

Week 1 website

andreasref.github.io/som/

Types of machine learning

Supervised Learning

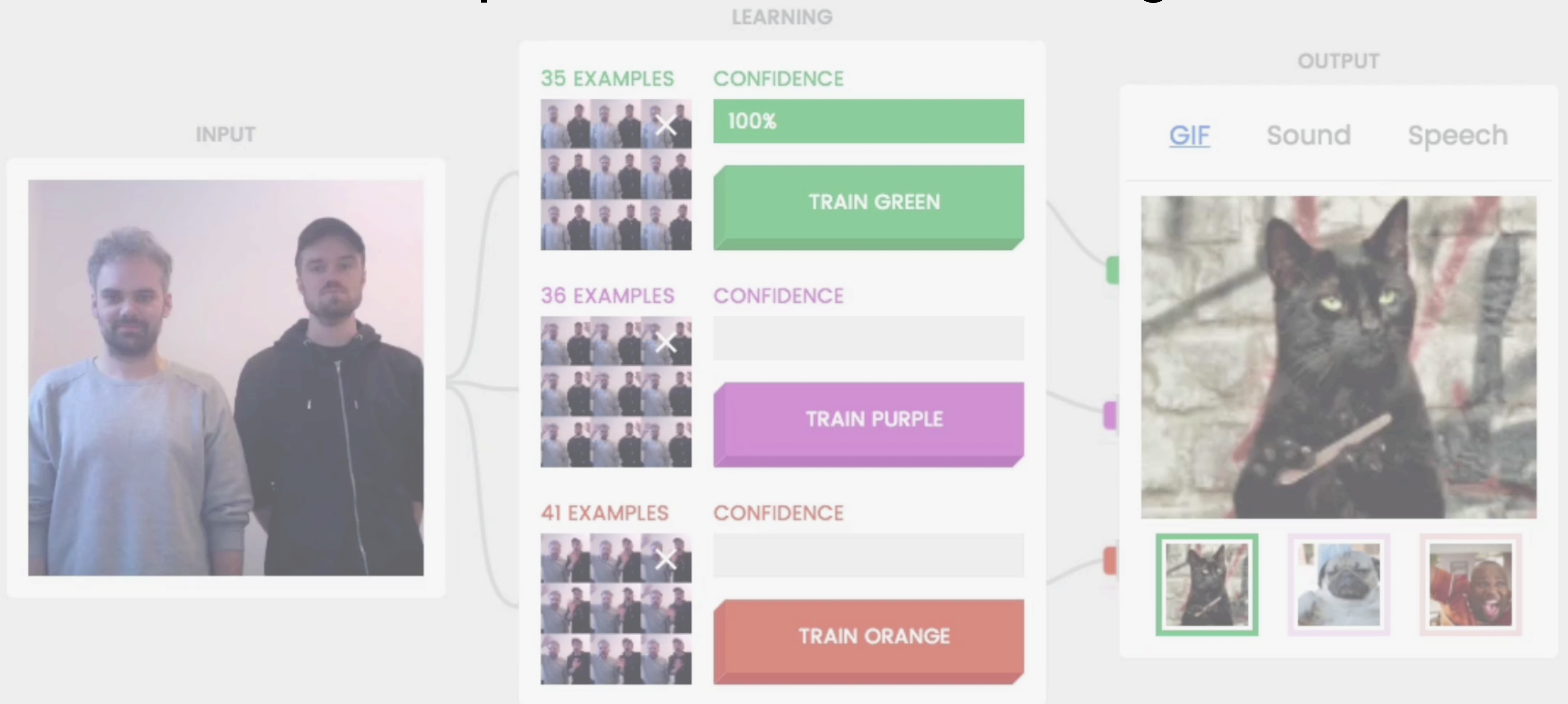
Unsupervised Learning

Reinforcement Learning

Types of machine learning

→ Supervised Learning
Unsupervised Learning
Reinforcement Learning

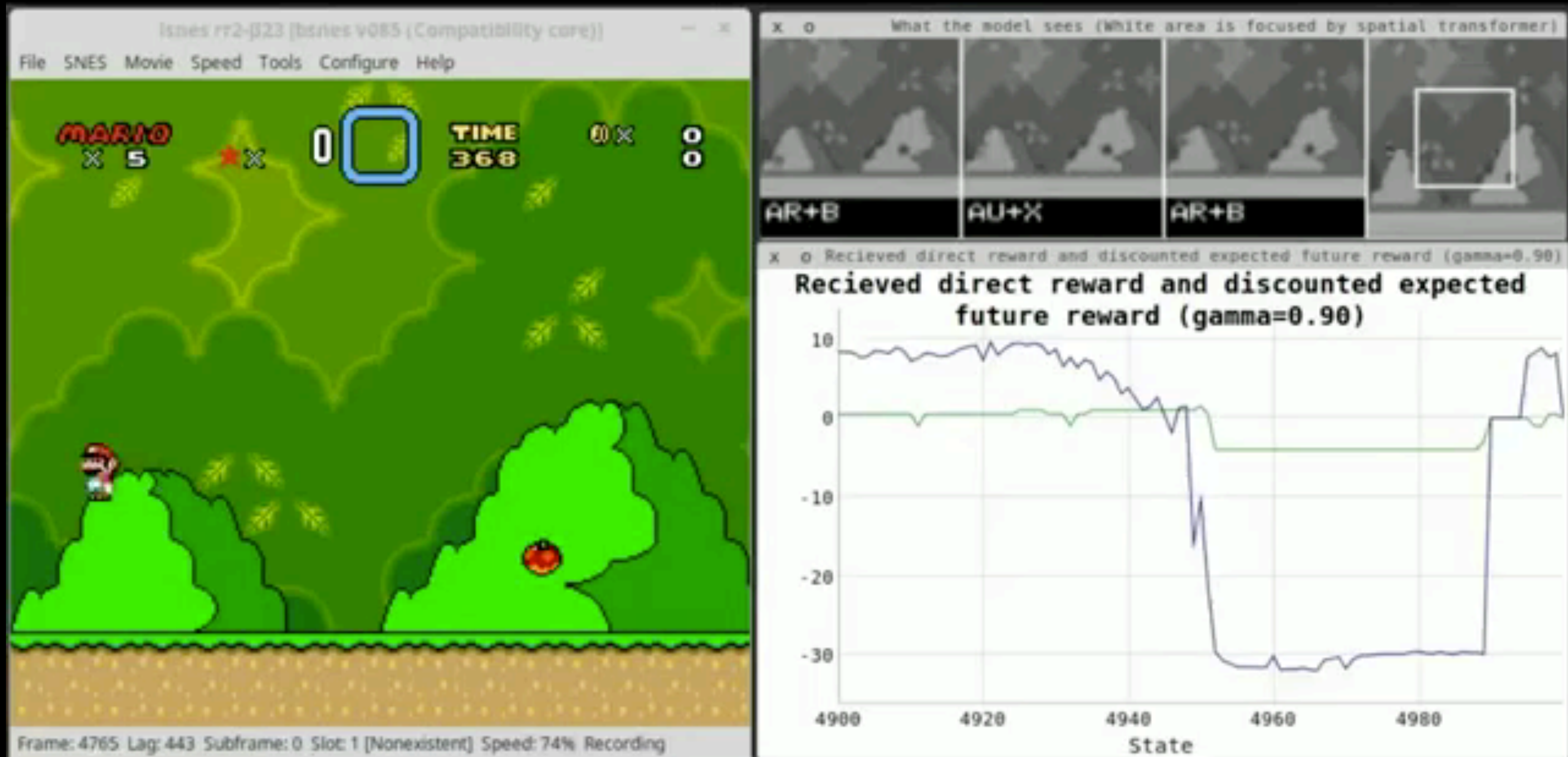
Supervised Learning



Unsupervised Learning



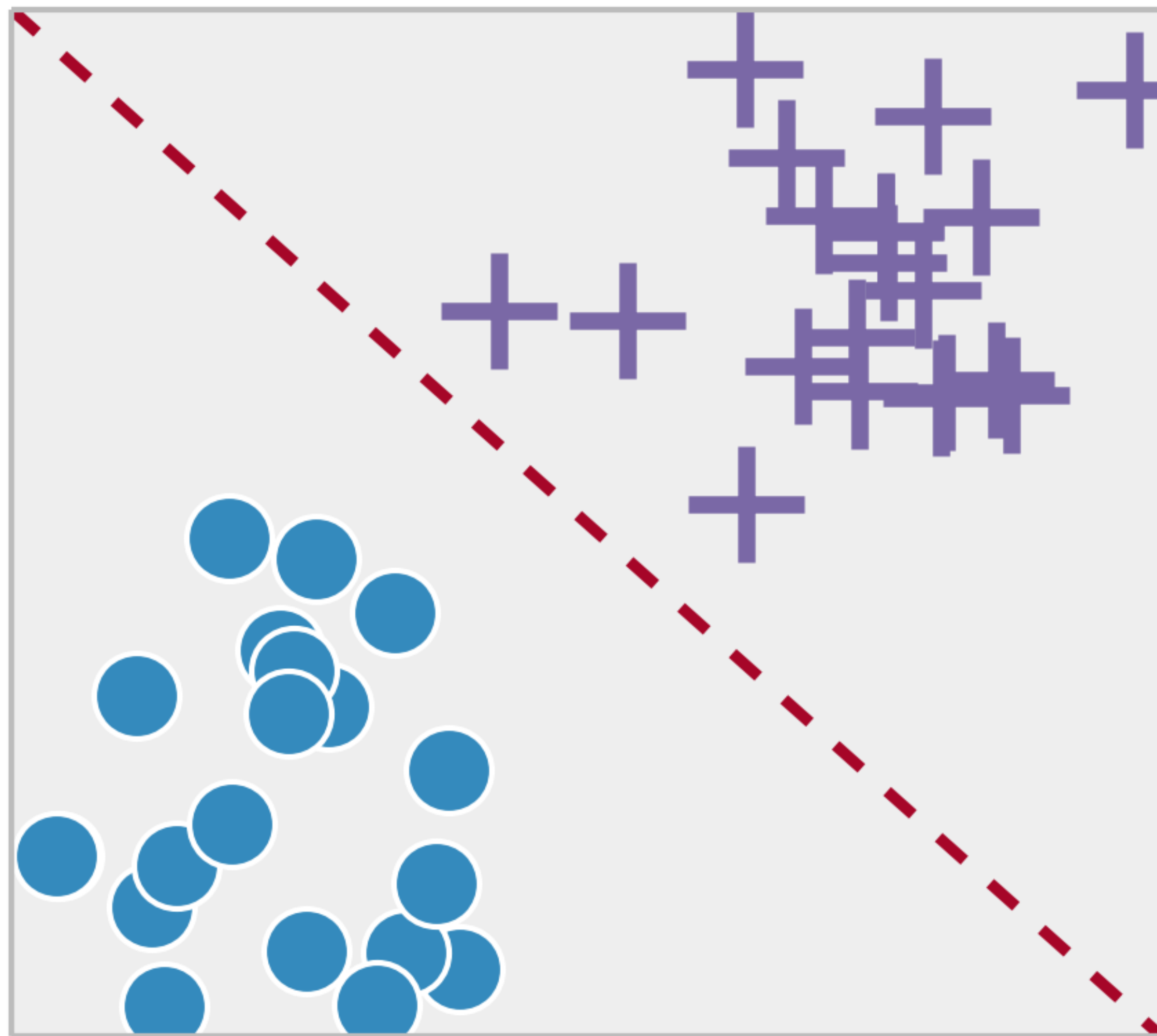
Reinforcement Learning



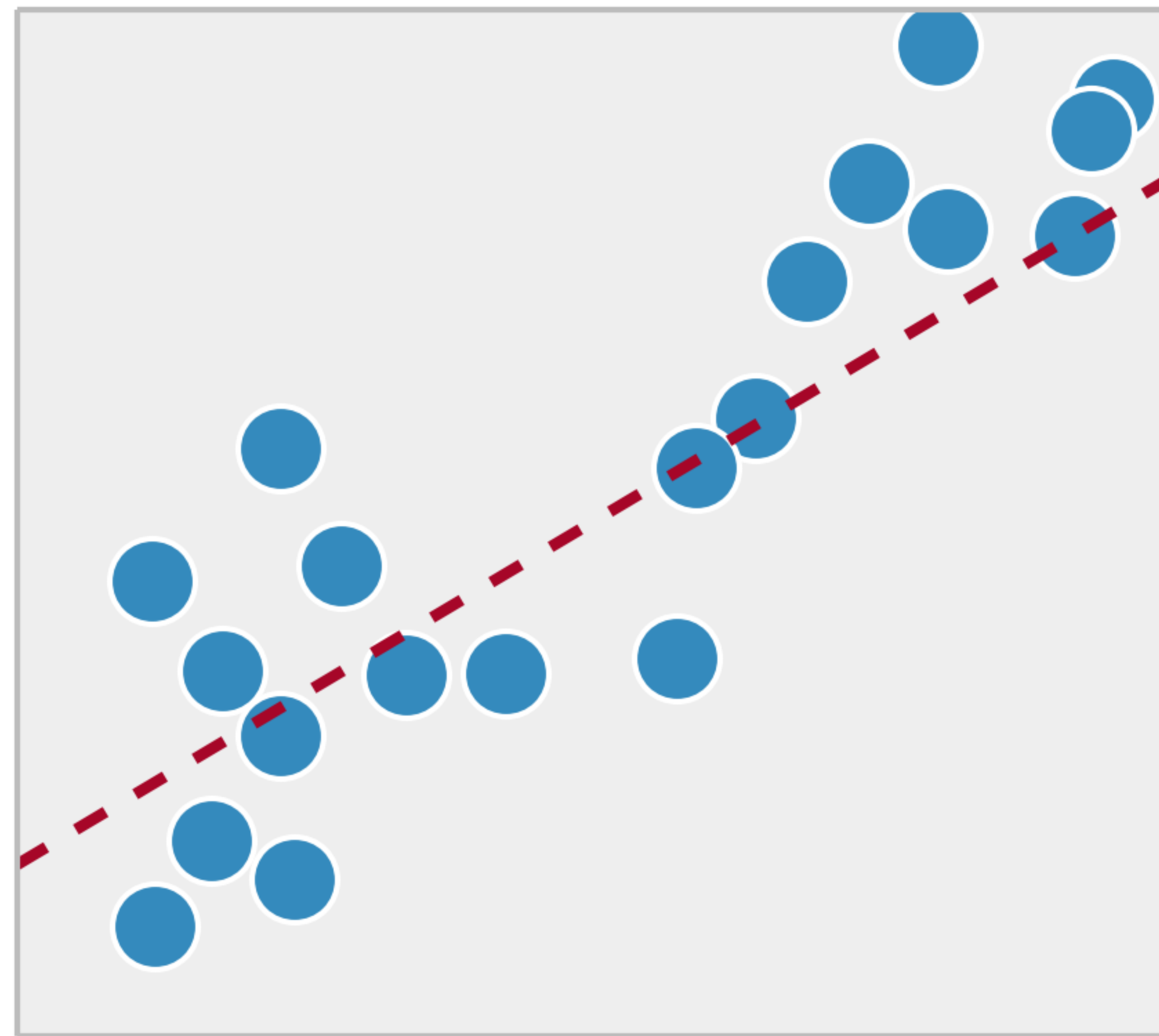
Types of machine learning

→ Supervised Learning
Unsupervised Learning
Reinforcement Learning

Classification



