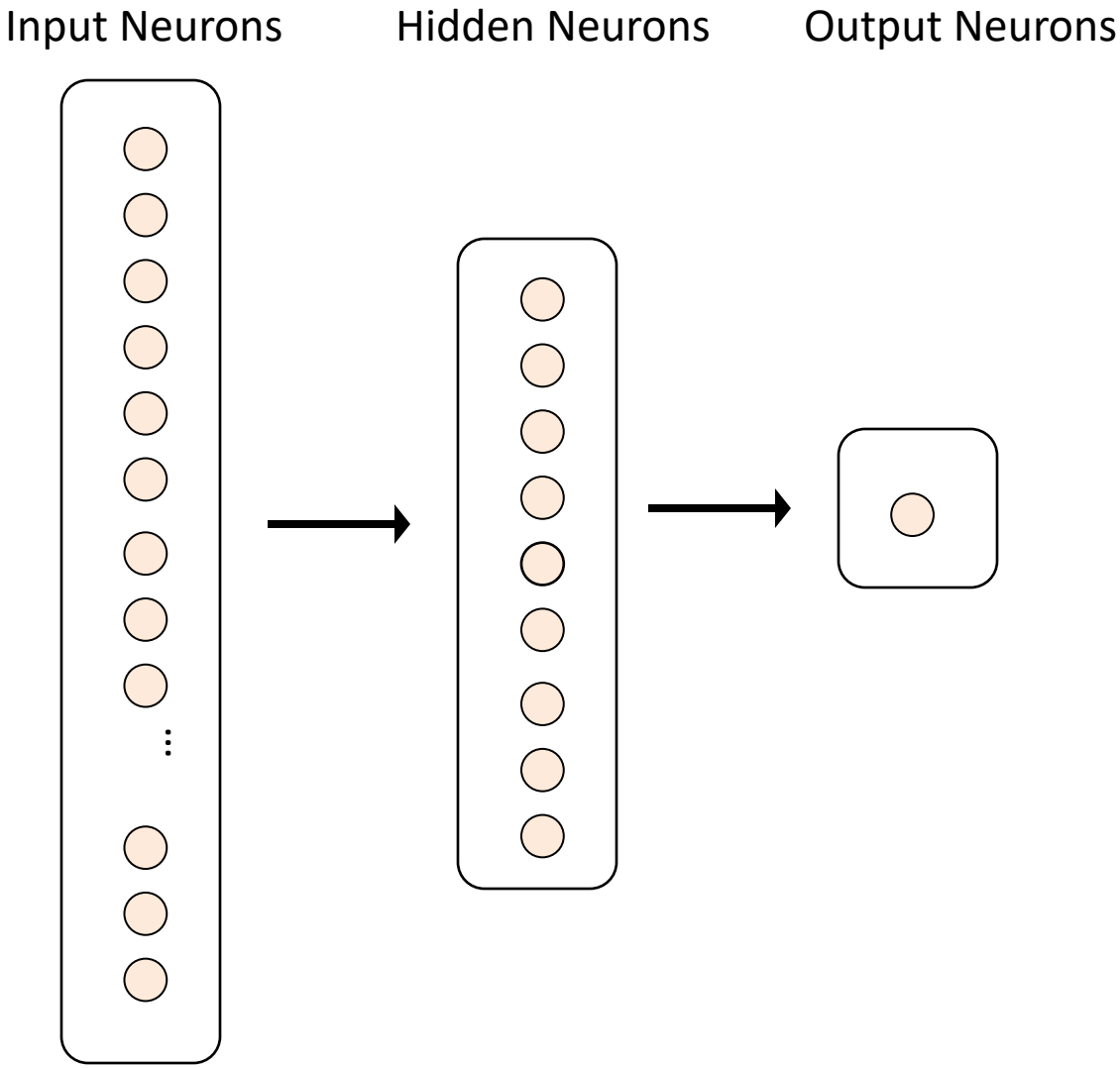
Filter and Output



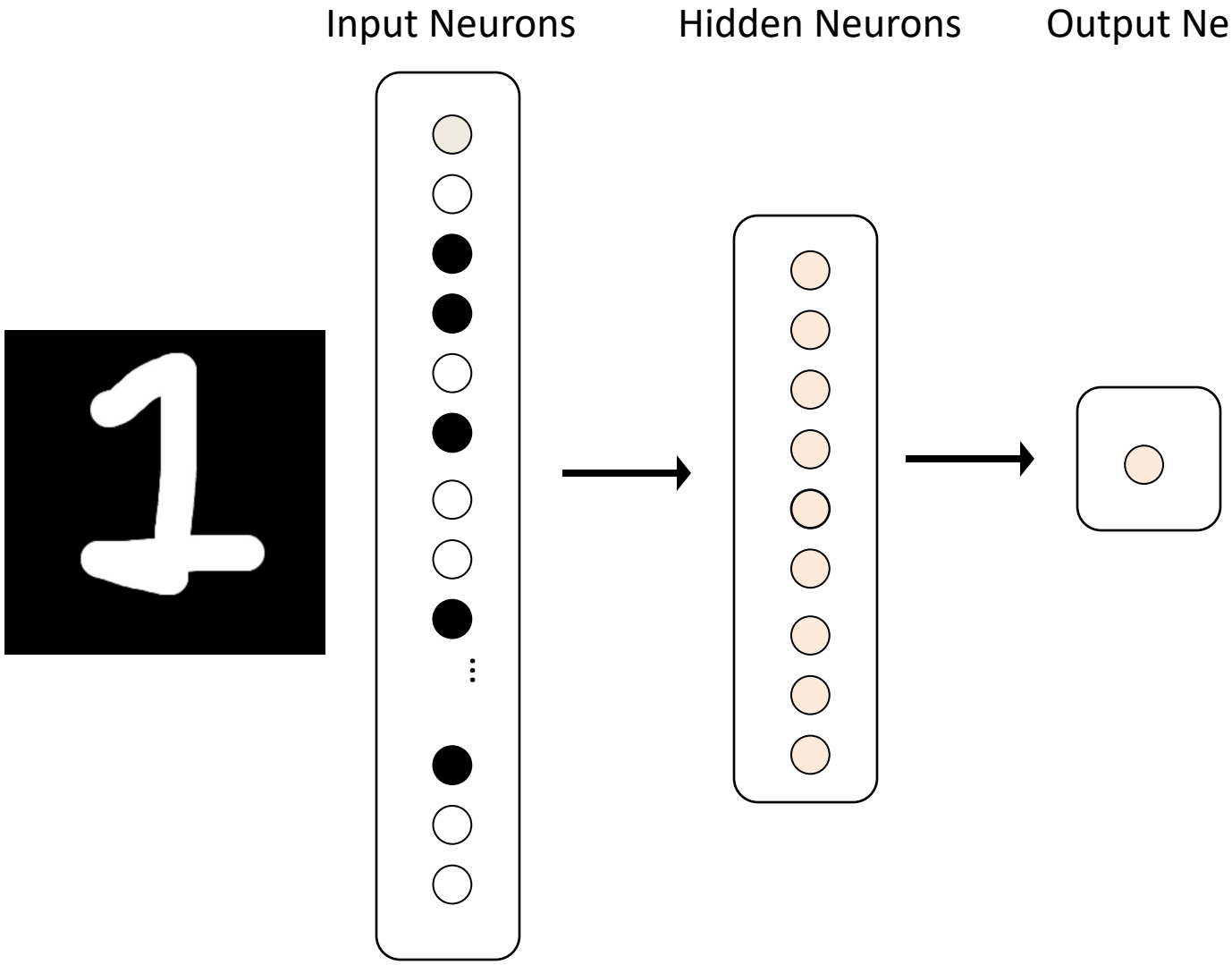
Put Many Together



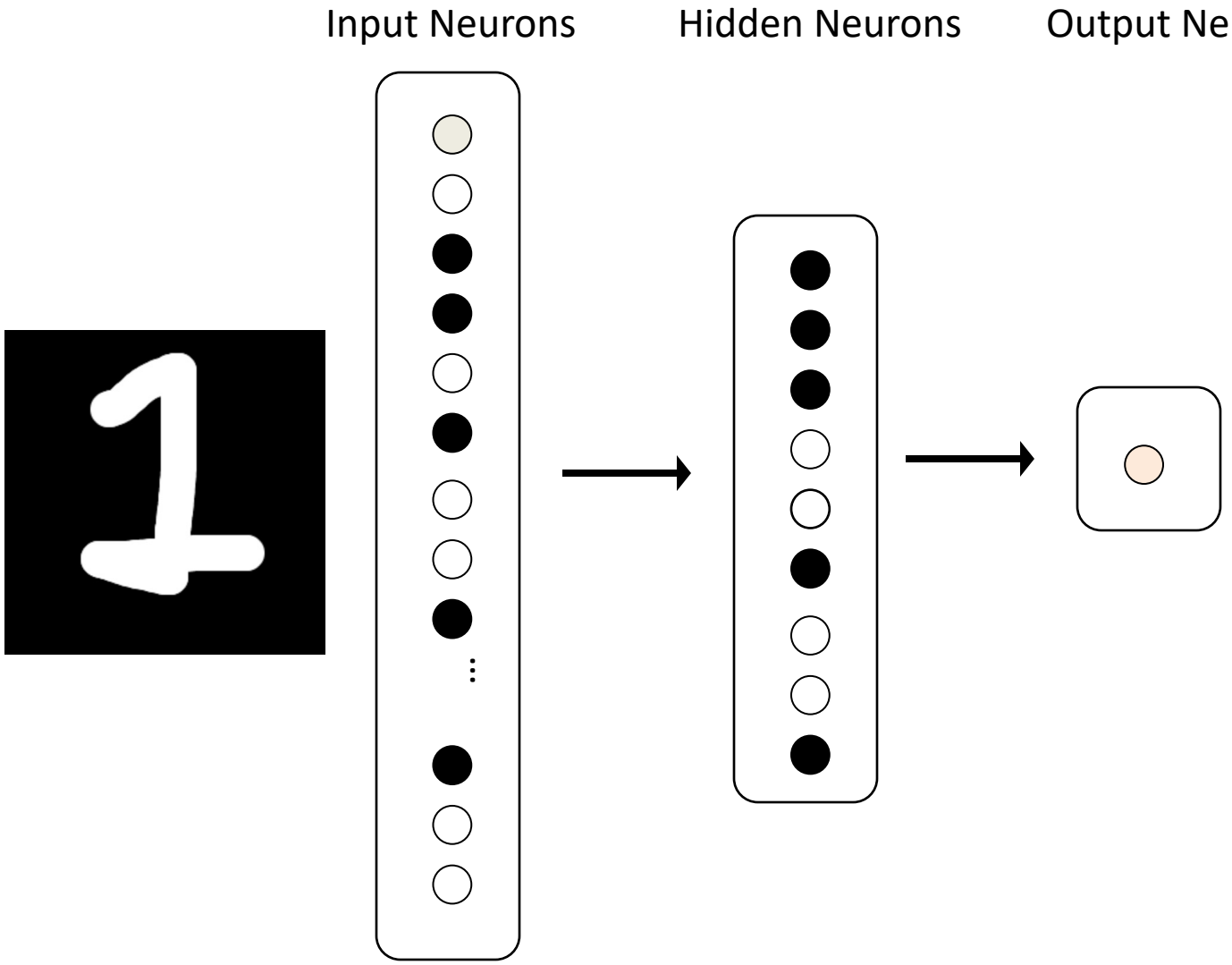
Making a Prediction



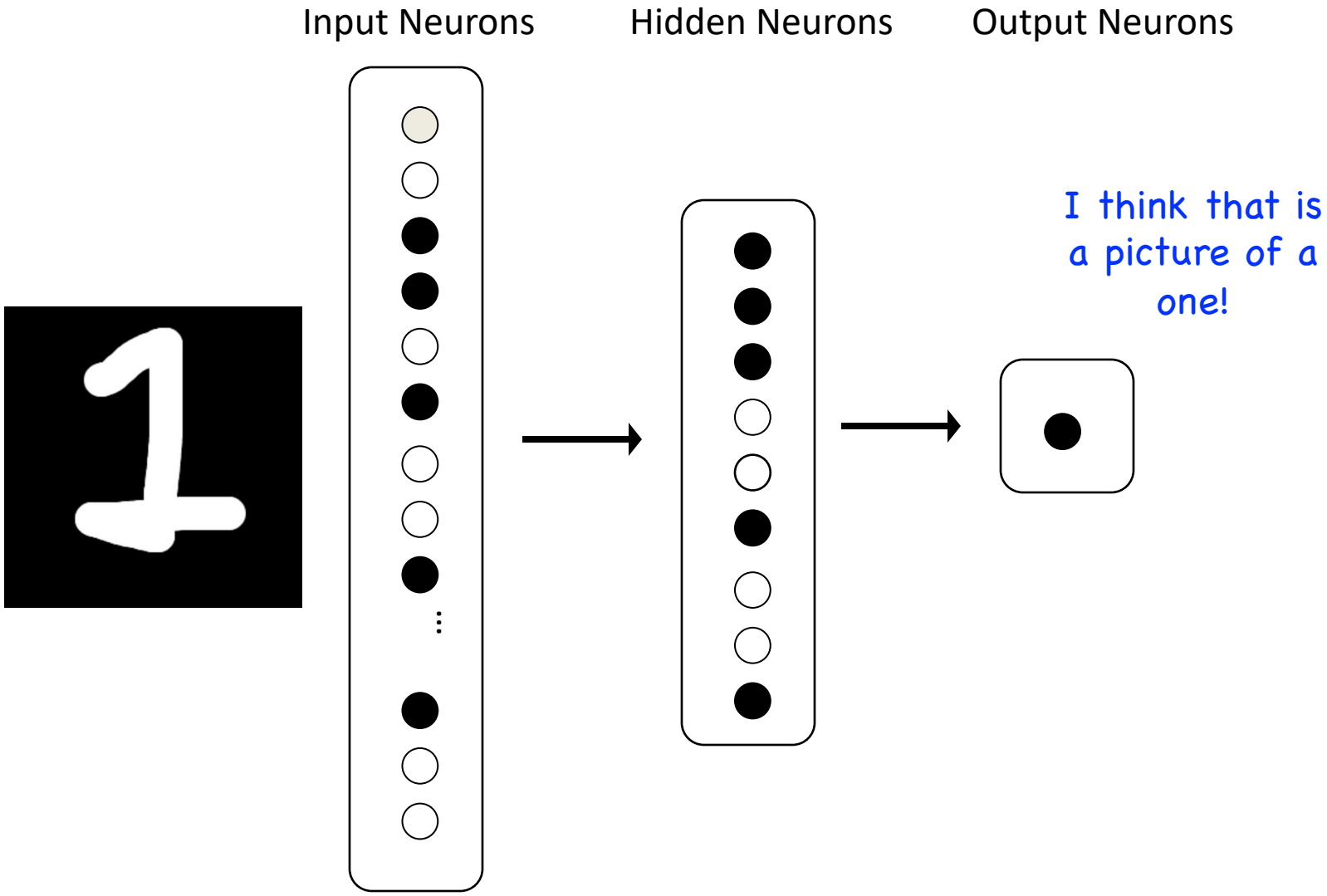
Making a Prediction



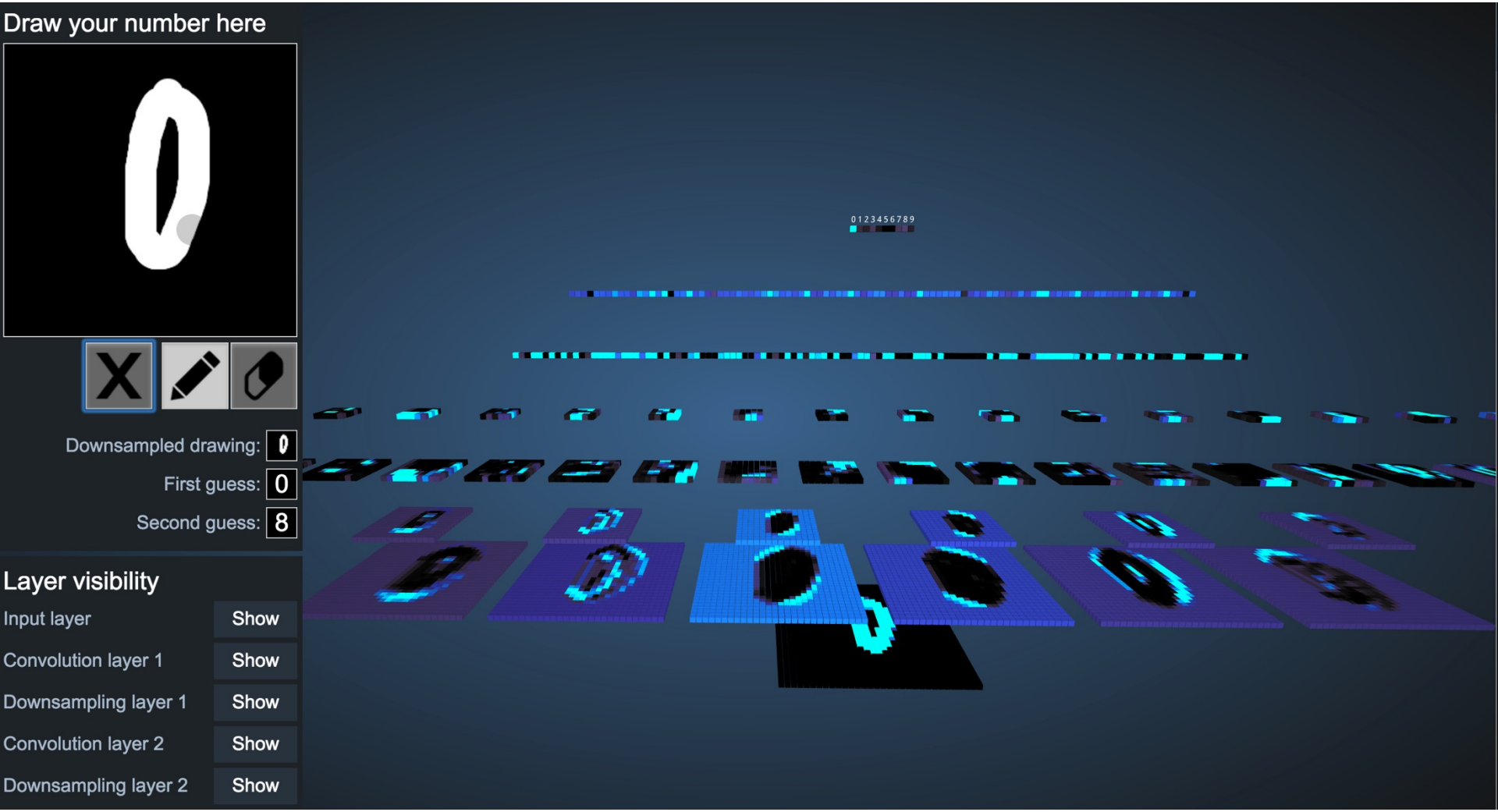
