

Week 1 website

andreasref.github.io/som/

Types of machine learning

Supervised Learning

Unsupervised Learning

Reinforcement Learning

Types of machine learning

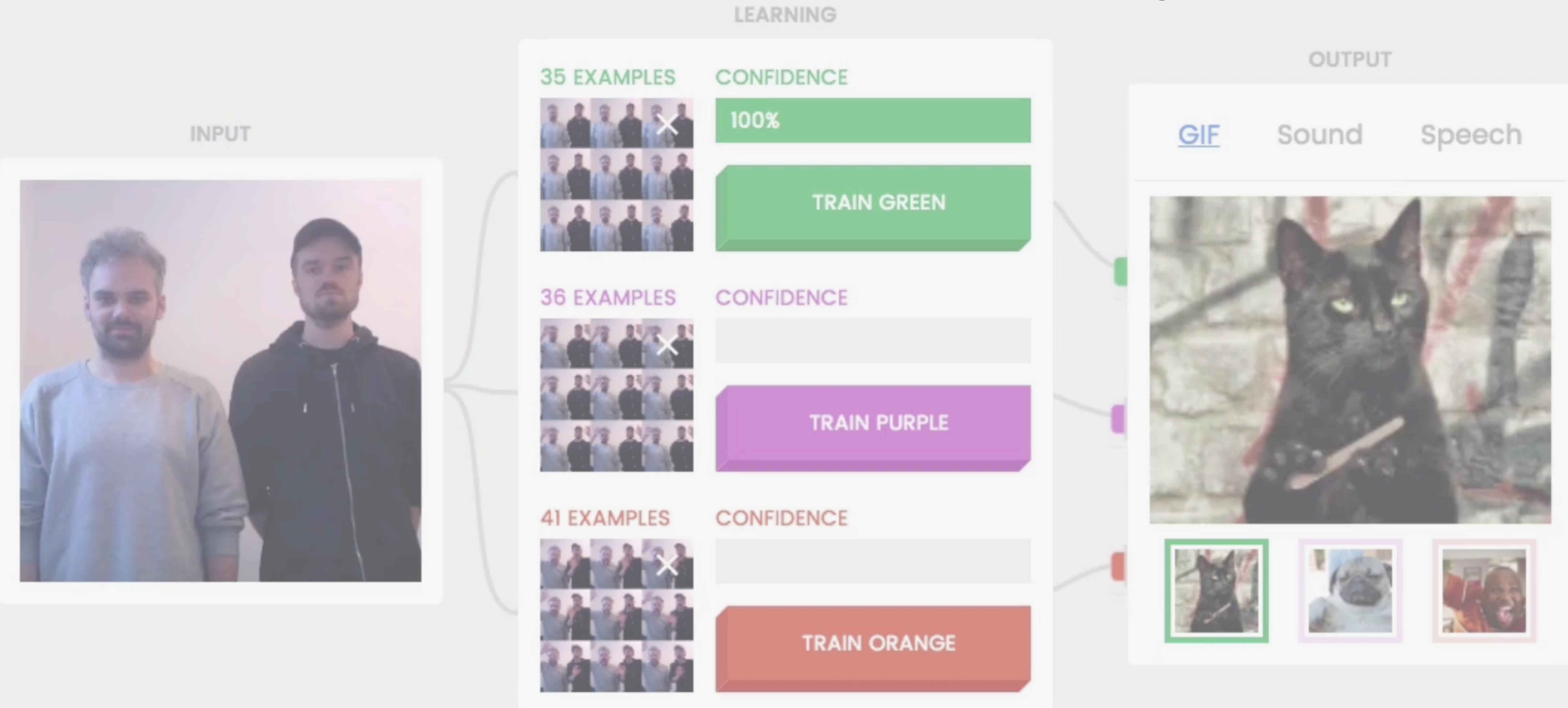


Supervised Learning

Unsupervised Learning

Reinforcement Learning

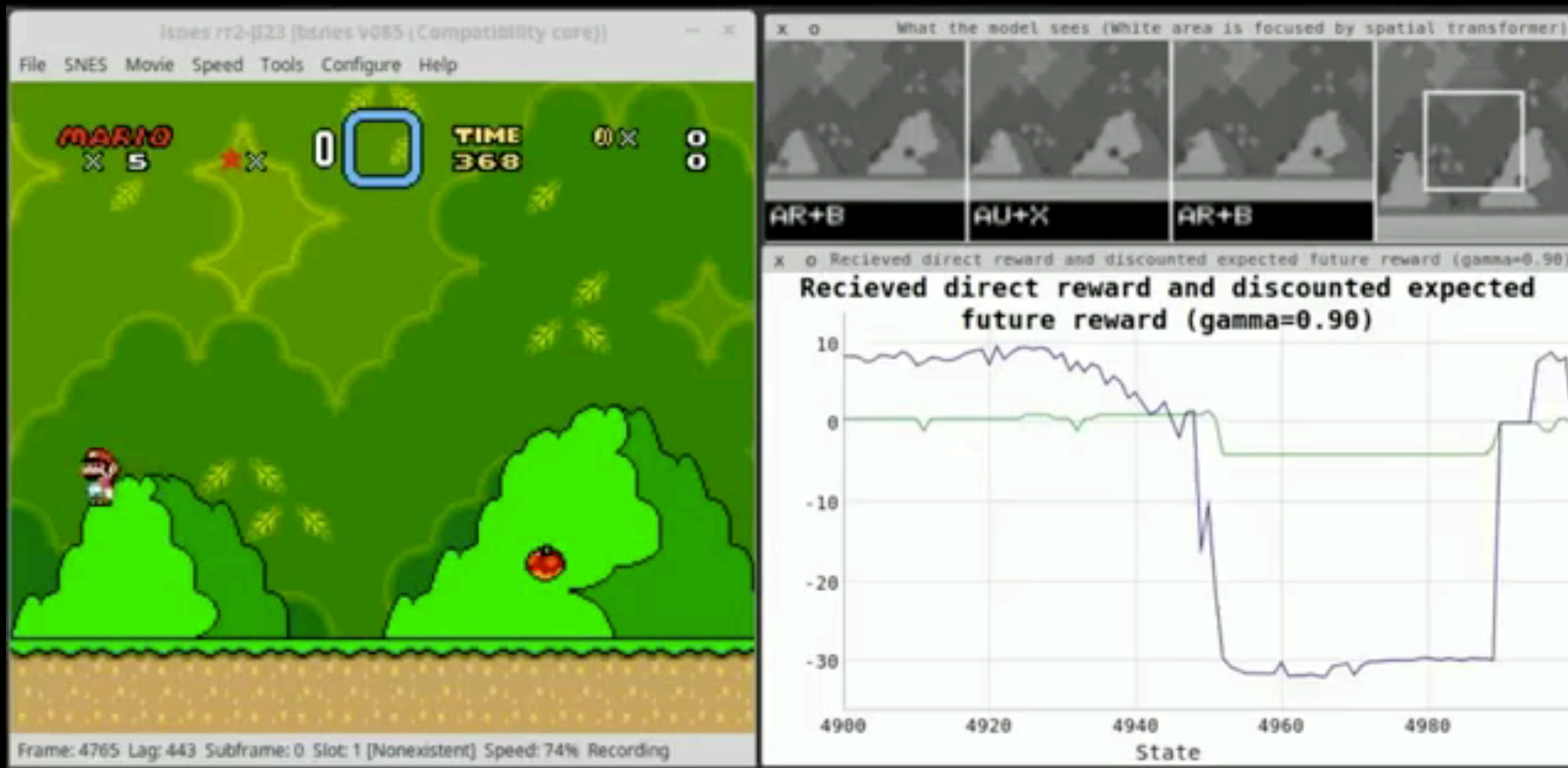
Supervised Learning



Unsupervised Learning



Reinforcement Learning



Types of machine learning

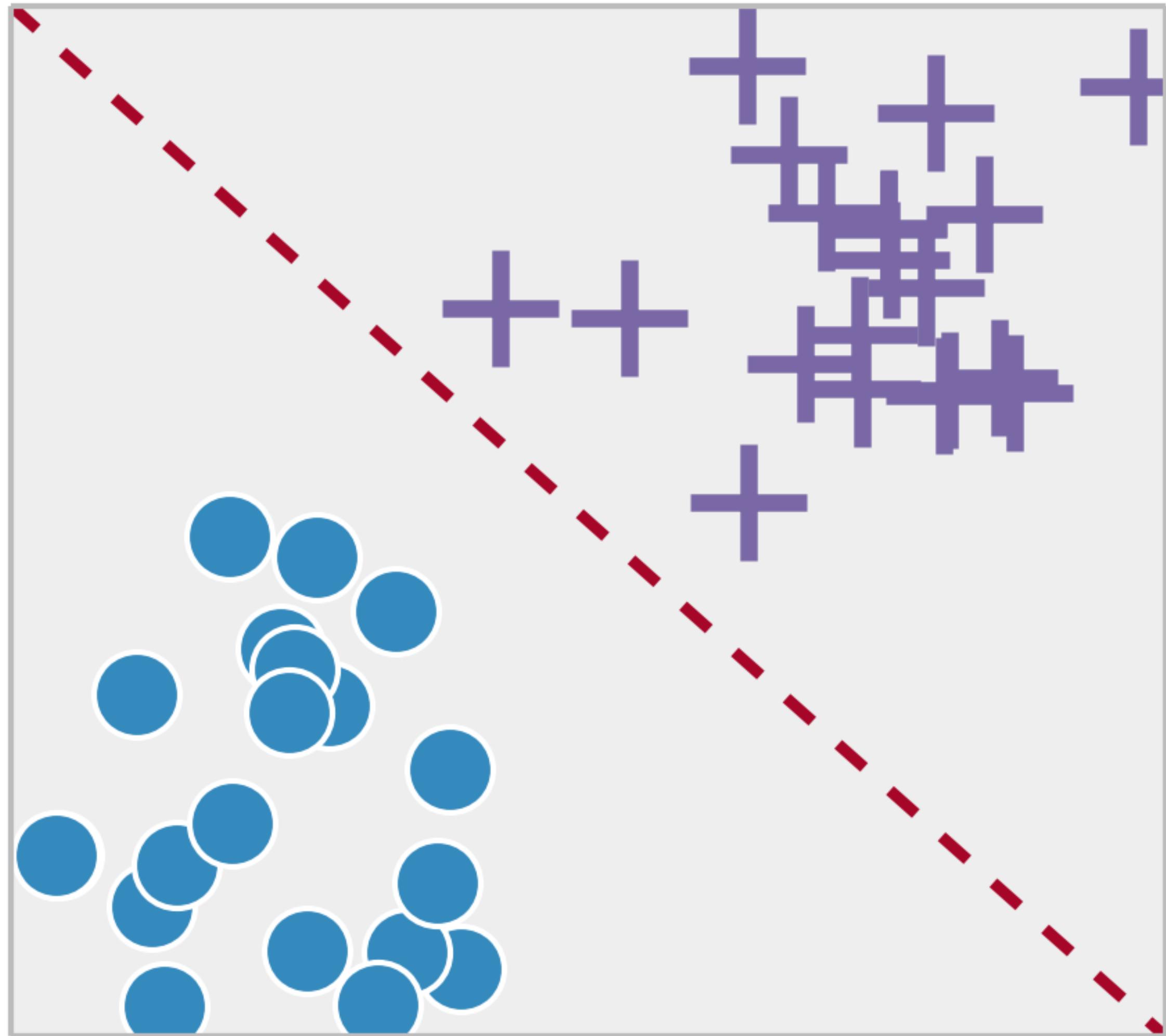


Supervised Learning

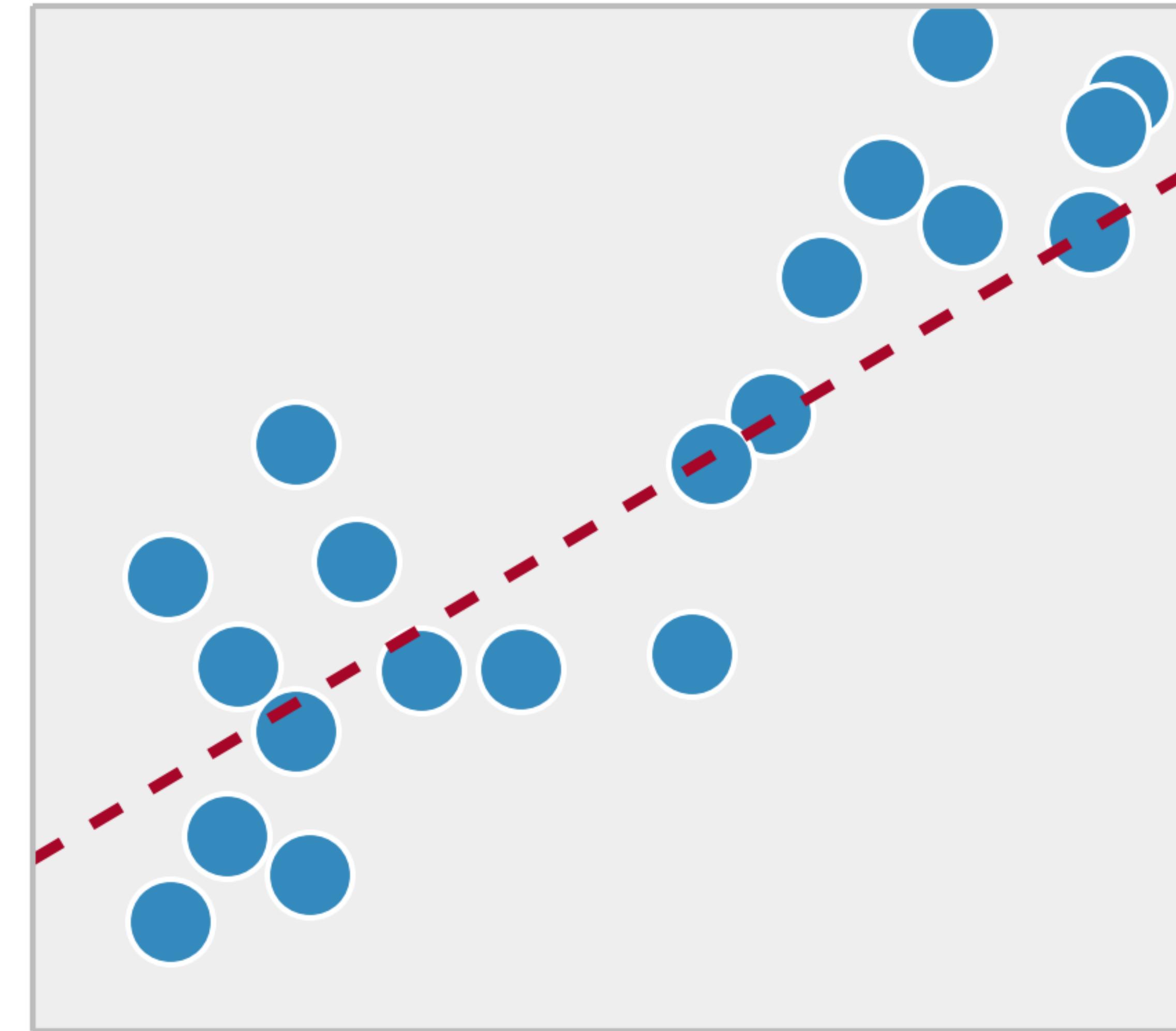
Unsupervised Learning

Reinforcement Learning

Classification



Regression



