Week 1 website

andreasref.github.io/som/

Types of machine learning

Supervised Learning
Unsupervised Learning
Reinforcement Learning

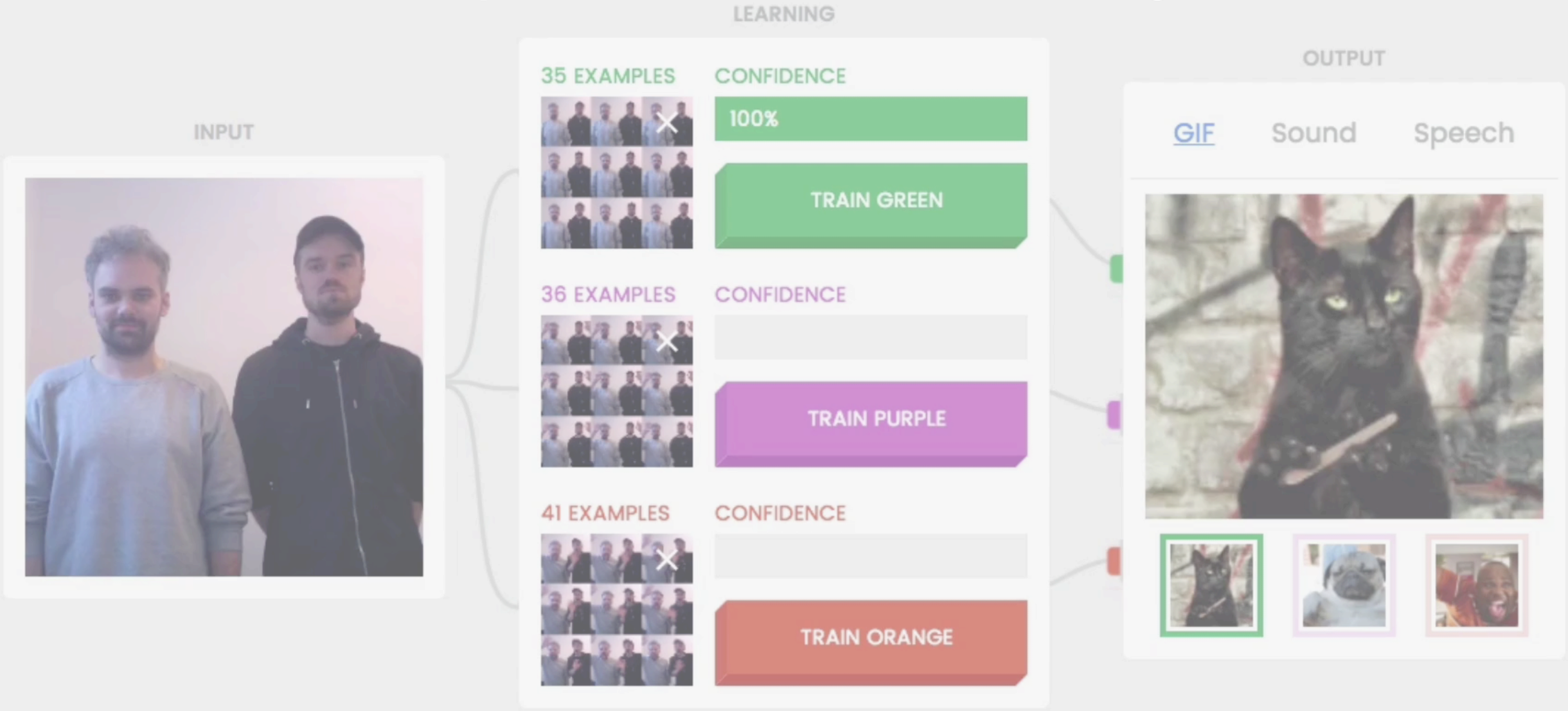
Types of machine learning

Supervised Learning

Unsupervised Learning

Reinforcement Learning

Supervised Learning




Unsupervised Learning

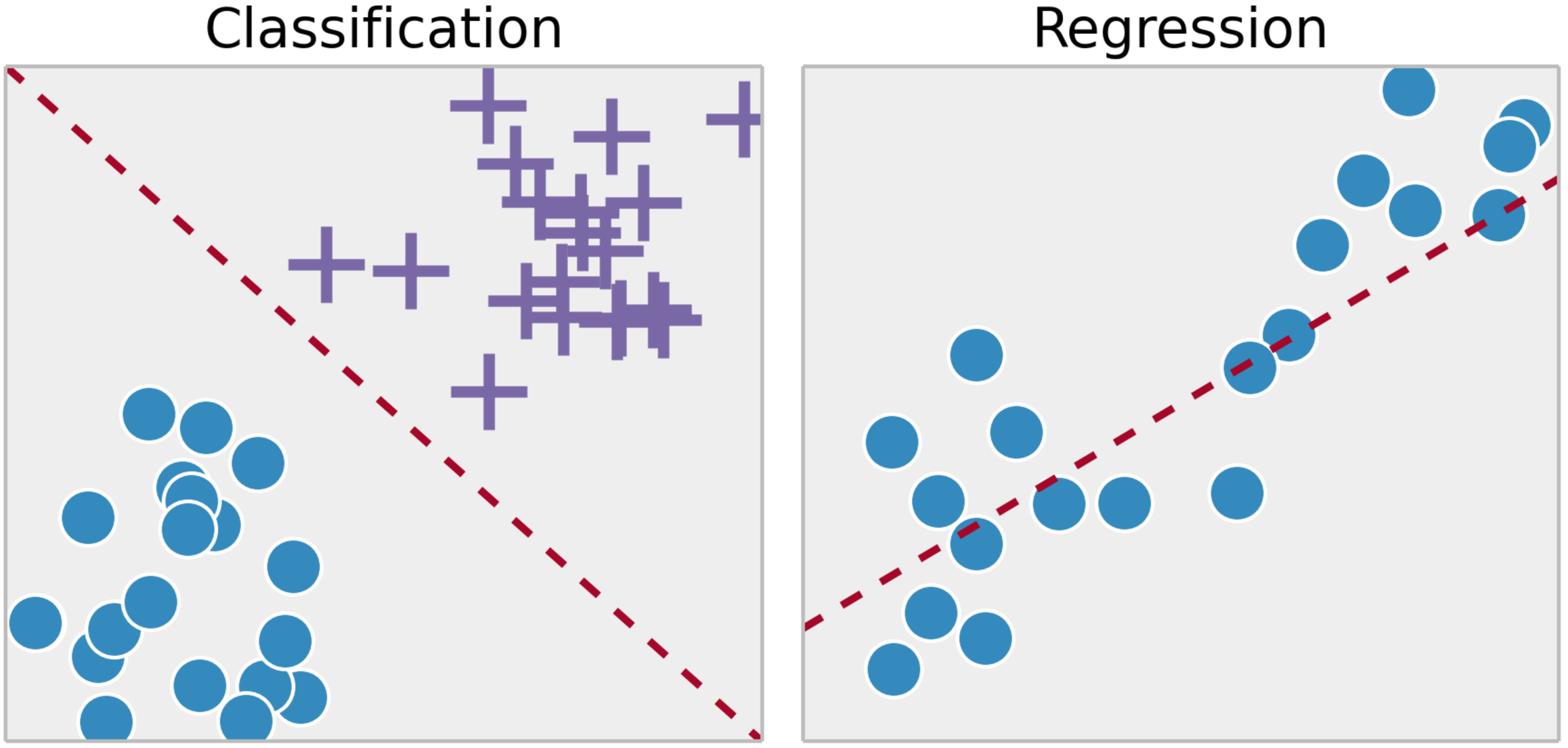
Reinforcement Learning

Types of machine learning

Supervised Learning

Unsupervised Learning

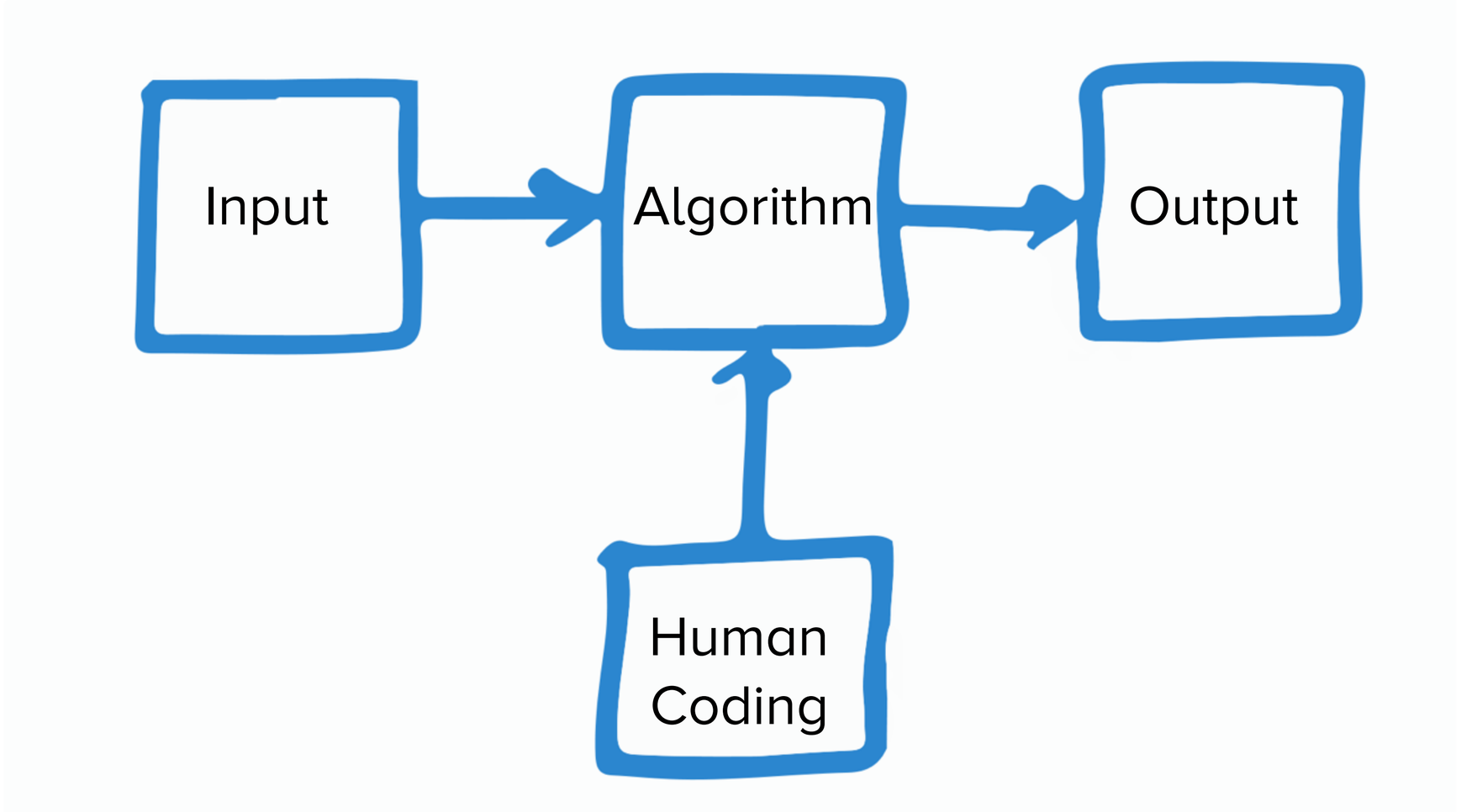