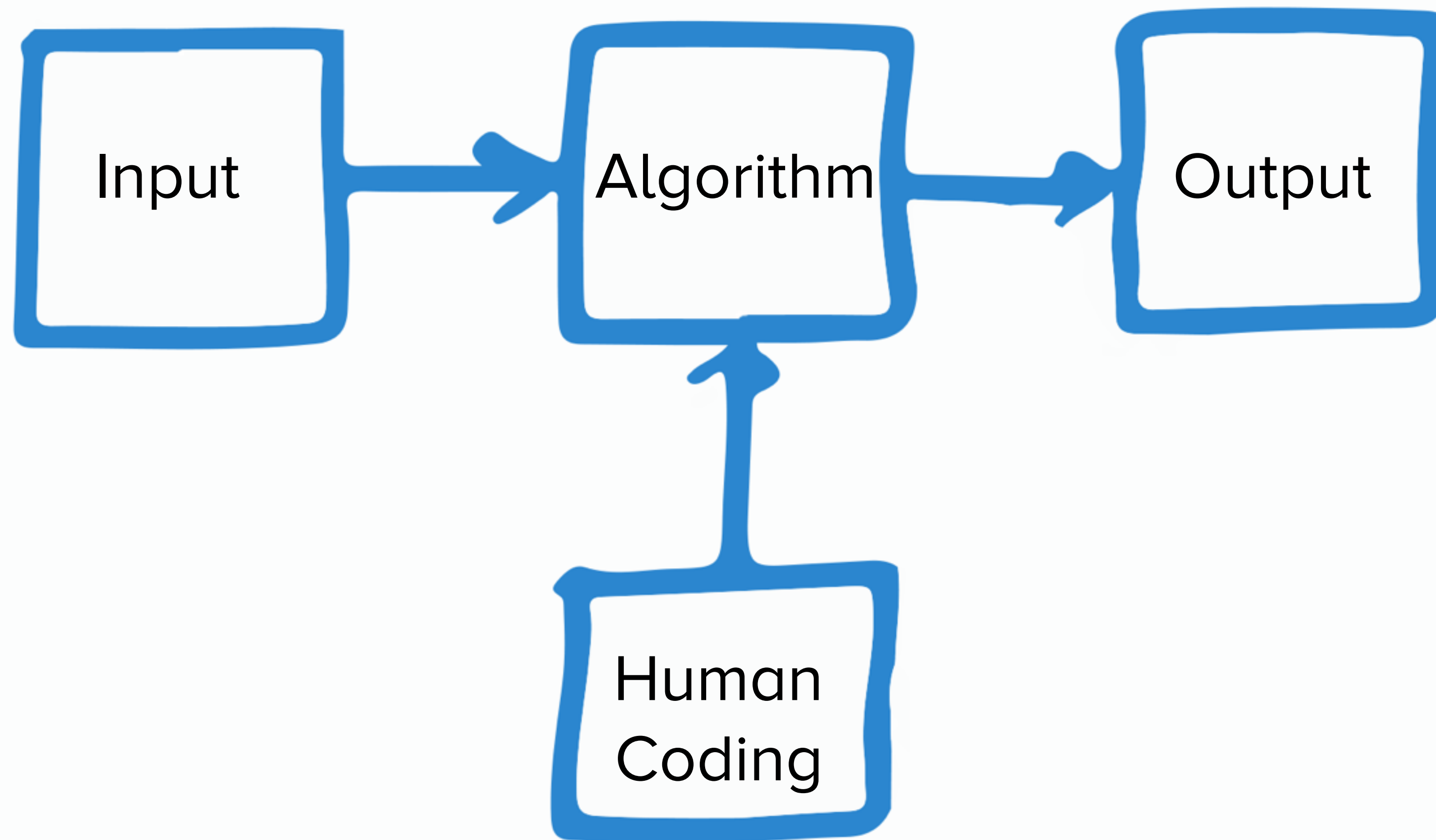
Regression



m14a book (in progress)
by Gene Kogan

Machine Learning 101 slides
by Jason Mayes

Standard programming

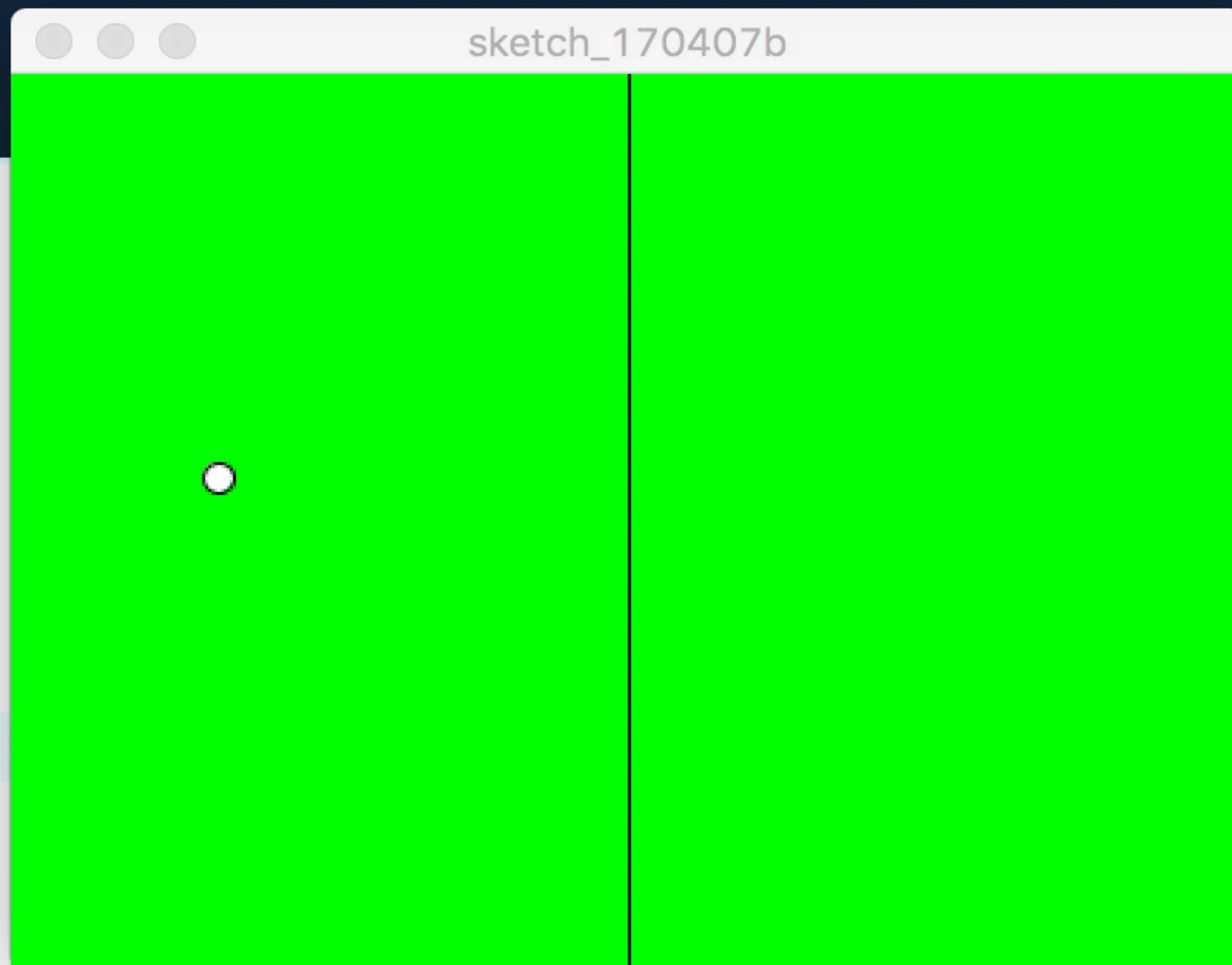




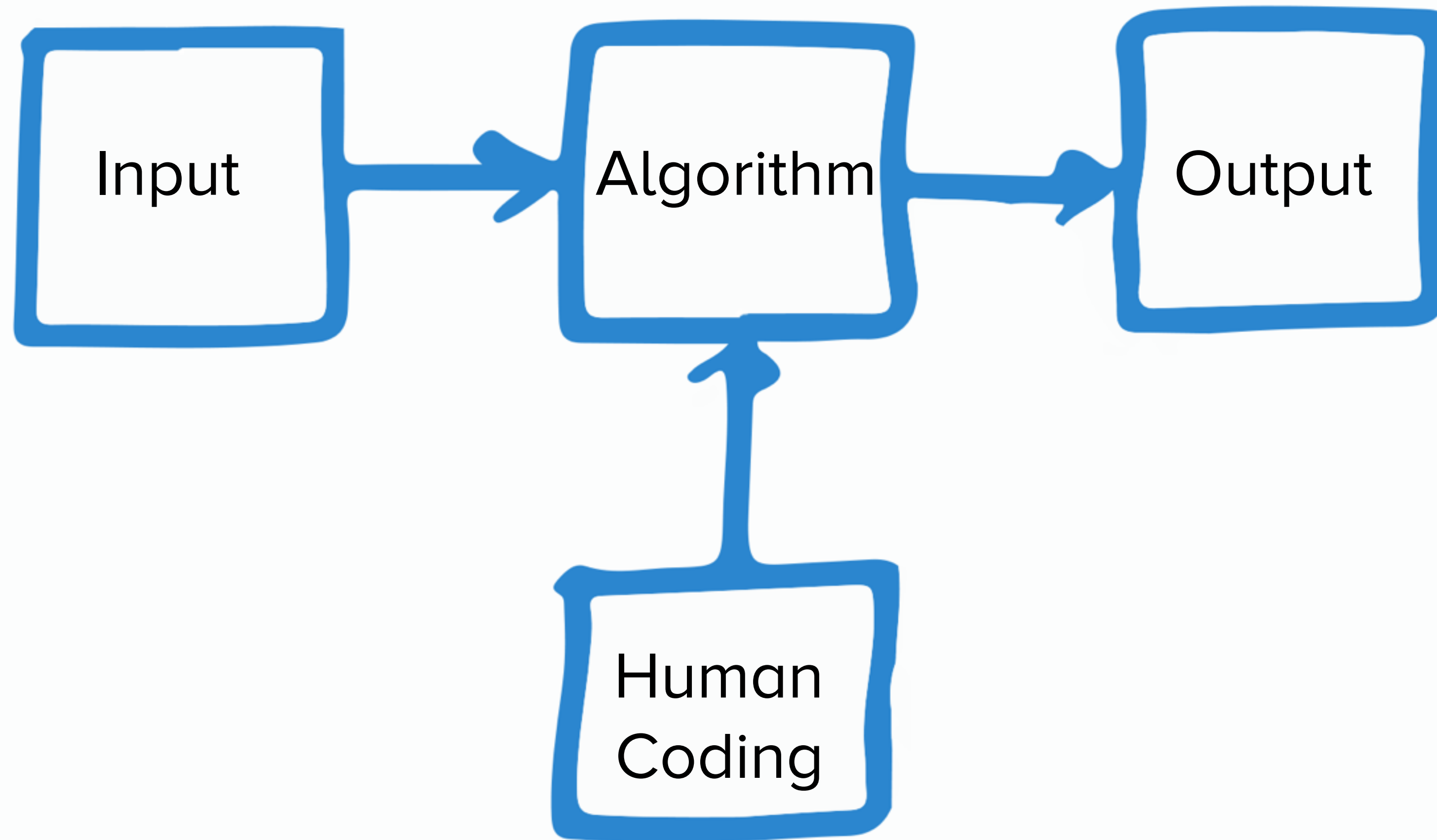
sketch_170407b



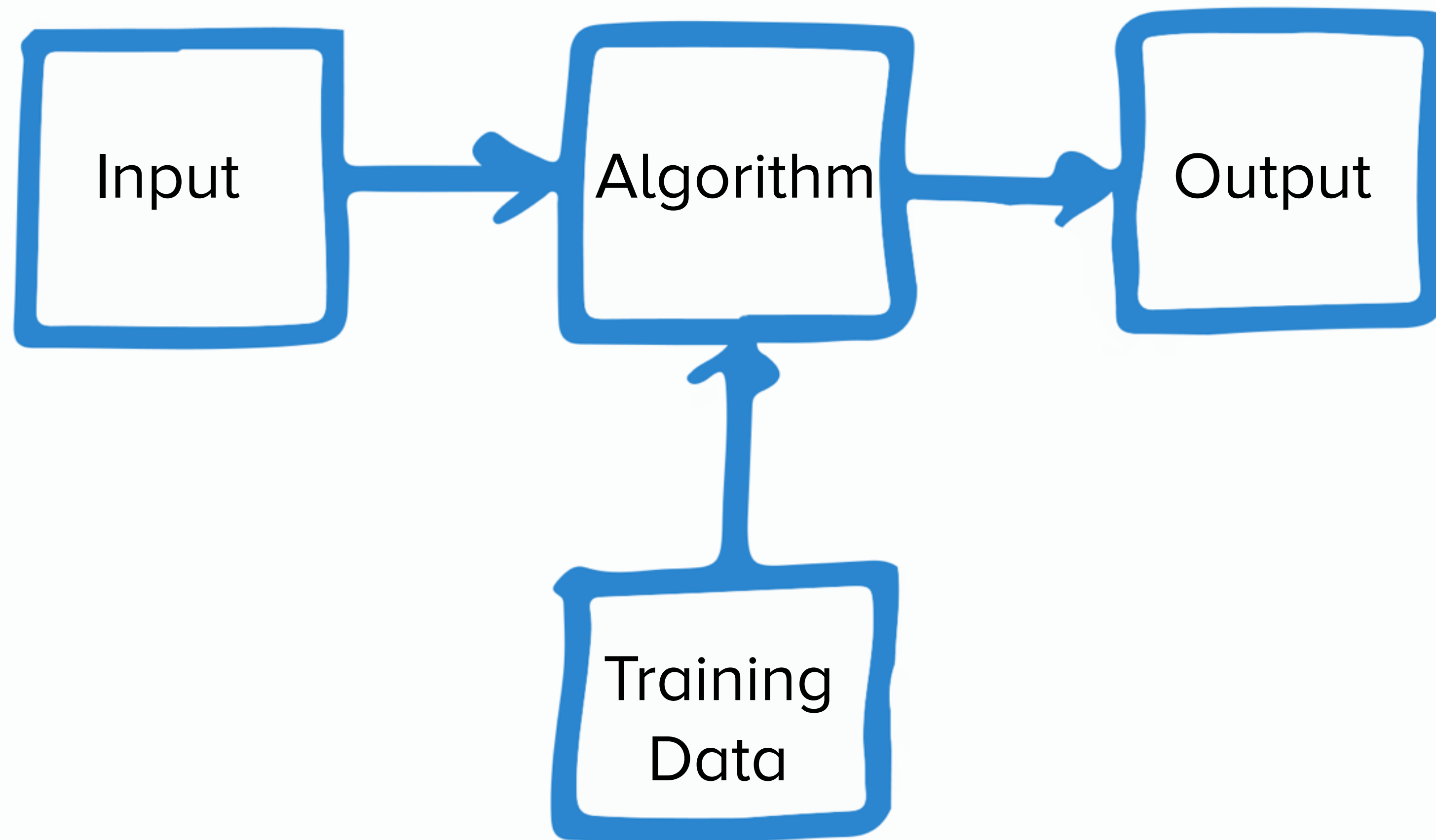
```
1 void setup() {  
2   size(400,300);  
3 }  
4  
5 void draw() {  
6   if (mouseX > width/2) {  
7     background(255,0,0);  
8   } else {  
9     background(0,255,0);  
10  }  
11  
12  ellipse(mouseX,mouseY, 10,10);  
13  line(width/2,0,width/2, height);  
14 }
```