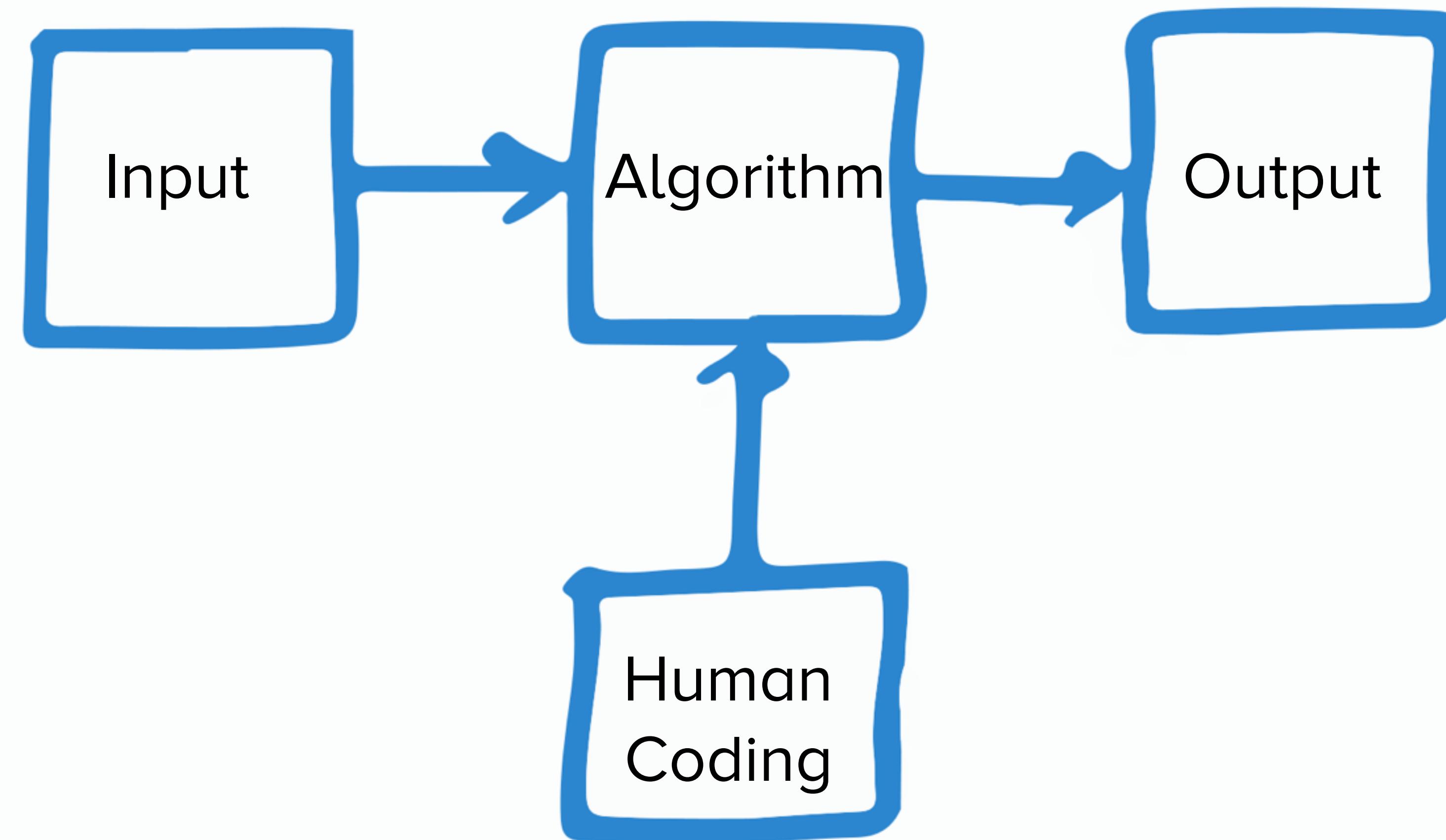
ml4a book (in progress)

by Gene Kogan

Machine Learning 101 slides

by Jason Mayes

Standard programming

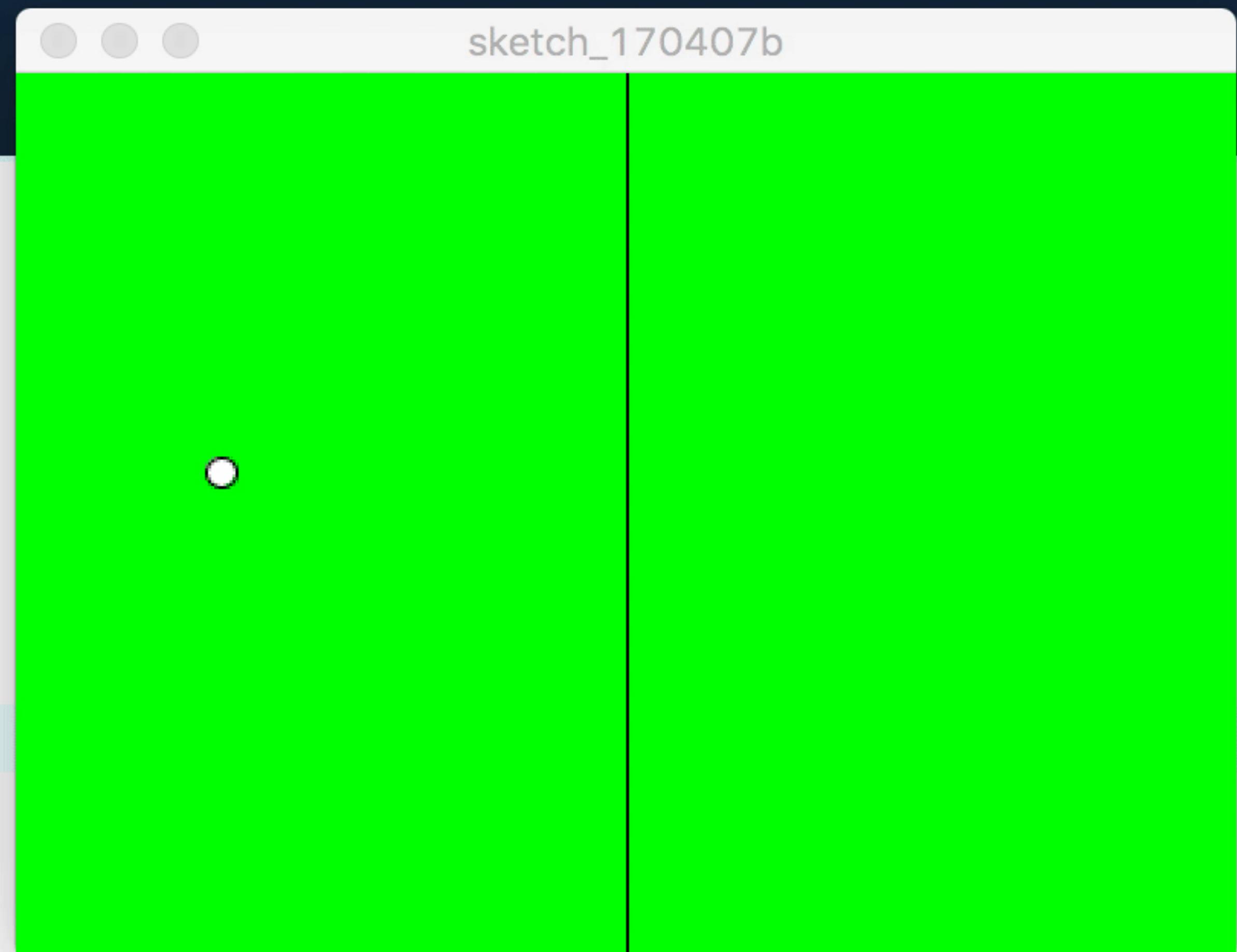




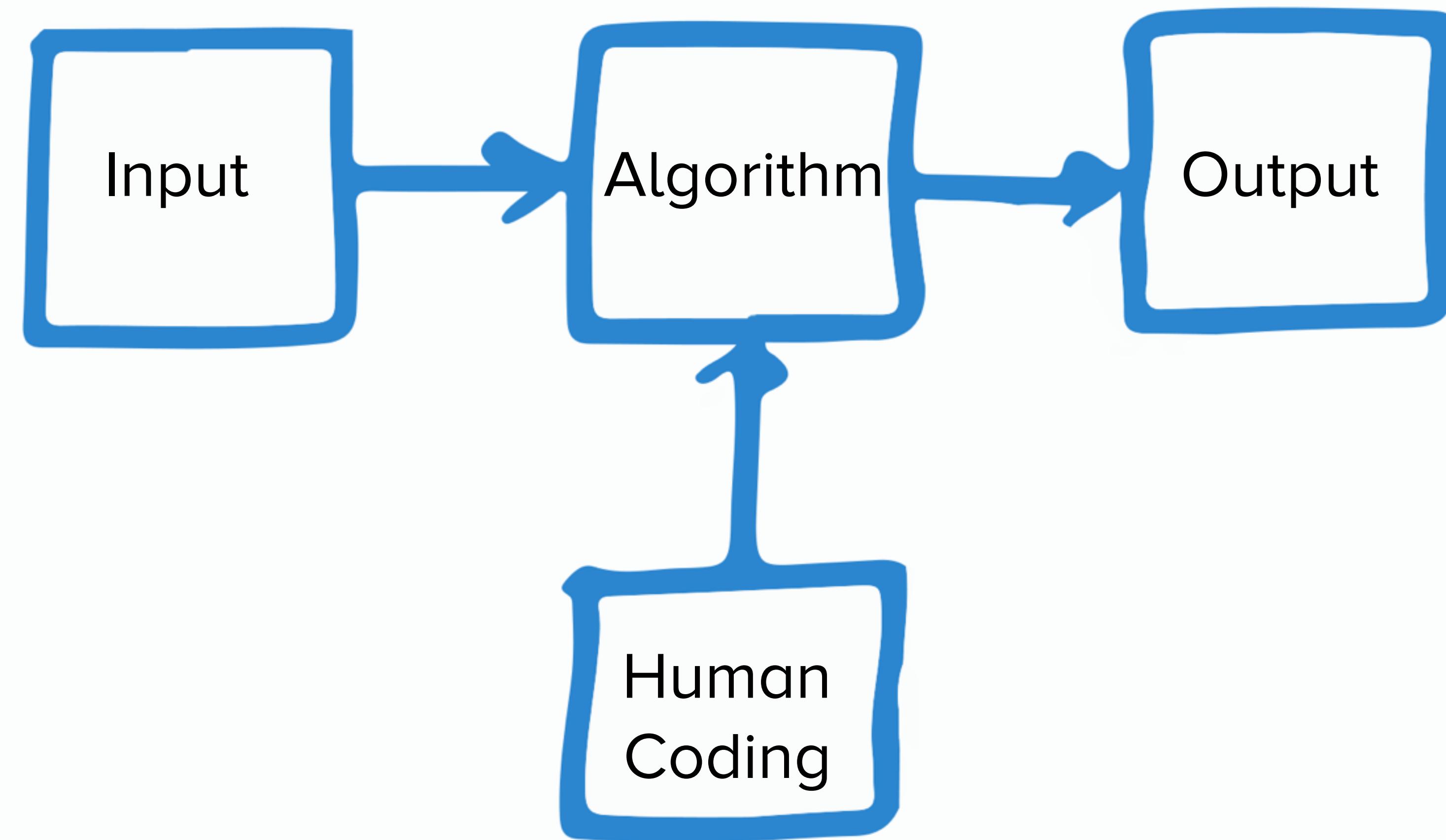
sketch_170407b

sketch_170407b

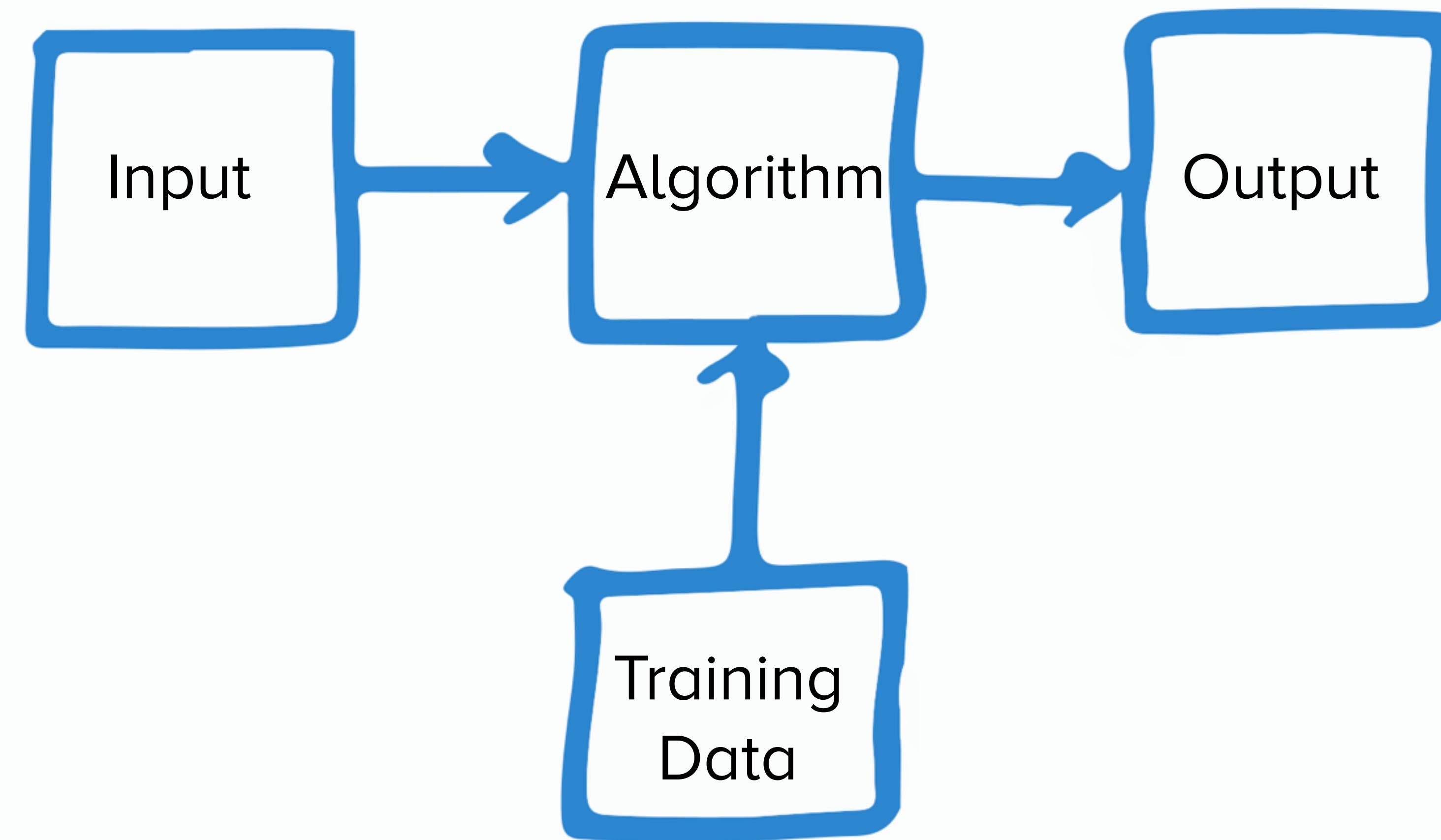
```
1 void setup() {  
2     size(400,300);  
3 }  
4  
5 void draw() {  
6     if (mouseX > width/2) {  
7         background(255,0,0);  
8     } else {  
9         background(0,255,0);  
10    }  
11  
12    ellipse(mouseX,mouseY, 10,10);  
13    line(width/2,0,width/2, height);  
14 }
```