Reinforcement Learning


Classification
Regression

ml4a book (in progress)
by Gene Kogan

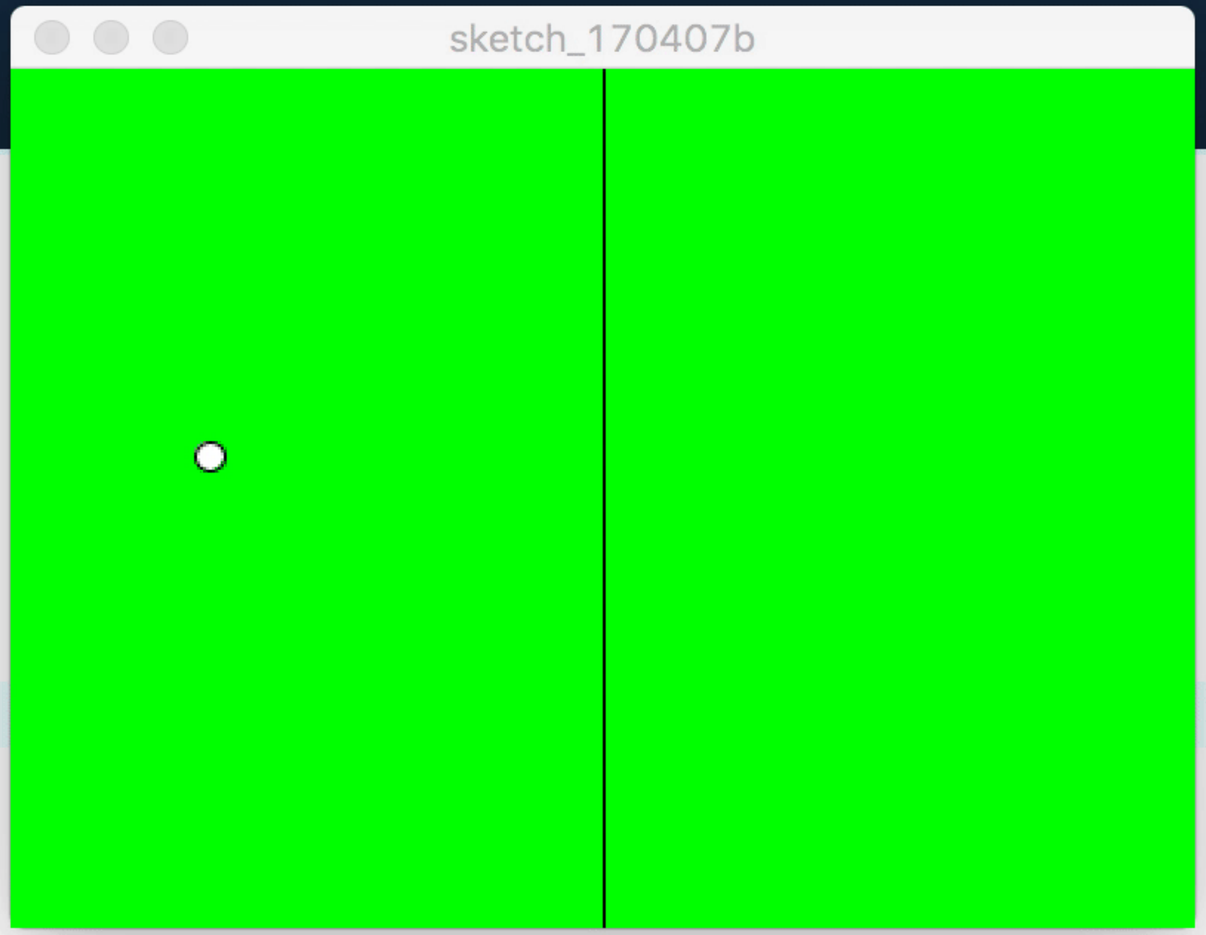
Machine Learning 101 slides
by Jason Mayes

Standard programming

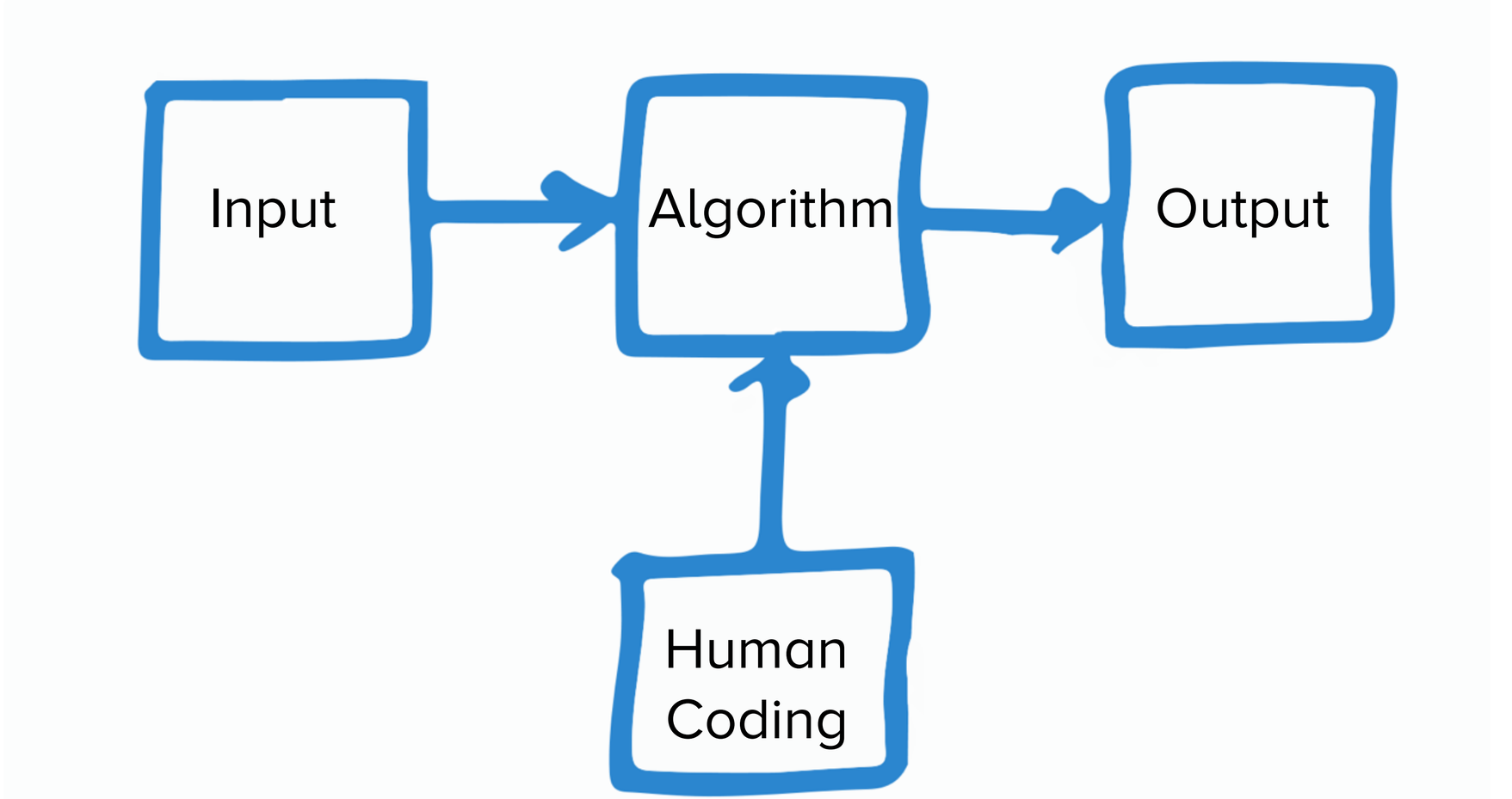


sketch_170407b

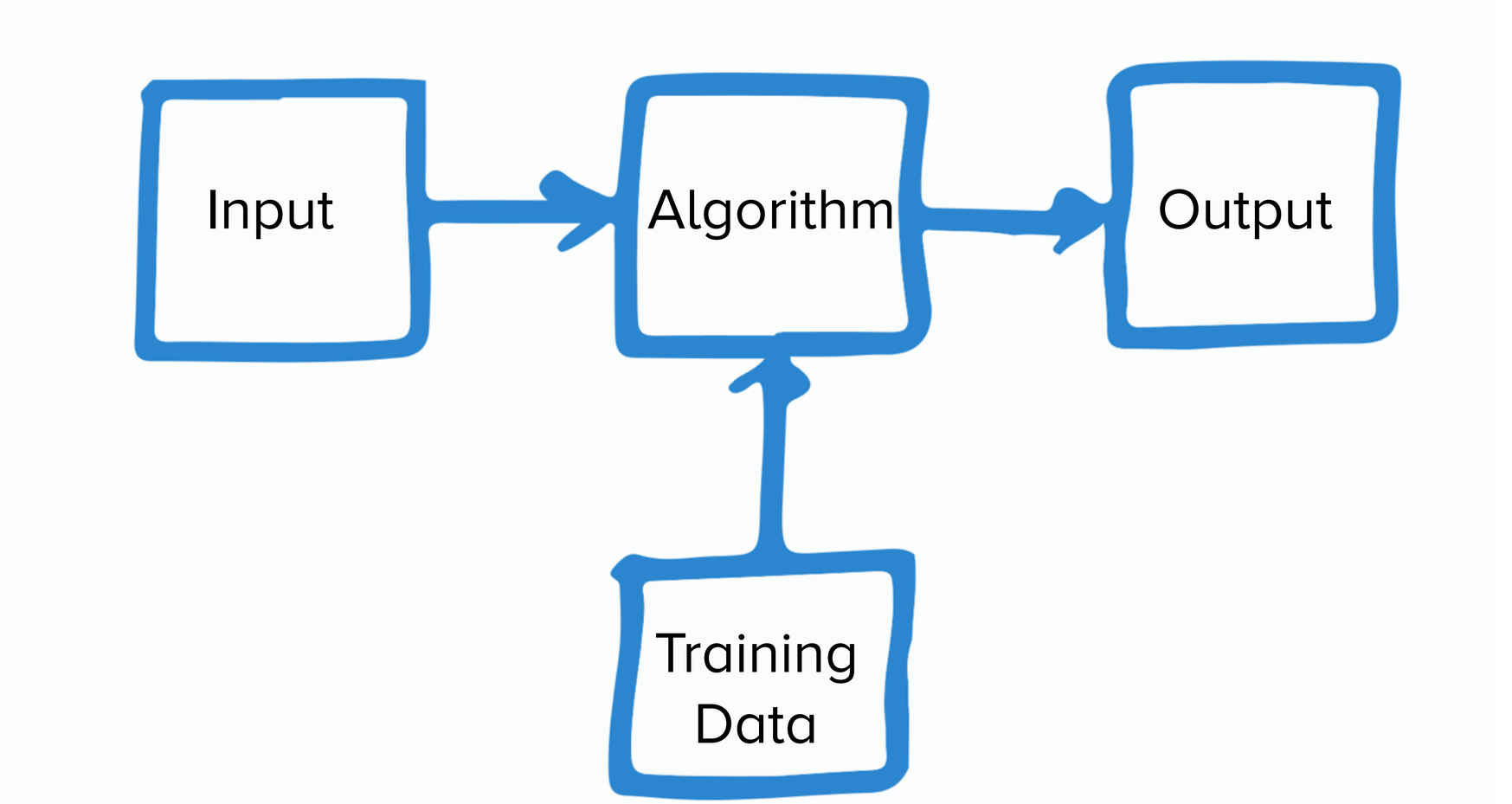
```
void setup() {
  size(400,300);
}

void draw() {
 if (mouseX > width/2) {
  background(255,0,0);
 } else {
  background(0,255,0);
 }

 ellipse(mouseX,mouseY, 10,10);
 line(width/2,0,width/2, height);
}
```