Making a Prediction



Making a Prediction

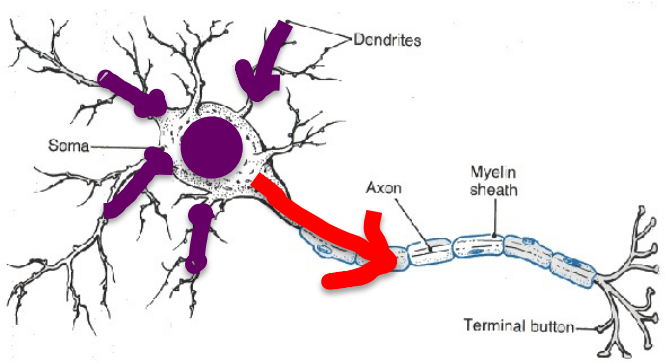


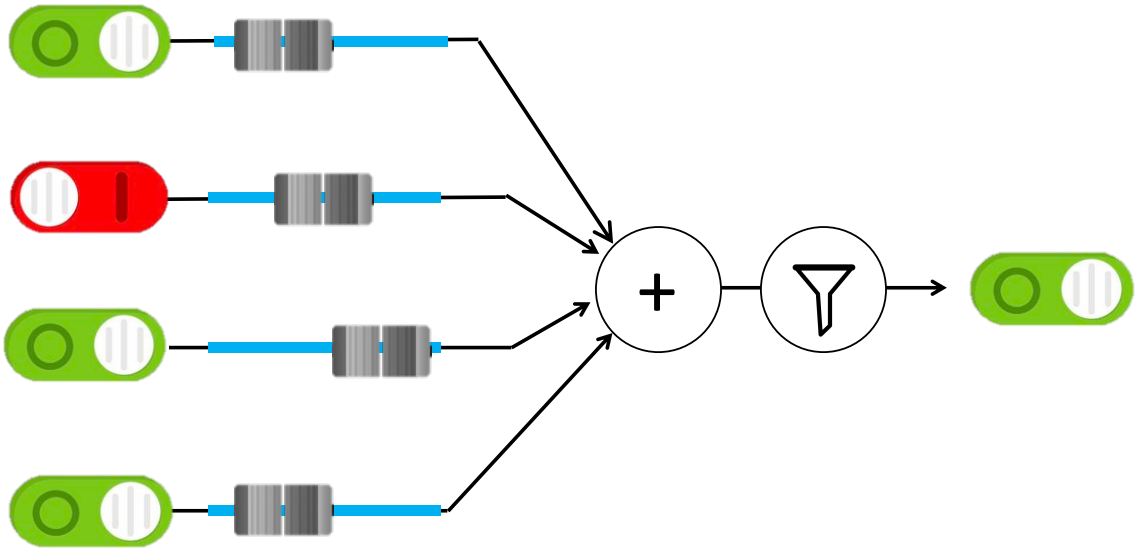
Demonstration



http://scs.ryerson.ca/~aharley/vis/conv/

Great Idea: Artificial Neurons





Neural Networks get their intelligence from their sliders (parameters)