Standard programming



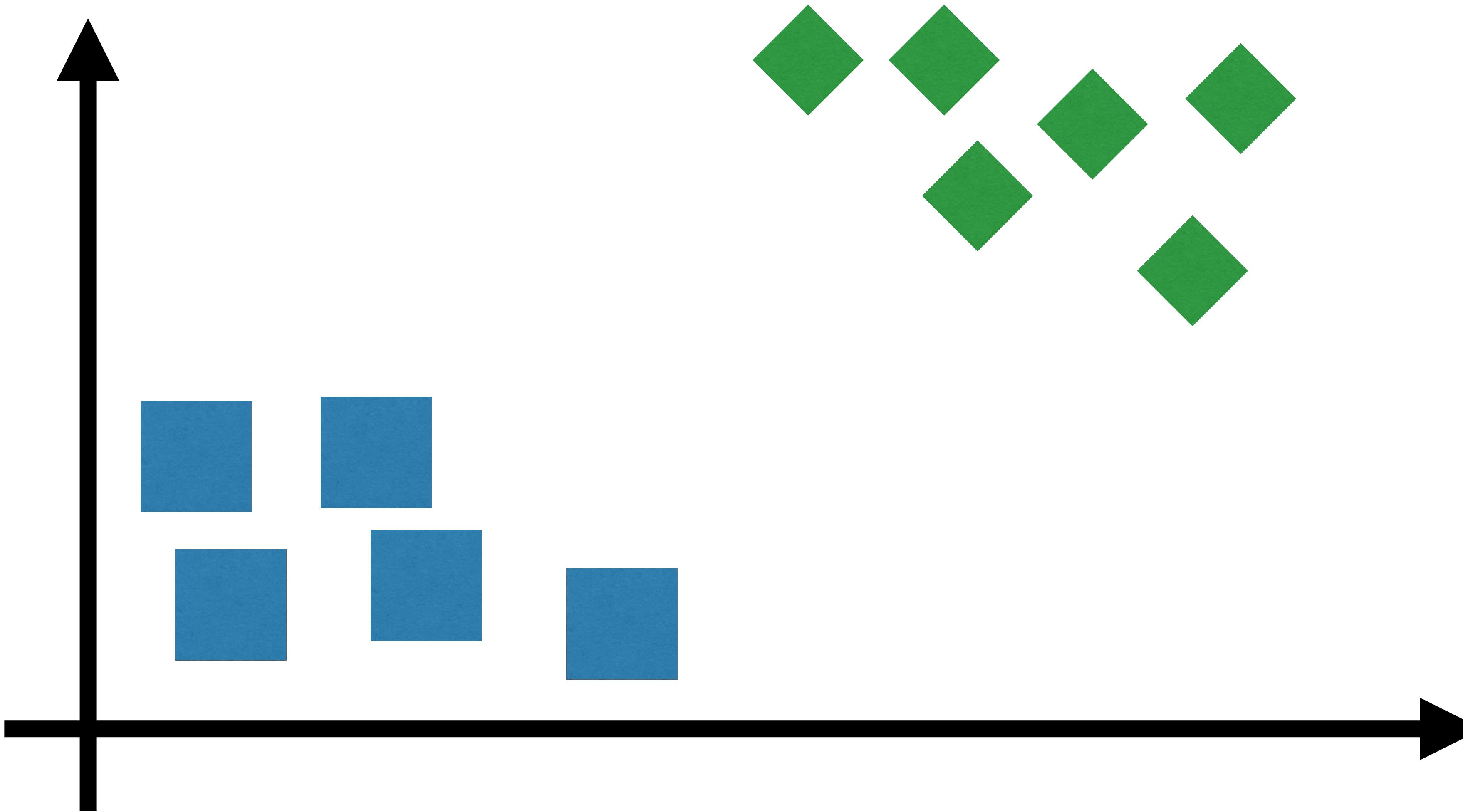
Machine Learning



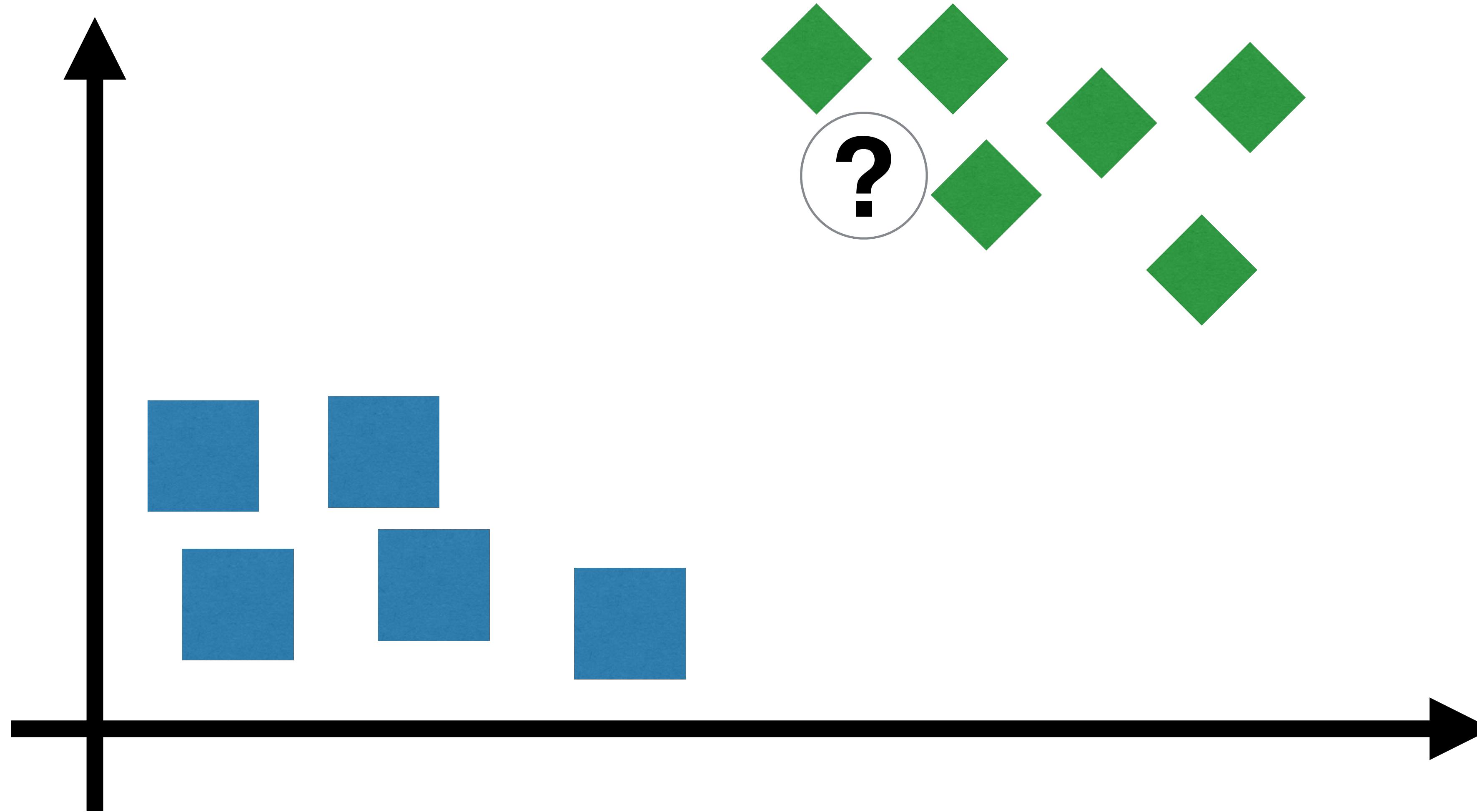
ML Classification

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

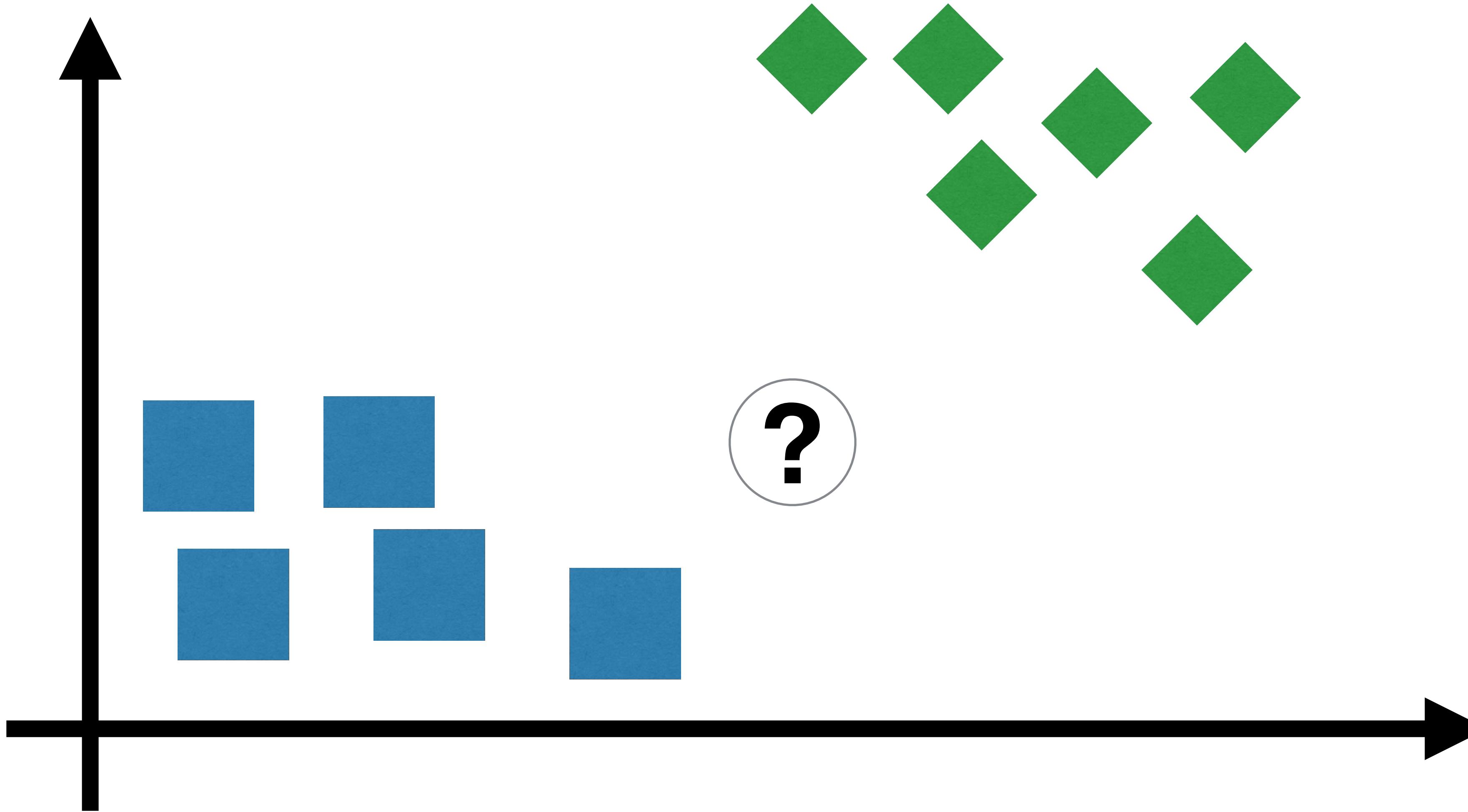
ML Classification



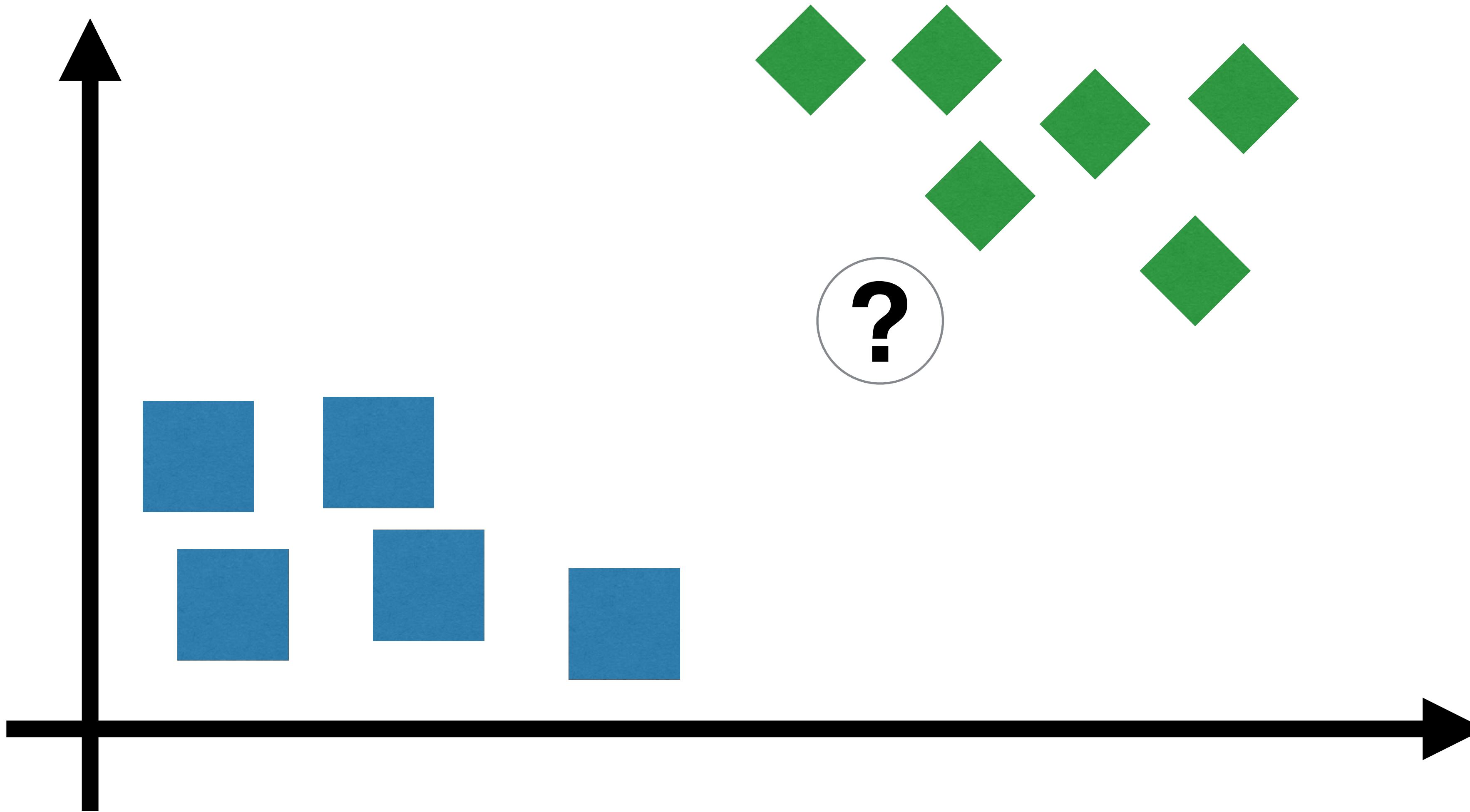
You be the classifier: 1 or 2?