Standard programming



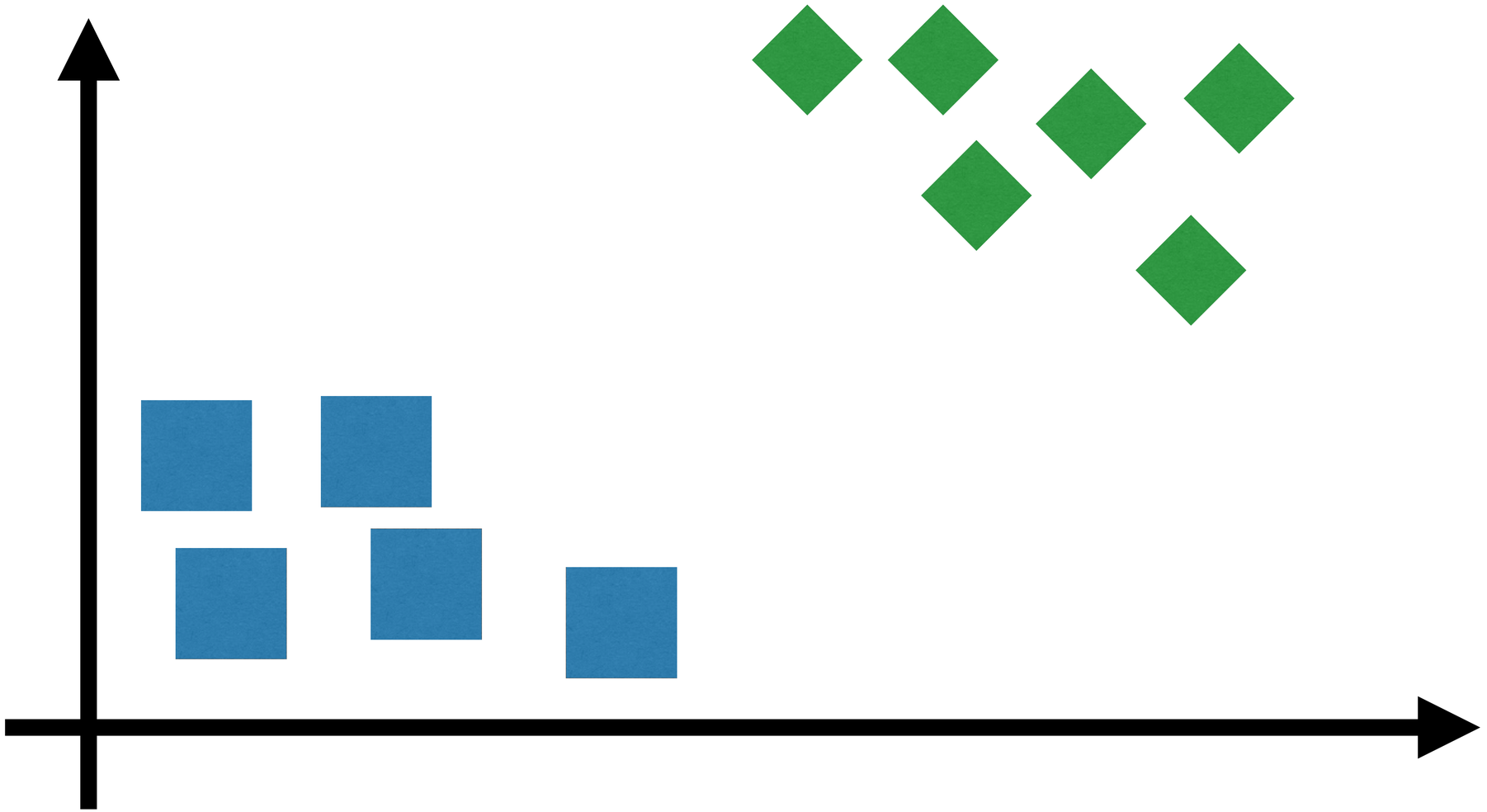
Machine Learning



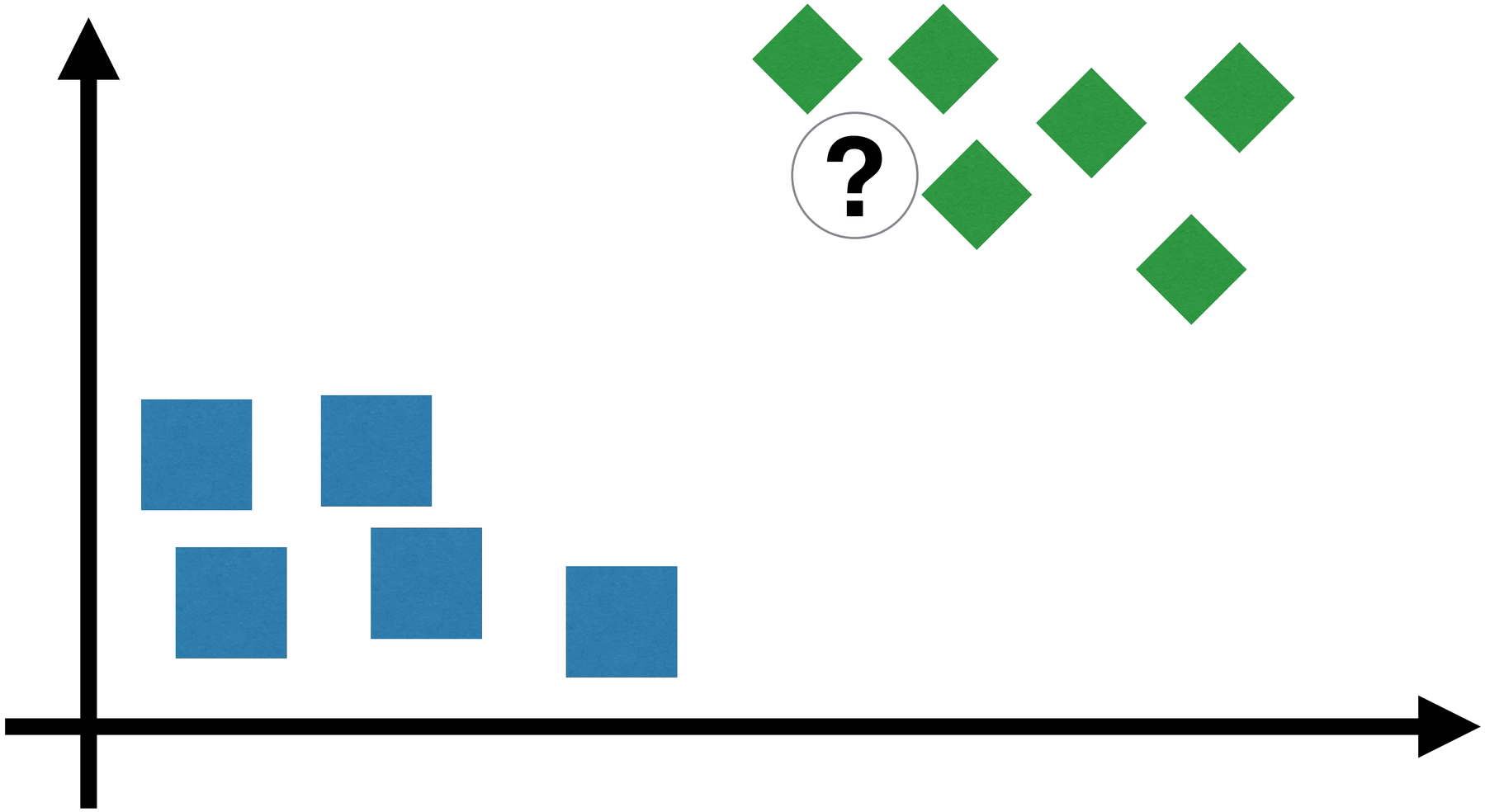
ML Classification

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

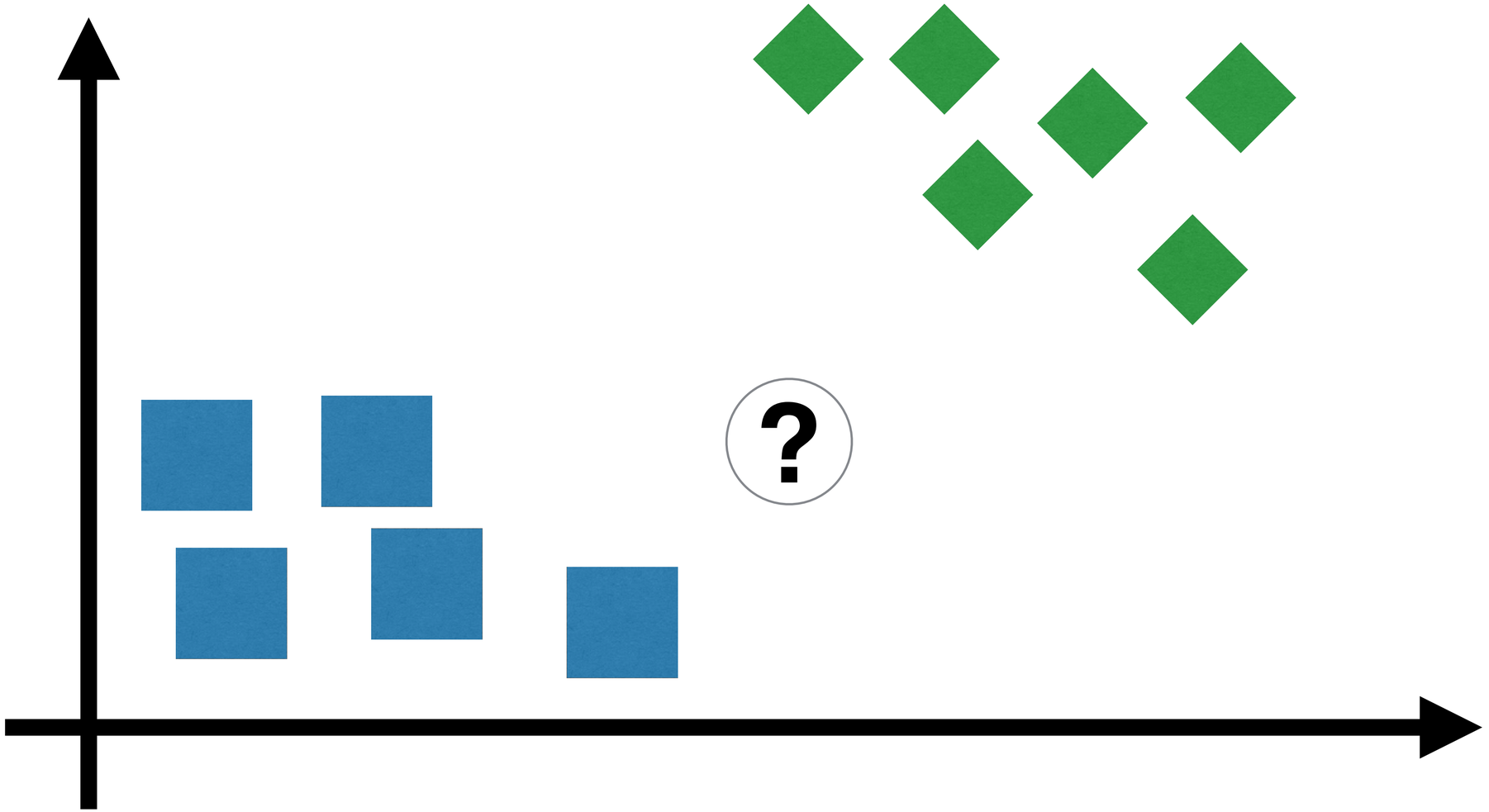
ML Classification



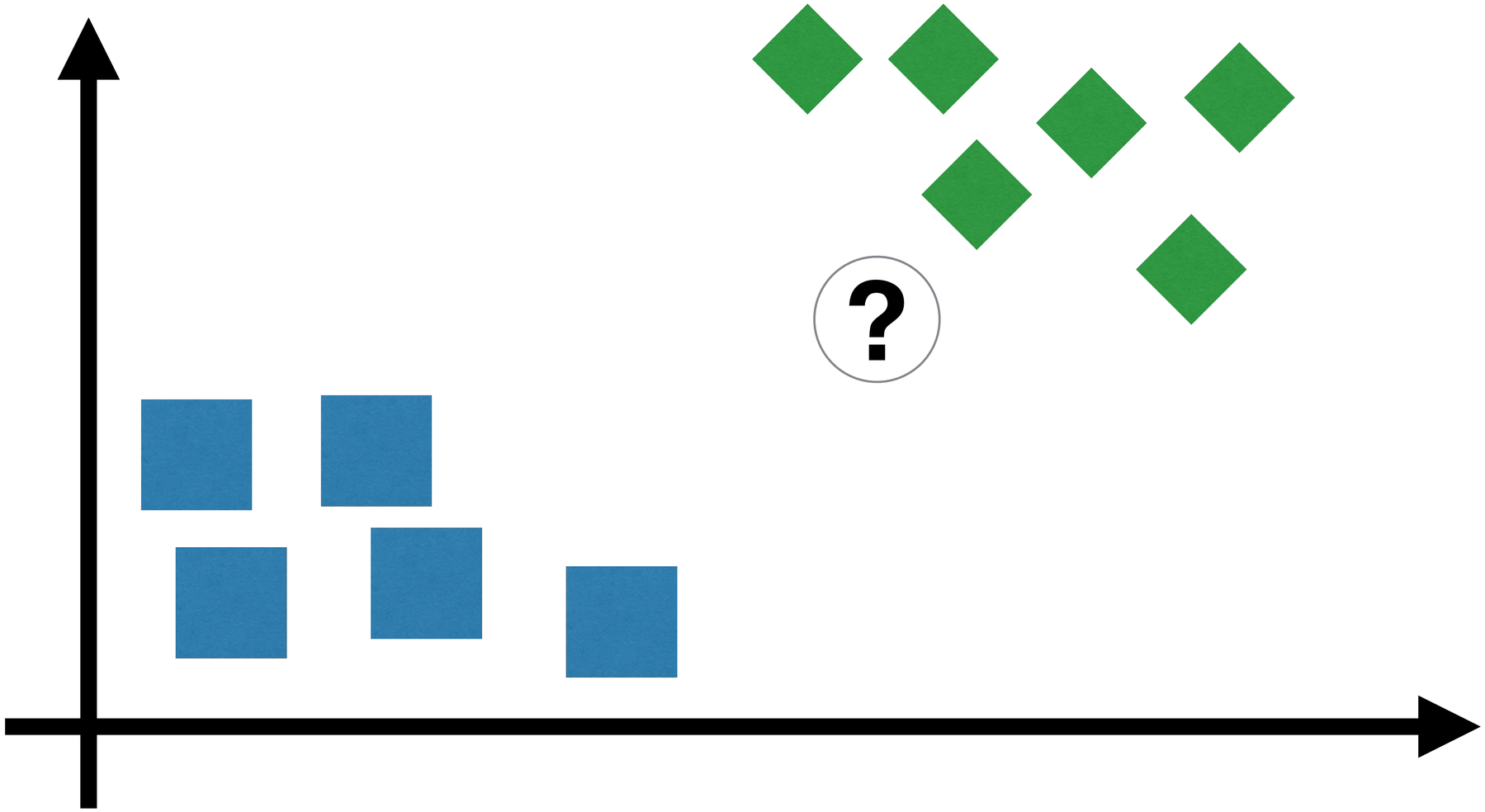
You be the classifier: 1 or 2?