Two Great Ideas

1. Artificial Neurons

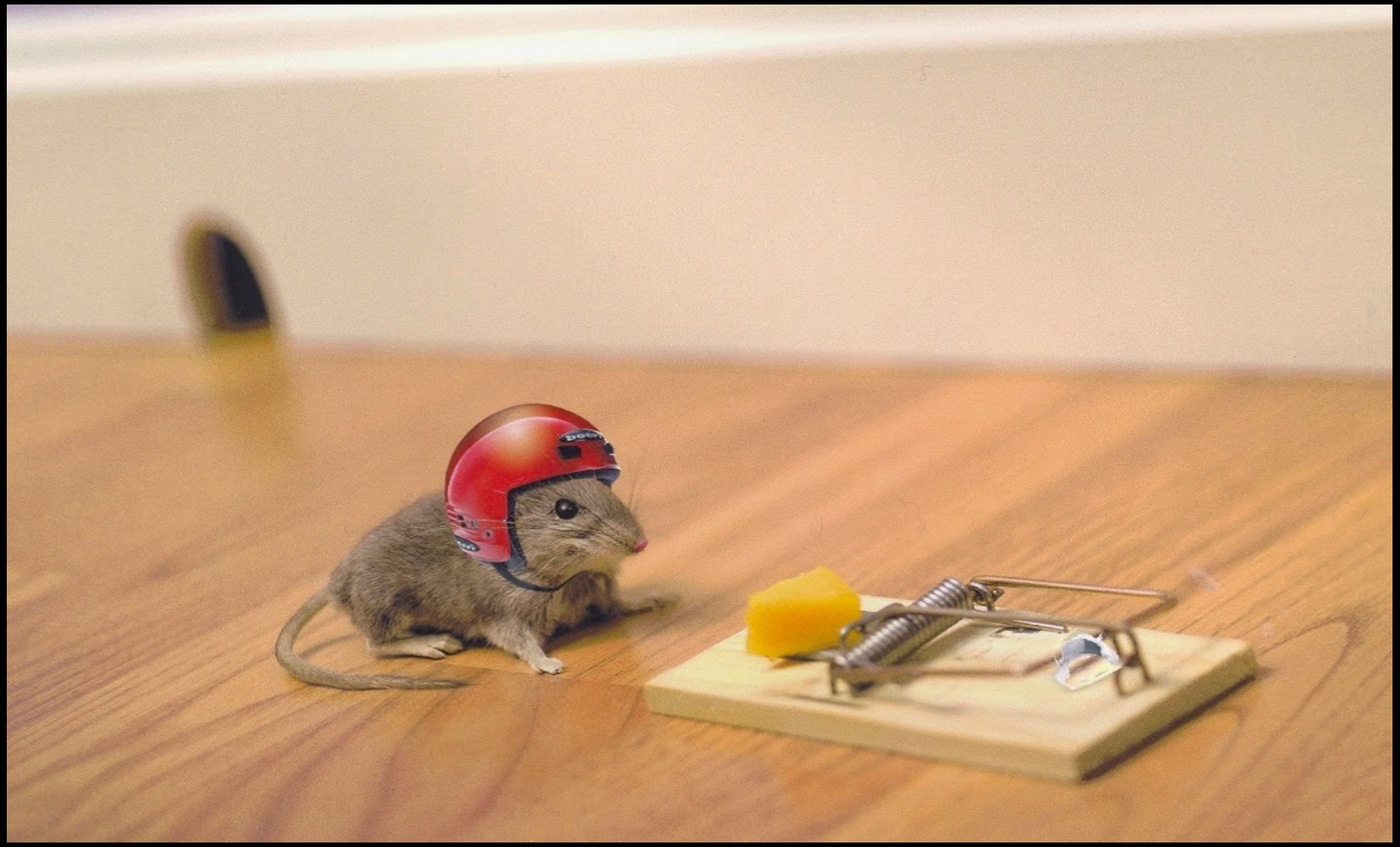
2. Learn by Example

Two Great Ideas

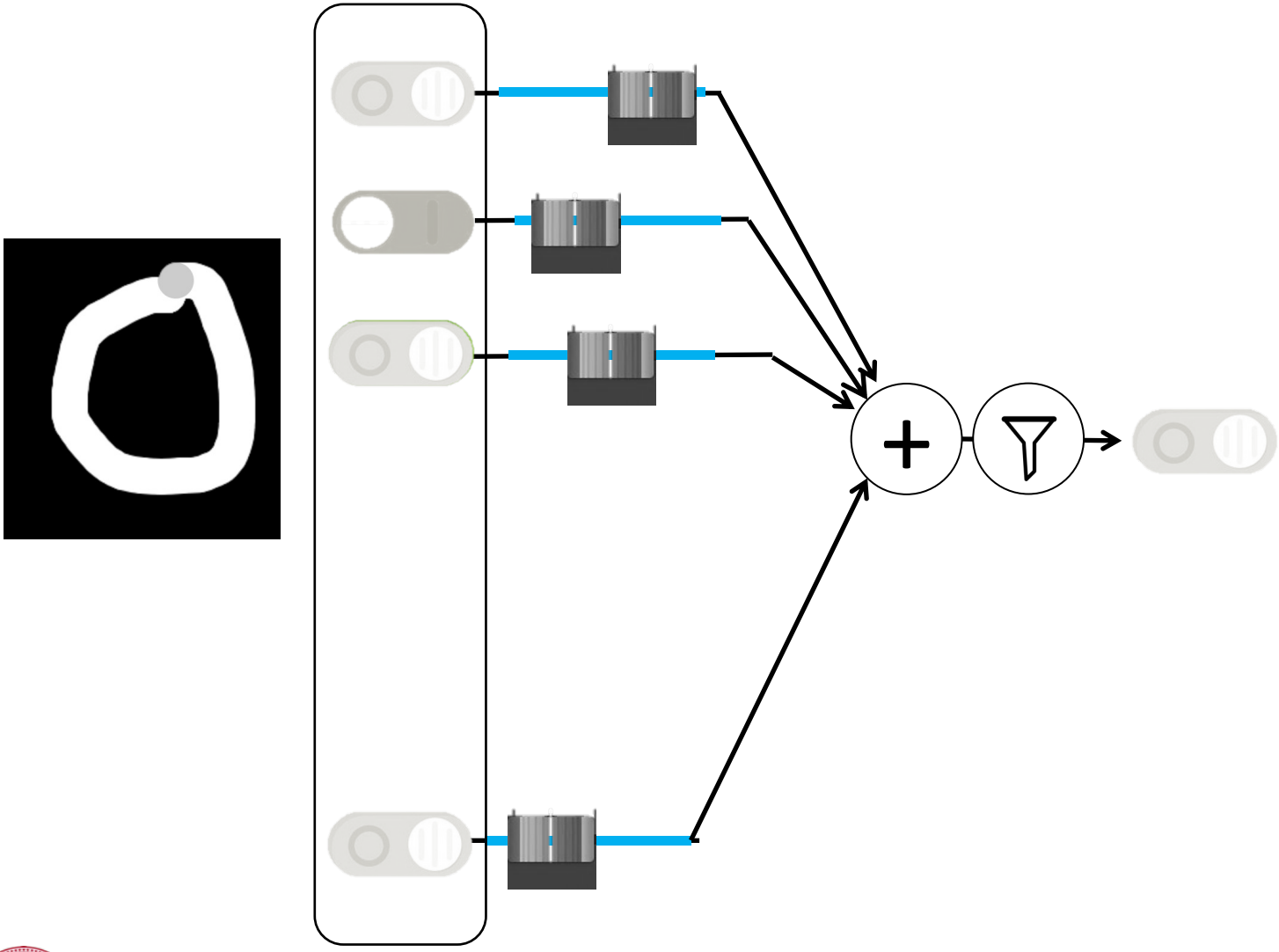
1. Artificial Neurons

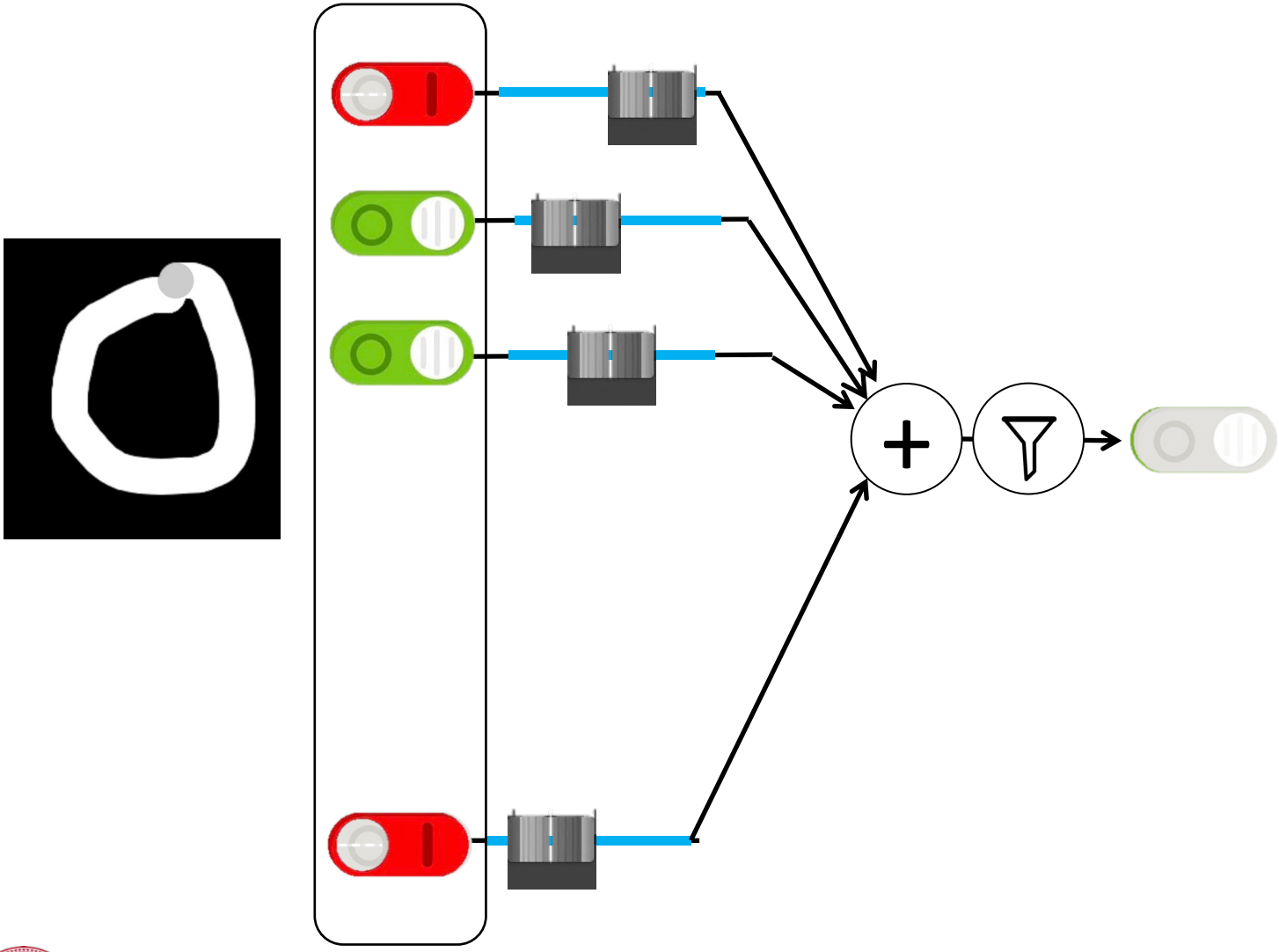
2. Learn by Example

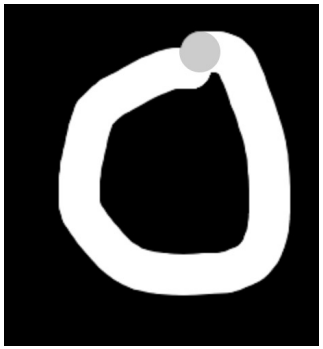
2. Learn From Experience

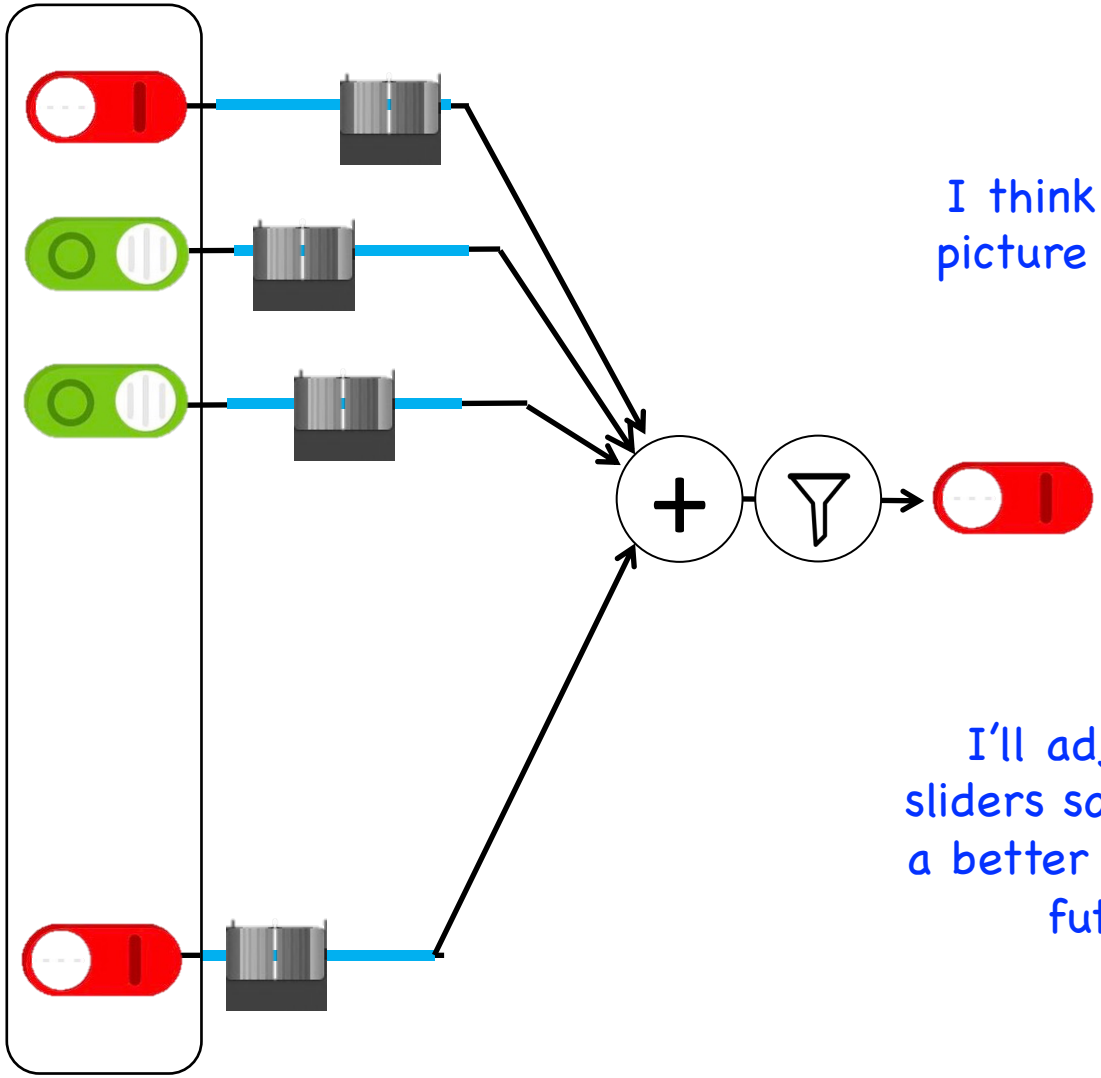


Learn by Example





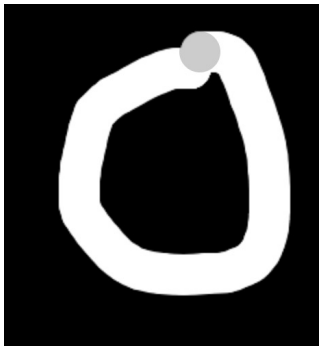


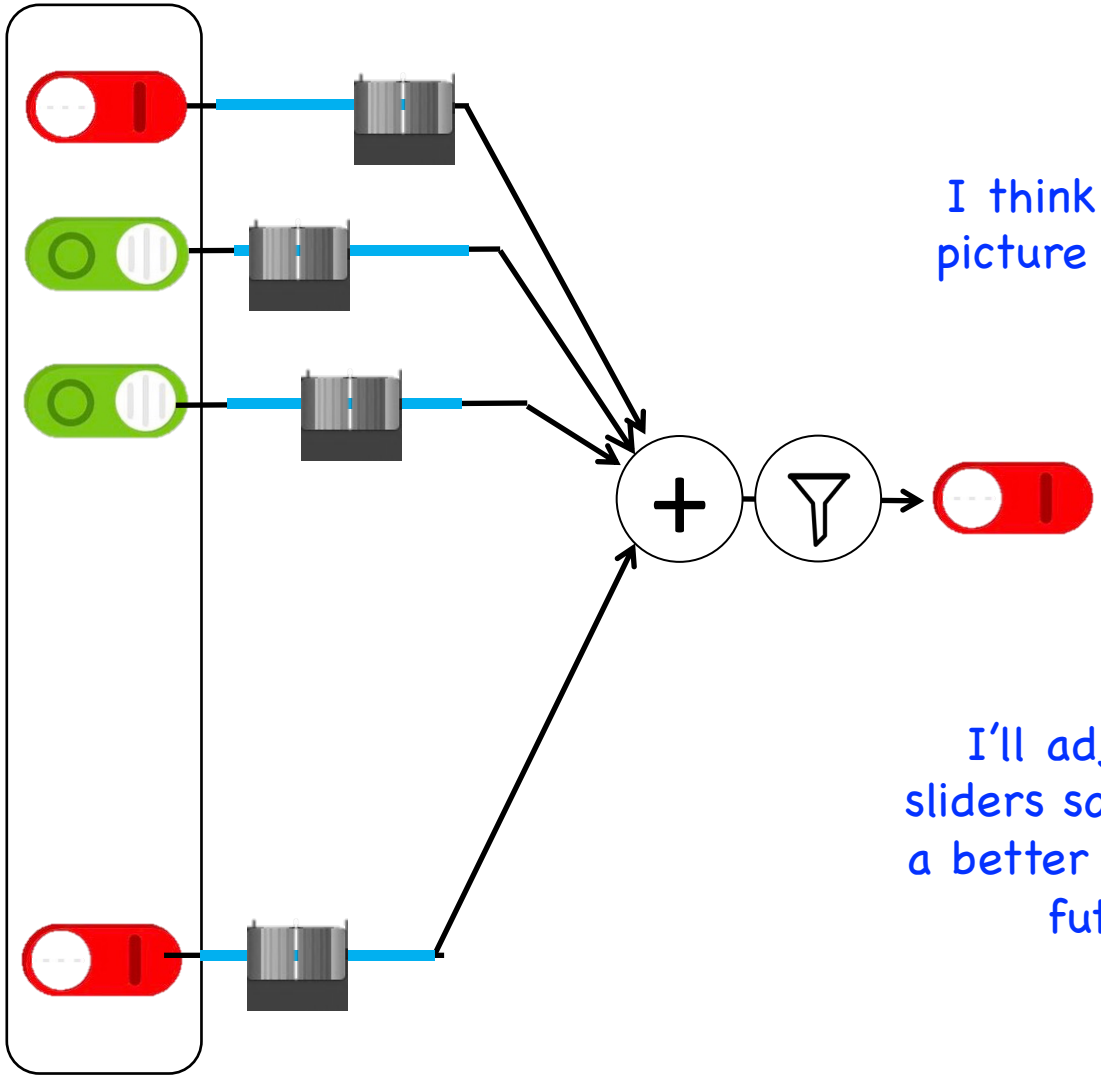


I think that is a picture of a **One**!

What do you mean it's actually a **Zero**?