Standard programming



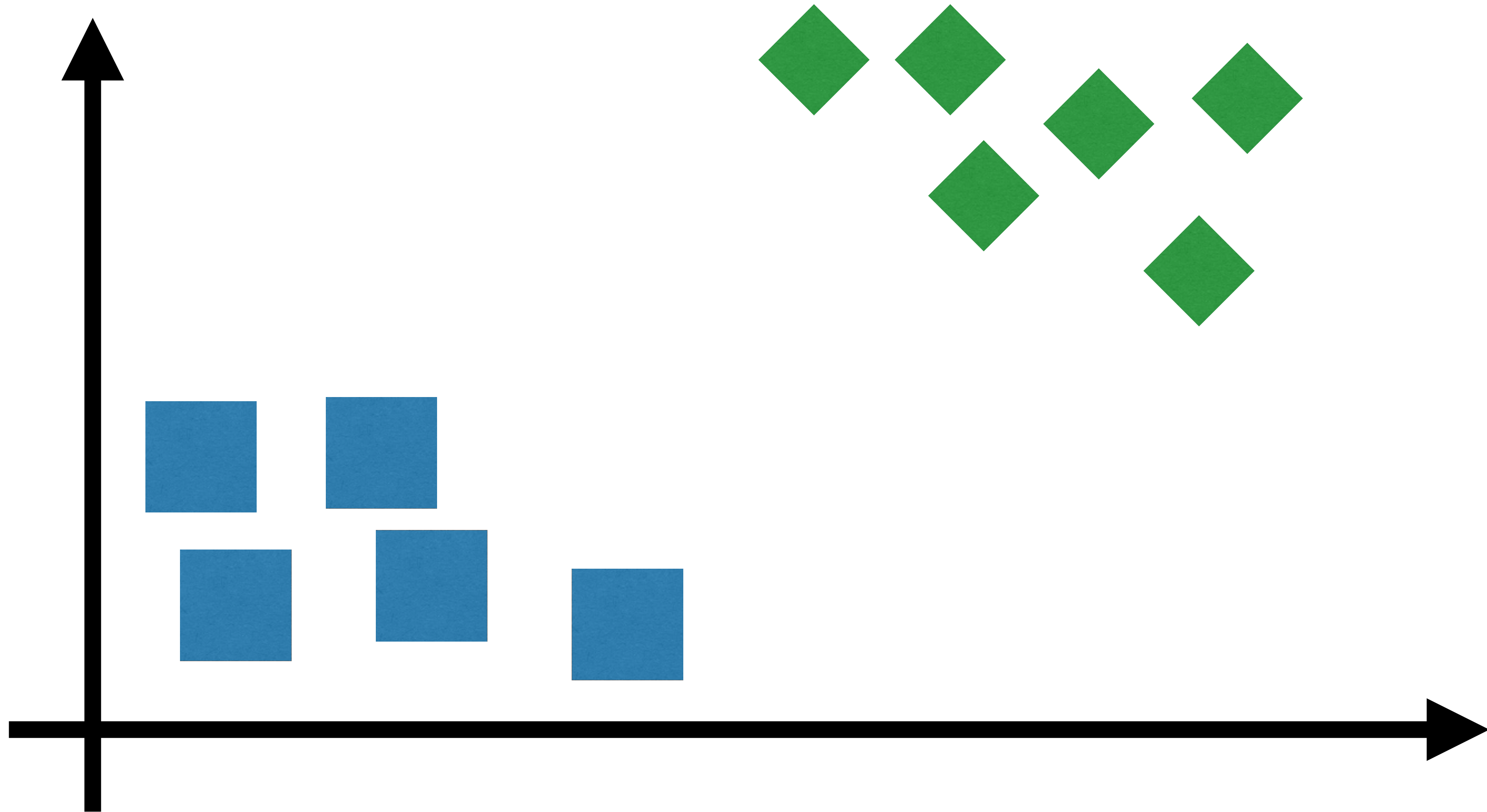
Machine Learning



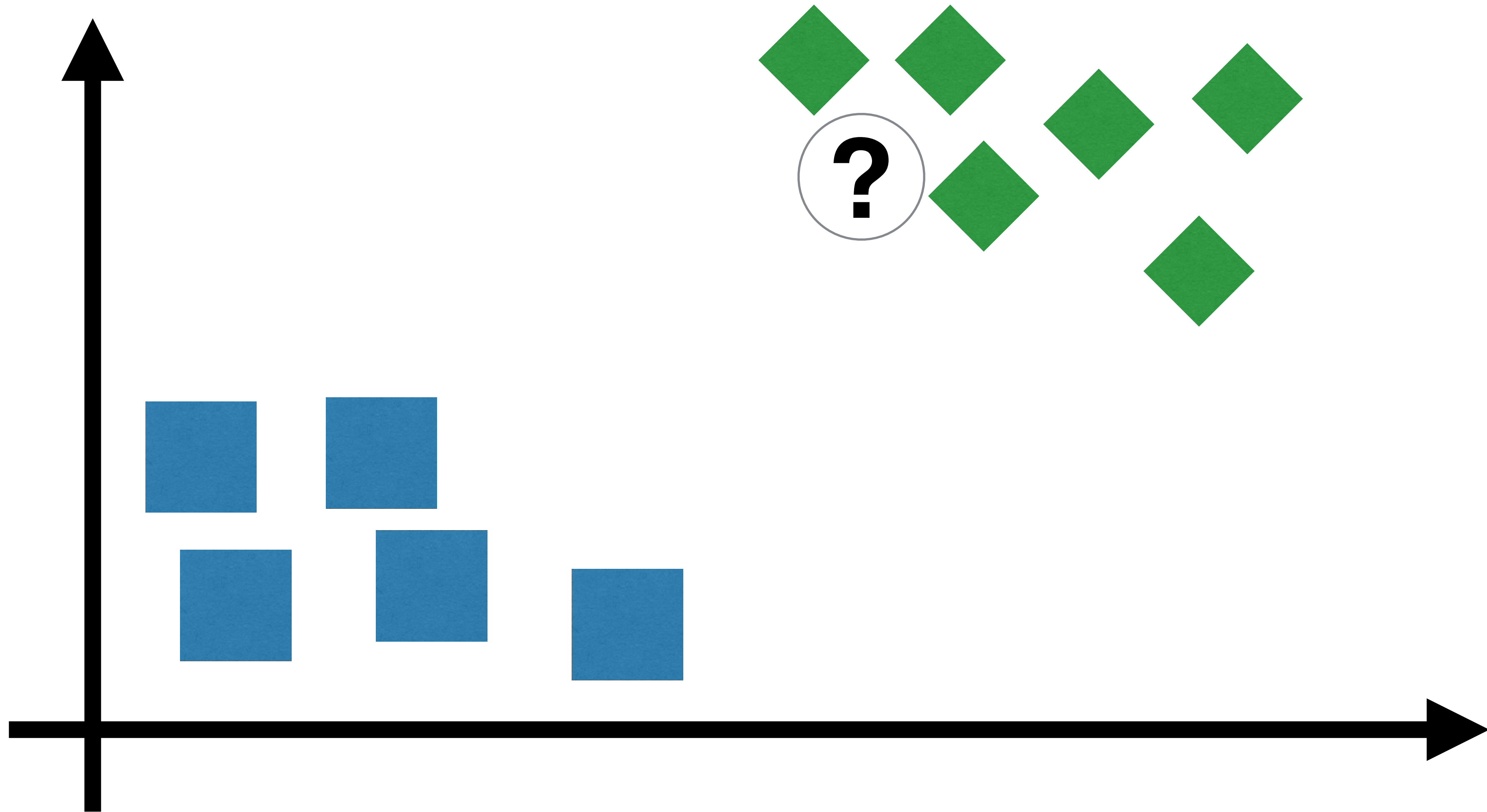
ML Classification

Input1 (mouseX)	Input2 (mouseY)	Label / Class/Output
20	30	1
15	25	1
300	350	2
400	320	2
...	...	...

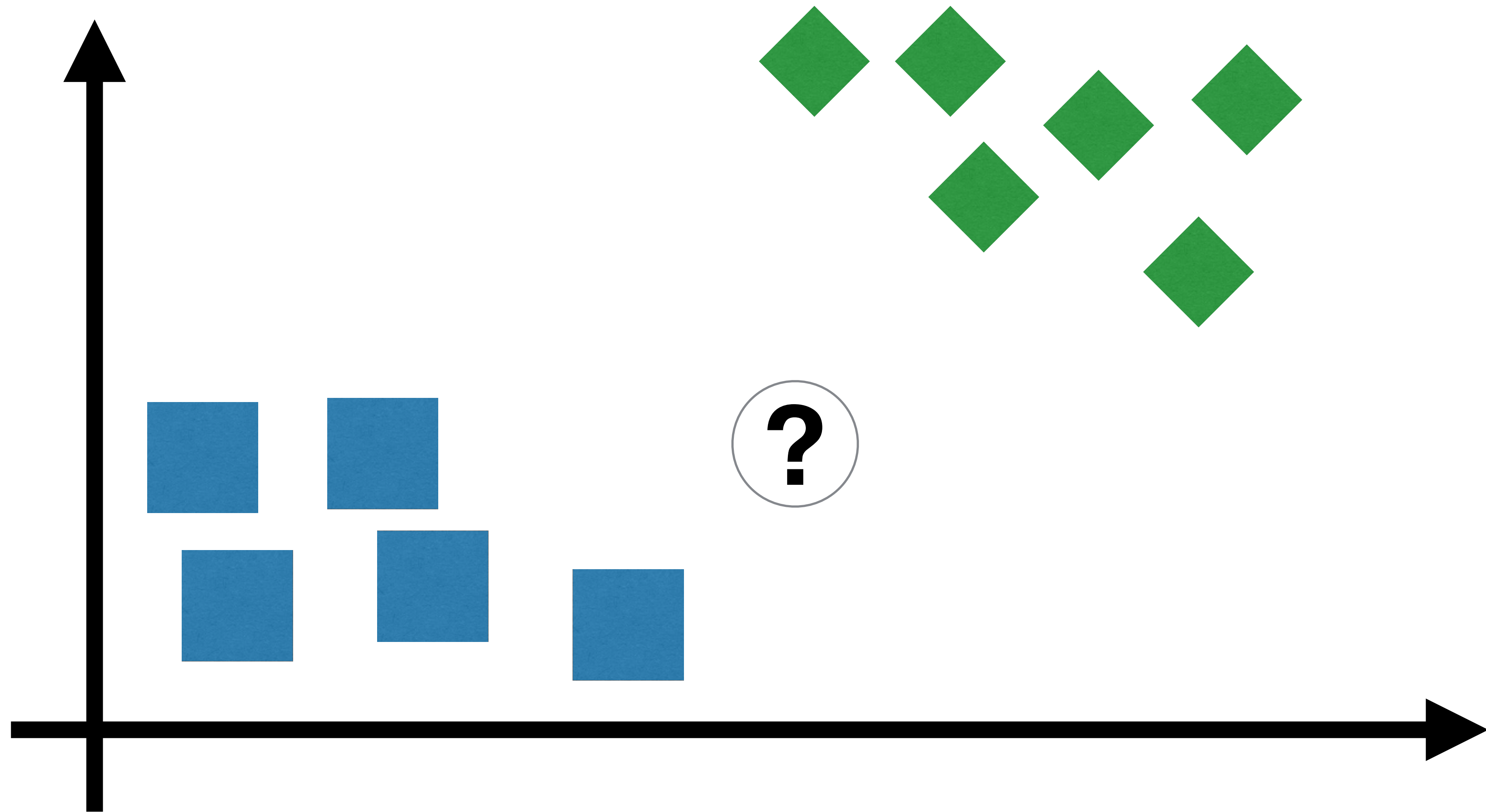
ML Classification



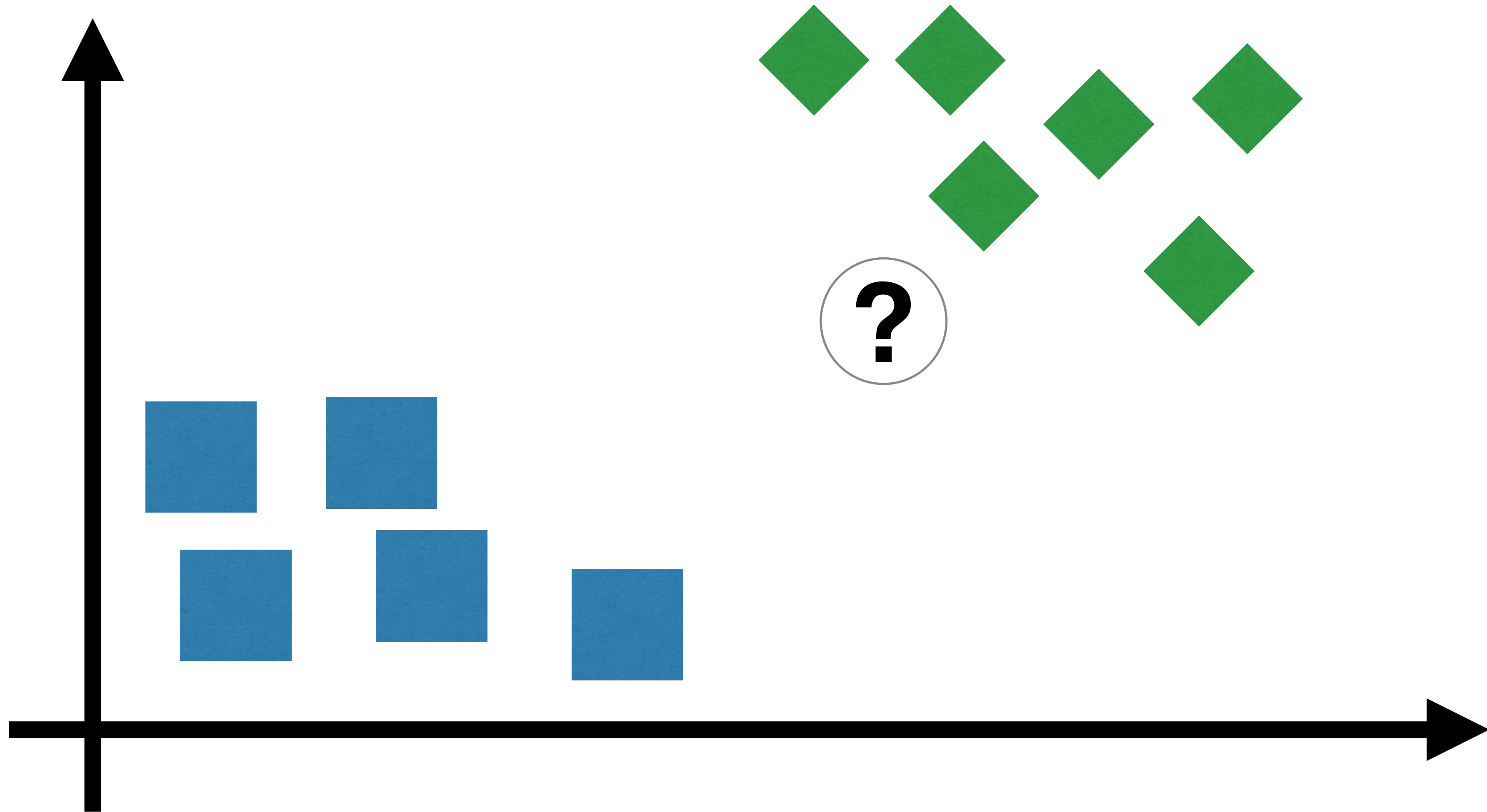
You be the classifier: 1 or 2?