You be the classifier: 1 or 2?

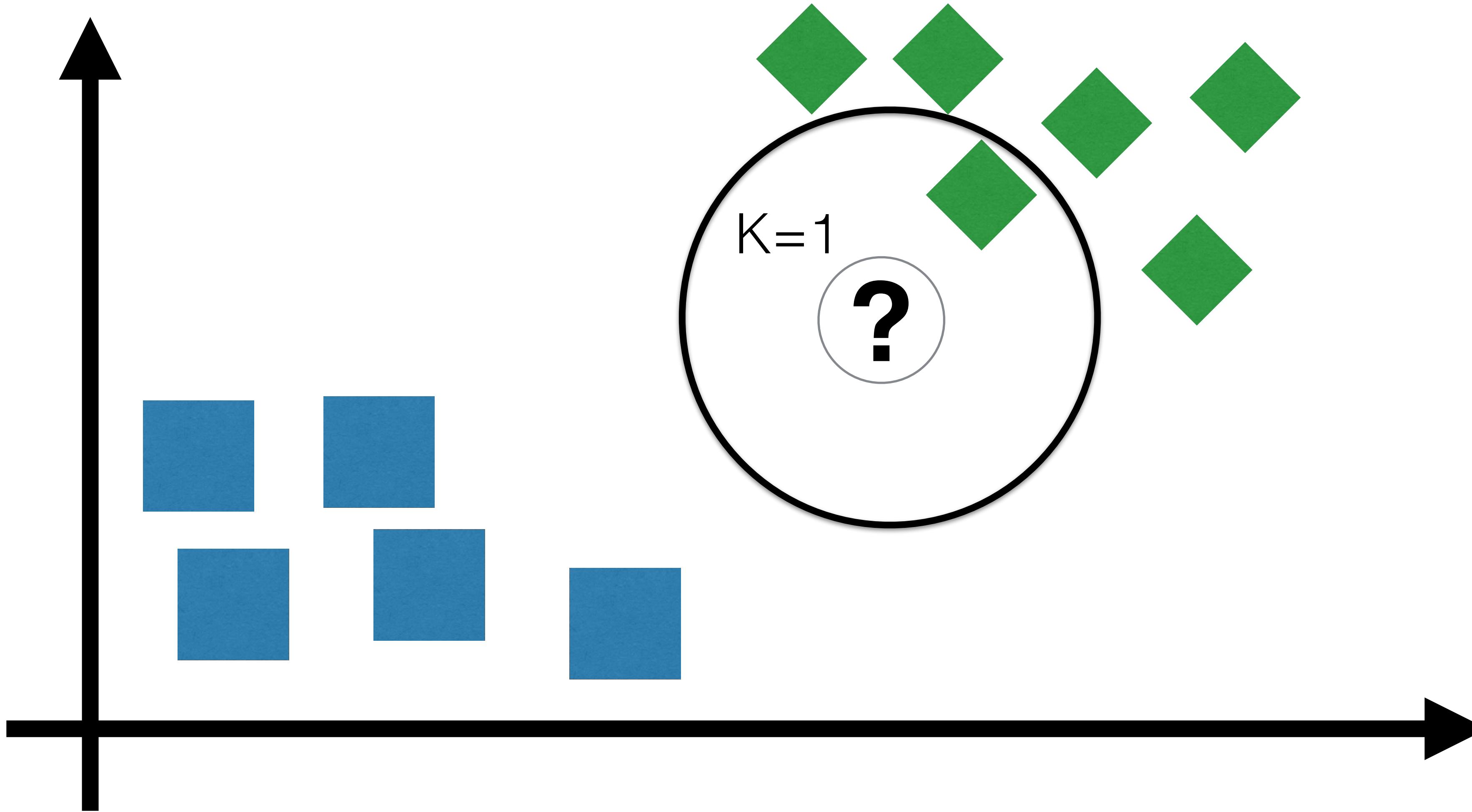


You be the classifier: 1 or 2?

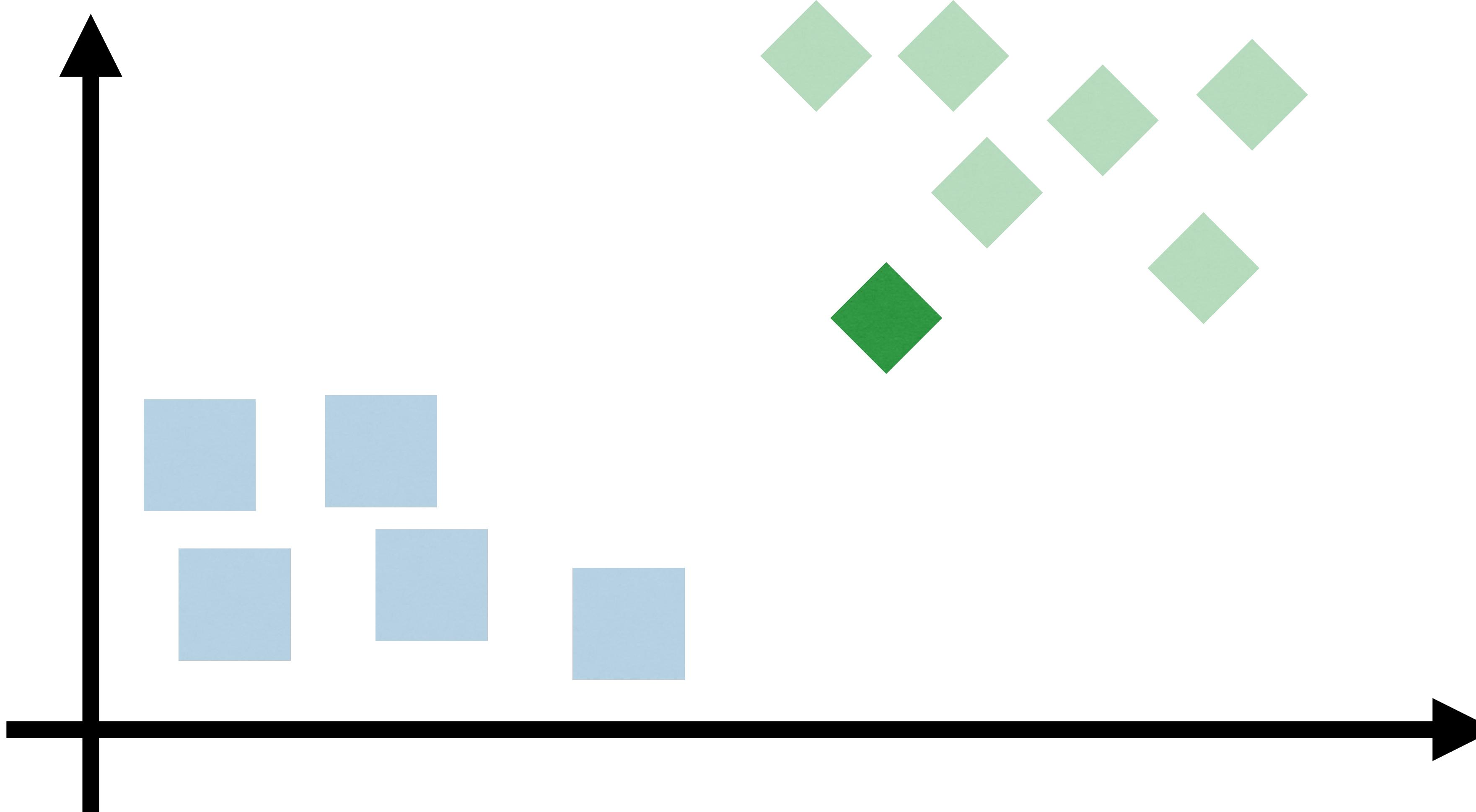


K-nearest neighbour-Classifier:

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!

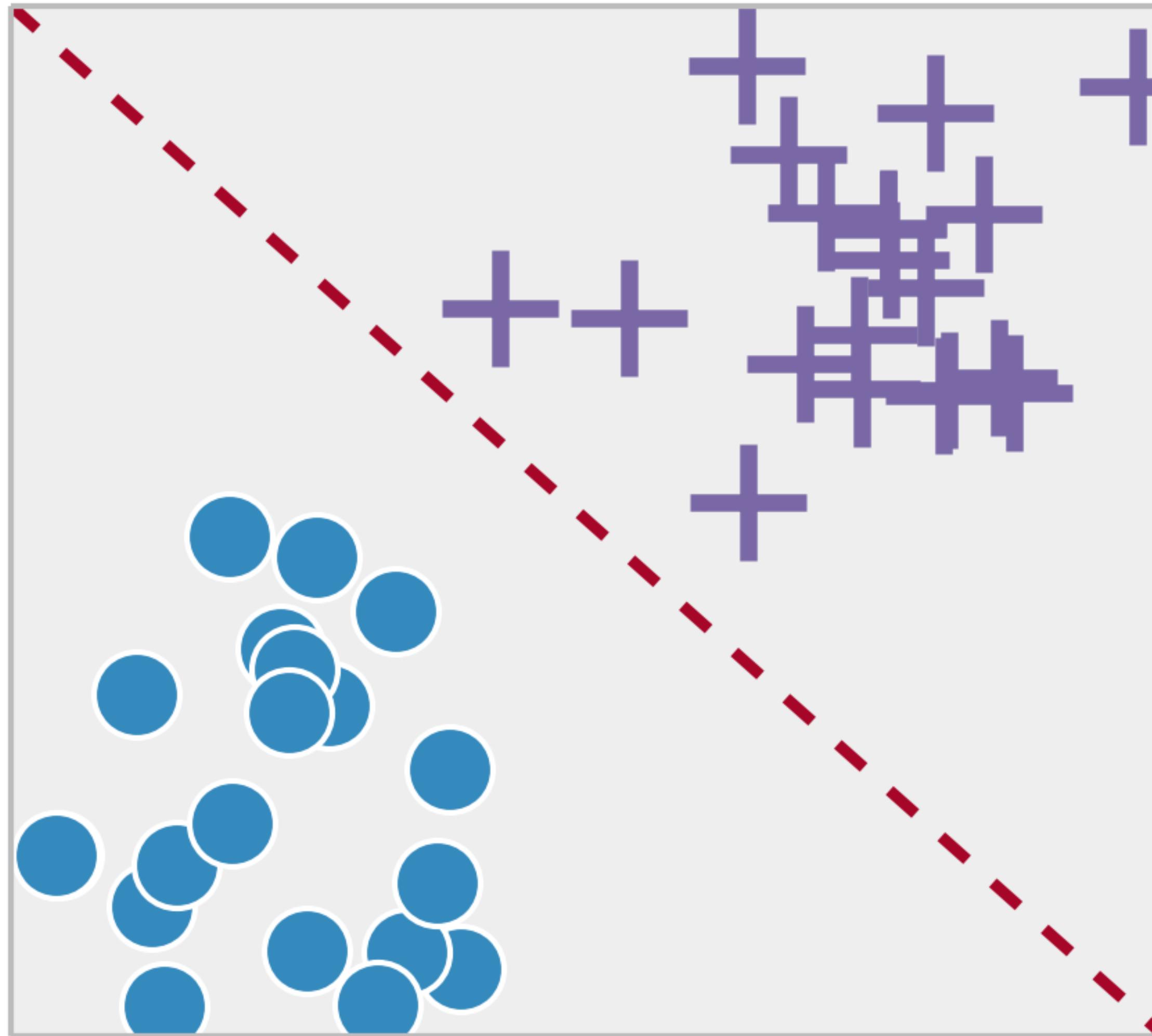
Training:

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.