I'll adjust my sliders so that I do a better job in the future





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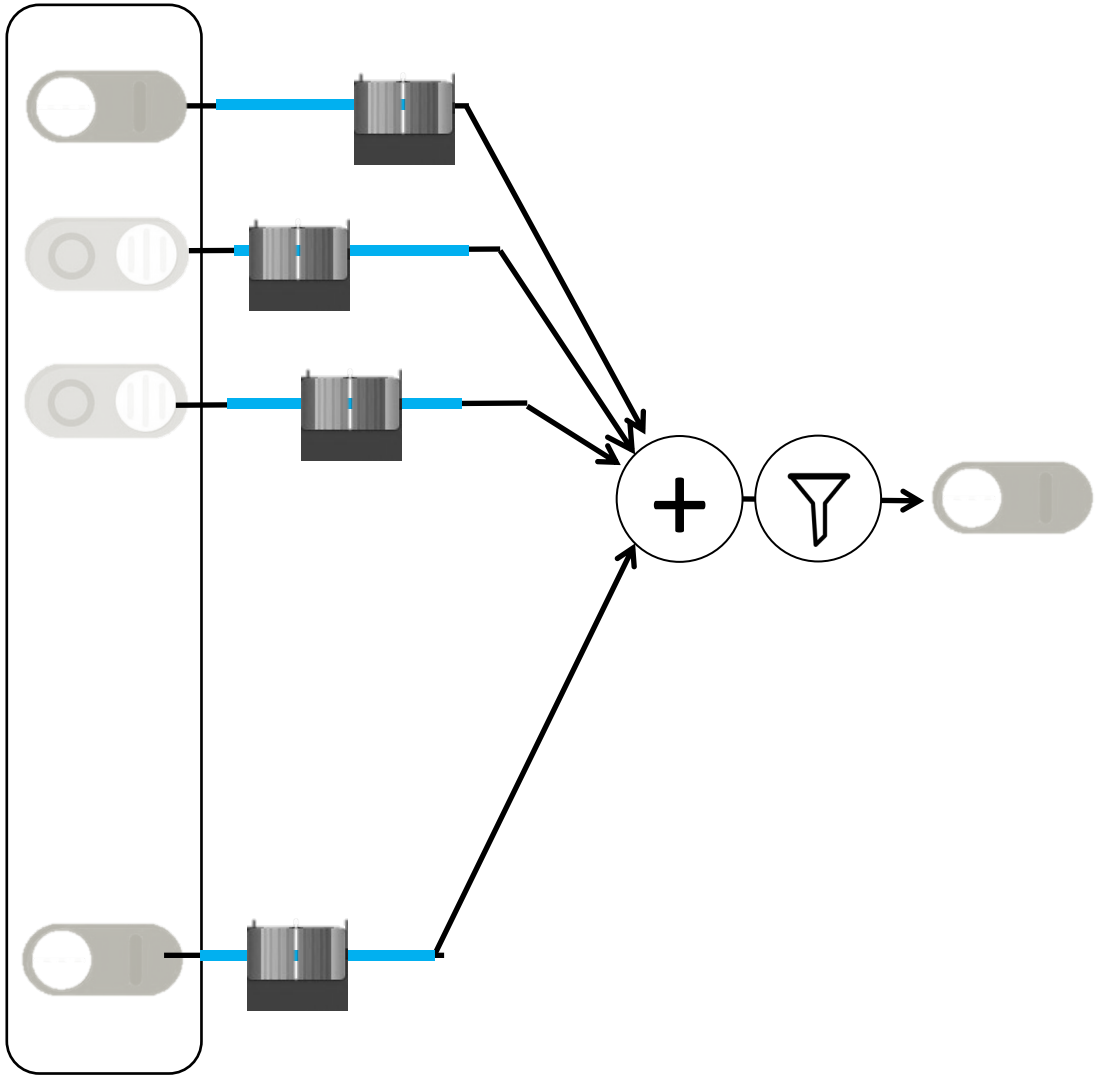
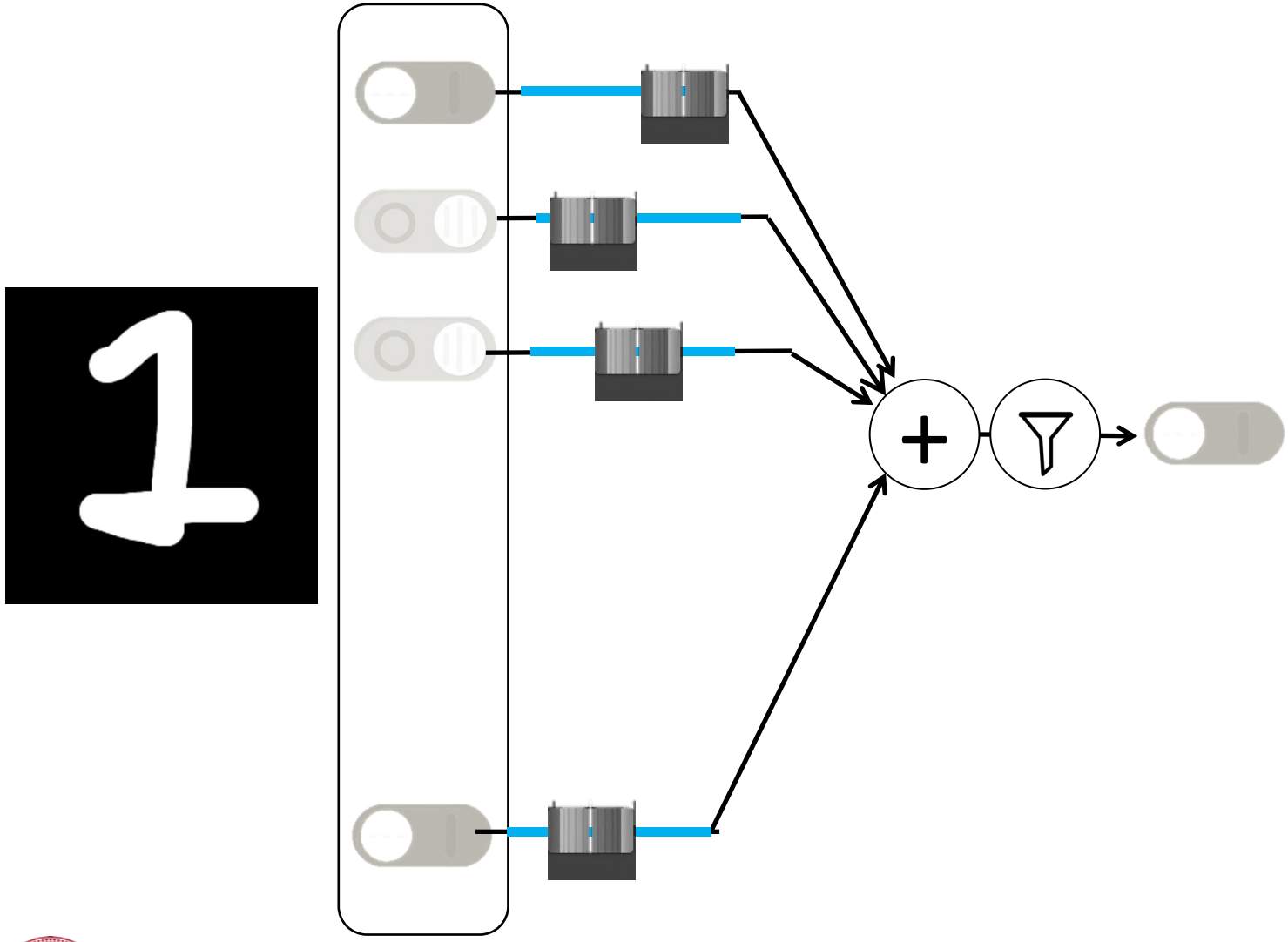