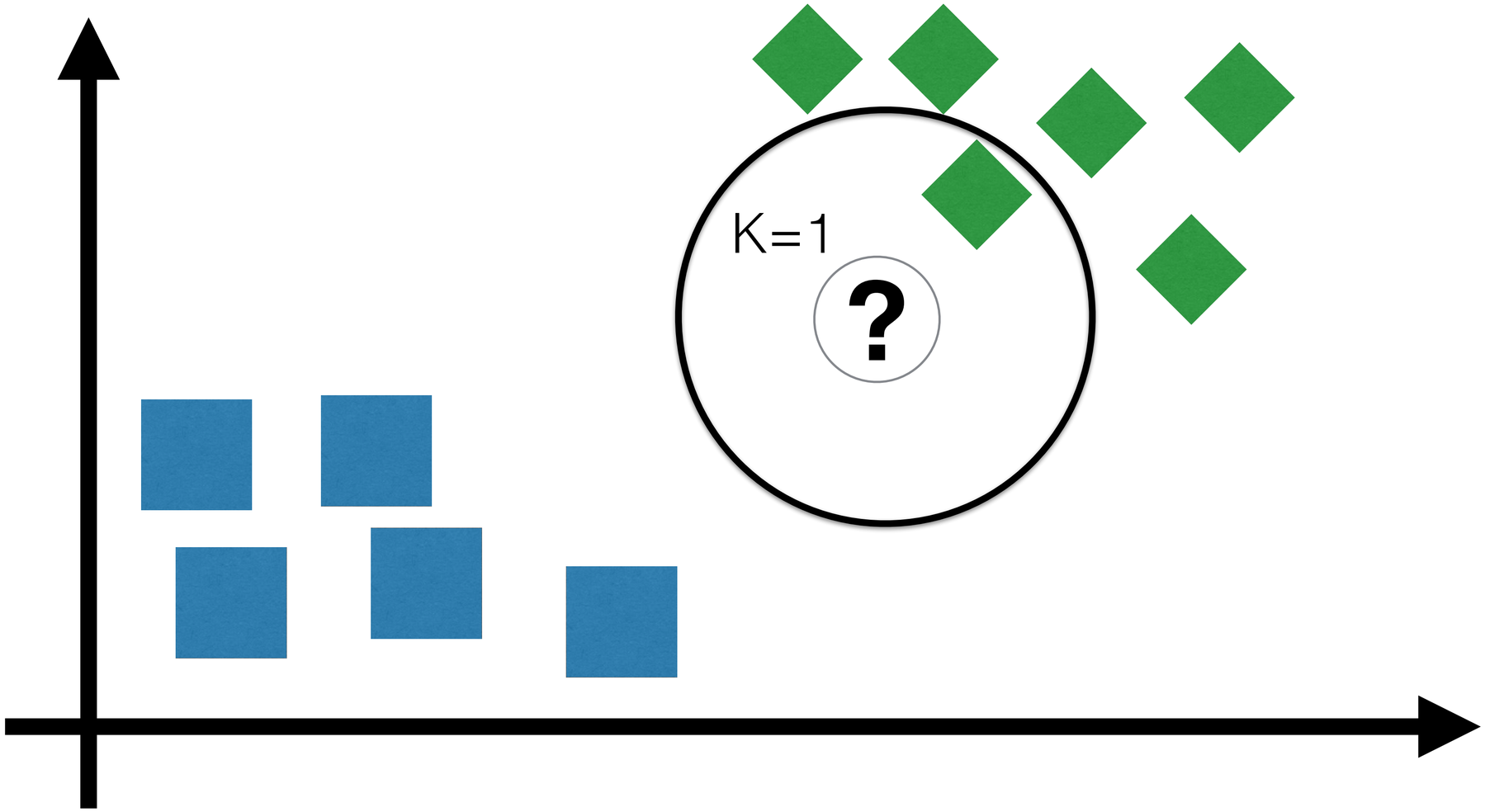
You be the classifier: 1 or 2?



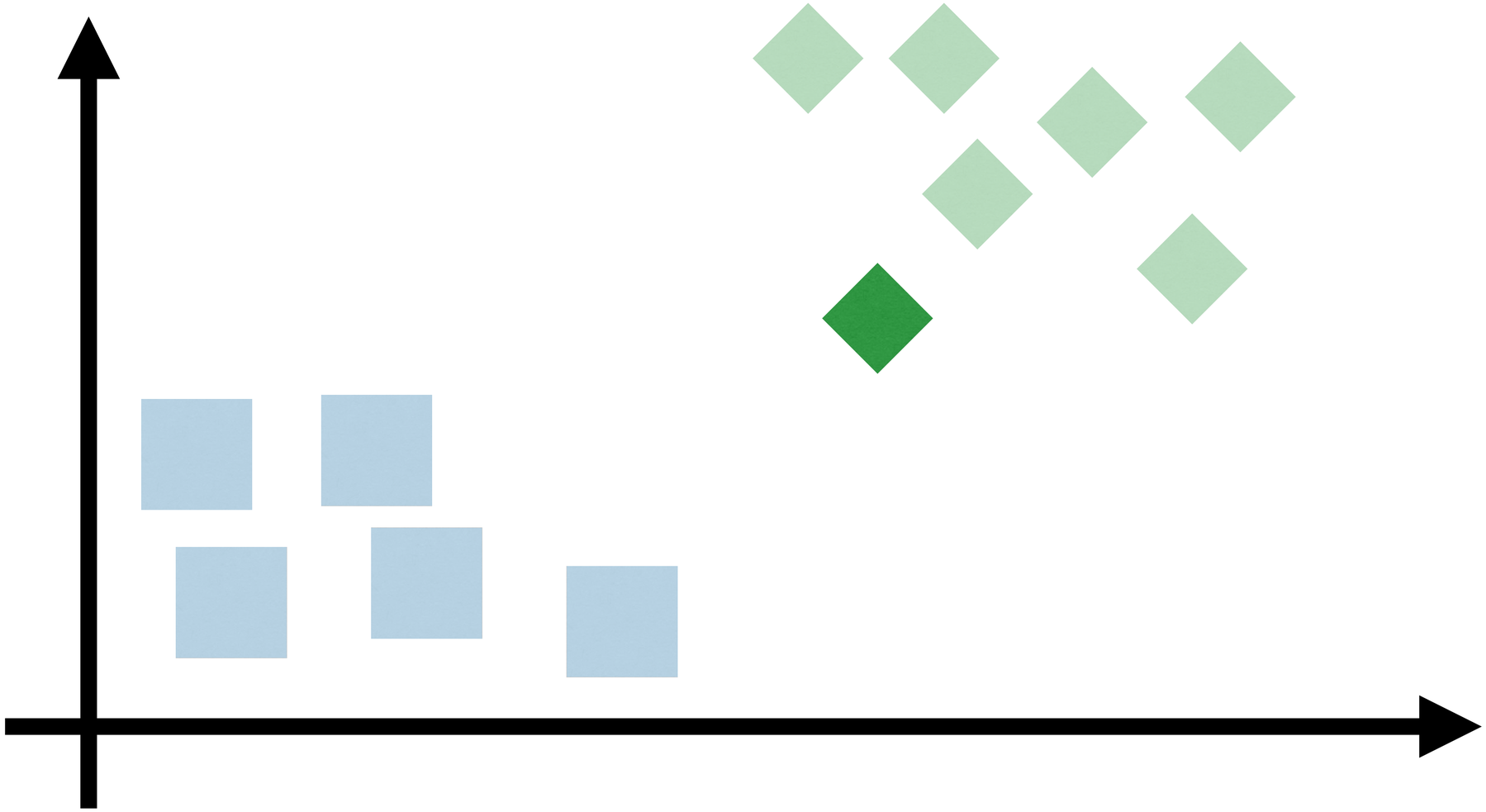
You be the classifier: 1 or 2?



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

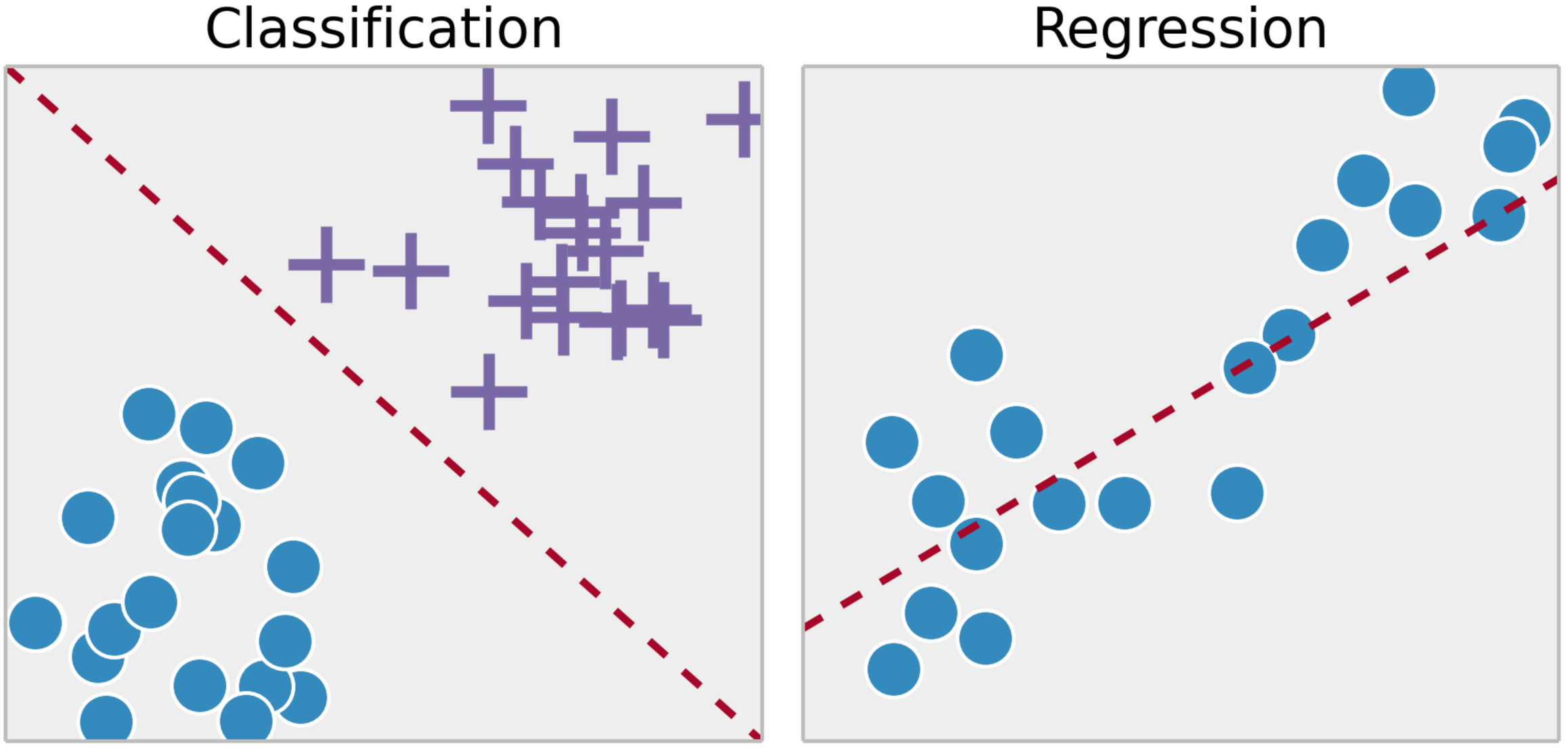
Use the techniques you have learned to build an interactive prototype.
Work in groups or individually. I am here to help!