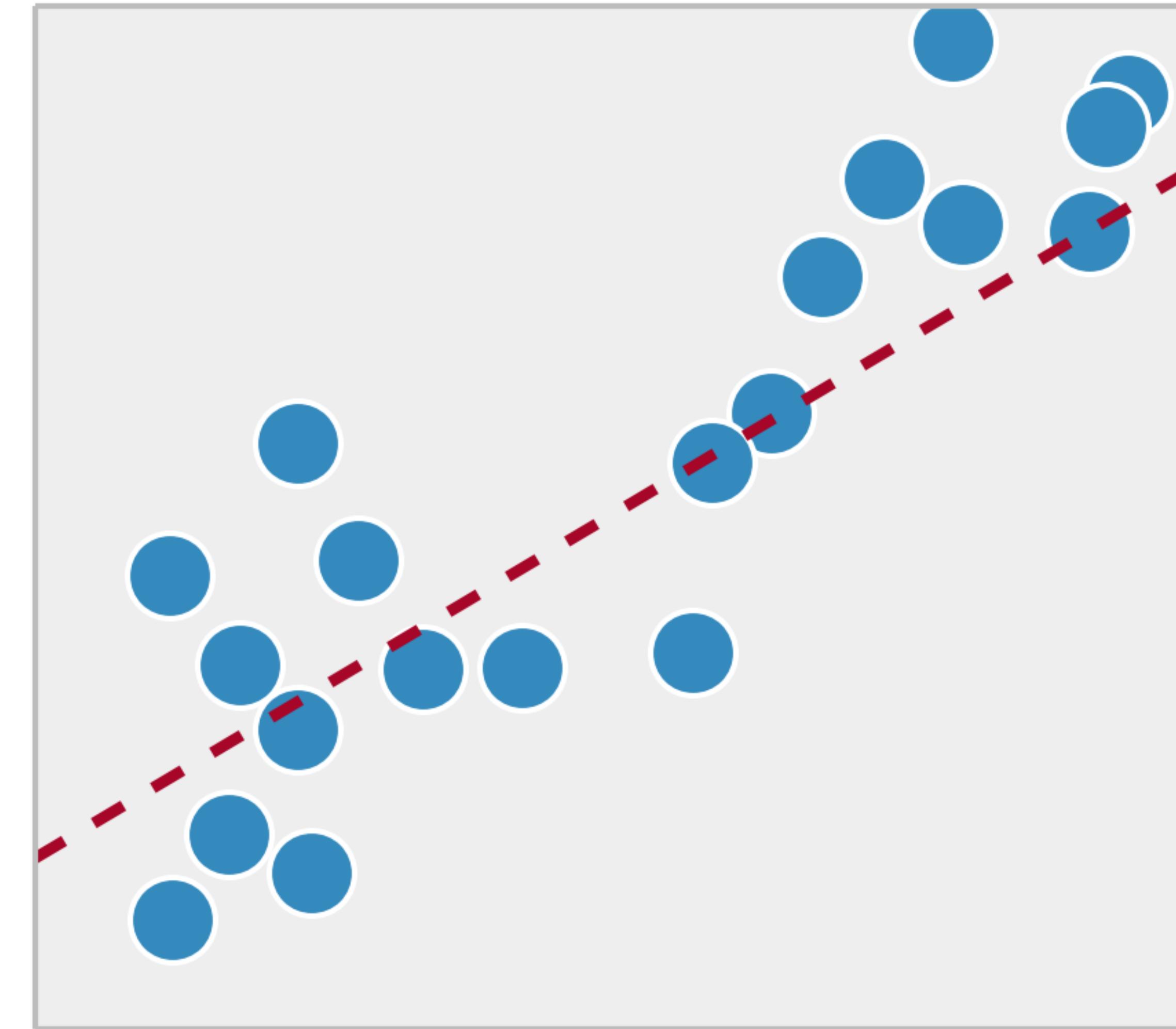
Informal presentations:

16:30

Classification



Regression



Classification

New Project

Values Examples Configure

randomize

Stop Recording

Train

Run

Delete last recording

Re-add last recording

Status: New examples recorded

outputs-1

1

56

Edit Status



Regression

The image shows a DAW interface with various windows and controls.

Models Panel: This panel displays three regression models with their outputs and status indicators.

- outputs-1 (v10):** Value 1.00325, 254 samples, status: OK (green)
- outputs-2 (v10):** Value 1, 175 samples, status: Error (red)
- outputs-3 (v10):** Value 0.37497, 175 samples, status: Error (red)

Mixer View: Shows a grid of faders and knobs for audio channels. The channels are labeled 1 through 7, A, and B. The faders have numerical values ranging from -Inf to 60. The A and B channels are labeled "Post".

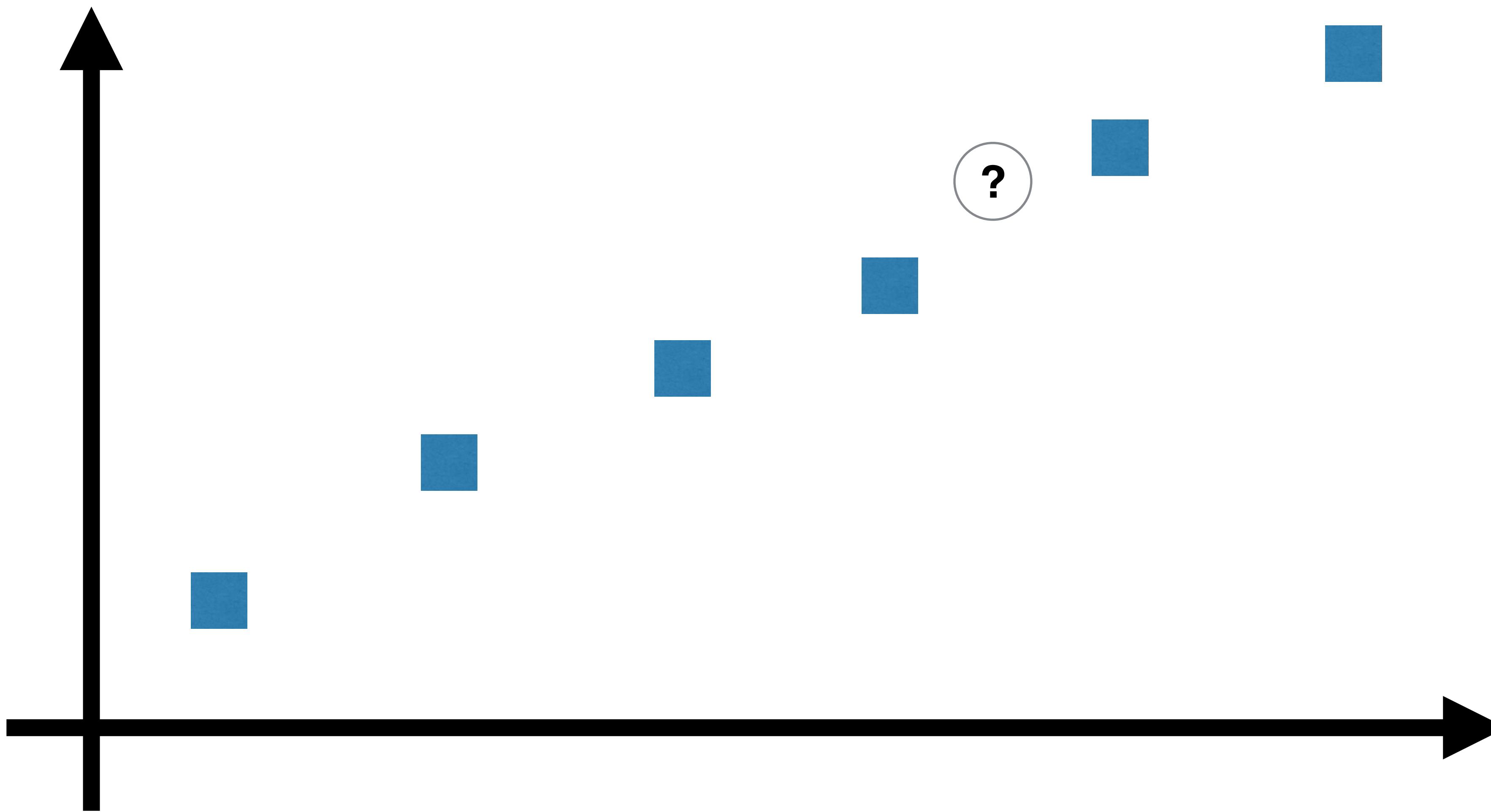
Track Editor View: Shows a track named "shVintage-Stick-Hit". The track volume slider is set to 100%. The track controls include:

- Start: 0.00 %
- Loop: 100 %
- Length: 100 %
- Fade: 0.00 %
- LOOP: ON
- Voices: 3
- Retrig: R
- SNAP: ON
- Attack: 0.00 ms
- Decay: 300 ms
- Sustain: 0.0 dB
- Release: 60.0 s
- Volume: -20.2 dB
- LFO: Off
- Attack: 0.00 ms
- Decay: 300 ms
- Sustain: 0.0 dB
- Release: 60.0 s
- Volume: -20.2 dB

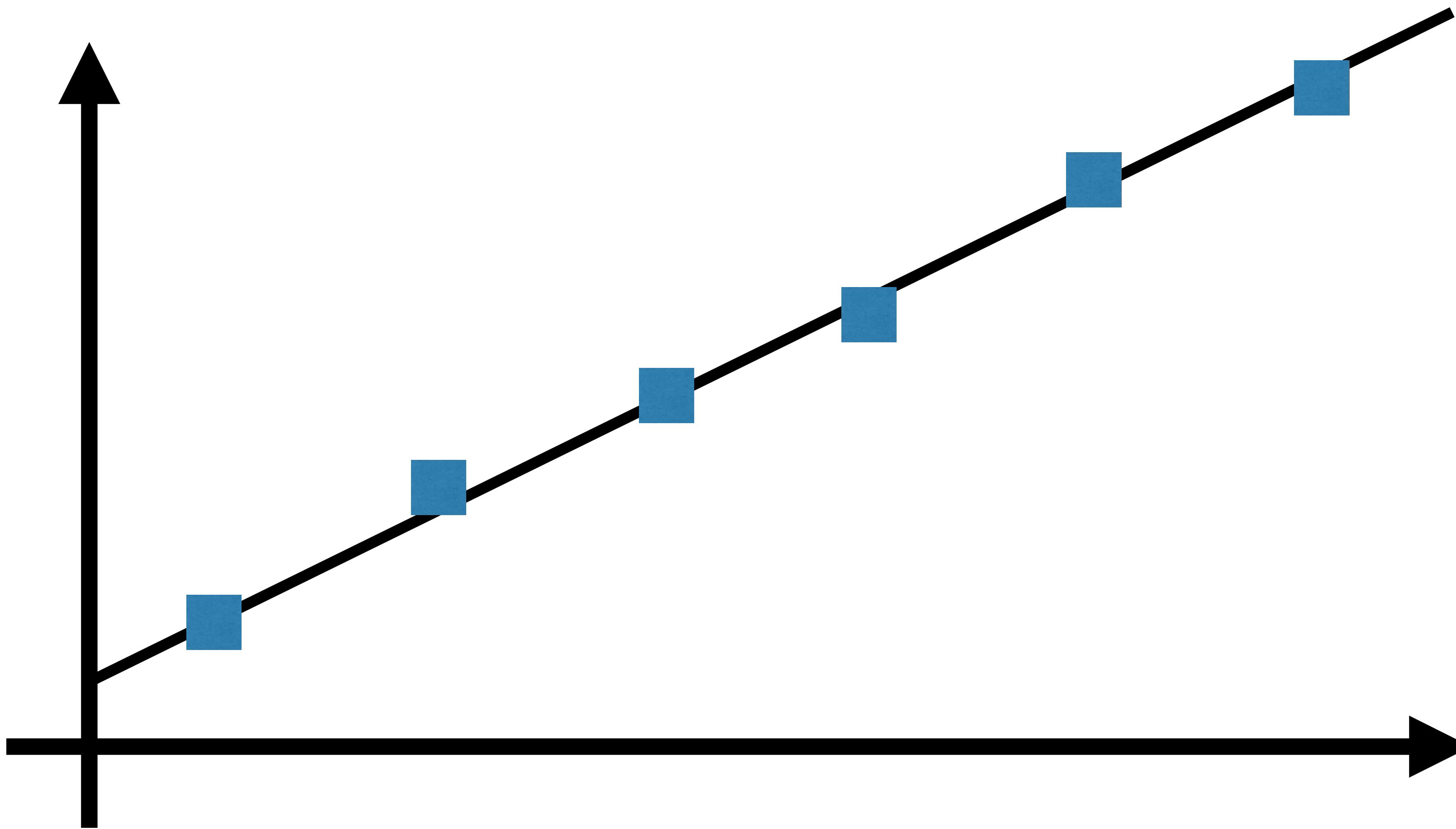
File Browser: Shows a sidebar with a file tree and a search bar.

Hand Image: A photograph of a person's hands interacting with a surface, likely a MIDI controller or a tablet, connected via a USB cable.

ML Regression

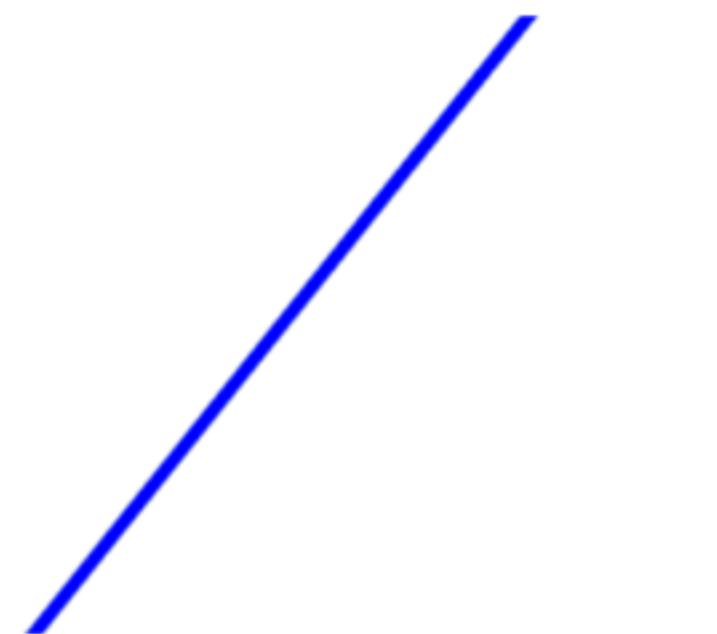


ML Regression



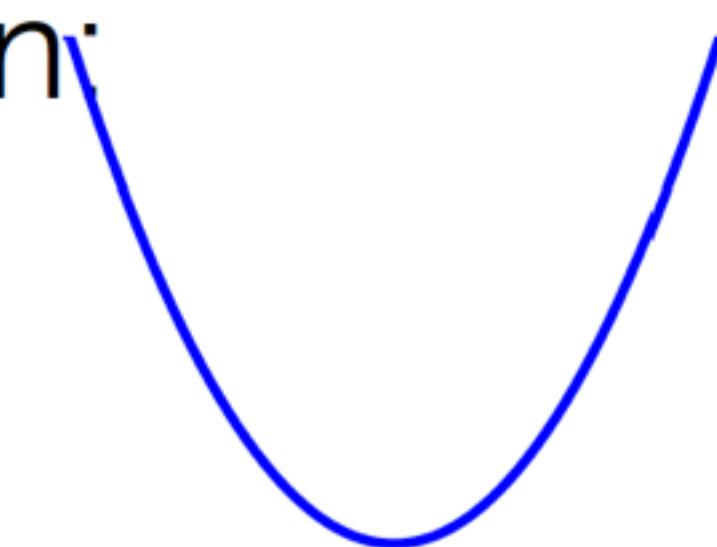
- Linear regression:

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



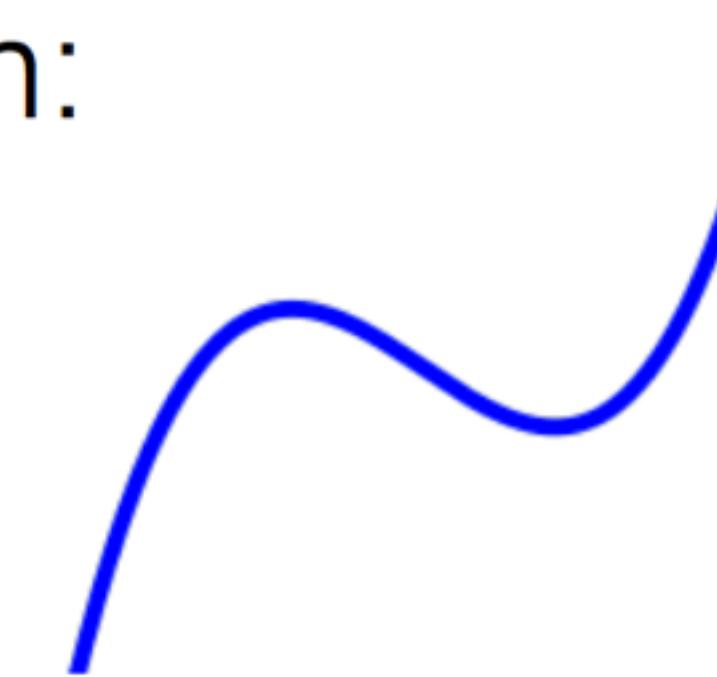
- 2nd-order polynomial regression:

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



- 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

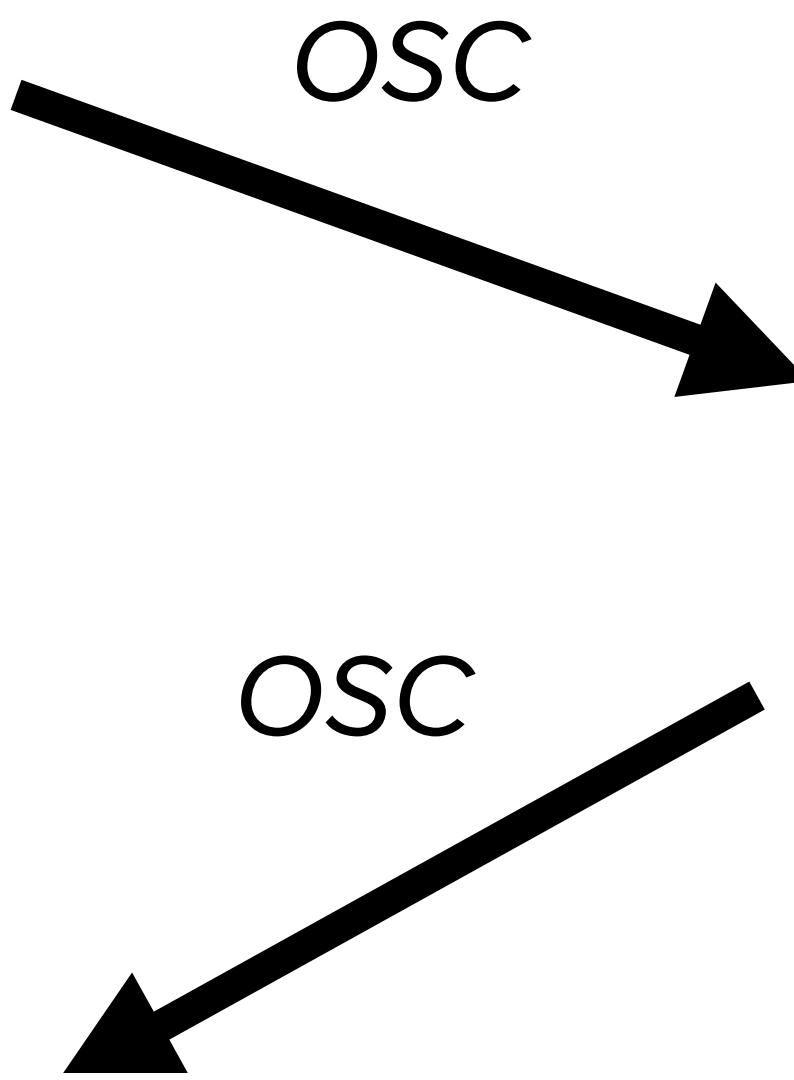
Mini Exercise

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

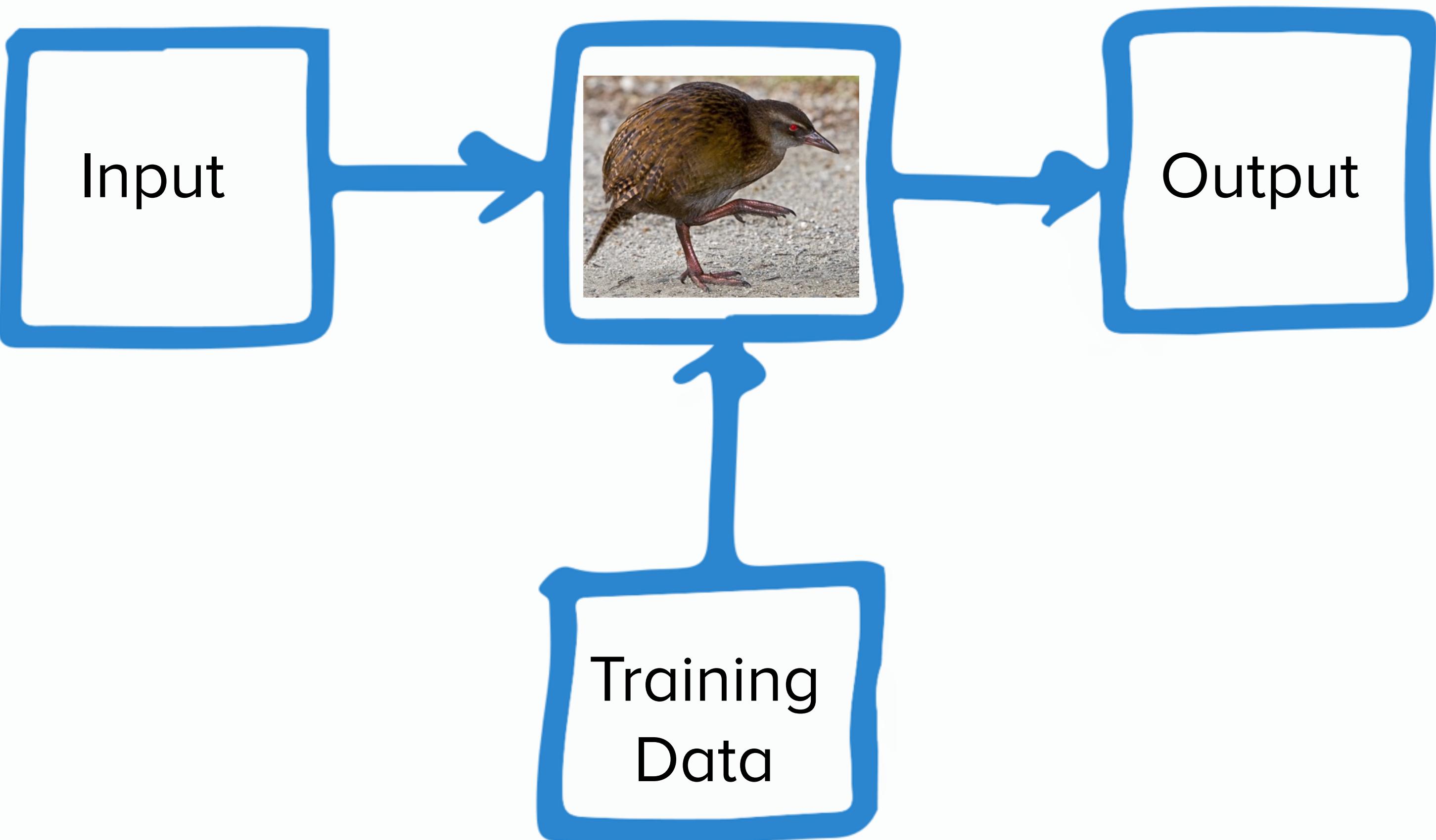
```
void sendOSC() {  
    OscMessage msg = new OscMessage("/wek/inputs");  
    msg.add((float)mouseX);  
    msg.add((float)mouseY);  
    oscP5.send(msg, dest);  
}
```



```
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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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=QLHMTxE5XsMs#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);

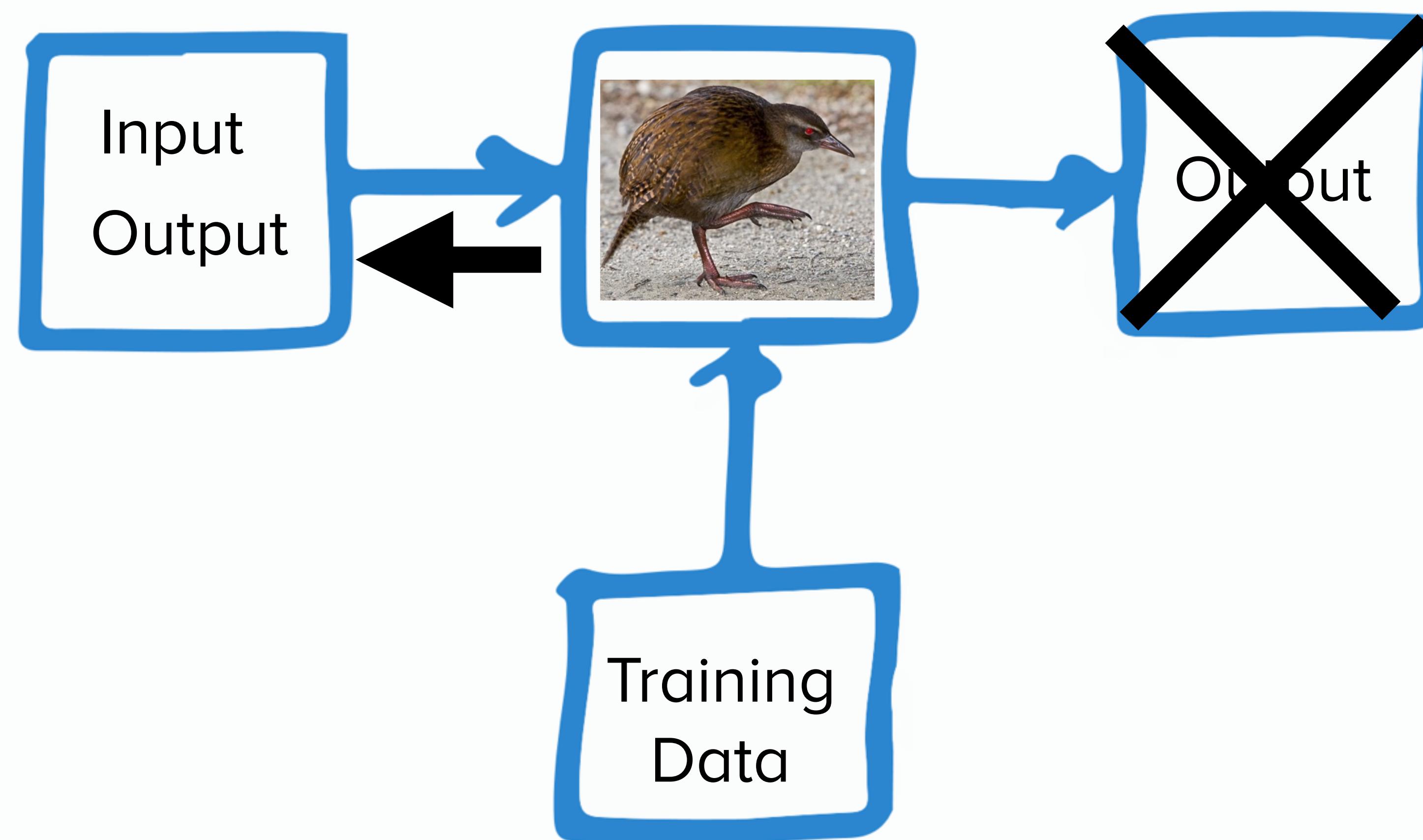
//inside draw function
sendOsc();

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

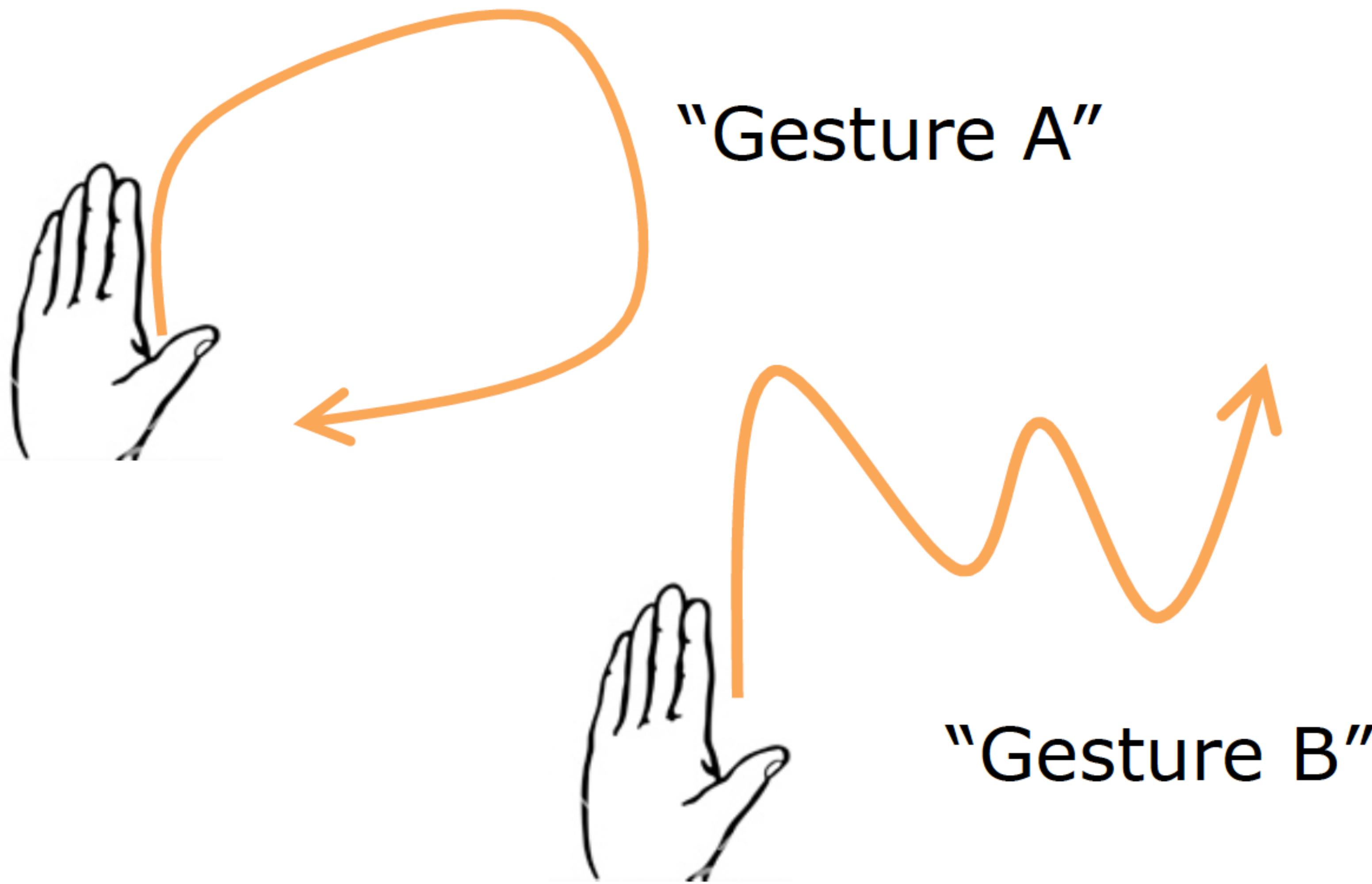
How do we make our own output?