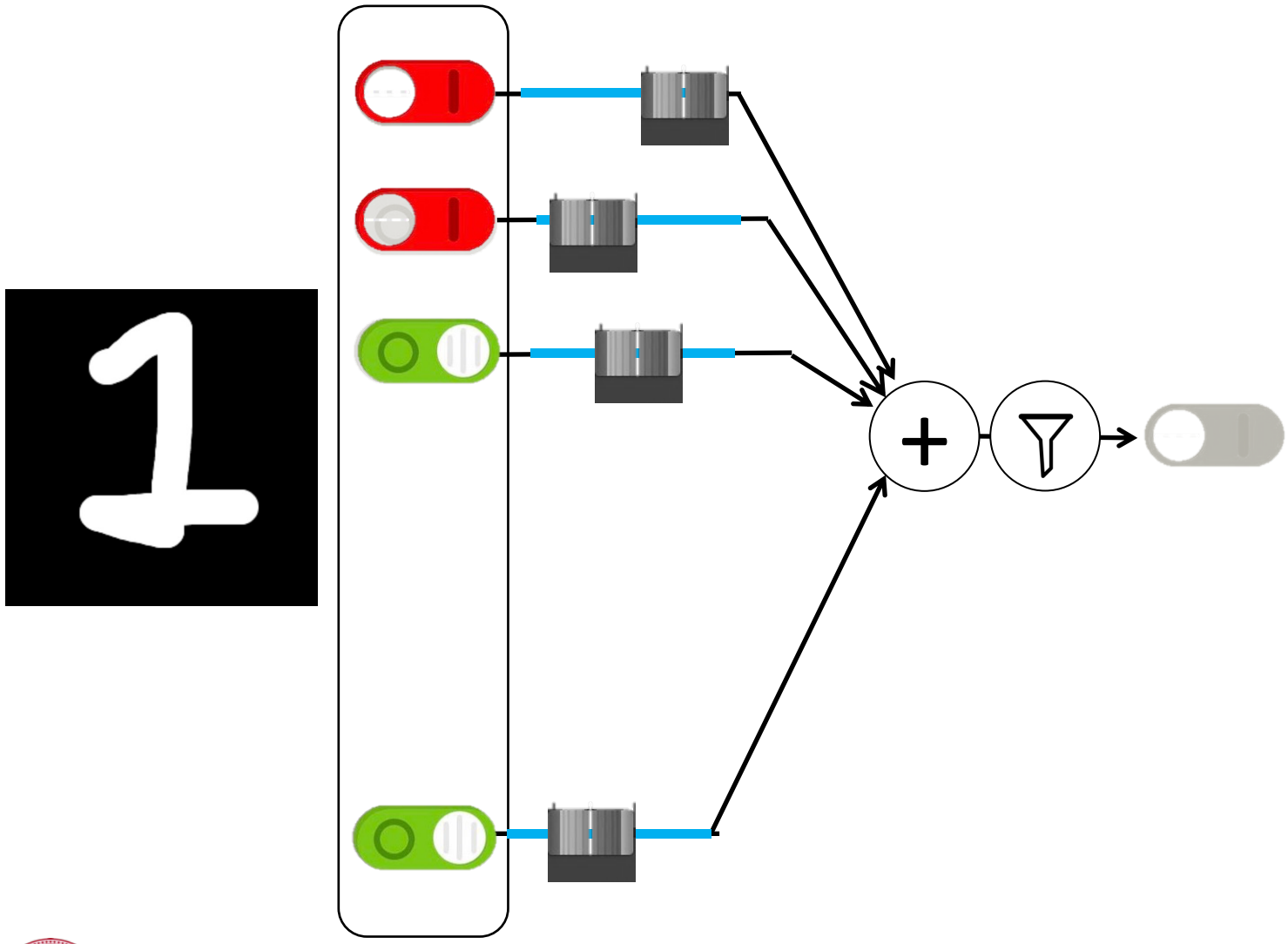
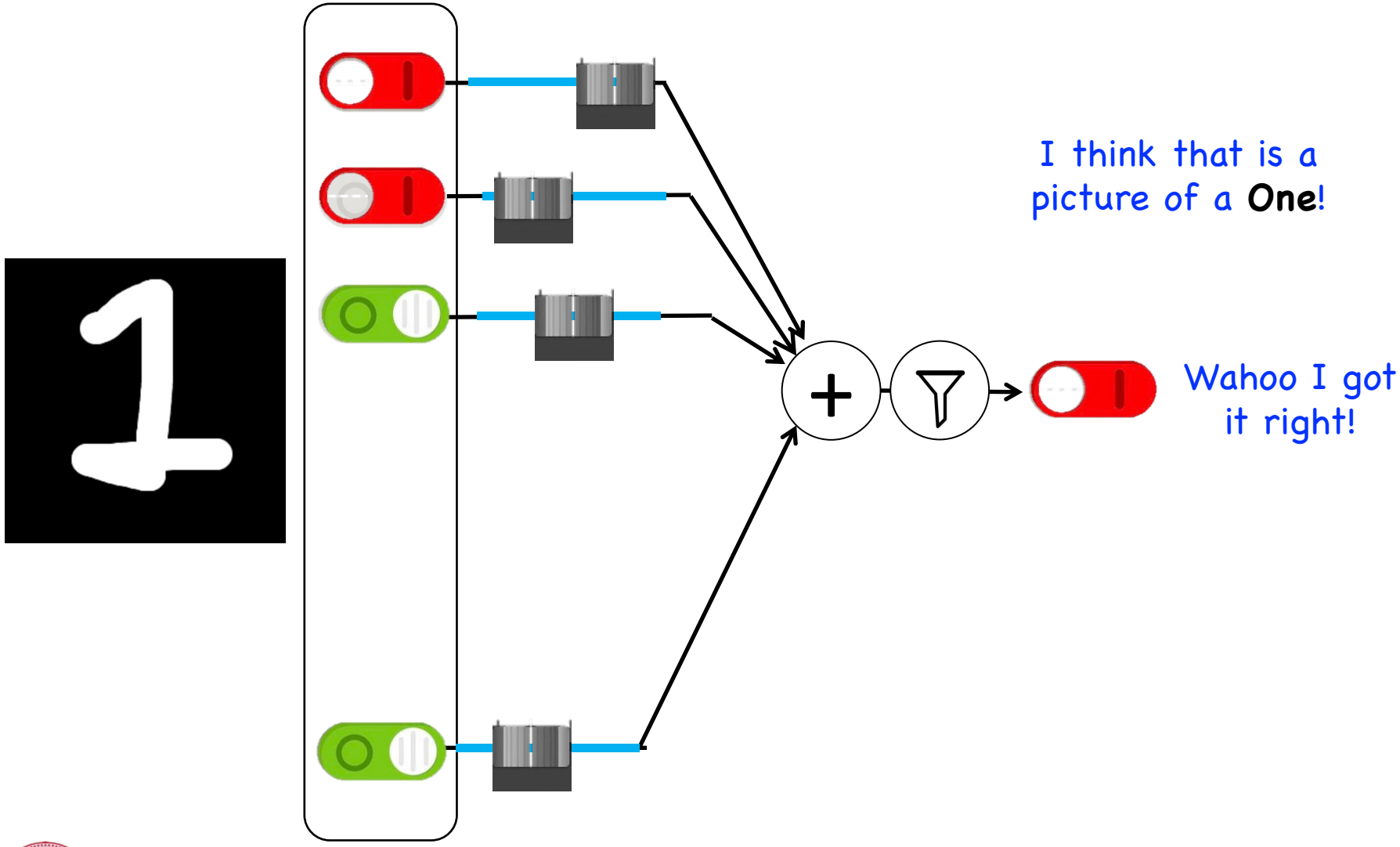
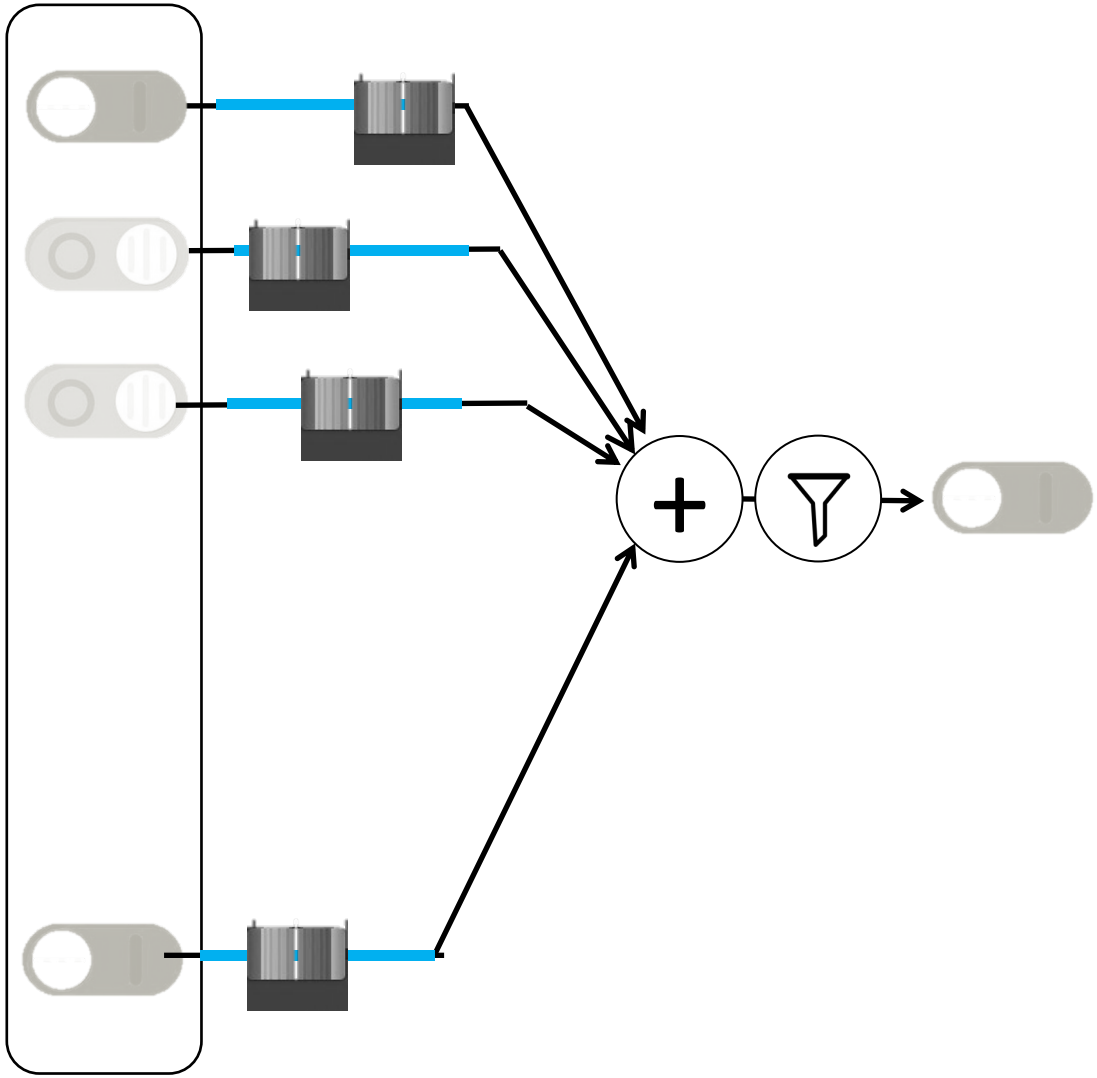
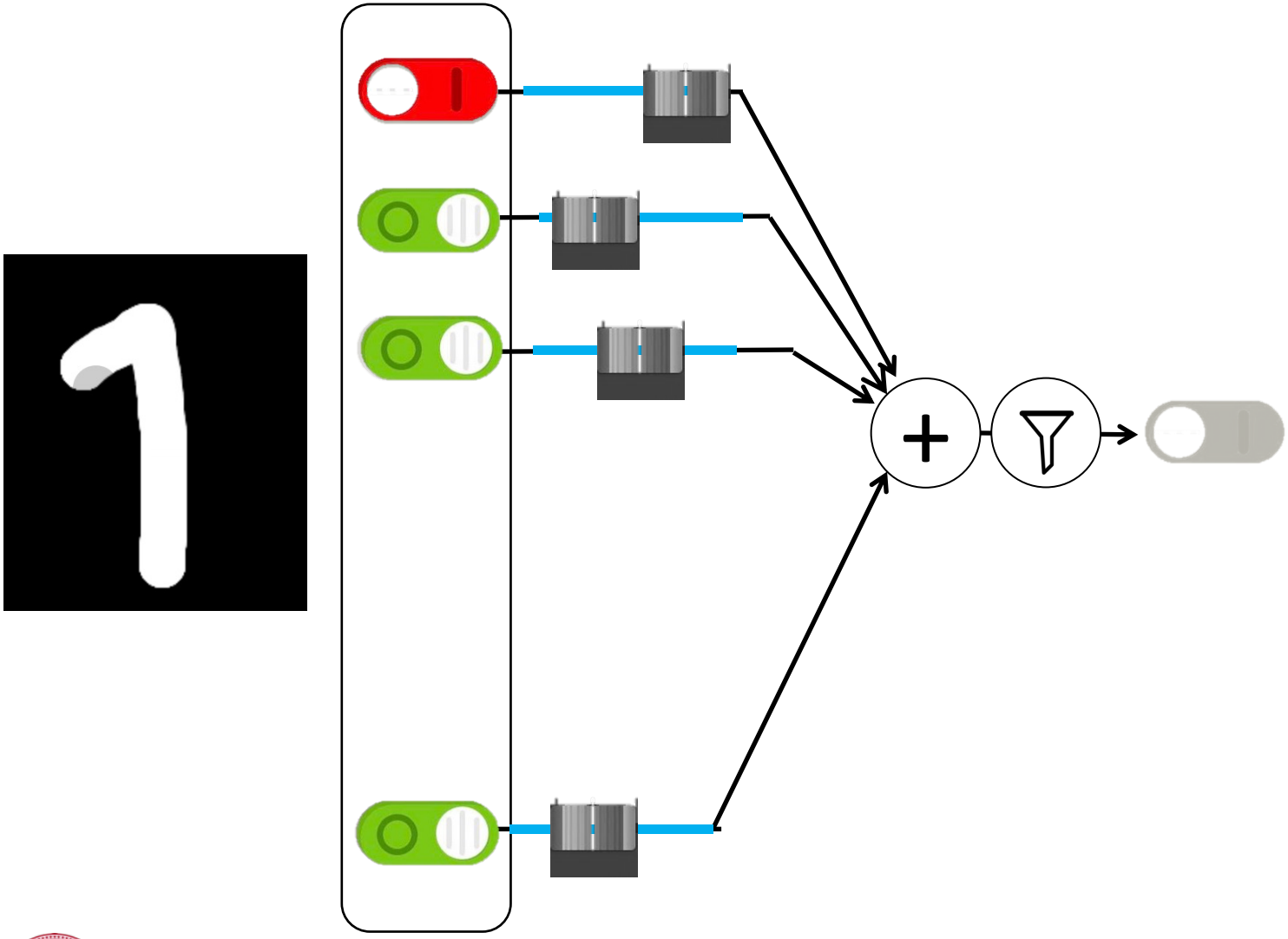