You be the classifier: 1 or 2?

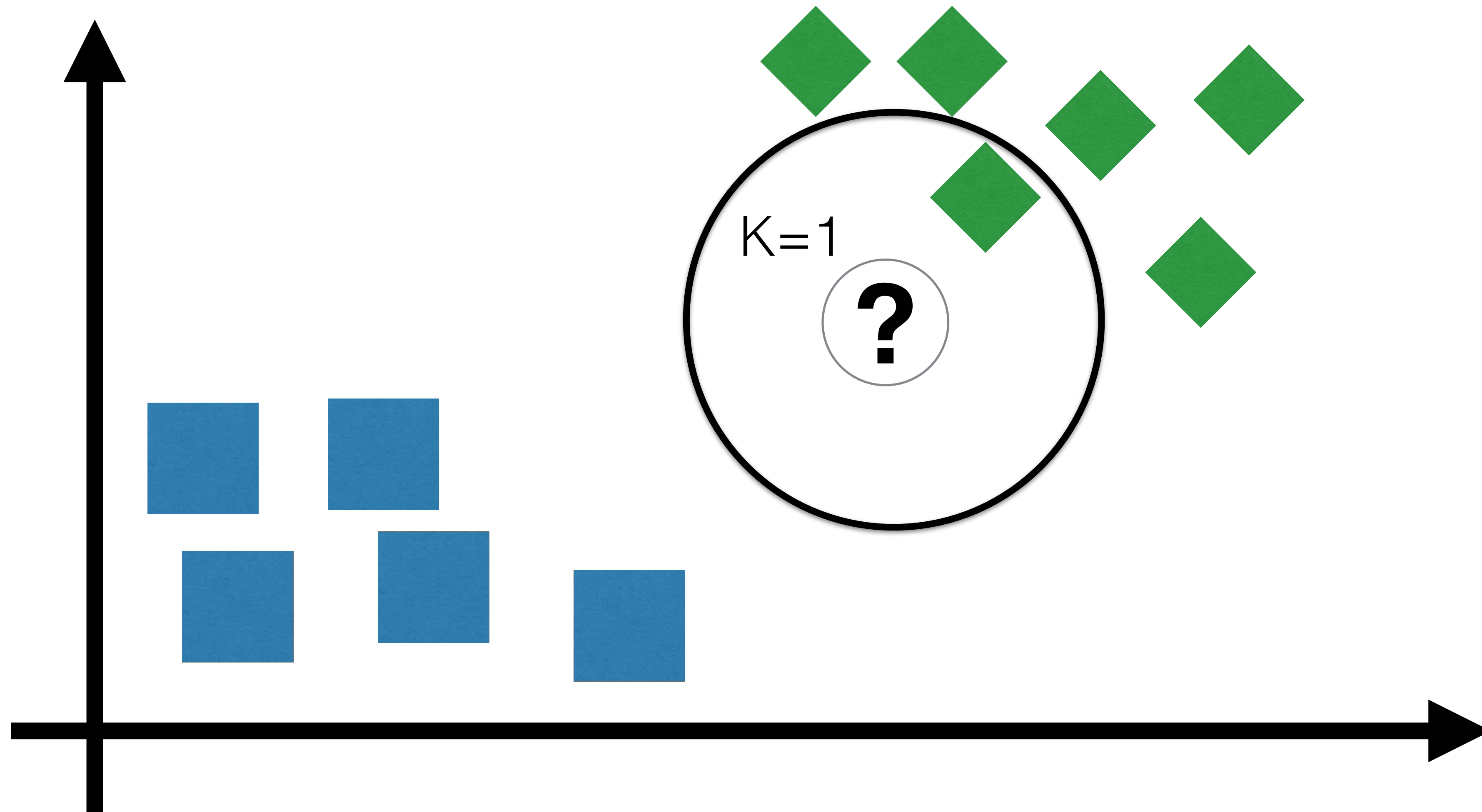


You be the classifier: 1 or 2?

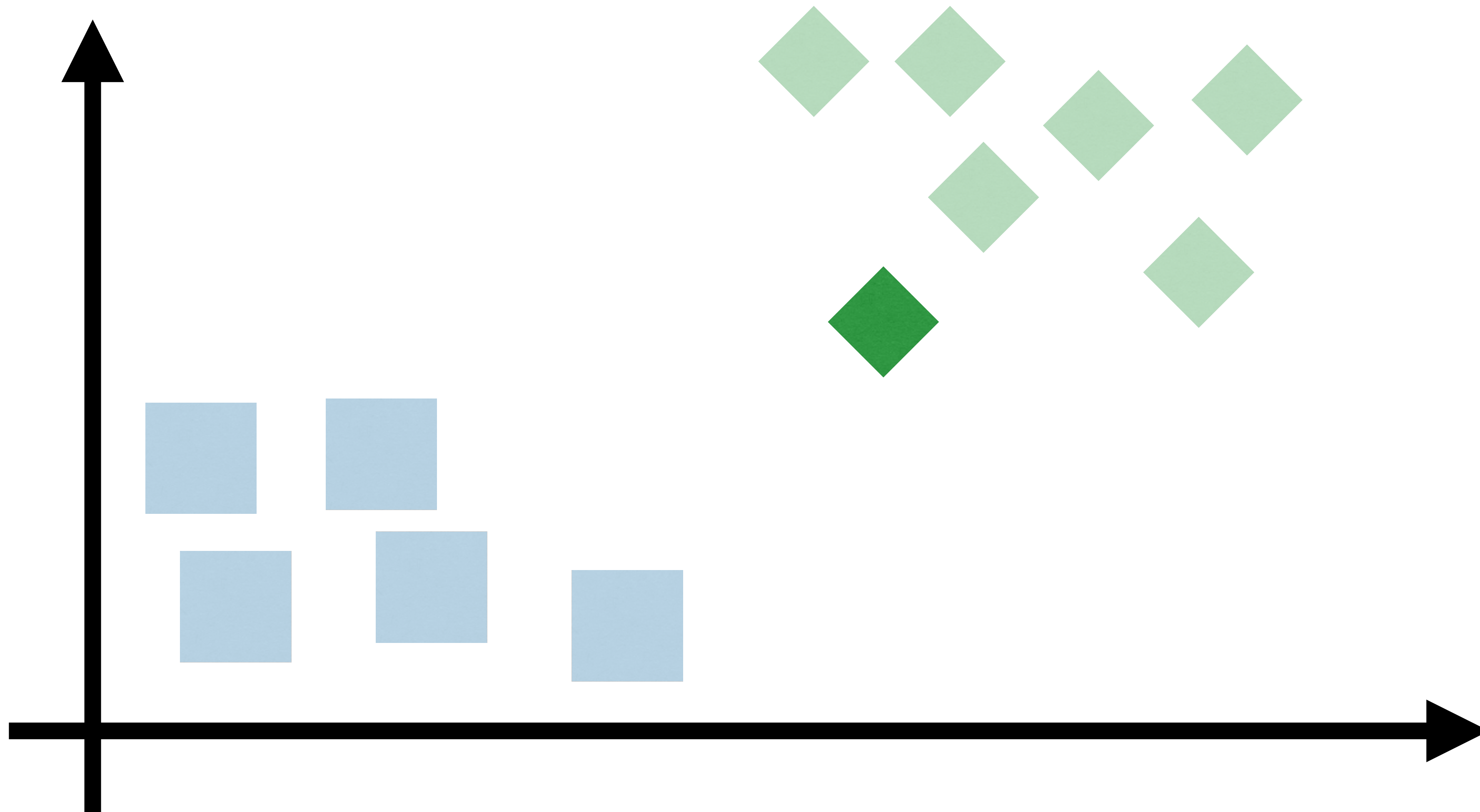


K-nearest neighbour-Classifier:

Take a vote on nearest k points



K-nearest neighbour-Classifier:
Take a vote on nearest k points



Different algorithms with different settings will make different decision boundaries

[google search for machine learning decision boundaries](#)

Simplest Wekinator Example

INPUT

inputs/mouse_XY_2_inputs

Simplest Wekinator Example

OUTPUT

outputs/classifier/simple_1_output

More advanced classification

INPUT

inputs/video_100_inputs

More advanced classification

OUTPUT

outputs/classifier/trigger_sounds_1_output

Walkthrough of inputs + outputs

Exercise: Yoga Classifier

Free assignment rest of day

Use the techniques you have learned to build an interactive prototype.
Work in groups or individually. I am here to help!

Sensors:

I brought 1 x Leap Motion, 1 x Kinect v1 and external webcams if anybody wants to borrow some sensors?

Inputs & outputs:

Build upon existing inputs and outputs or try to make your own!

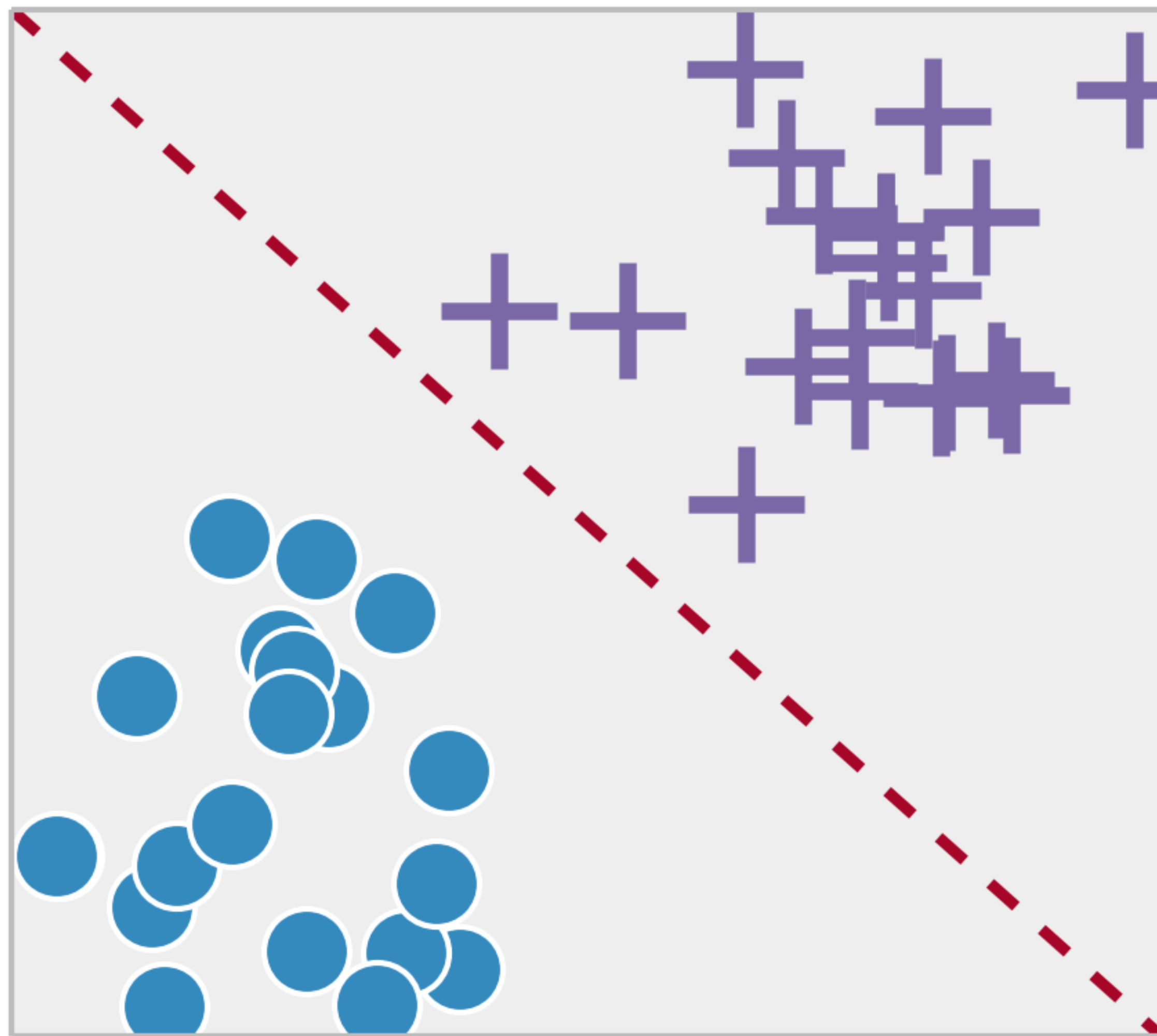
Training:

Try training Wekinator with enough varied examples so your prototype is also functional when other people try it, or when you move it to another setting for presentations.