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

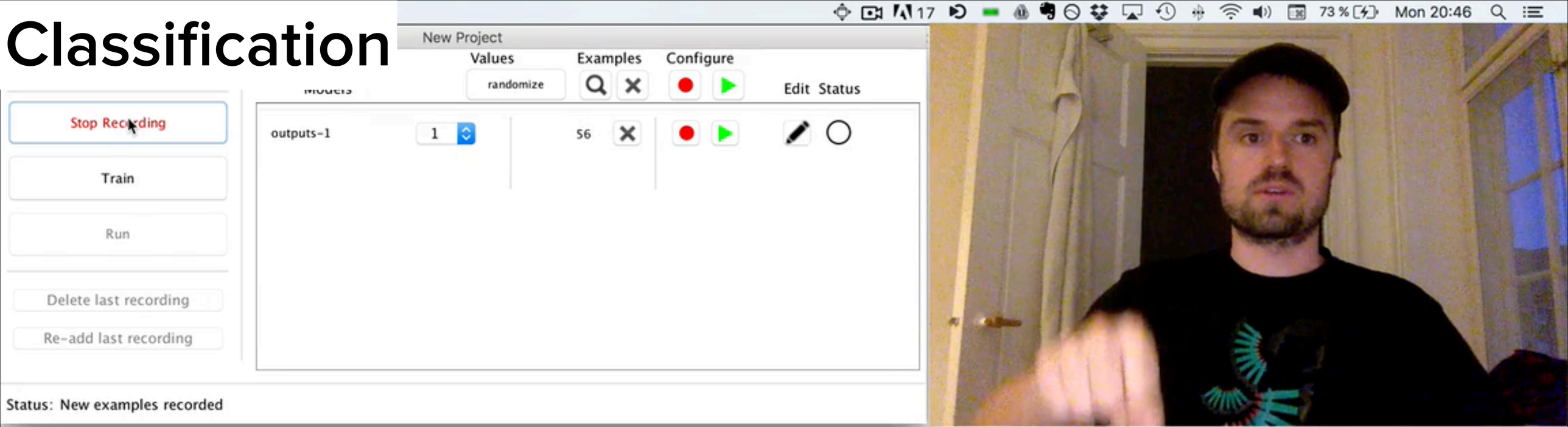
Inputs & outputs:
Build upon existing inputs and outputs or try to make your own!

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

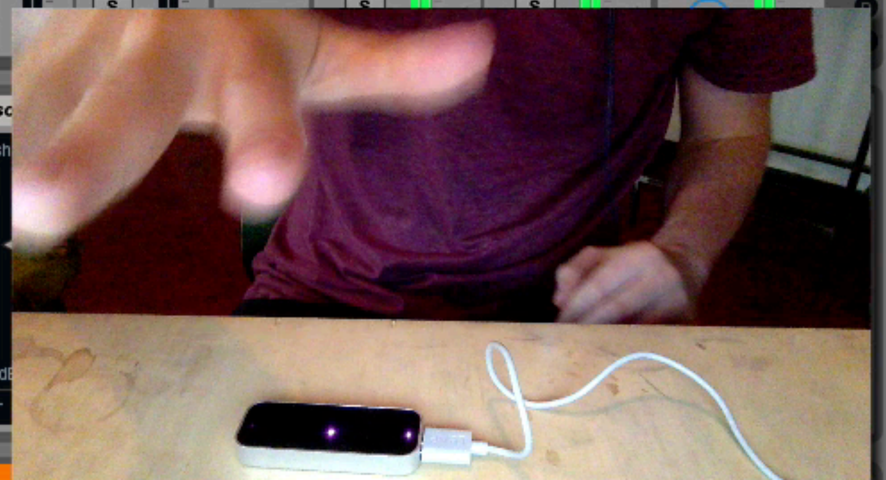


Regression

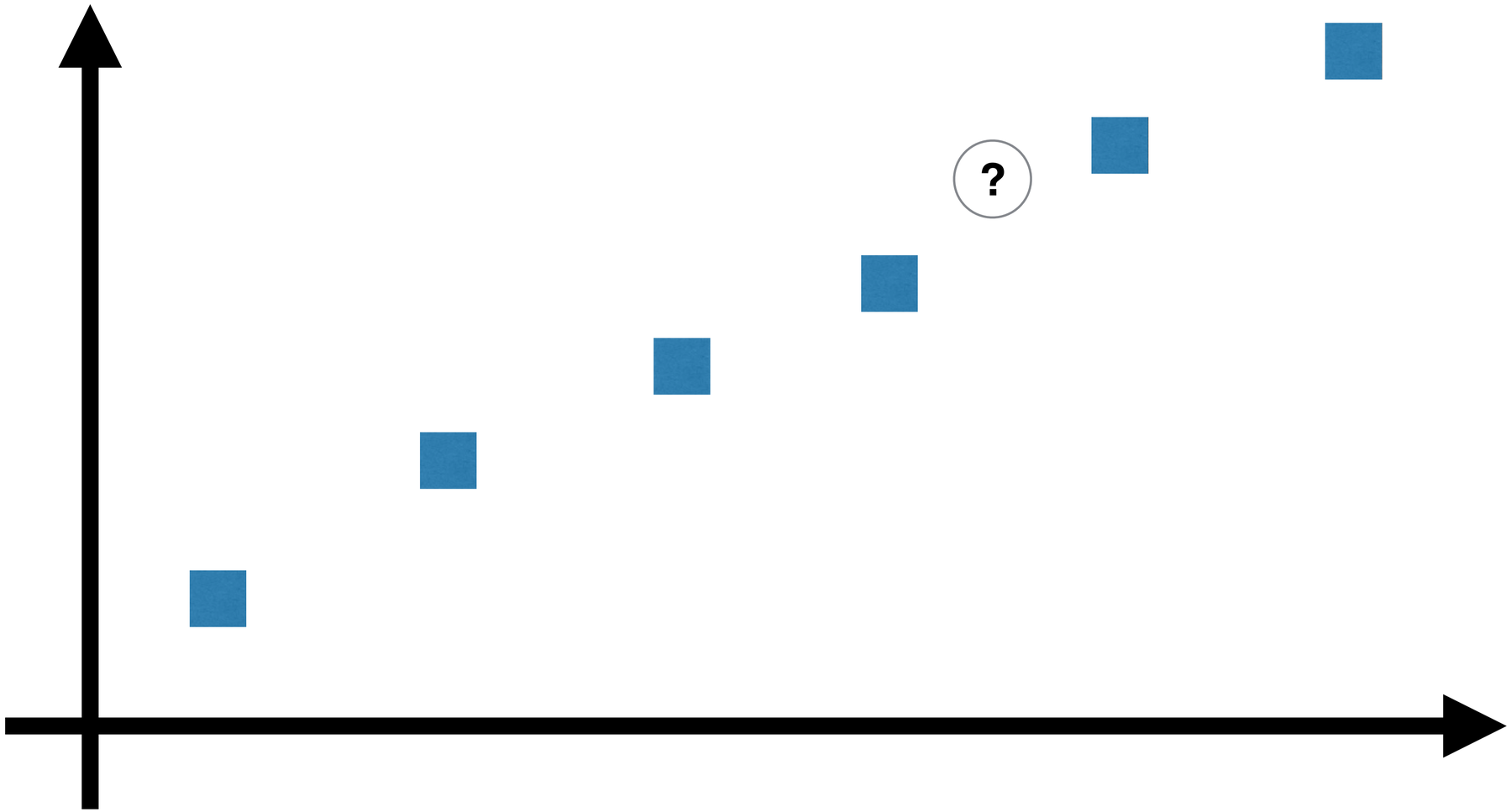
Models | randomize | Edit | Status

outputs-1 (v10)	1.00325	254	
outputs-2 (v10)	1	175	
outputs-3 (v10)	0.37497	175	

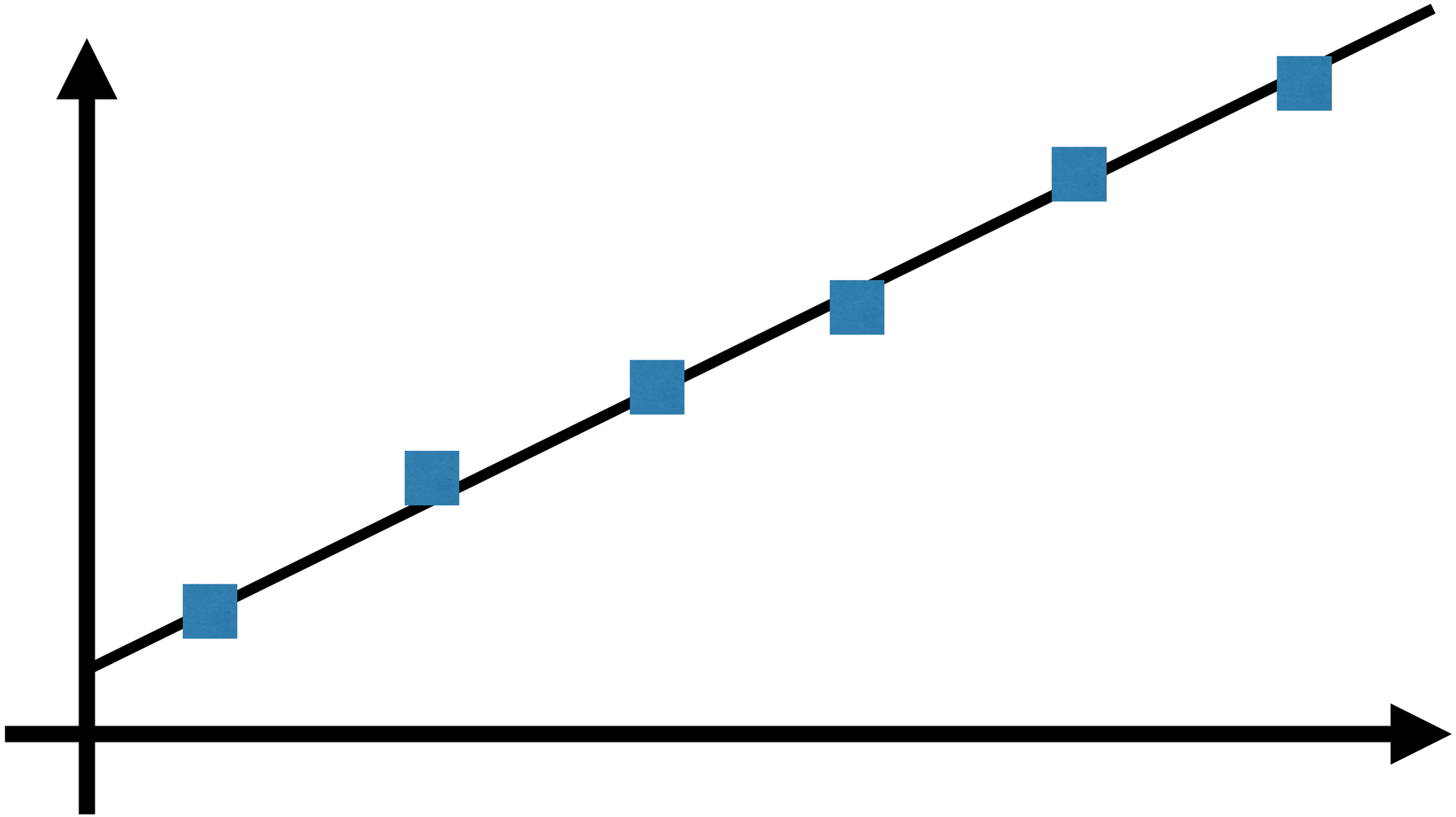
uts to arrive



ML Regression

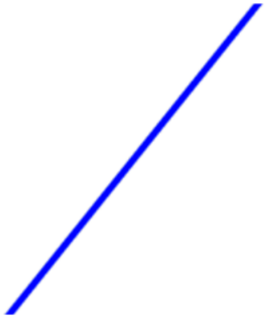


ML Regression



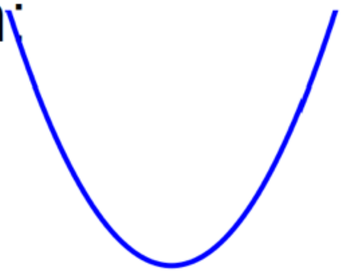
- Linear regression:

  $y = a \cdot x + b$



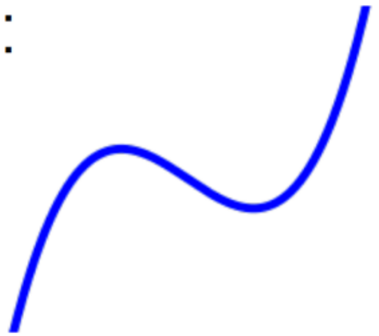
- 2^{nd}-order polynomial regression:

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



- 3^{rd}-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

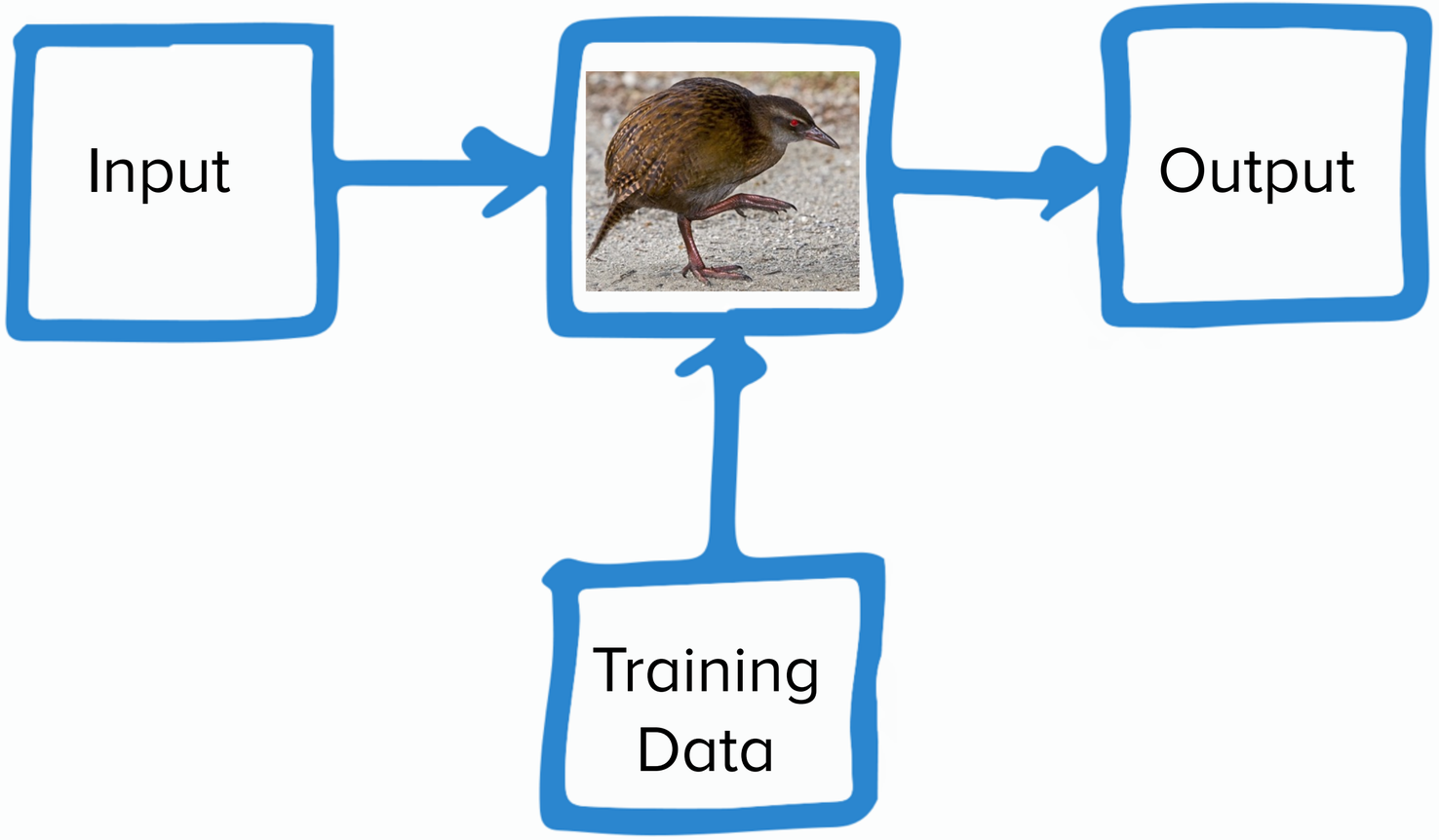
```
void sendOsc() {
  OscMessage msg = new OscMessage("/wek/inputs");
  msg.add((float)mouseX);
  msg.add((float)mouseY);
  oscP5.send(msg, dest);
}
```

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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Processing
Pure
Pure Data
QLab
Quartz Composer
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=QLHMtE5XsMs#t=16m30s

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

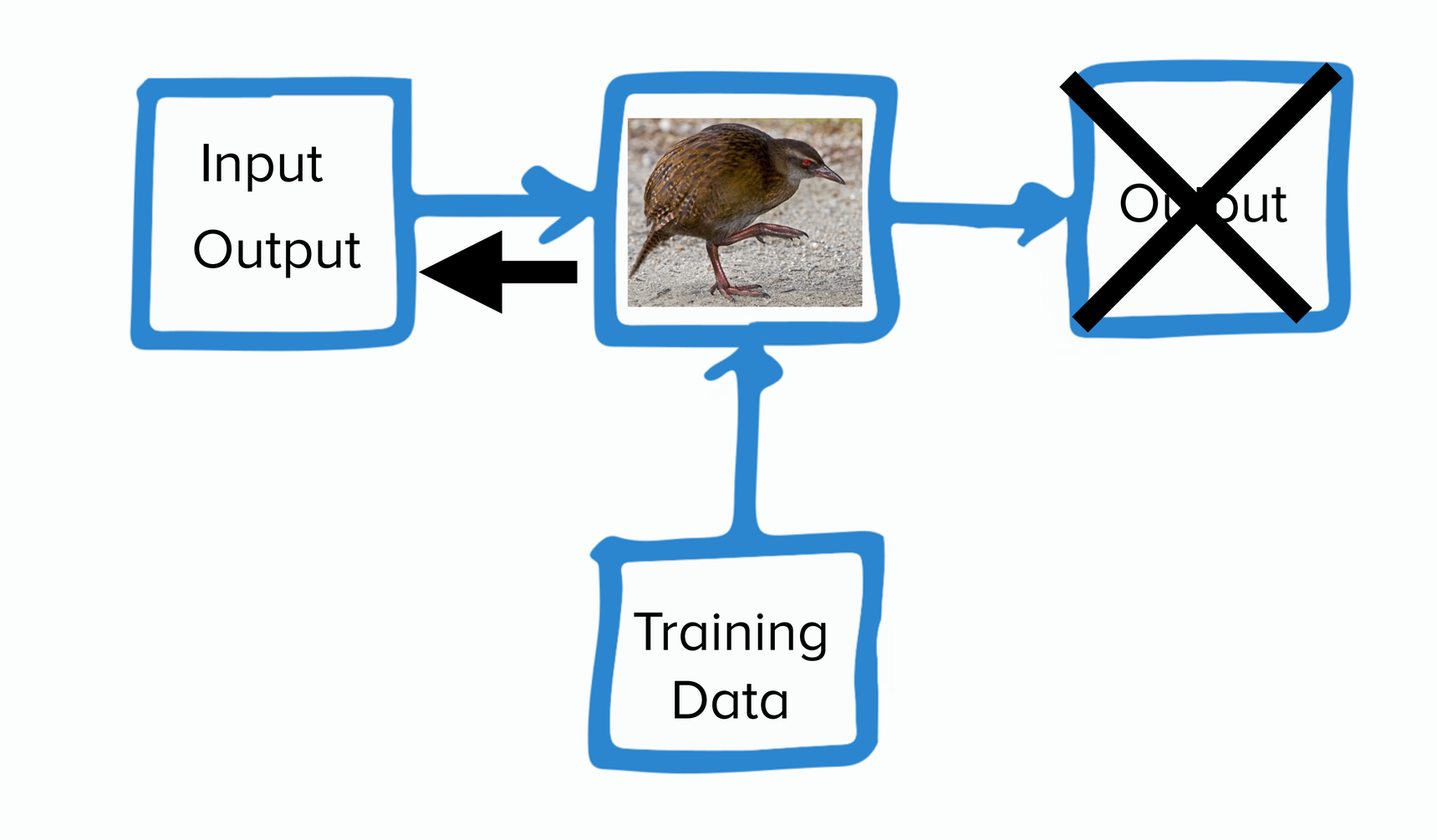
What to add?

```
//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);
}
```