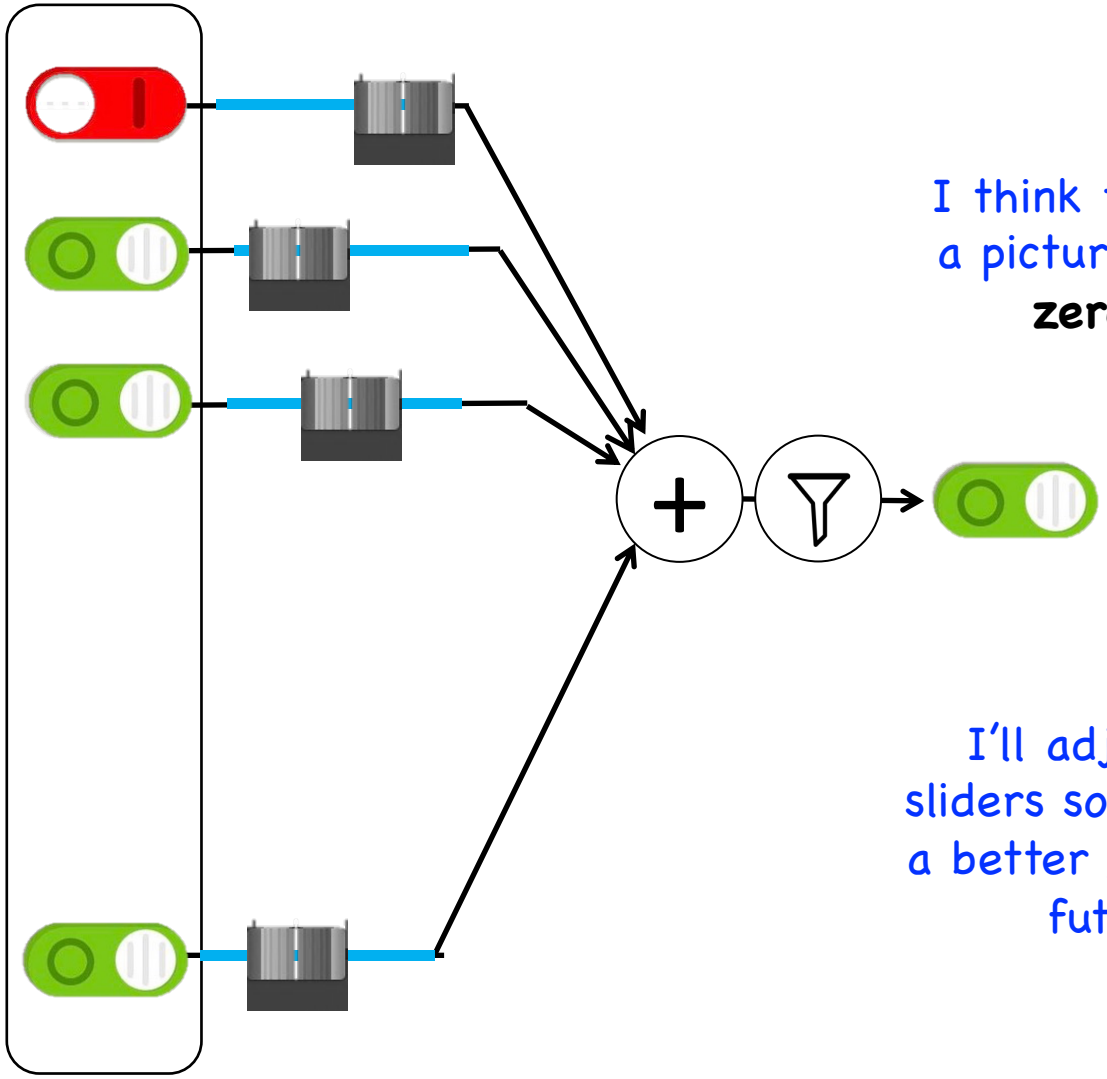





I think that is a picture of a **One**!
Wahoo I got it right!



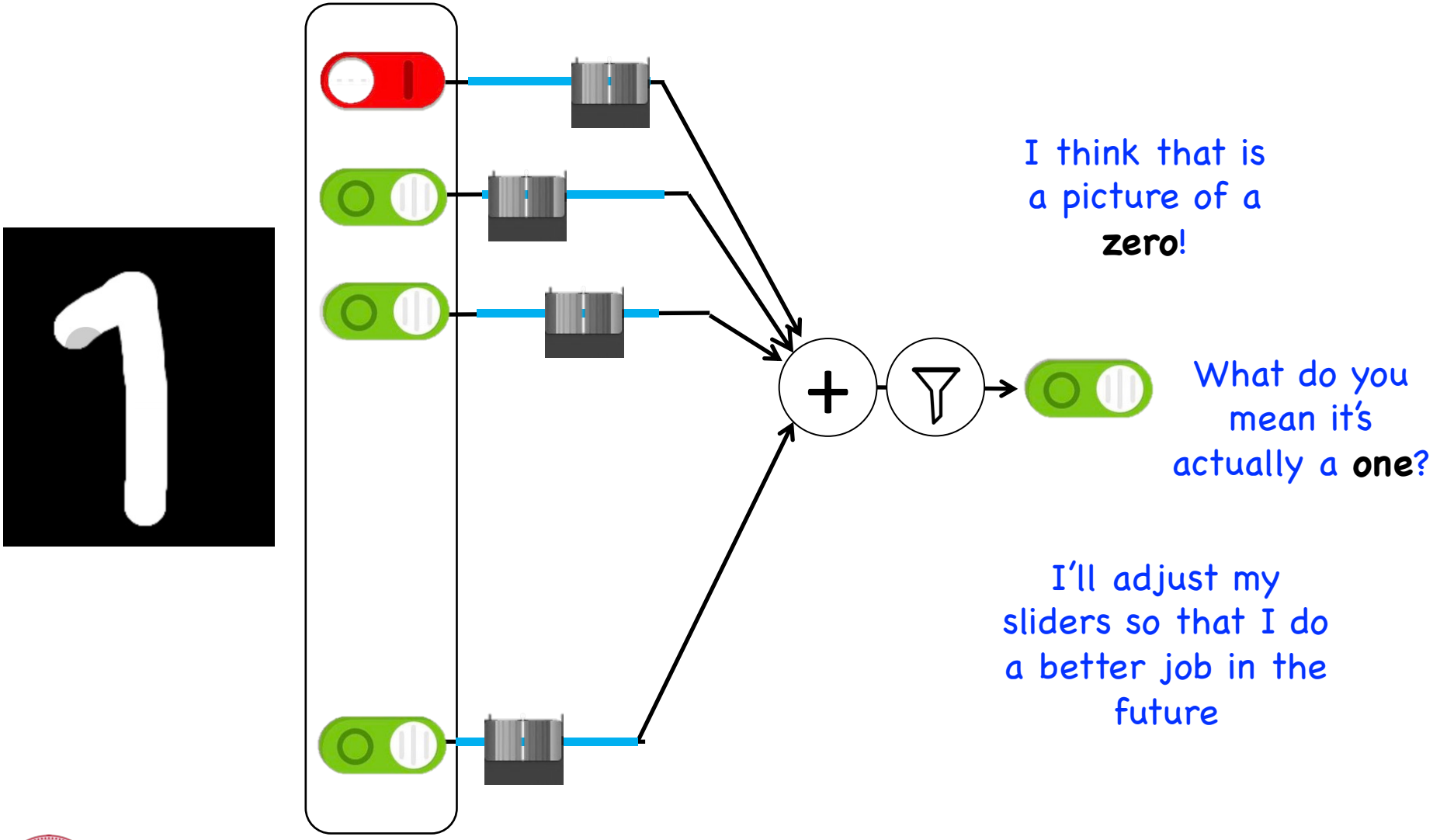




I think that is a picture of a **zero**!

What do you mean it's actually a **one**?

I'll adjust my sliders so that I do a better job in the future

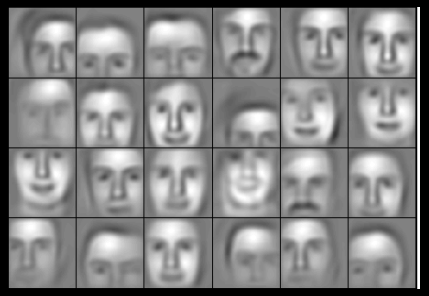

I think that is a picture of a **zero**!
What do you mean it's actually a **one**?
I'll adjust my sliders so that I do a better job in the future

Study Hard!

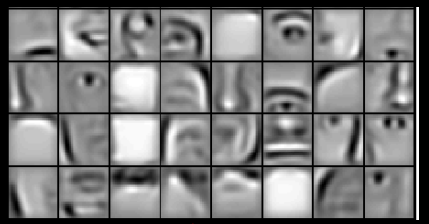
Train on Faces

Visualize the Sliders

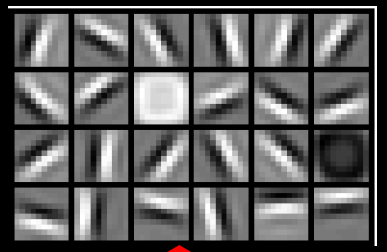
Training set: Aligned images of faces.



object models



object parts (combination of edges)



edges

pixels

[Honglak Lee]

Woah… that’s like a brain…

True.