```
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



New Project Examples

OSC In OSC Out

Gesture Types Add / Remove

stable (v22) + - 3 degree of match: [green slider]

hand_approaching (v29) + - 10 degree of match: [white slider]

hand_removing (v29) + - 10 degree of match: [white slider]

wiggle (v132) + - 9 degree of match: [white slider]

Match threshold [white slider]

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

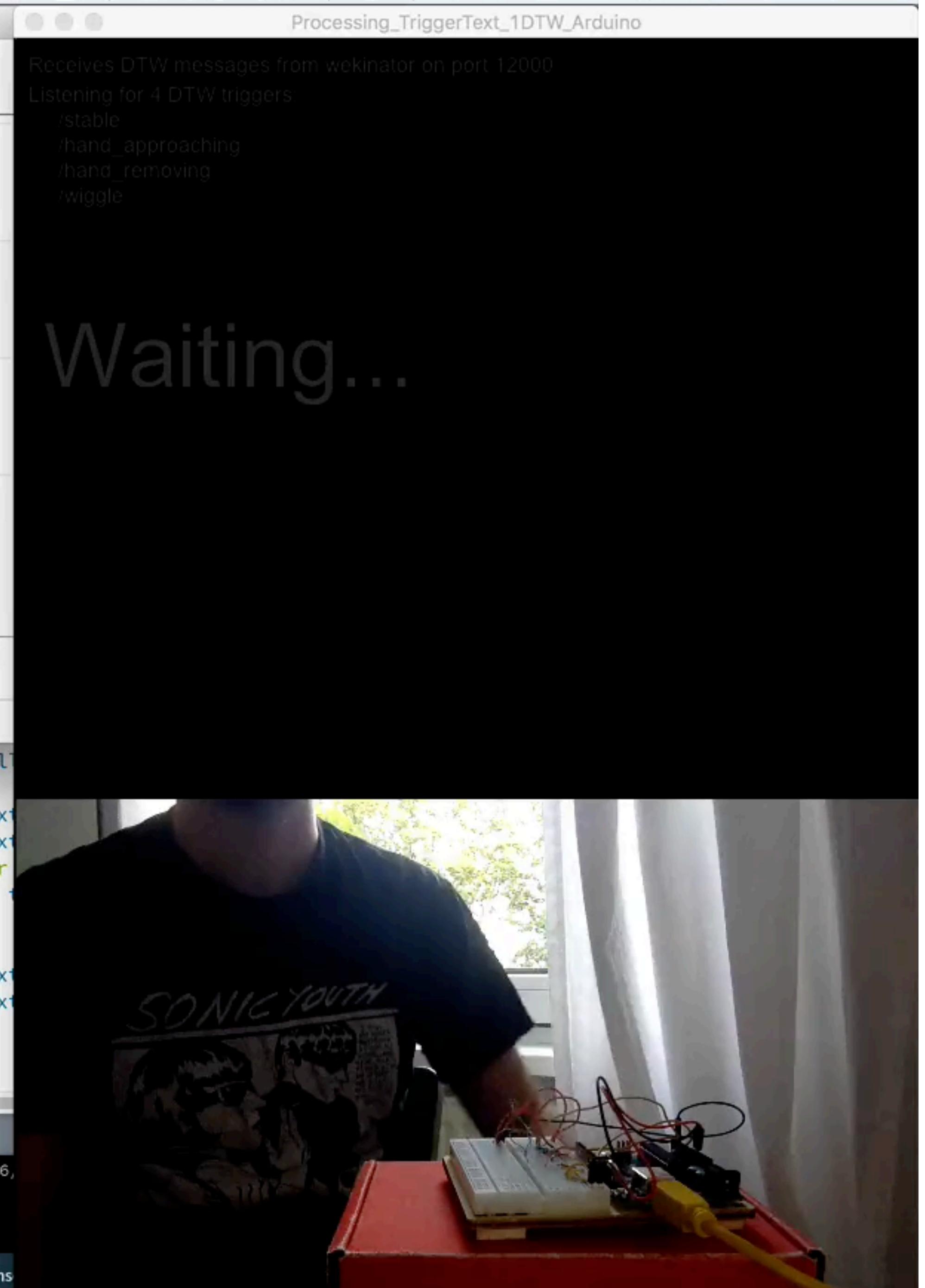
file
text
text
for
}
}
text
text
}
}
[2016,
12000

Processing_TriggerText_1DTW_Arduino

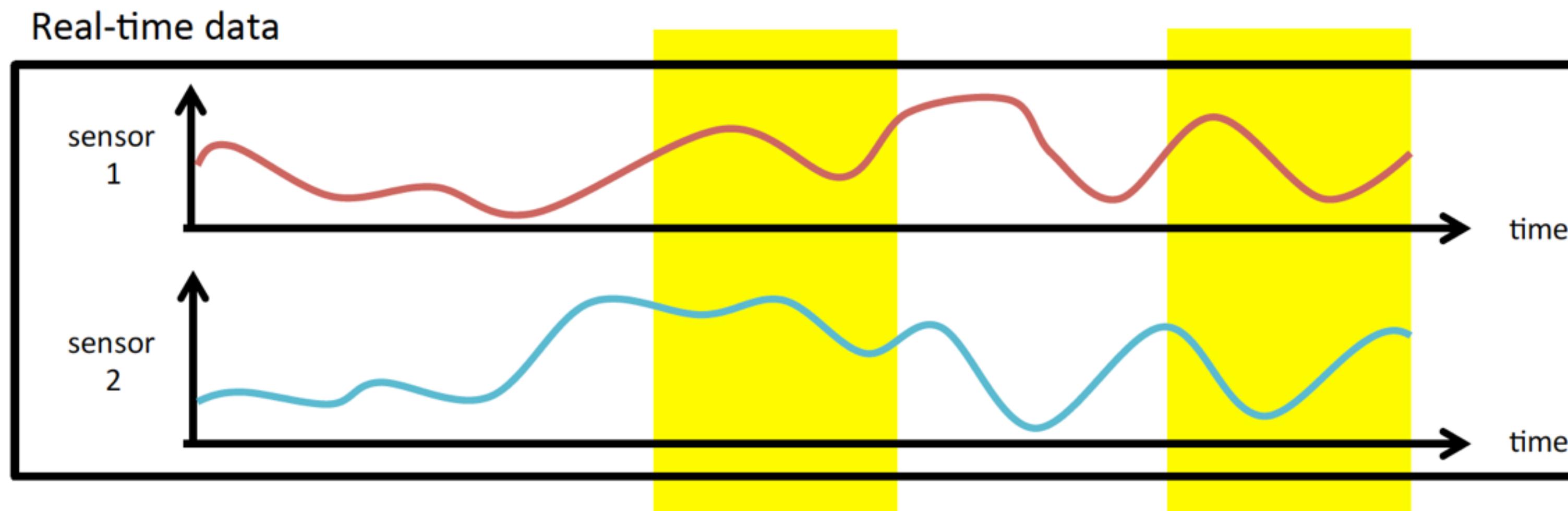
Receives DTW messages from wekinator on port 12000
Listening for 4 DTW triggers
/stable
/hand_approaching
/hand_removing
/wiggle

Waiting...