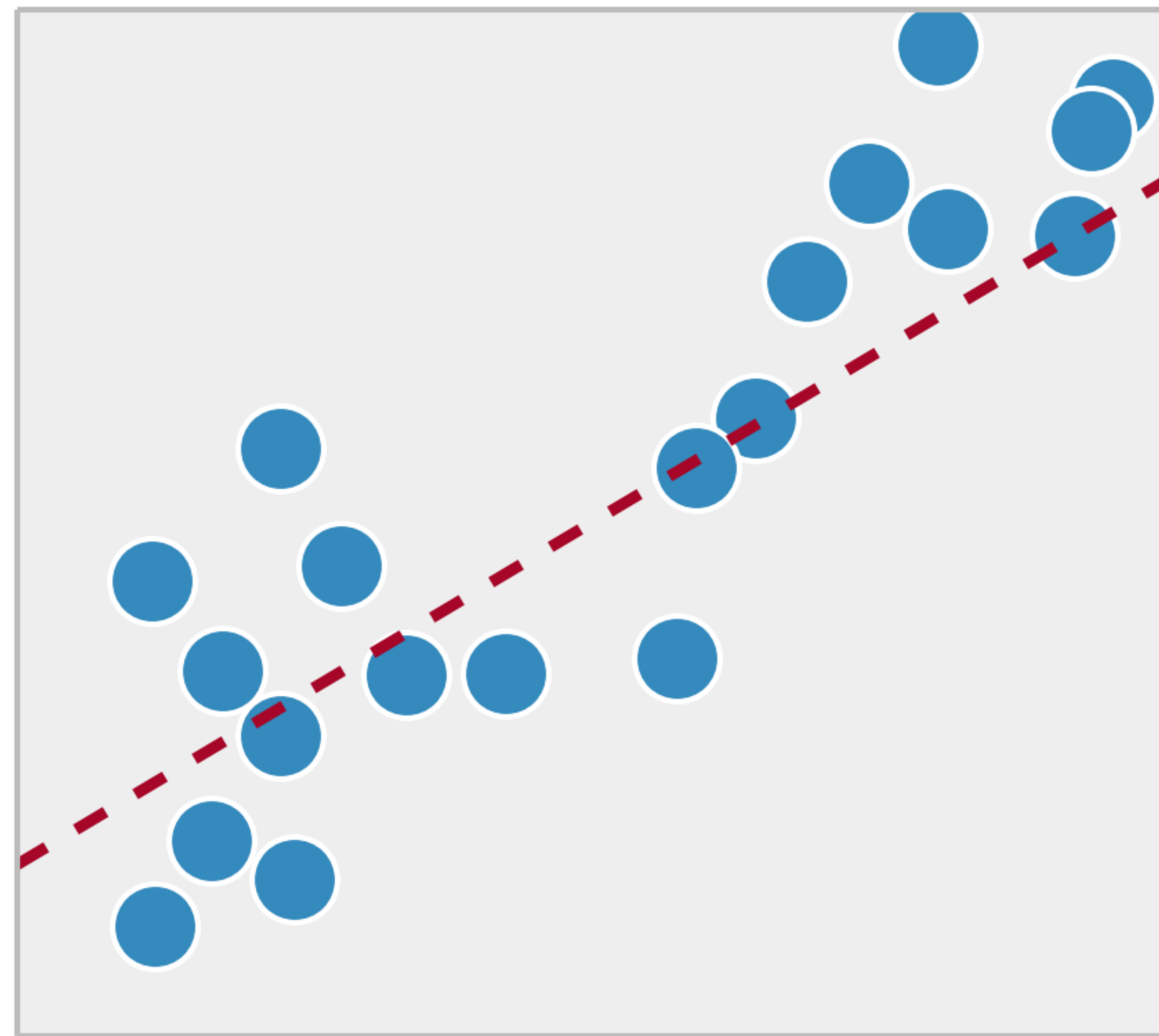
Informal presentations:

16:30

Classification



Regression



Classification

New Project

Values Examples Configure

randomize

Stop Recording

Train

Run

Delete last recording

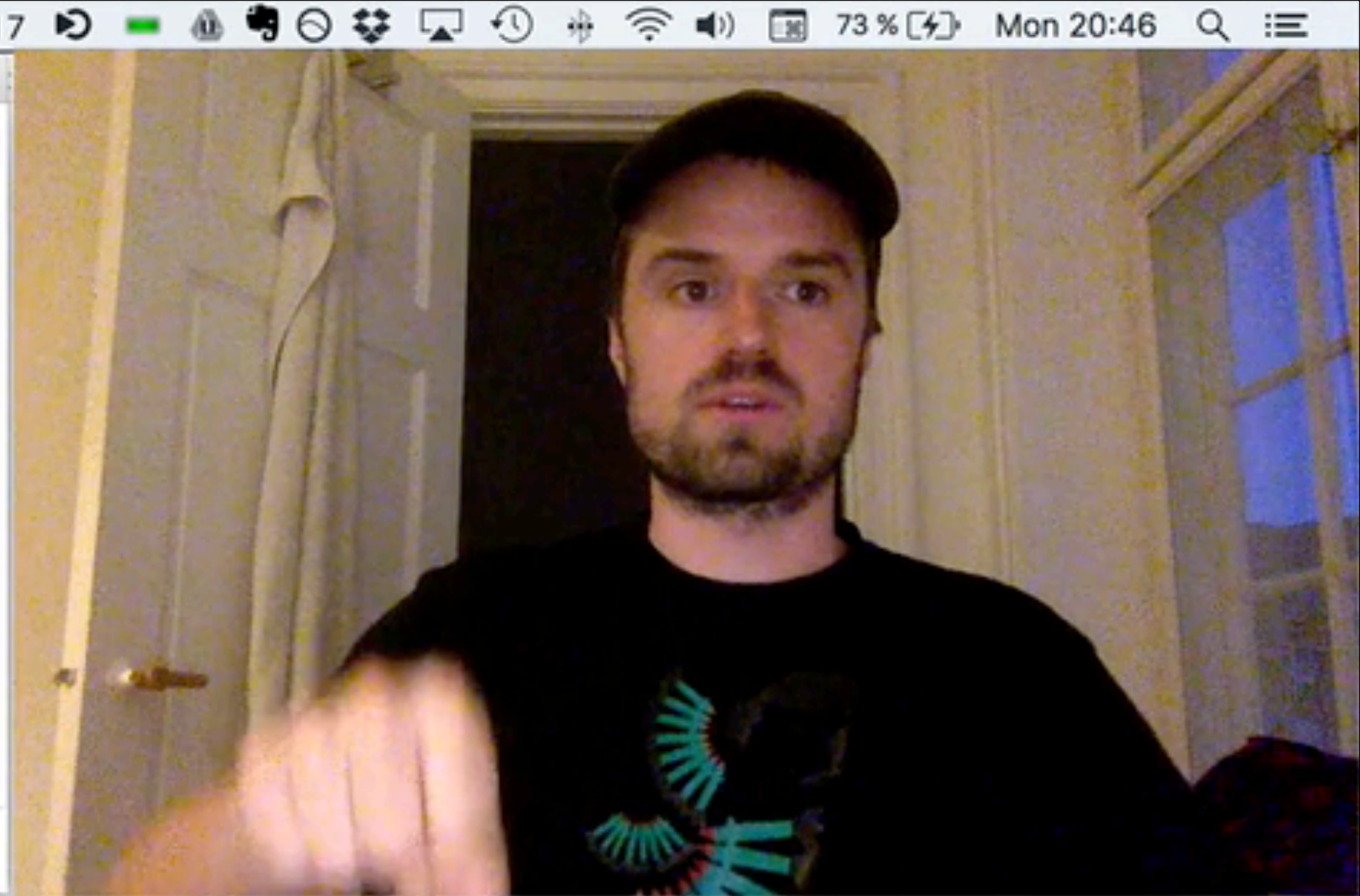
Re-add last recording

models

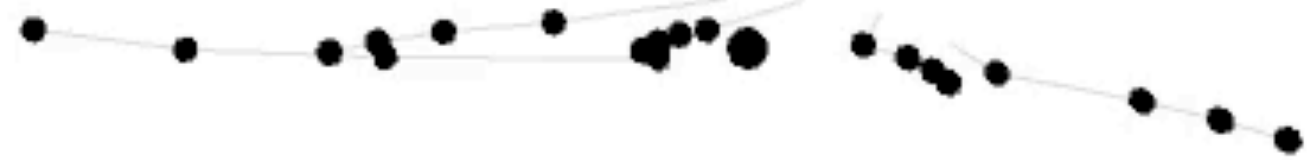
outputs-1 1 56

Edit Status

Status: New examples recorded



Regression



Models

randomize 🔍 ✕ 🔴 ▶ Edit Status

Model	Value	Count	✕	🔴	▶	✎	🟢
outputs-1 (v10)	1.00325	254	✕	🔴	▶	✎	🟢
outputs-2 (v10)	1	175	✕	✕	✕	✎	🟢
outputs-3 (v10)	0.37497	175	✕	✕	▶	✎	🟢

uts to arrive

Sends

1 2 3 4 5 6 7 A B Post Post

shVintage-Stick-Hit

Upgrade Sample Controls

Track Volume

This slider is used to adjust and display the track's output signal level (peak level and RMS). Click and drag to adjust track volume.

Start Loop Length Fade LOOP SNRP Voices Retrig WARP 2 Bars

0.00 % 100 % 100 % 0.00 % 3 R

Attack Decay Sustain Release Volume

0.00 ms 300 ms 0.0 dB 60.0 s -20.2 dB

Compressor

Ratio 1.03 : 1

Attack 2.00 ms

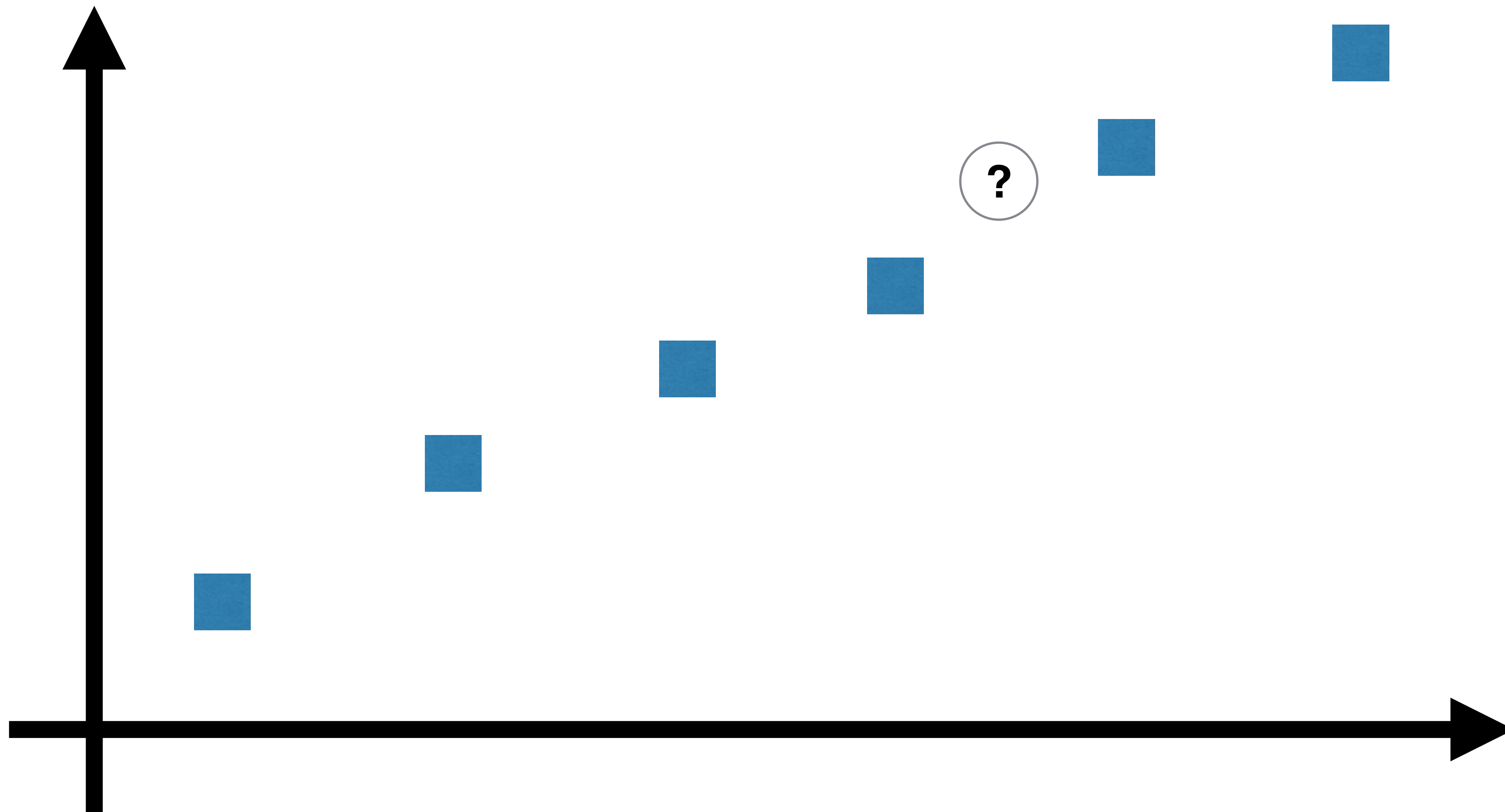
Release 50.0 ms

Thresh -10.5 dB

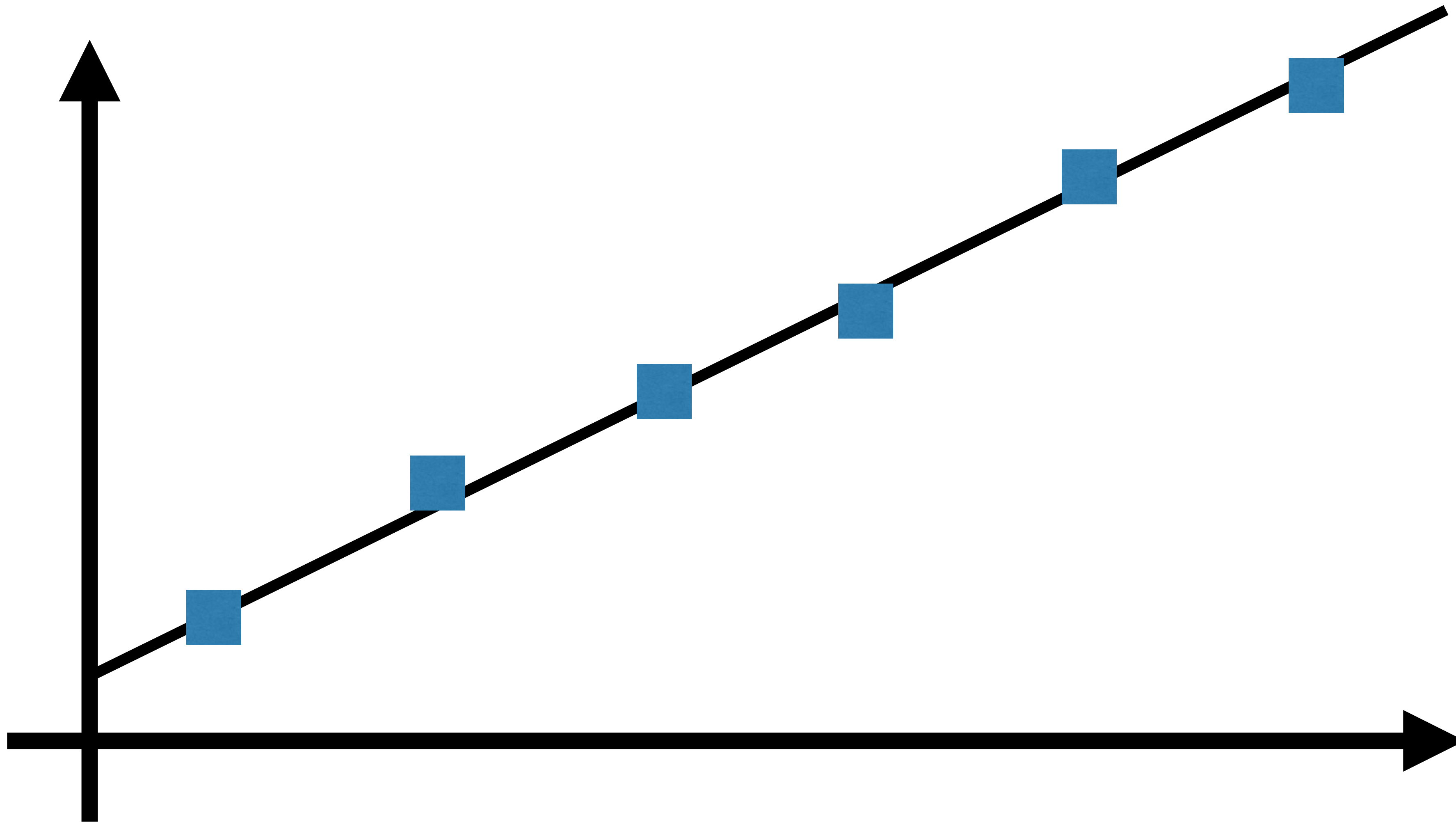
Track Volume: -2.0 dB

A person wearing a purple shirt is sitting at a desk. A smartphone is connected to a white cable, and the person's hands are visible near the device.