0.005%

Random guess

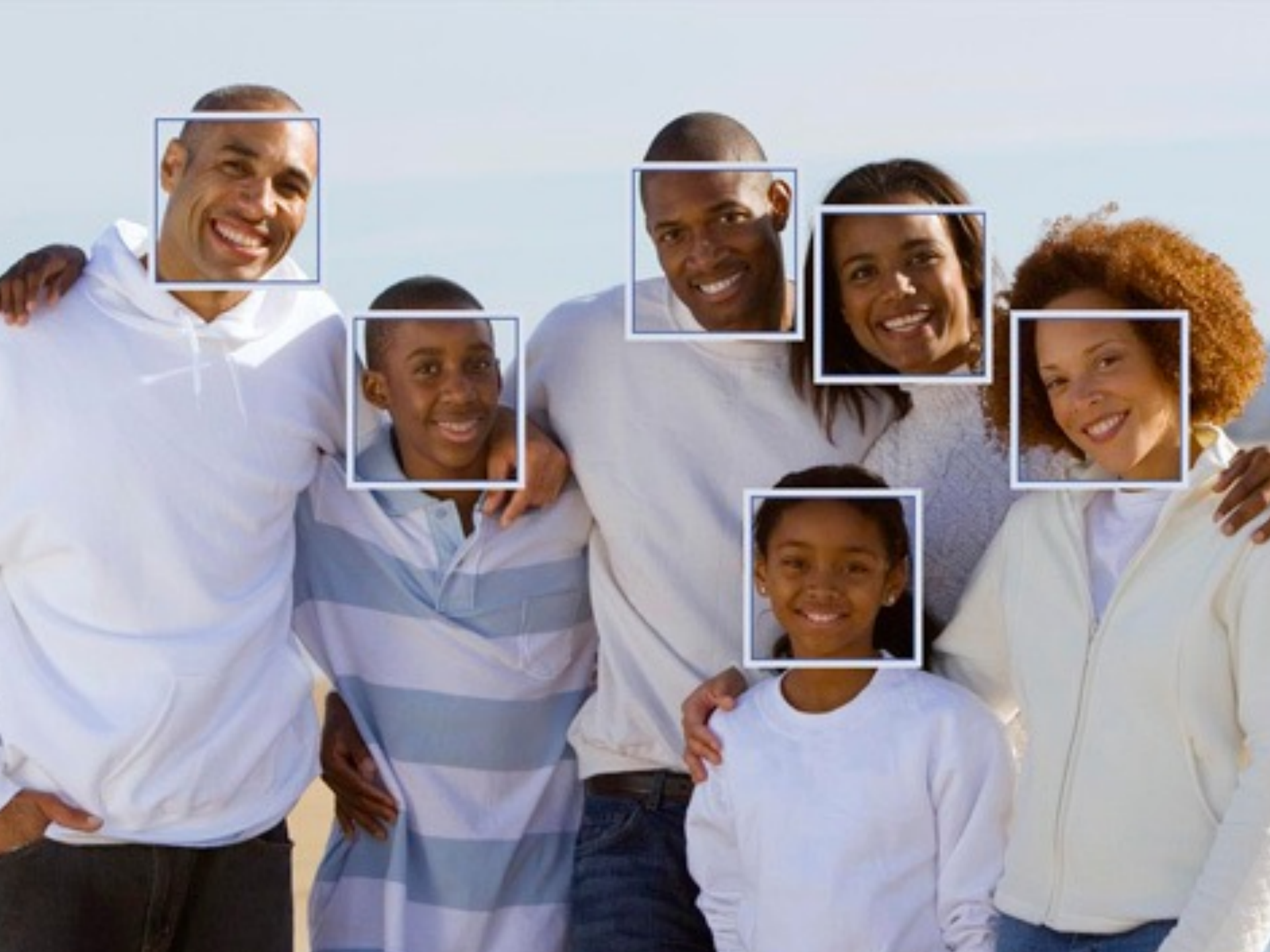
1.5%

Pre Neural Networks

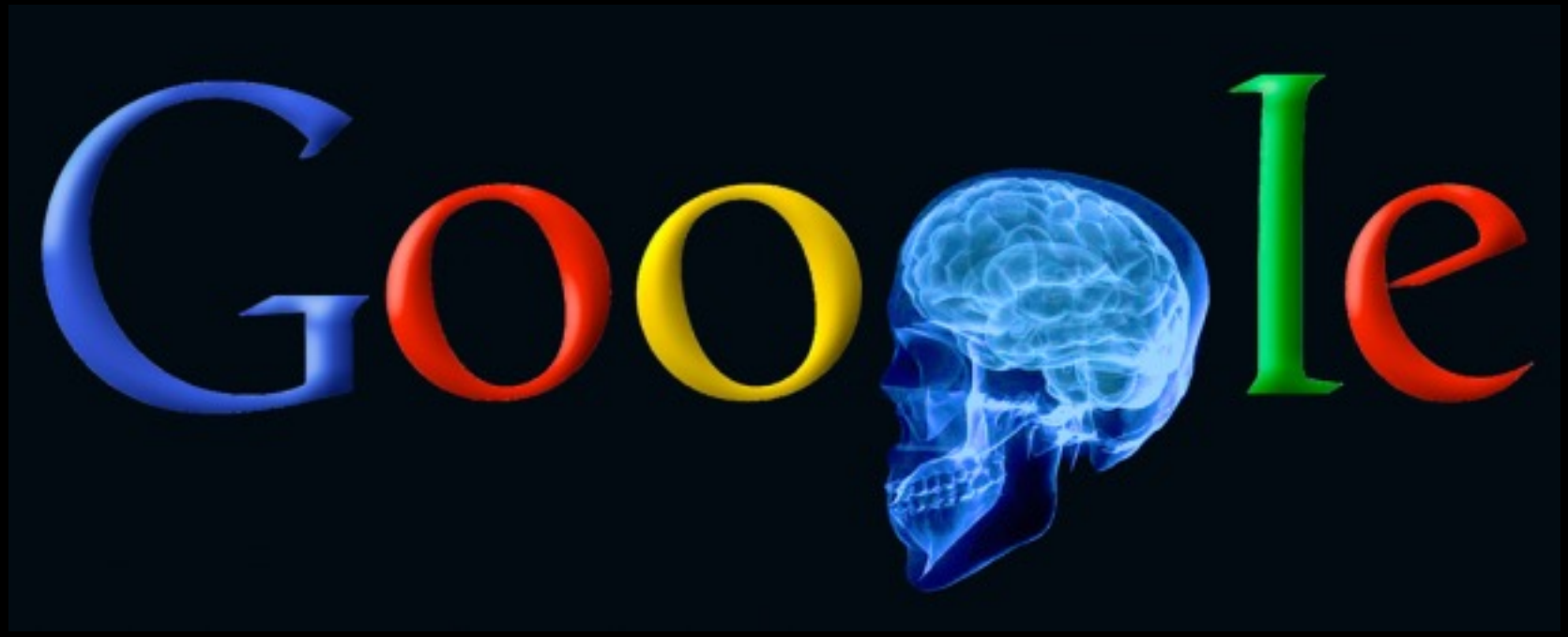
66.3%

2016

http://image-net.org/challenges/LSVRC/2016/results

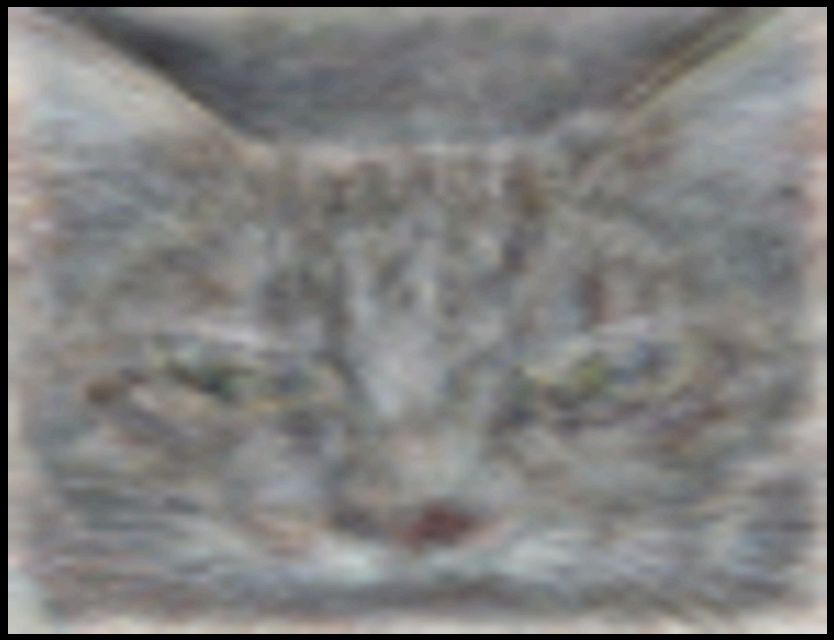


Google Brain



A Neuron That Fires When It Sees Cats

Top stimuli from the test set



Optimal stimulus
by numerical optimization

Le, et al., *Building high-level features using large-scale unsupervised learning*. ICML 2012


HIRE THE SMARTEST PEOPLE IN THE WORLD
INVENT CAT DETECTOR
memegenerator.net

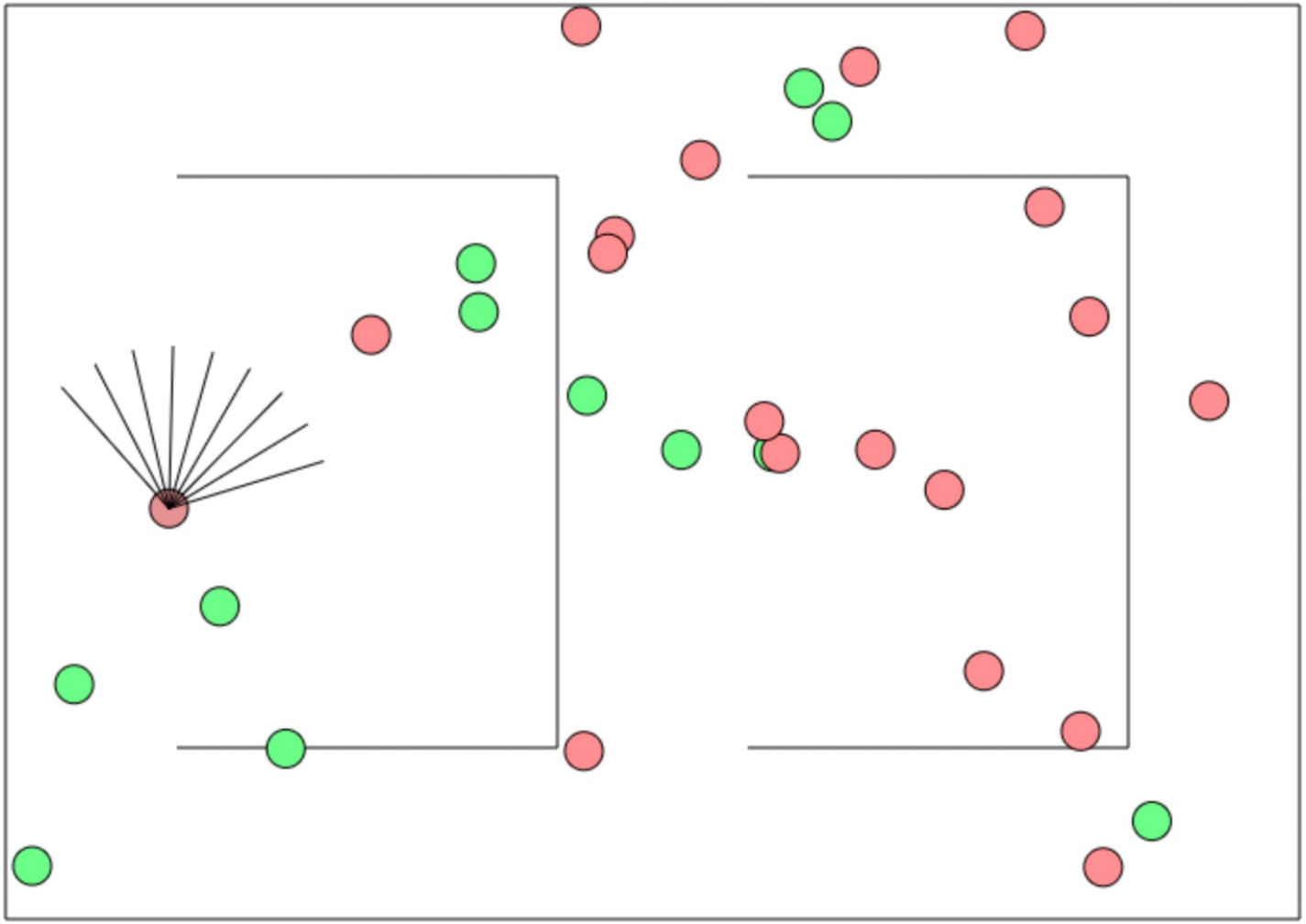
It can be useful

An algorithm learned to detect skin cancer from photo, better than the worlds top expert.

Developed last year

Esteva, Andre, et al. "Dermatologist-level classification of skin cancer with deep neural networks." *Nature* 542.7639 (2017): 115-118.