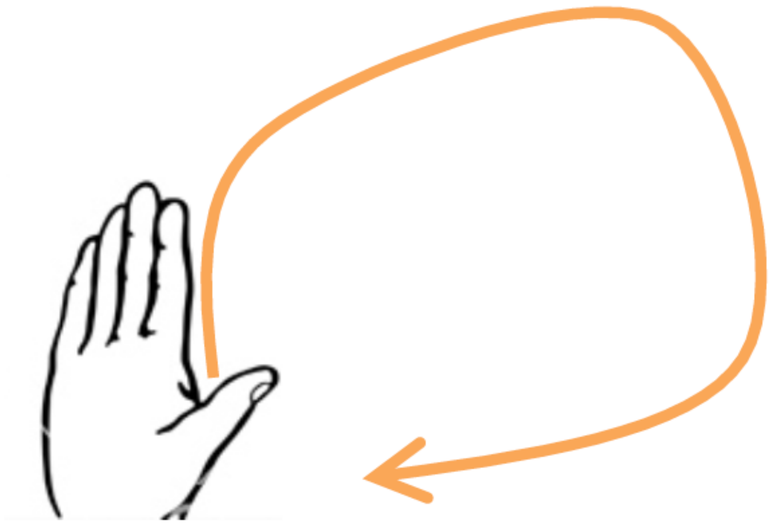
How do we make our own output?

```
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?



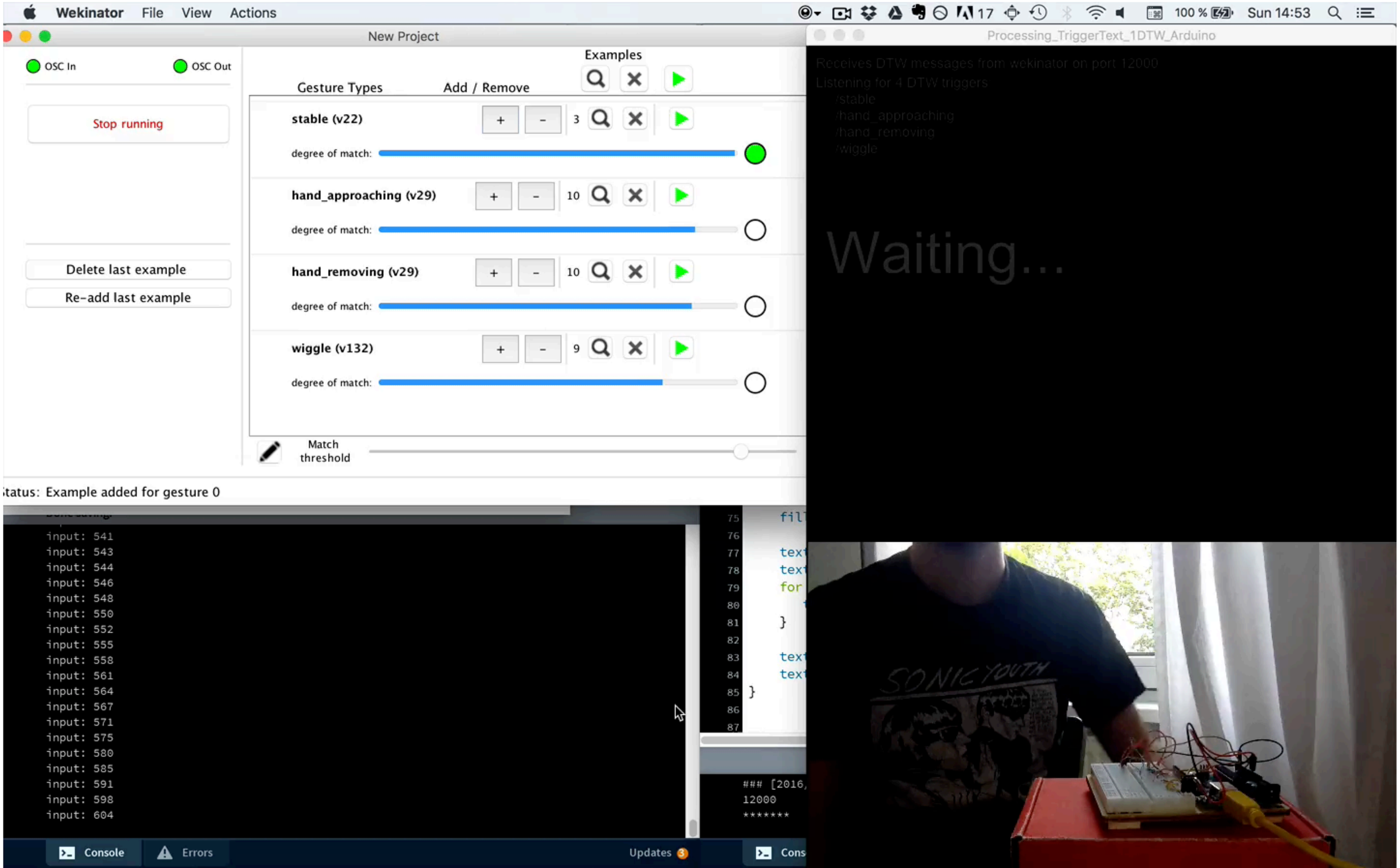
Dynamic Time Warping



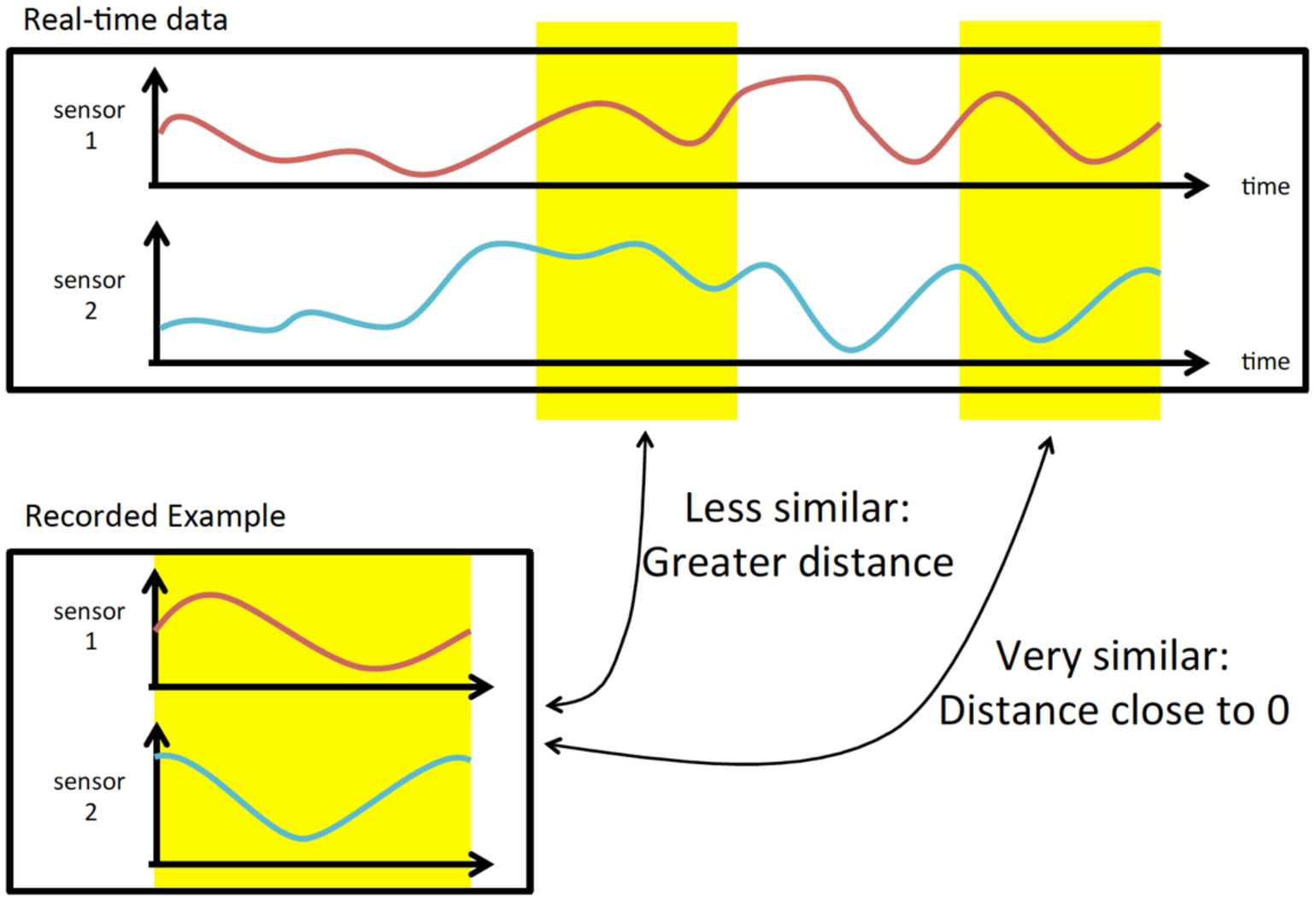
"Gesture A"

"Gesture B"

Slide by Rebeca Fiebrink

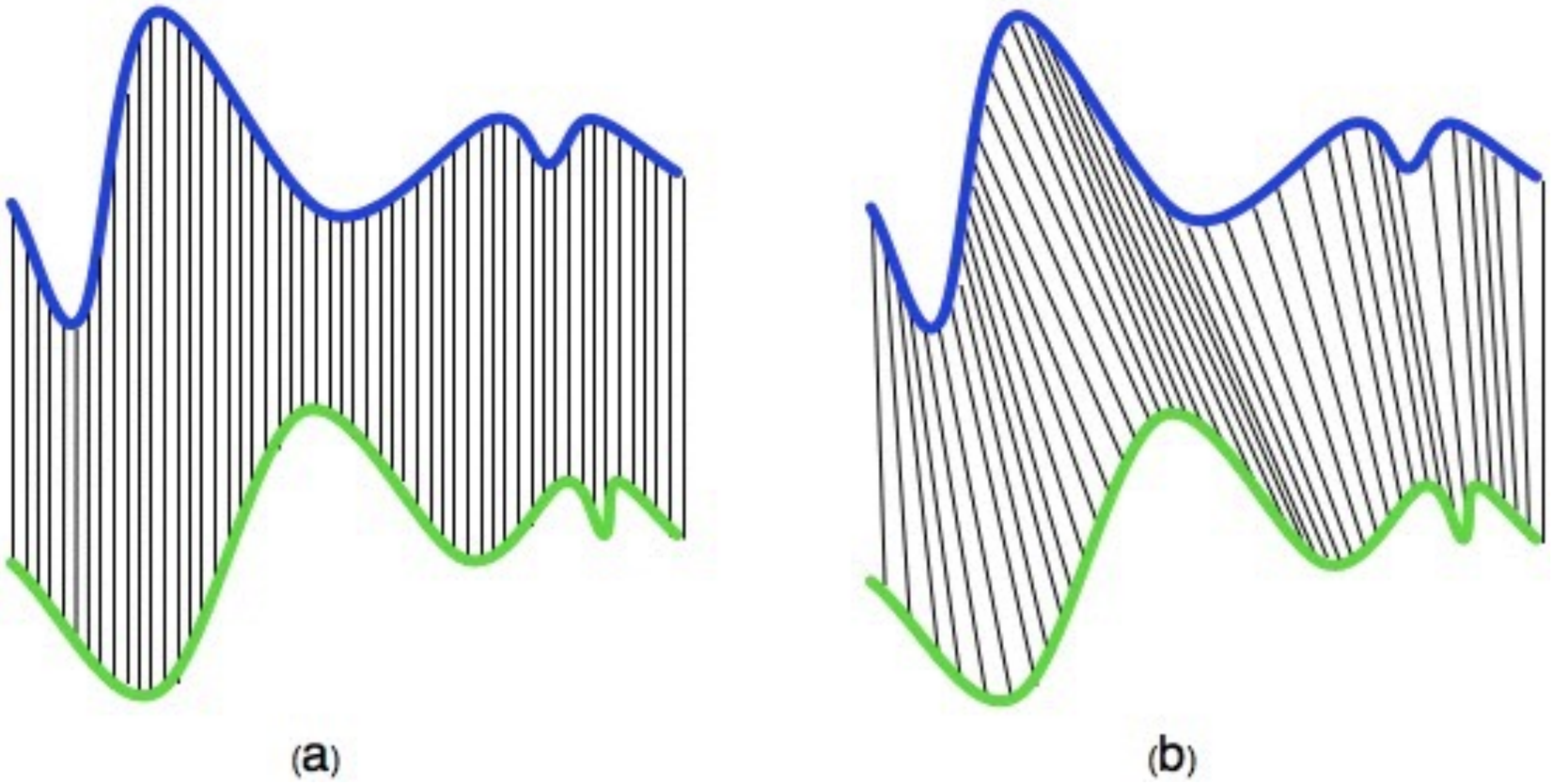

Wekinator File View Actions
New Project
OSC In
OSC Out
Stop running
Delete last example
Re-add last example
Examples
Gesture Types
Add / Remove
stable (v22)
3
degree of match:
hand_approaching (v29)
10
degree of match:
hand_removing (v29)
10
degree of match:
wiggle (v132)
9
degree of match:
Match threshold
Status: Example added for gesture 0
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
Console
Errors
Updates
Processing_TriggerText_1DTW_Arduino
Receives DTW messages from wekinator on port 12000
Listening for 4 DTW triggers
/stable