ML Regression

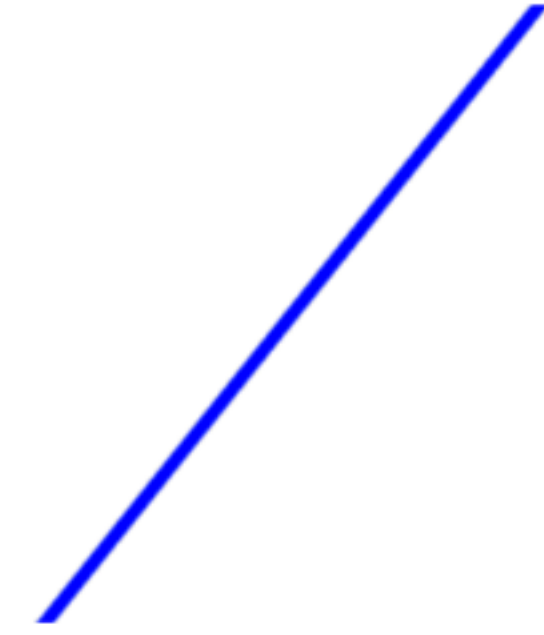


ML Regression



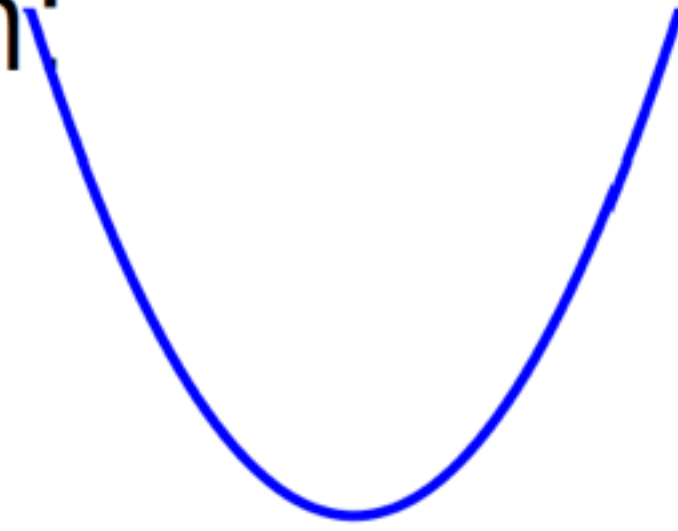
- Linear regression:

$$y = a \cdot x + b$$



- 2nd-order polynomial regression:

$$y = a \cdot x^2 + b \cdot x + c$$



- 3rd-order polynomial regression:

$$y = a \cdot x^3 + b \cdot x^2 + c \cdot x + d$$



Regression

<http://cs.stanford.edu/people/karpathy/convnetjs/demo/regression.html>

Input

inputs/video_100_inputs

OUTPUT

outputs/continuous/object_animation_4_outputs

Hand controlled chair design - with lerping!

Input

inputs/LeapMotion_Fingertips_15_inputs

OUTPUT

outputs/continuous/chair_5_outputs

Mini Exercise

25 minutes: Find an new input that you want to control the *chair_5_outputs* with and try to make some fun connections between inputs and outputs.

FaceTracking / Kinect / Sound / Webcam / etc?

Wekinator & OSC

```
void sendOsc() {  
  OscMessage msg = new OscMessage("/wek/inputs");  
  msg.add((float)mouseX);  
  msg.add((float)mouseY);  
  oscP5.send(msg, dest);  
}
```

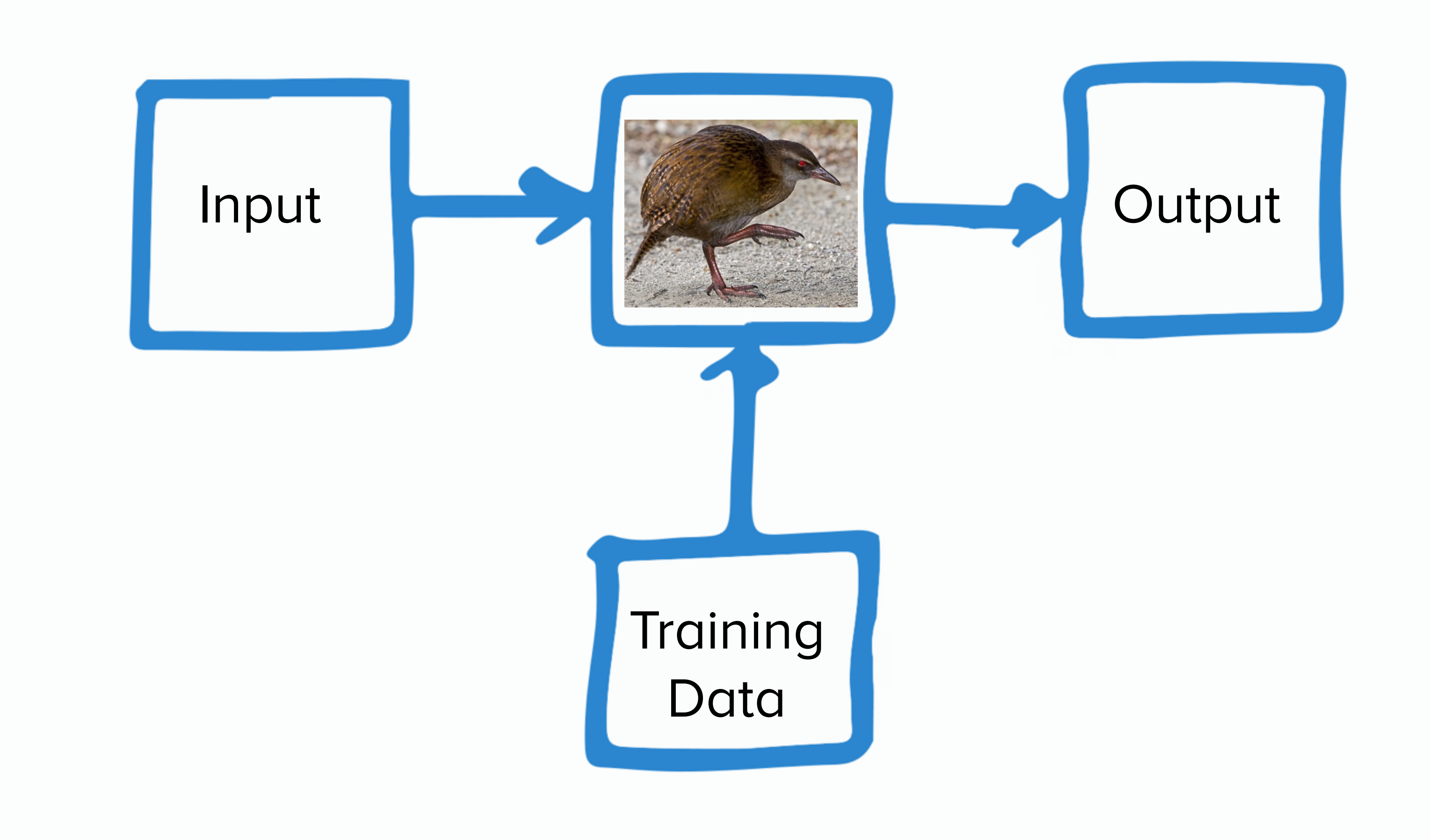
OSC

OSC



```
void oscEvent(OscMessage message) {  
  if (message.checkAddrPattern("/wek/outputs") == true) {  
    currentState = (int) message.get(0).floatValue();  
  }  
}
```

Ardour
Bidule
CasparCG
Chuck
Crystal Space
CSound
Digital Performer
Fluxus
FreeJ
Gesture Recognition Toolkit
IanniX
Impromptu
Isadora (v.1.1)
Kyma
Lily
LiVES
Logelloop
Max/MSP
Mocolo
Modul8
Mxwendler
OpenFrameworks
Overtone (Clojure)
Processing
Pure
Pure Data
QLab
Quartz Composer
Reaktor
REAPER
Renoise
Resolume
Sonic Pi
SuperCollider
Squeak
Traktor DJ Studio
Unity
Unreal Engine
Veejay
VirtualDJ
vvvv



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Reaktor
REAPER
Renoise
Resolume
Sonic Pi
SuperCollider
Squeak
Traktor DJ Studio
Unity
Unreal Engine
Veejay
VirtualDJ
vvvv

How do we make our own input from an existing sketch?

<https://www.youtube.com/watch?v=QLHMTtE5XsMs#t=16m30s>

[https://github.com/CodingTrain/Rainbow-Code/blob/master/Tutorials/Processing/
11_video/sketch_11_6_MotionDetection/sketch_11_6_MotionDetection.pde](https://github.com/CodingTrain/Rainbow-Code/blob/master/Tutorials/Processing/11_video/sketch_11_6_MotionDetection/sketch_11_6_MotionDetection.pde)

What to add?

```
//global
```

```
import oscP5.*;  
import netP5.*;
```

```
OscP5 oscP5;  
NetAddress dest;
```

```
//inside setup function
```

```
oscP5 = new OscP5(this, 9000);  
dest = new NetAddress("127.0.0.1", 6448);
```

```
//inside draw function
```

```
sendOsc();
```

```
//new function
```

```
void sendOsc() {  
    OscMessage msg = new OscMessage("/wek/inputs");  
    msg.add((float)lerpX);  
    msg.add((float)lerpY);  
    oscP5.send(msg, dest);  
}
```

How do we make our own output?

```
import oscP5.*;

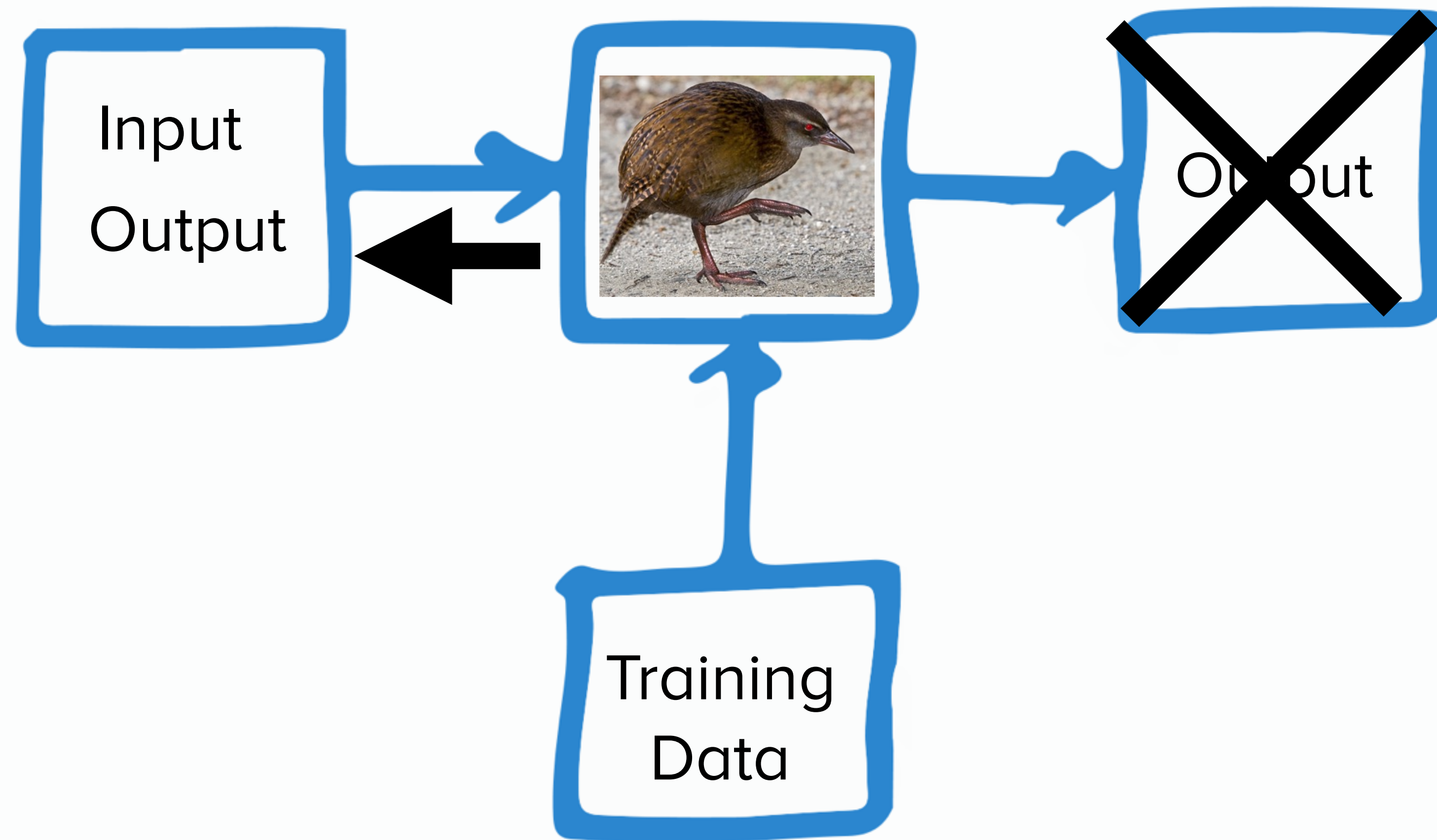
OscP5 oscP5Receiver;
int currentState;

void setup() {
    size(600, 400);
    oscP5Receiver = new OscP5(this, 12000);
}

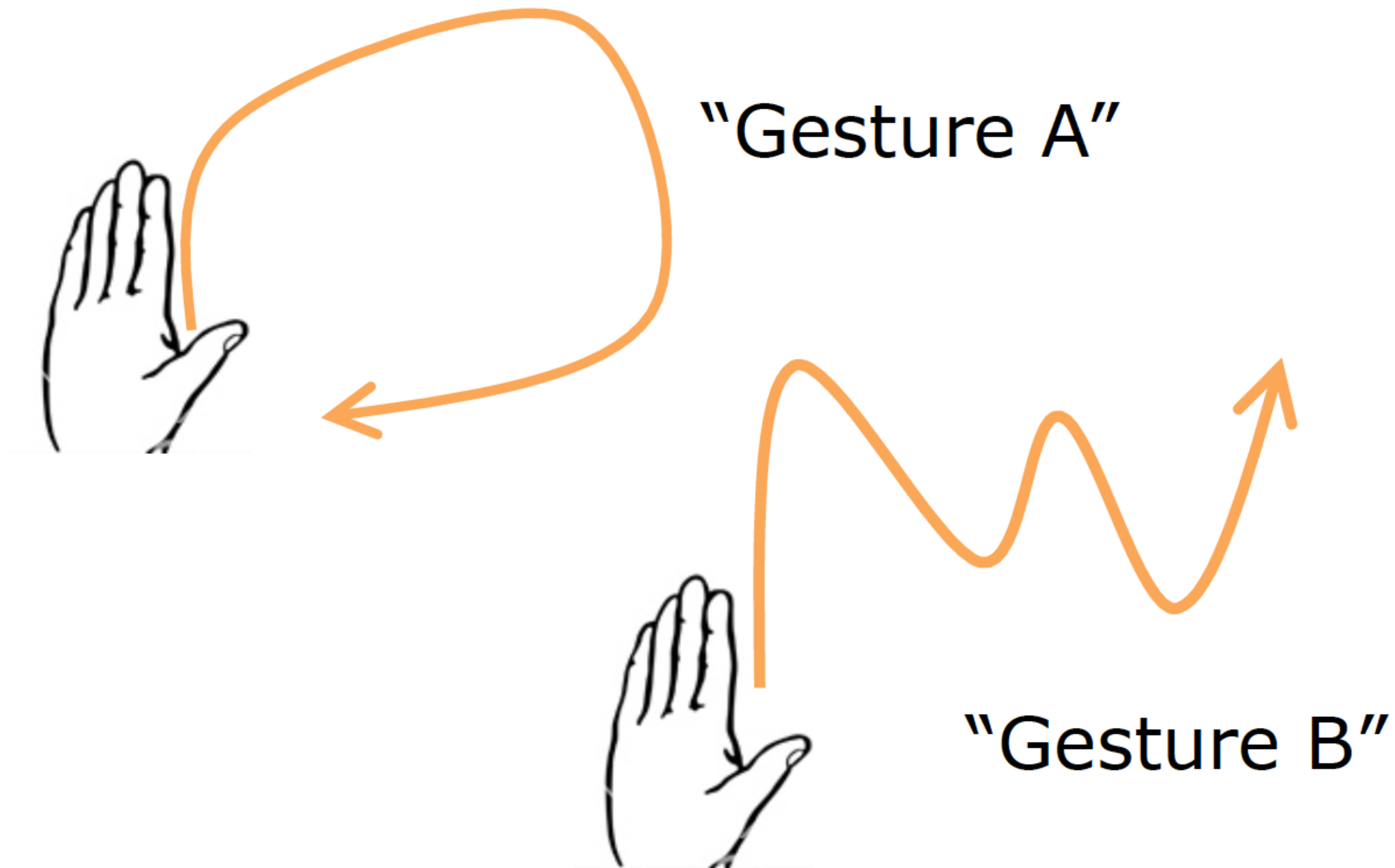
void draw() {
    background(0);
    textSize(64);
    text(currentState, width/2, height/2);
}

void oscEvent(OscMessage message) {
    if (message.checkAddrPattern("/wek/outputs") == true) {
        currentState = (int) message.get(0).floatValue();
    }
}
```