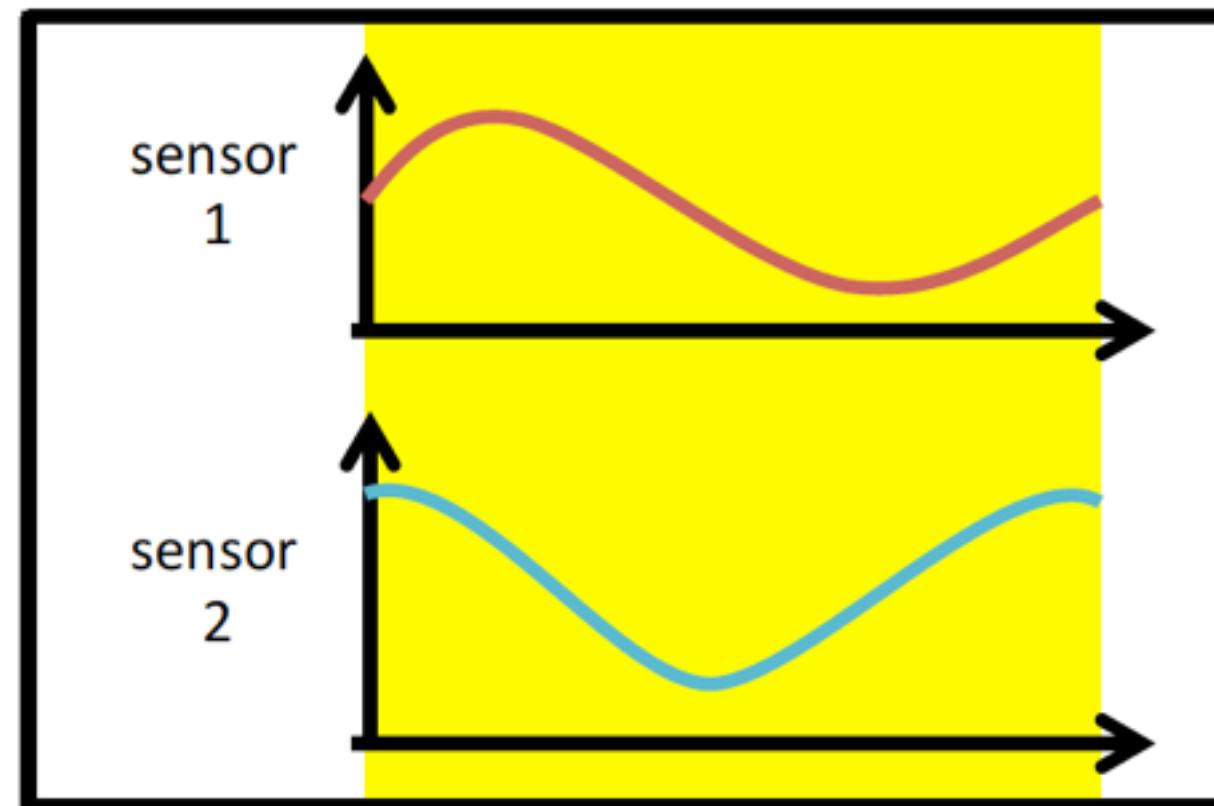
Console Errors Updates 3 Cons



Dynamic Time Warping



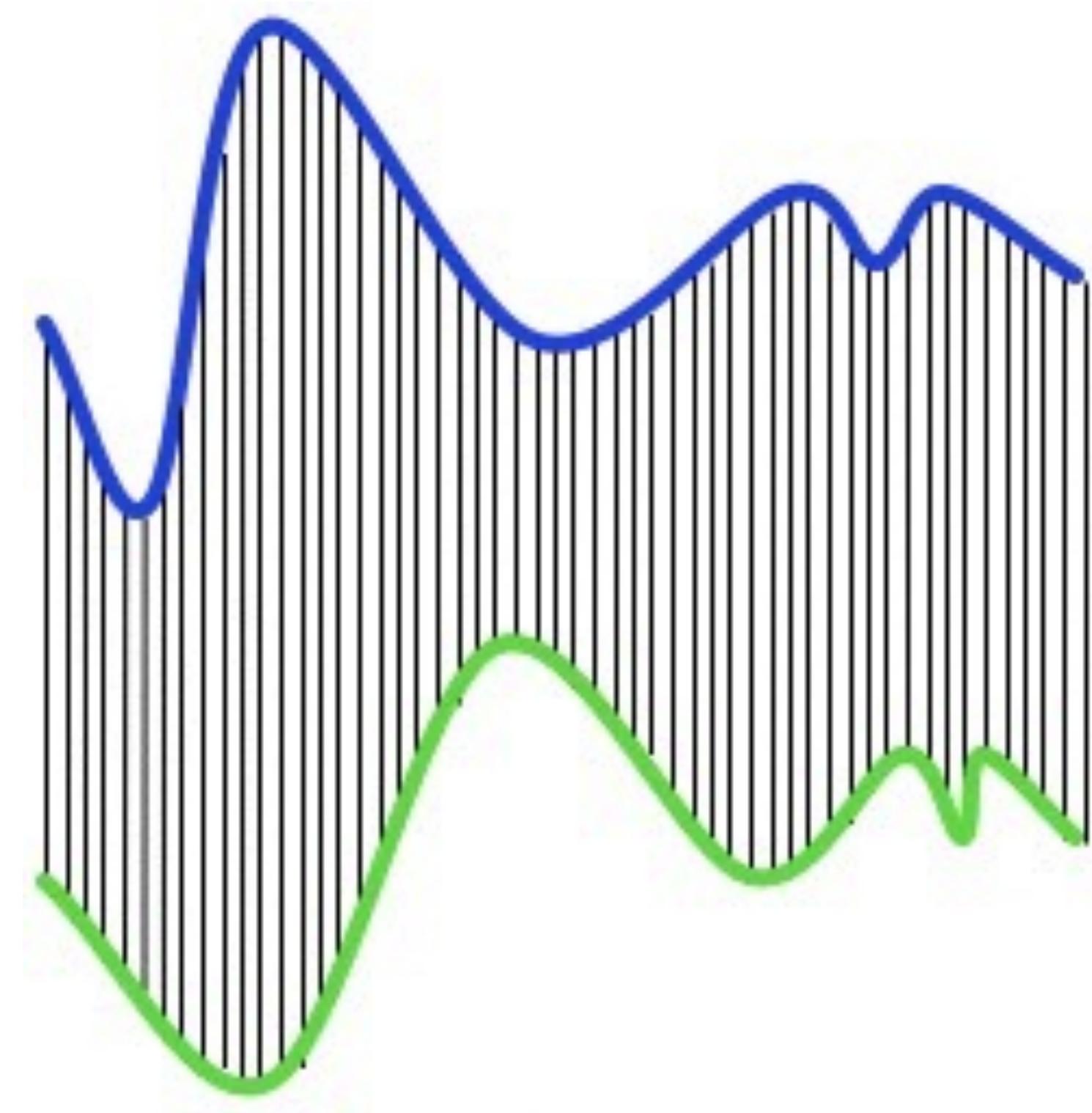
Recorded Example



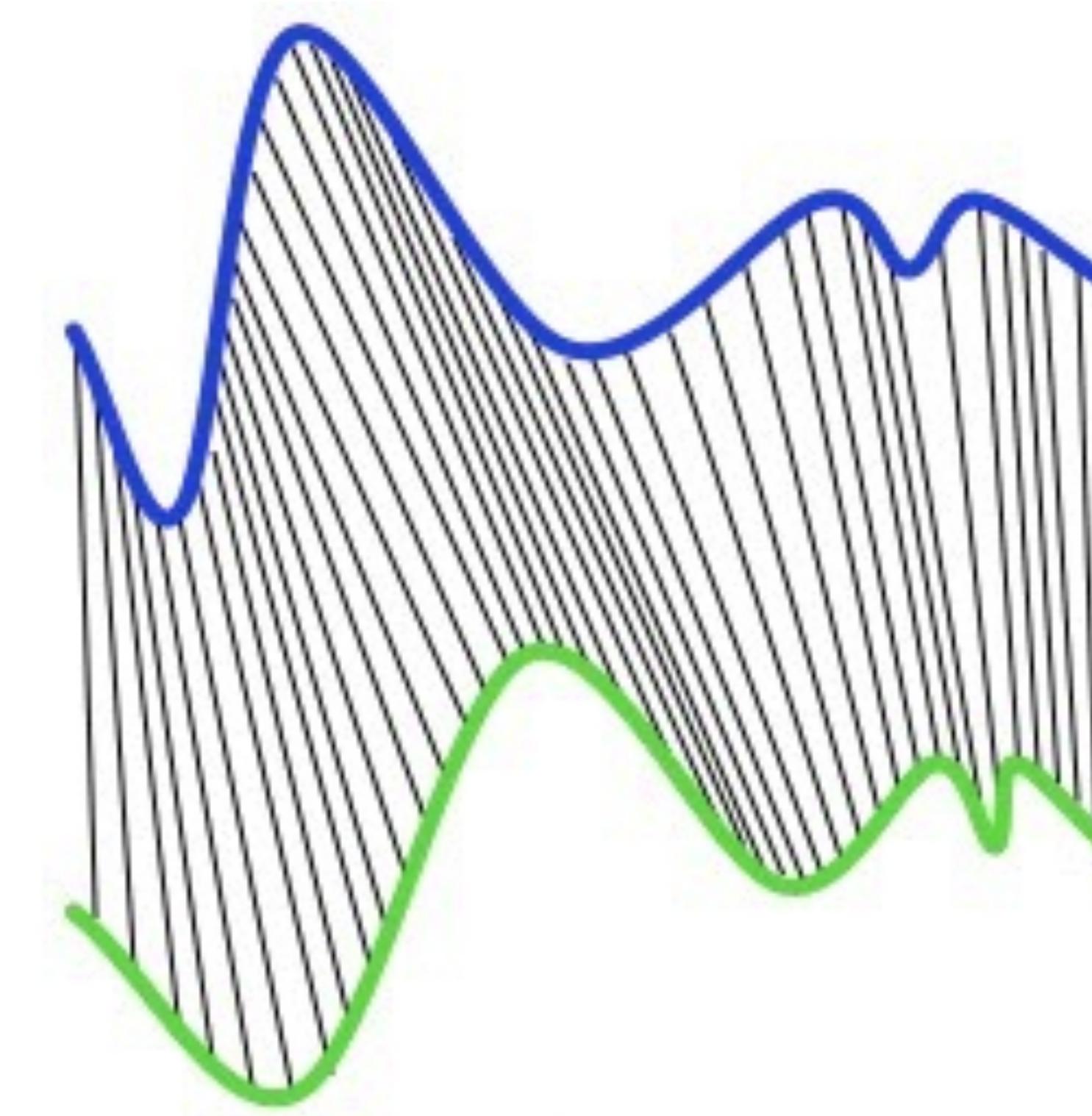
Less similar:
Greater distance

Very similar:
Distance close to 0

Dynamic Time Warping



(a)



(b)

Dynamic Time Warping

dynamic_time_warping/DTW_Mouse_Explorer

This afternoon

Free time to play with 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?

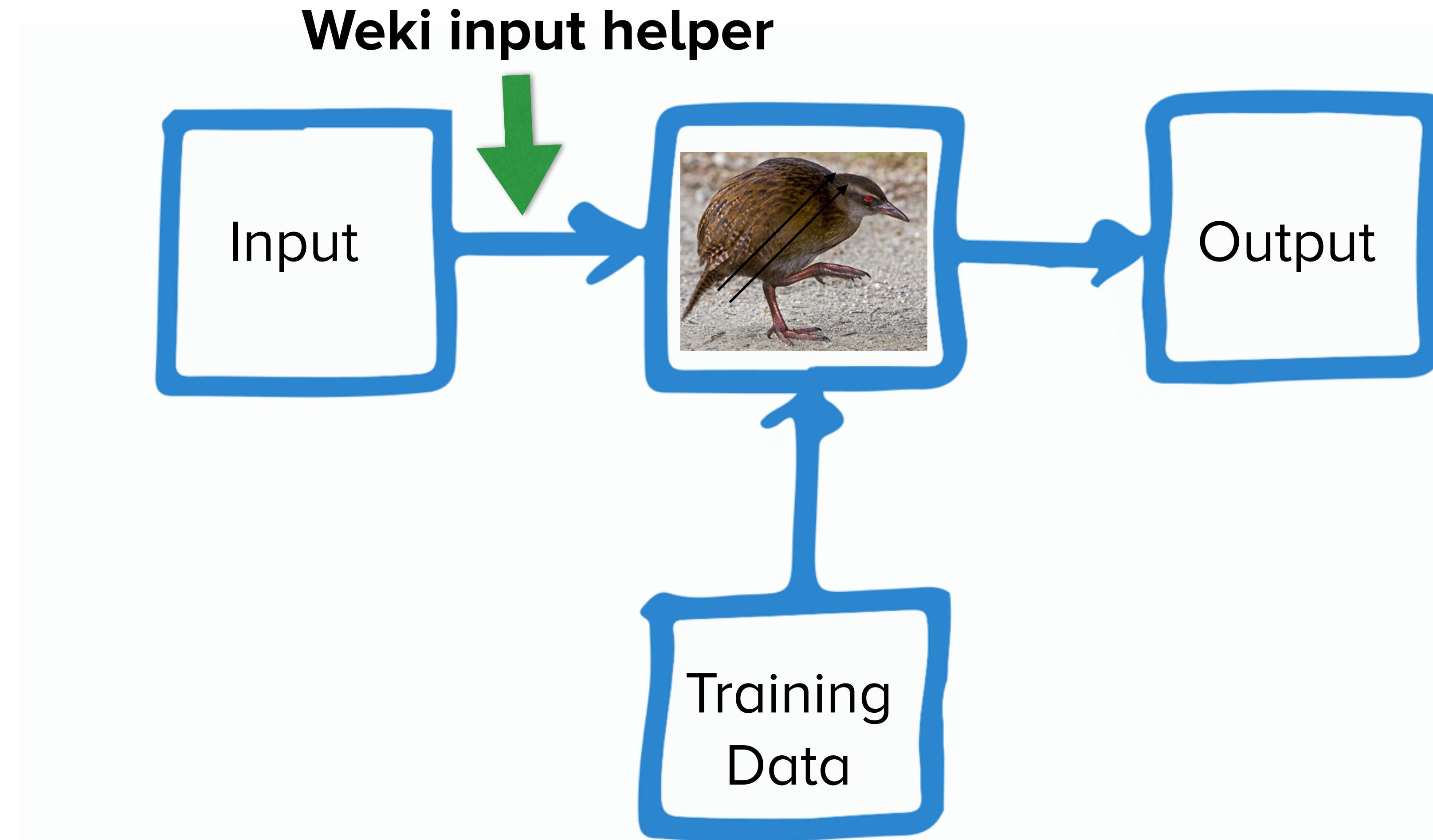
```
//global
OscP5 oscP5Receiver;
int currentState;

//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



FLOOR	SCORE	LIVES	HEALTH	AMMO
1	0	3	100%	16

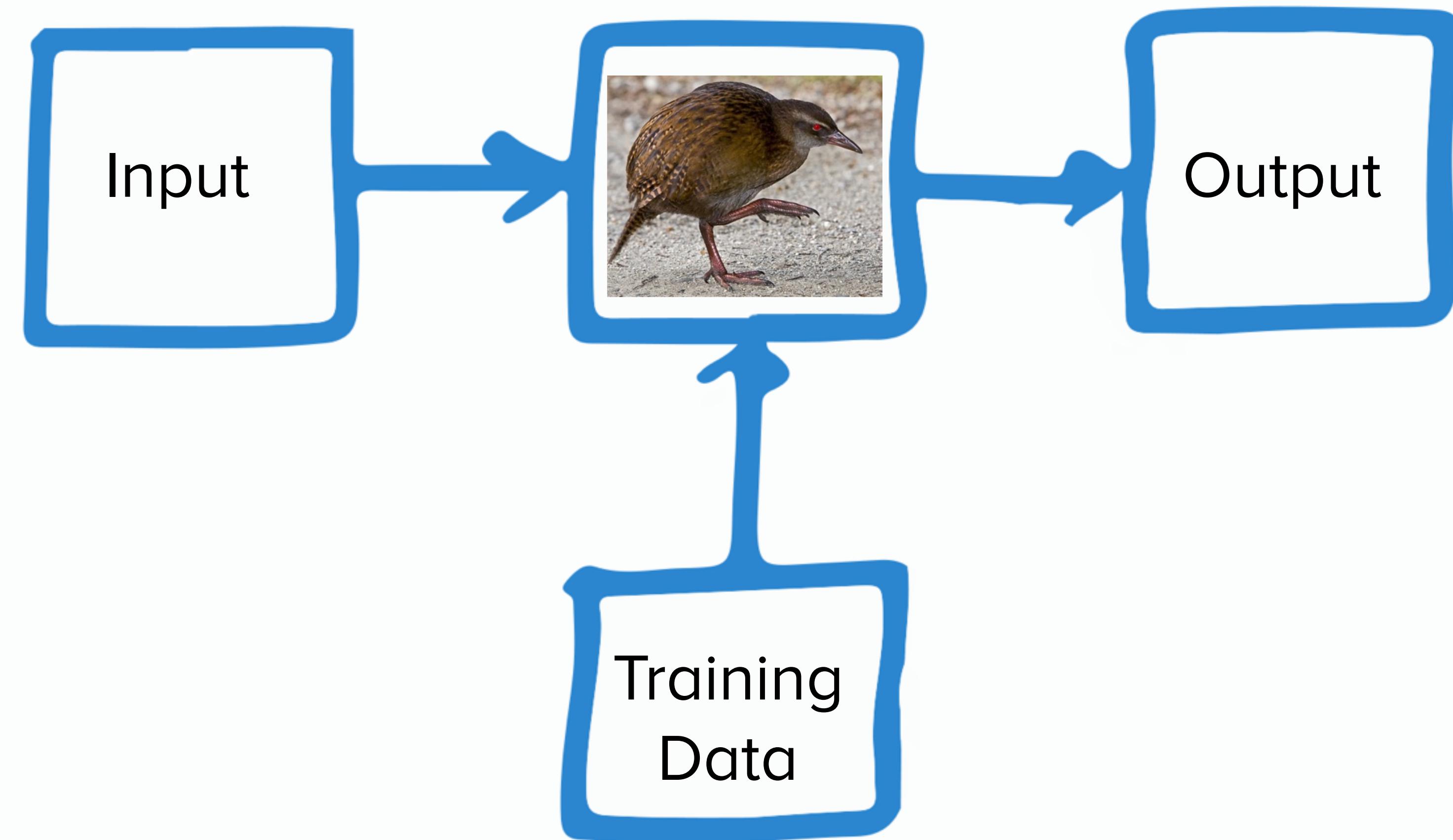


Lets try it out!

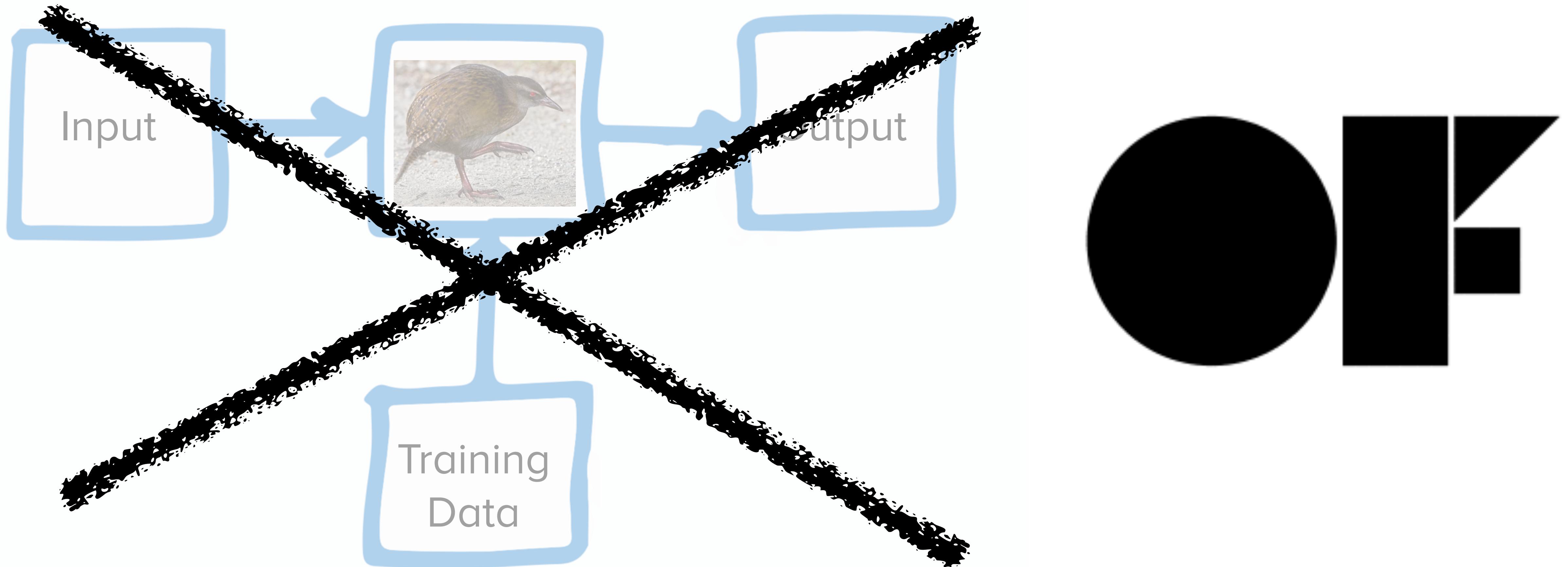
Input: Simplest_MouseXY_2Inputs

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>

The screenshot shows the GitHub repository page for 'nickgillian / ofxGrt'. The repository is described as an 'OpenFrameworks extension for the Gesture Recognition Toolkit'. Key statistics displayed include 169 commits, 2 branches, 0 releases, and 10 contributors. The latest commit was made on Jan 24, 2017. The repository has 9 stars and 21 forks. The 'Code' tab is selected. A list of recent commits shows updates to various example files like 'example_audio_classification', 'example_bar_plot', etc.

nickgillian / ofxGrt

Watch 9 Star 77 Fork 21

Code Issues 10 Pull requests 1 Projects 0 Wiki Insights

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

Commit	Message	Date
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_gyroscope_orientation_clas...	updated readme	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