/hand_approaching
/hand_removing
/wiggle
Waiting...
SONIC YOUTH

Dynamic Time Warping



Slide by Rebeca Fiebrink

Dynamic Time Warping



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!

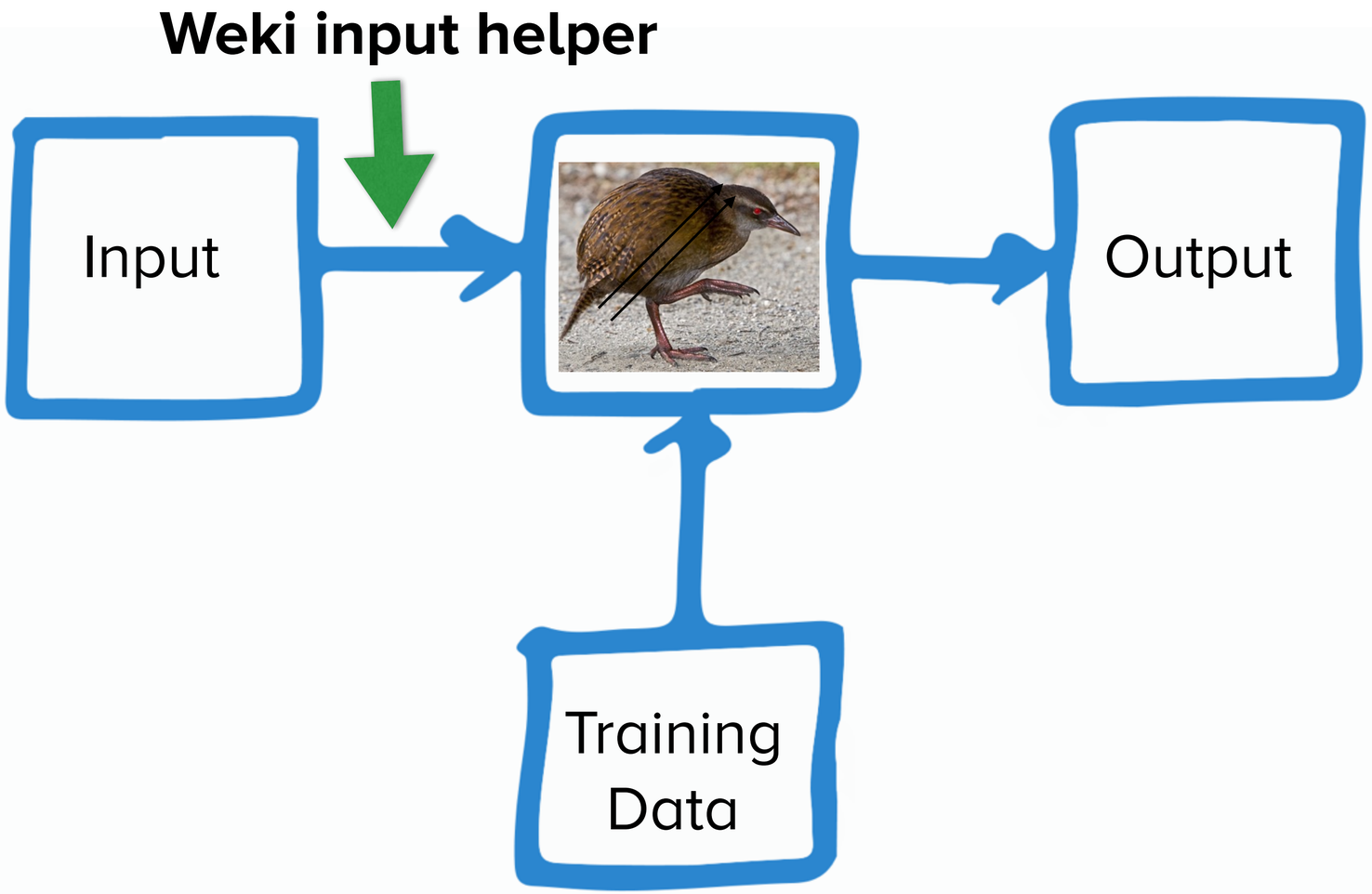
Lightning talks at 5:30

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

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

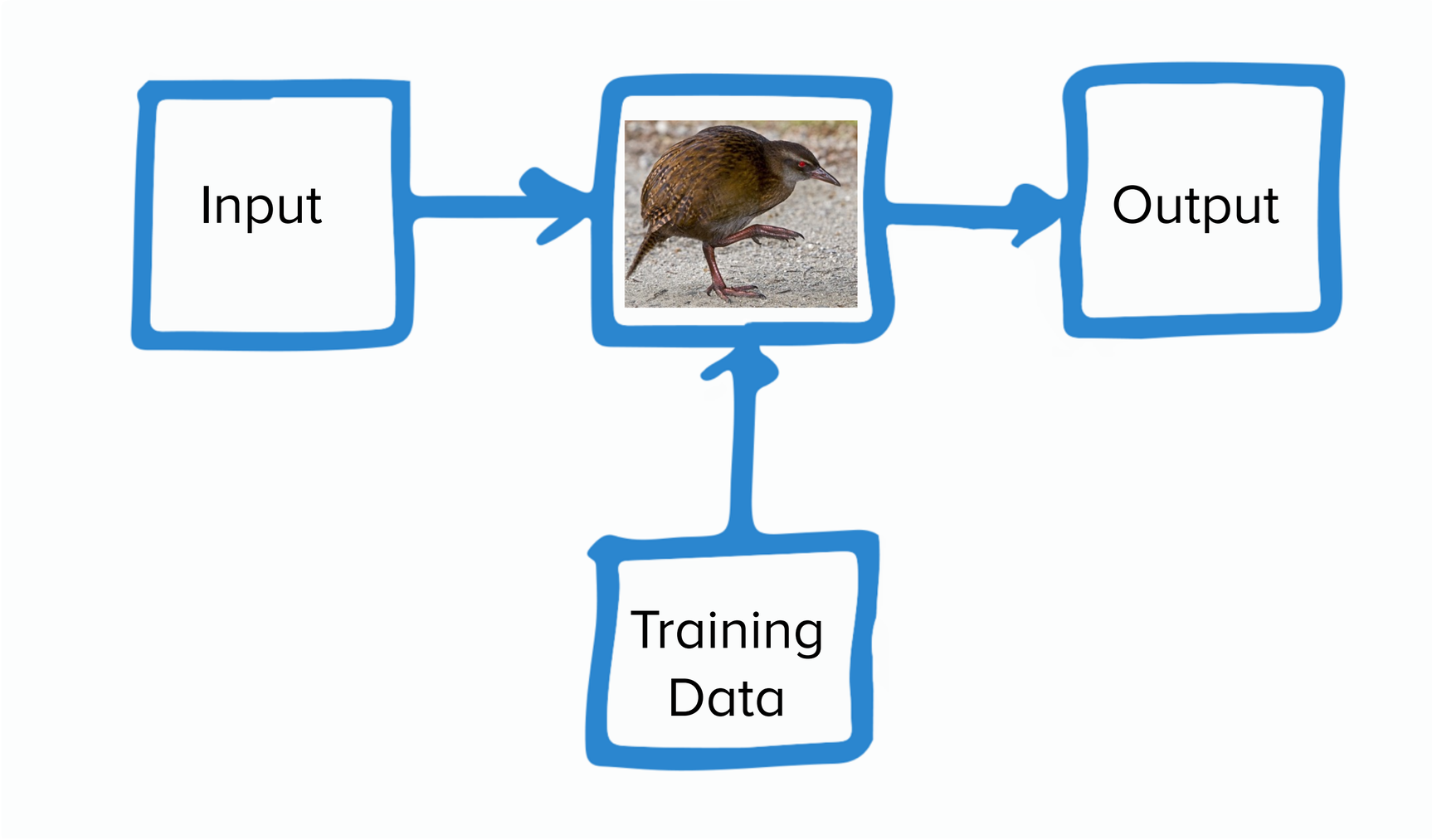
Sound controlled
Wolfenstein

Lets try it out!

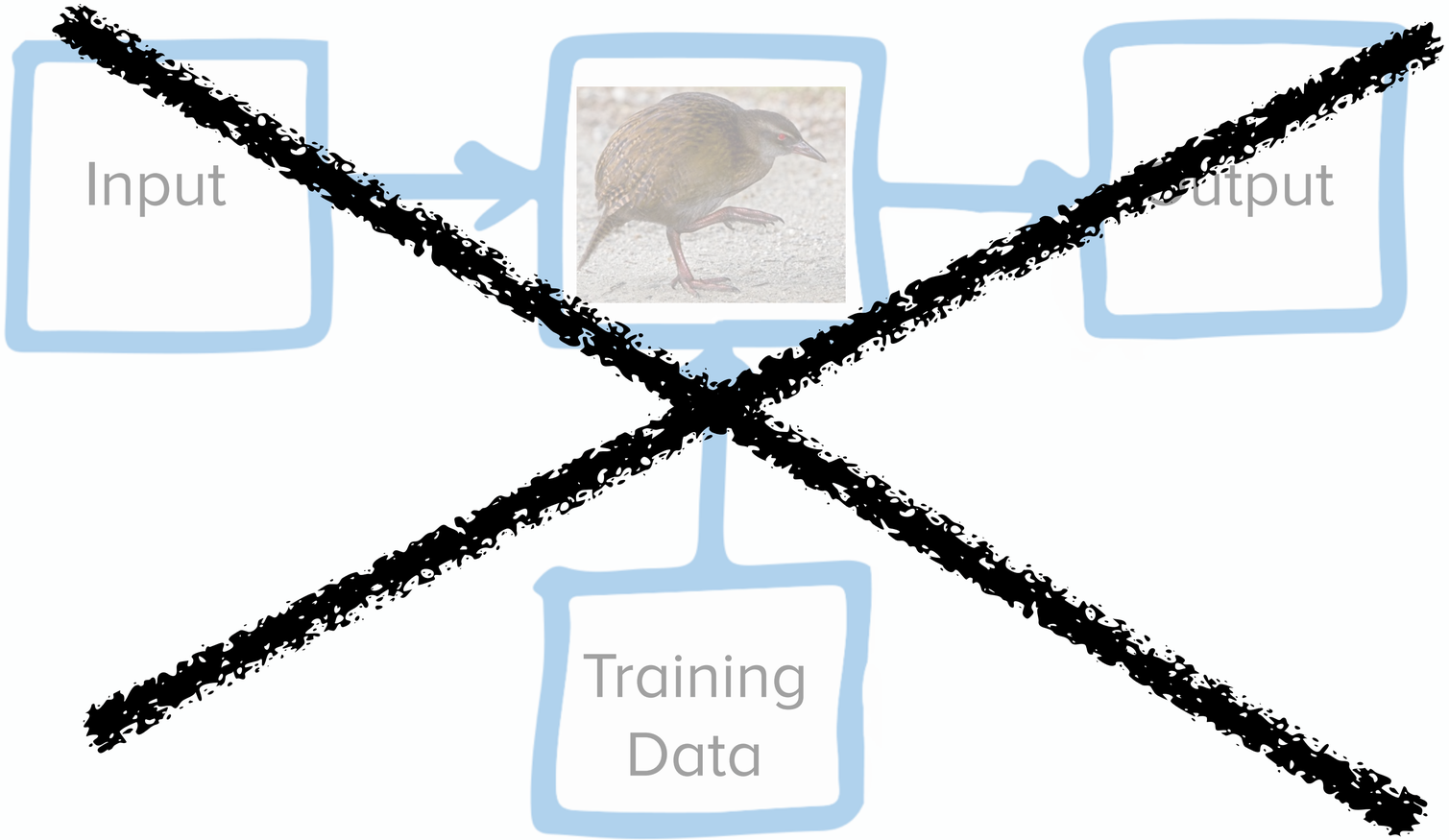
Input: Simplest_MouseXY_2Inputs

Weki input helper (port 6448 - 2 inputs)

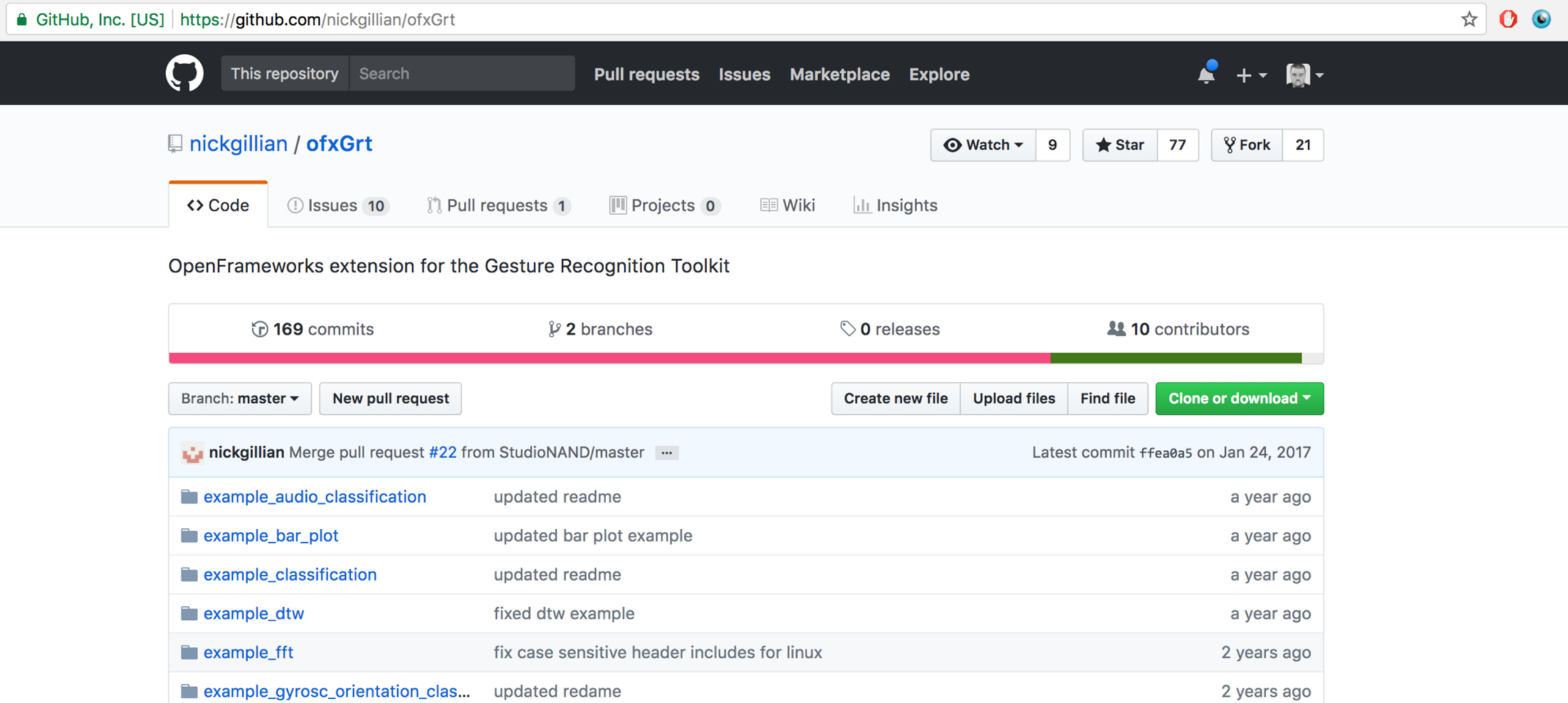
Wekinator (port 6449, classification, 1 input, 1 output, 2 classes)


Input
Output
Training
Data

Single app bundle with ofxGrt



Single app bundle with ofxGrt



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 your 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