How do we make a combined input/output?



Dynamic Time Warping



WekinatorFileViewActions

New Project

OSC In

OSC Out

Stop running

Delete last example

Re-add last example

Examples

Gesture Types

Add / Remove

stable (v22)

+

-

3

degree of match:

hand_approaching (v29)

+

-

10

degree of match:

hand_removing (v29)

+

-

10

degree of match:

wiggle (v132)

+

-

9

degree of match:

Match threshold

status: Example added for gesture 0

Processing_TriggerText_1DTW_Arduino

Receives DTW messages from wekinator on port 12000
Listening for 4 DTW triggers
/stable
/hand_approaching
/hand_removing
/wiggle

Waiting...

input: 541
input: 543
input: 544
input: 546
input: 548
input: 550
input: 552
input: 555
input: 558
input: 561
input: 564
input: 567
input: 571
input: 575
input: 580
input: 585
input: 591
input: 598
input: 604

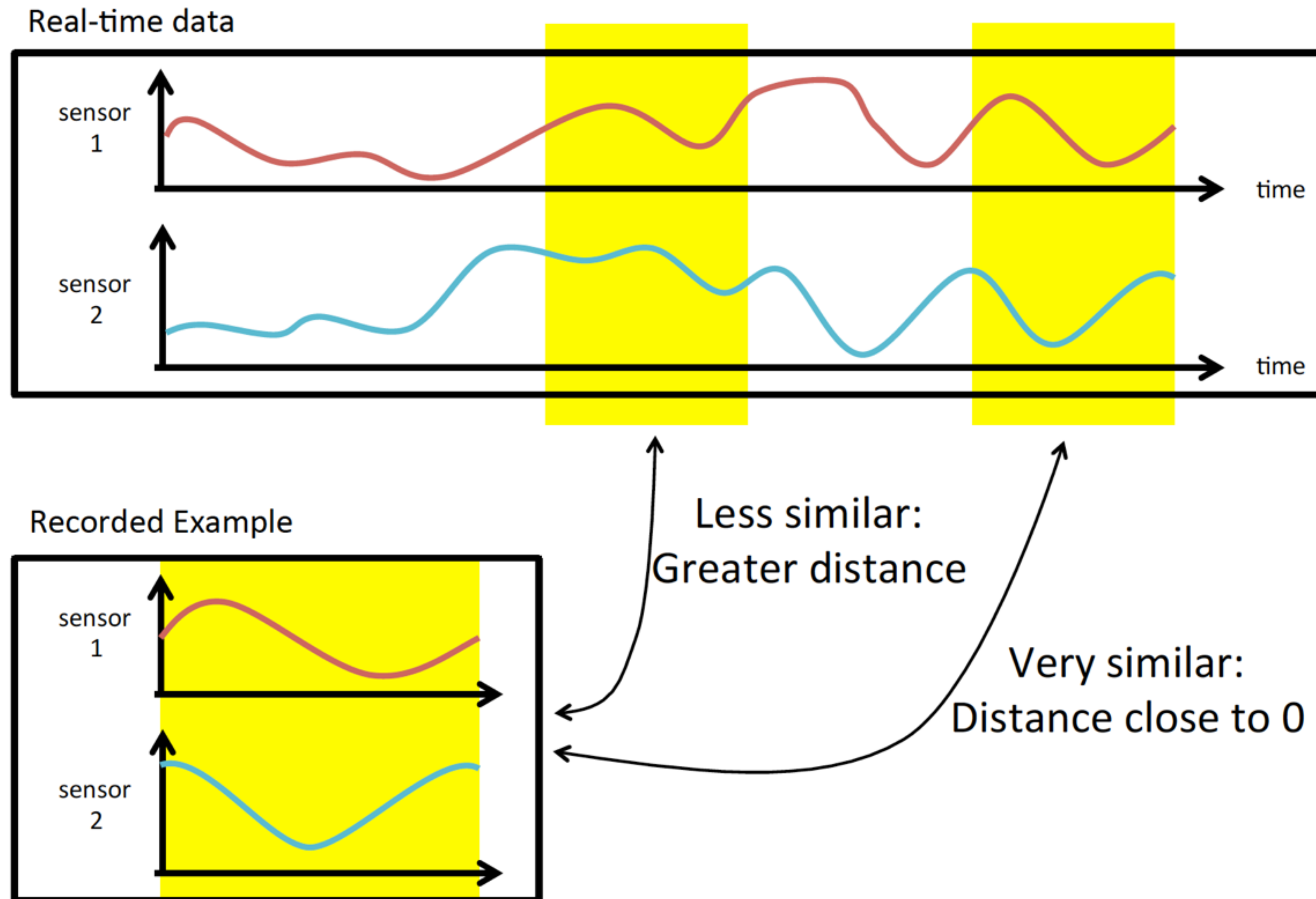
75
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78
79
80
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82
83
84
85
86
87

fil
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for
}
tex
tex
}
[2016,
12000

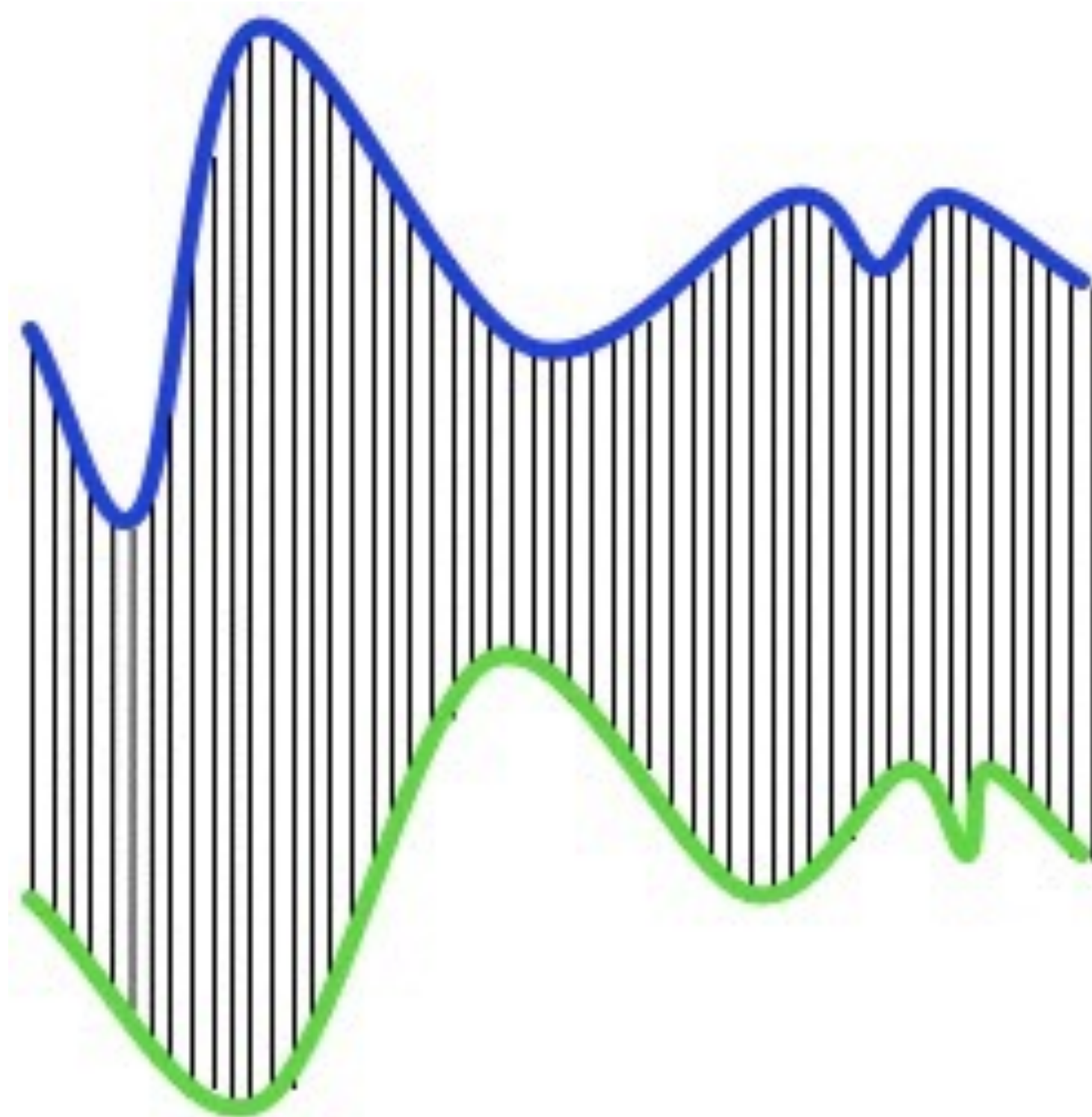
ConsoleErrorsUpdates 3Cons



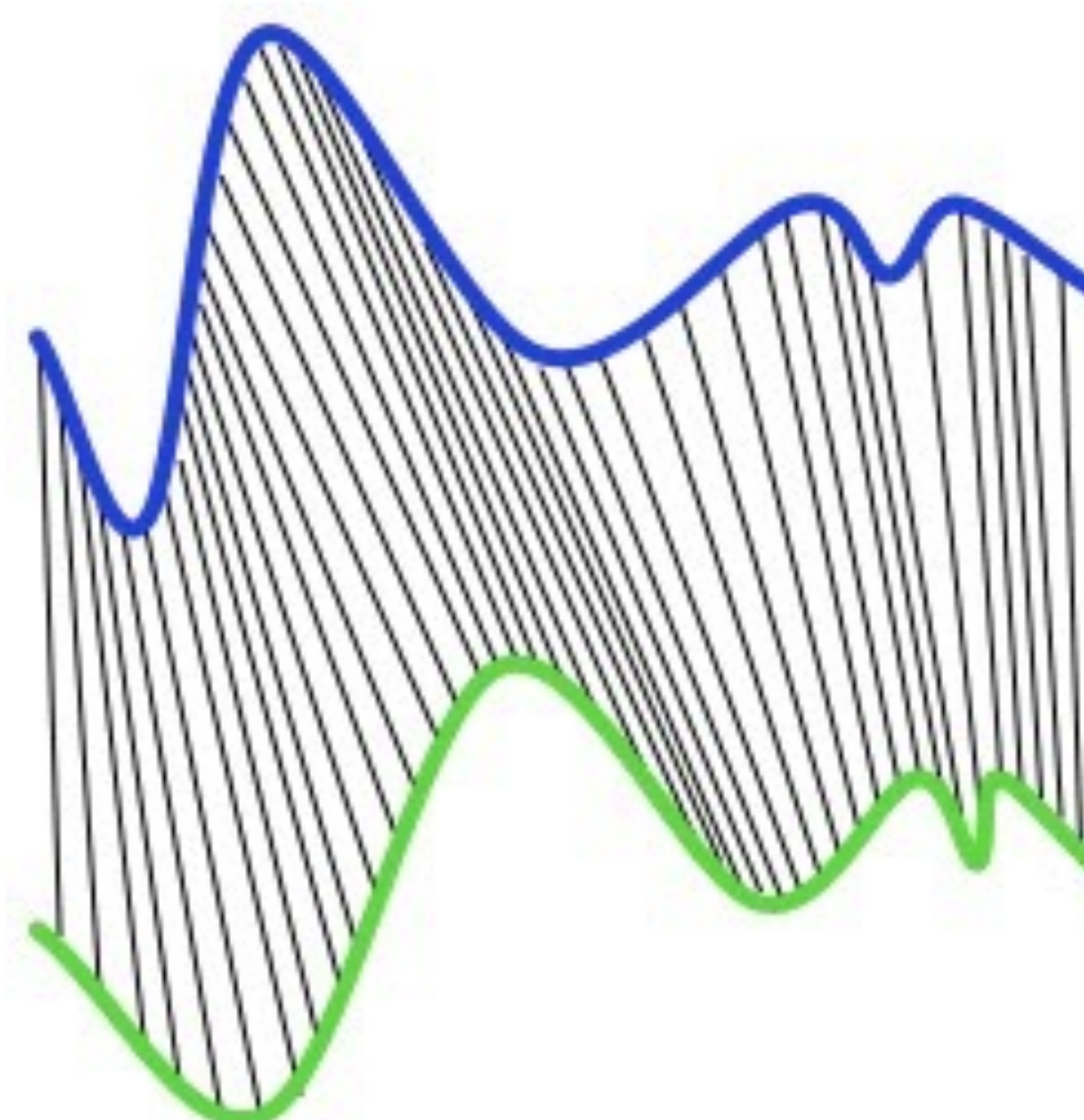
Dynamic Time Warping



Dynamic Time Warping



(a)



(b)

Dynamic Time Warping

`dynamic_time_warping/DTW_Mouse_Explorer`

This afternoon

Free time to play with the the tools

Ask us to help you with specific ideas!