Beyond Harry Potter Hats



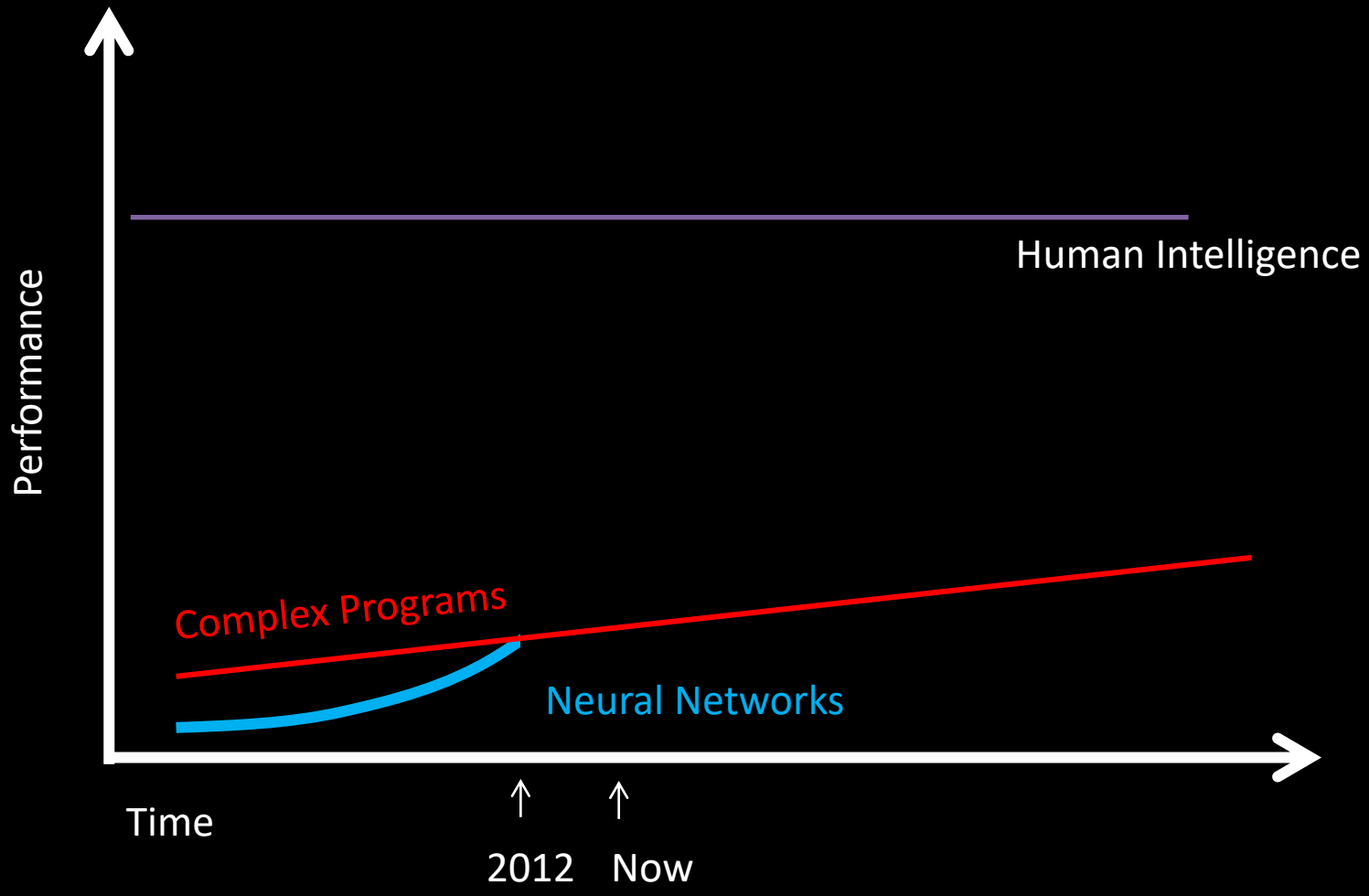
http://cs.stanford.edu/people/karpathy/convnetjs/demo/rldemo.html

Beyond Classification

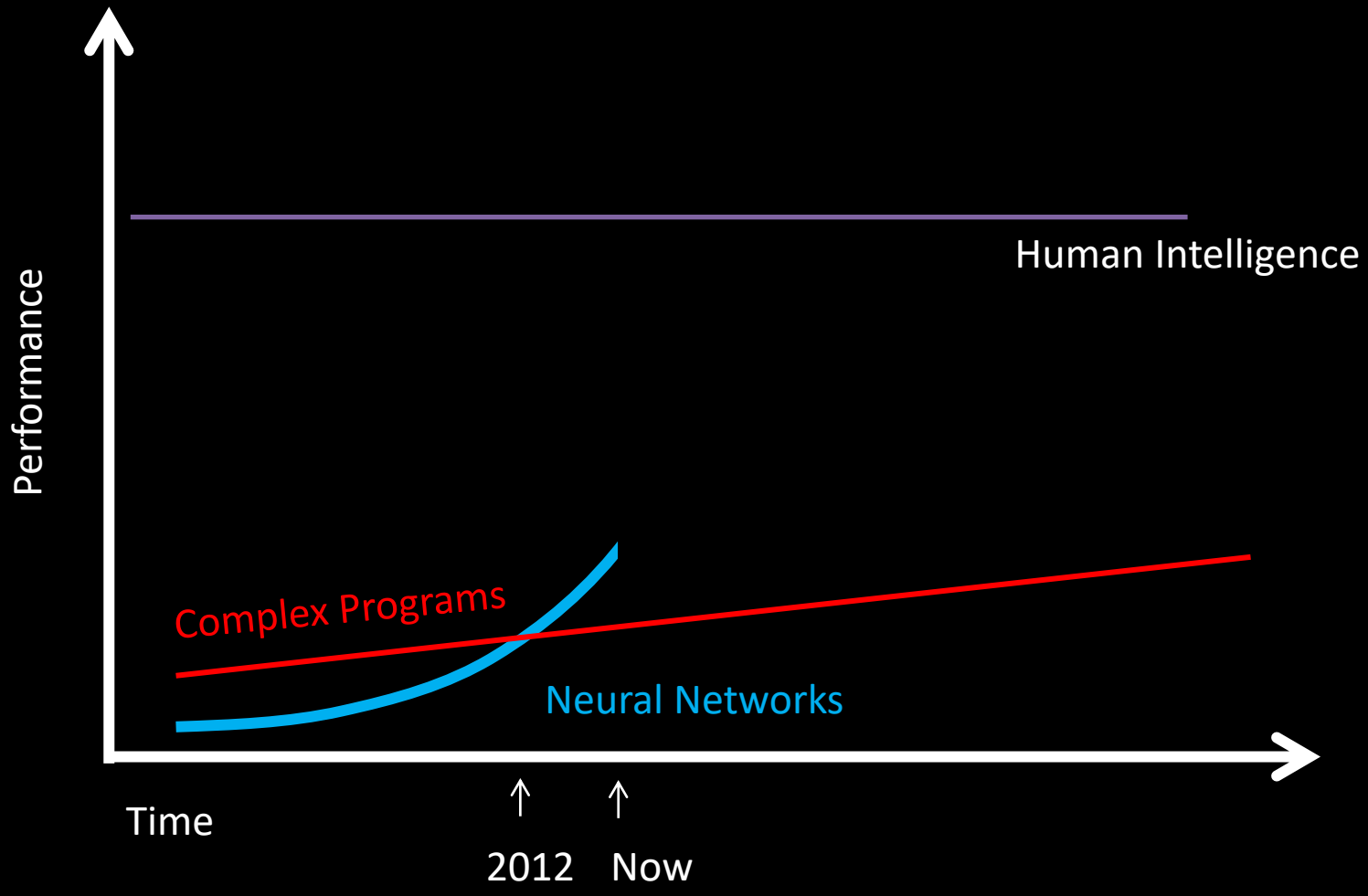
Starting out - 10 minutes of training

The algorithm tries to hit the ball back, but
it is yet too clumsy to manage.

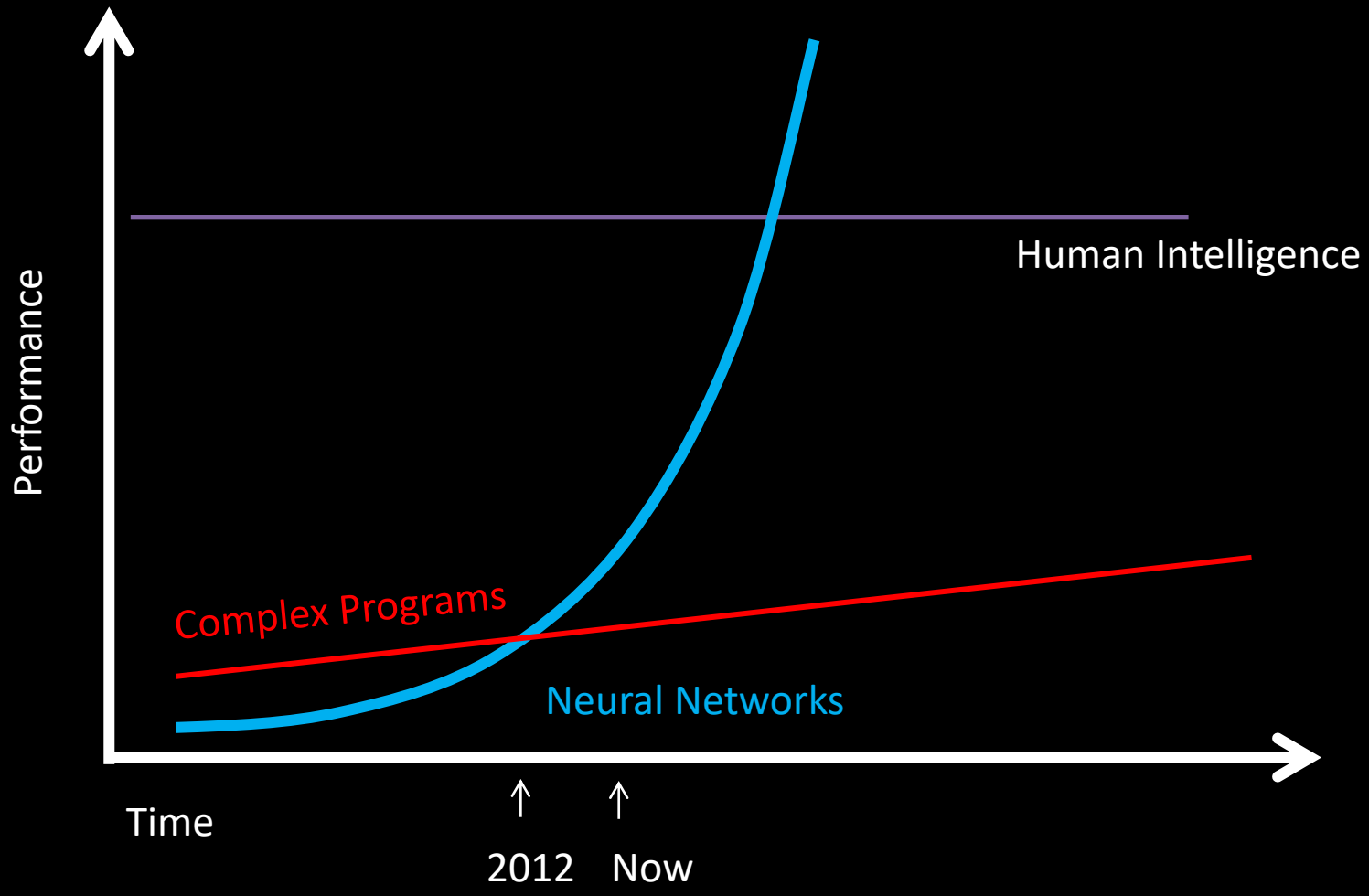
The Future of AI



The Future of AI



The Future of AI



Where is my robot?

… coming soon

Should I study AI?

Powerful technology

Now is an amazing time

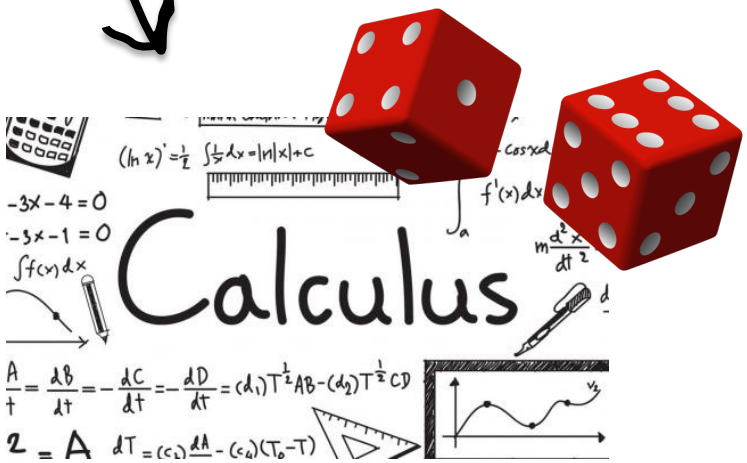
Know It So You Can Beat It

Little math

Todos son bienvenidos

Road towards AI

Libraries to use AI



Mathematics to invent AI

Next Step:

Nimm

```
There are 20 stones left
Player 1 would you like to remove 1 or 2 stones? 2

There are 18 stones left
Player 2 would you like to remove 1 or 2 stones? 2

There are 16 stones left
Player 1 would you like to remove 1 or 2 stones? 1

There are 15 stones left
Player 2 would you like to remove 1 or 2 stones? 2

                    . . .


Player 1 wins!
```


The End?