Lightning talks at 5:30

Start thinking about rough ideas or areas of interest for tomorrow

What to add?

//global

```
OscP5 oscP5Receiver;  
int currentState;
```

//in setup function

```
oscP5Receiver = new OscP5(this, 12000);
```

//in draw function

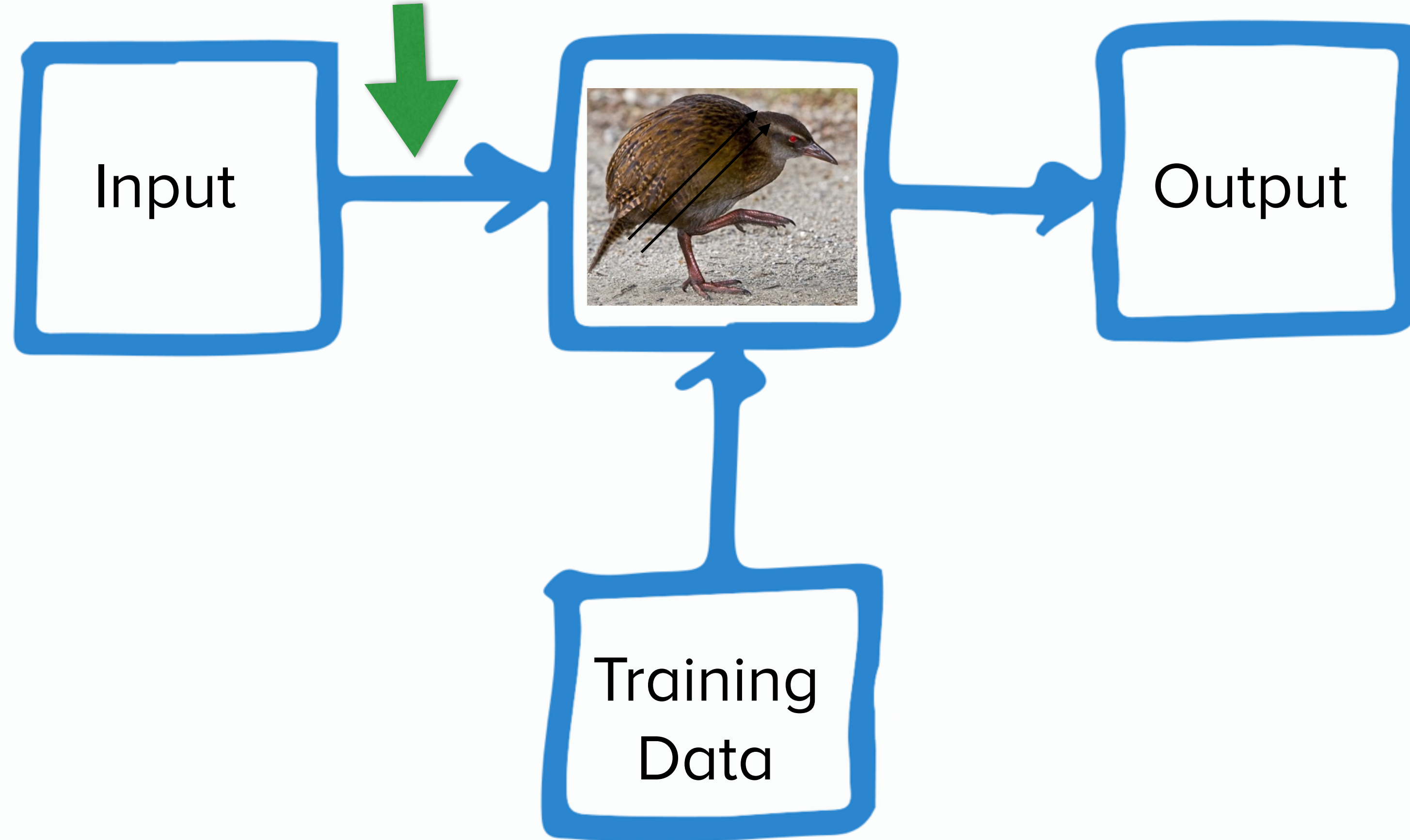
```
  textSize(64);  
  text(currentState, width/2, height/2);
```

//new function

```
void oscEvent(OscMessage message) {  
  if (message.checkAddrPattern("/wek/outputs") == true) {  
    currentState = (int) message.get(0).floatValue();  
  }  
}
```


Weki input helper

Weki input helper



Weki input helper

Change what to send:

Send min, max, average, standard deviation of a feature over an analysis window

Send velocity or acceleration of a feature

Change when to send:

Frequency

Only send when a trigger condition is satisfied

Sound controlled Wolfenstein



FLOOR	SCORE	LIVES		HEALTH	AMMO
1	0	3		100%	16

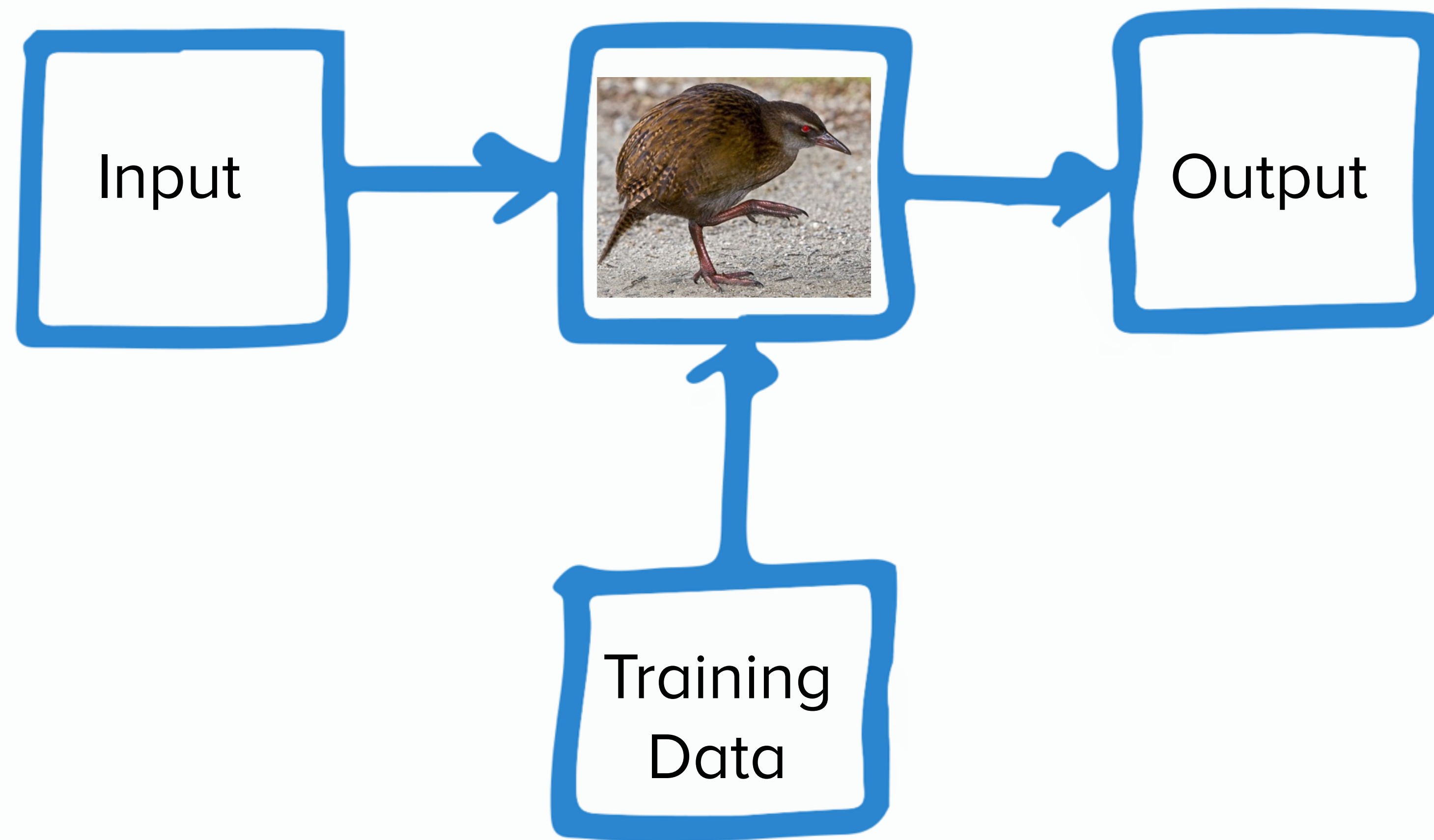


Lets try it out!

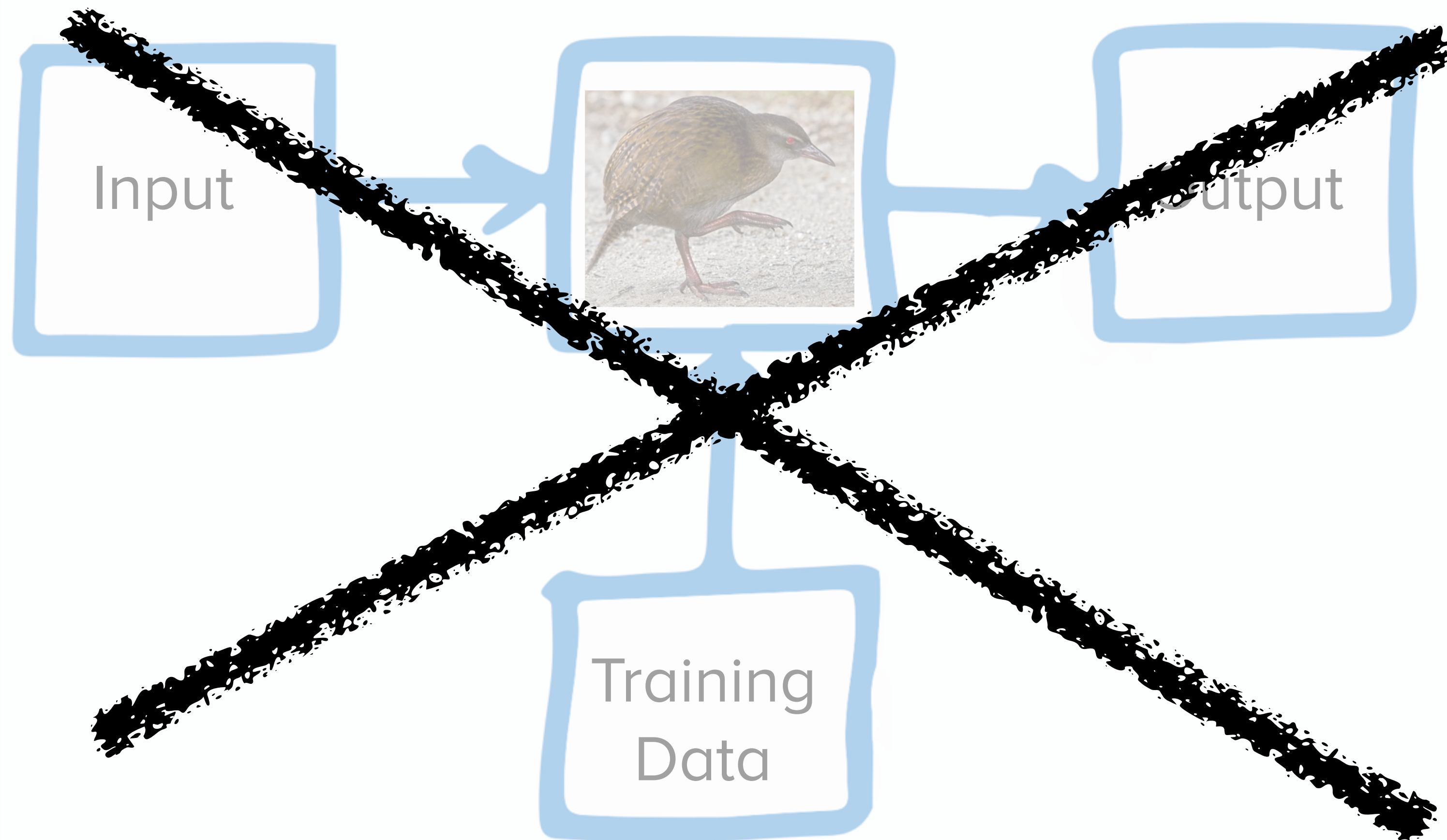
Input: Simplest_MouseXY_2Inputs

Weki input helper (port 6448 - 2 inputs)

Wekinator (port 6449, classification, 1 input, 1 output, 2 classes)



Single app bundle with ofxGrt



Single app bundle with ofxGrt

GitHub, Inc. [US]

https://github.com/nickgillian/ofxGrt

☆🔥🌐



This repository

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🔗 Pull requests 1

📁 Projects 0

📖 Wiki

📊 Insights

OpenFrameworks extension for the Gesture Recognition Toolkit

🕒 169 commits

🌿 2 branches

🏷 0 releases

👤 10 contributors

Branch: master ▾

New pull request

Create new file

Upload files

Find file

Clone or download ▾

 nickgillian Merge pull request #22 from StudioNAND/master ...

Latest commit ffea0a5 on Jan 24, 2017

📁 example_audio_classification	updated readme	a year ago
📁 example_bar_plot	updated bar plot example	a year ago
📁 example_classification	updated readme	a year ago
📁 example_dtw	fixed dtw example	a year ago
📁 example_fft	fix case sensitive header includes for linux	2 years ago
📁 example_gyrosc_orientation_clas...	updated redame	2 years ago

ofxGrt functionality

Does everything Wekinator does:

Regression, classification & dynamic time warping

Bonus: pre-processing + post-processing

True value: Allows your whole project to be contained in a single app (*assuming you are able to code your input + output in openFrameworks*)

ofxGrt downsides

- no graphical user interface
- more time consuming to set up
- not as easy to edit training data