The Machine Learning Starter Pack

CENTER FOR
COMPLEXITY &
EMERGING
TECHNOLOGIES

Today's Outline

- Who am I?
- What I do?
- What we do..
- What is Machine Learning?
- There's Math?
- Some topics to consider
- Coding in TensorFlow

Hello..

I am Jordan Deja

I do human computer interaction research. Follow @jordandoinwork in twitter

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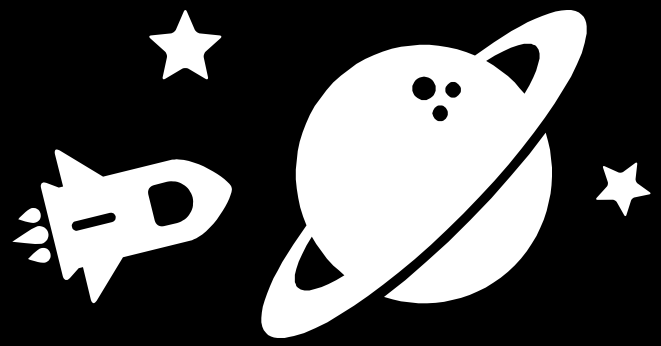


I'm part of COMET

... that's short for Center for Complexity and Emerging Technologies

https://www.facebook.com/dlsucomet/

What do we do in the lab

recruit

As early as second year our CCS students are recruited to do some training in preparation for thesis in advance

train

Apart from their usual curriculum they learn advance techniques like python, data visualization, machine learning, etc

investigate

Members called cohorts find real-world problems that they wish to solve as part of their research preparation

research

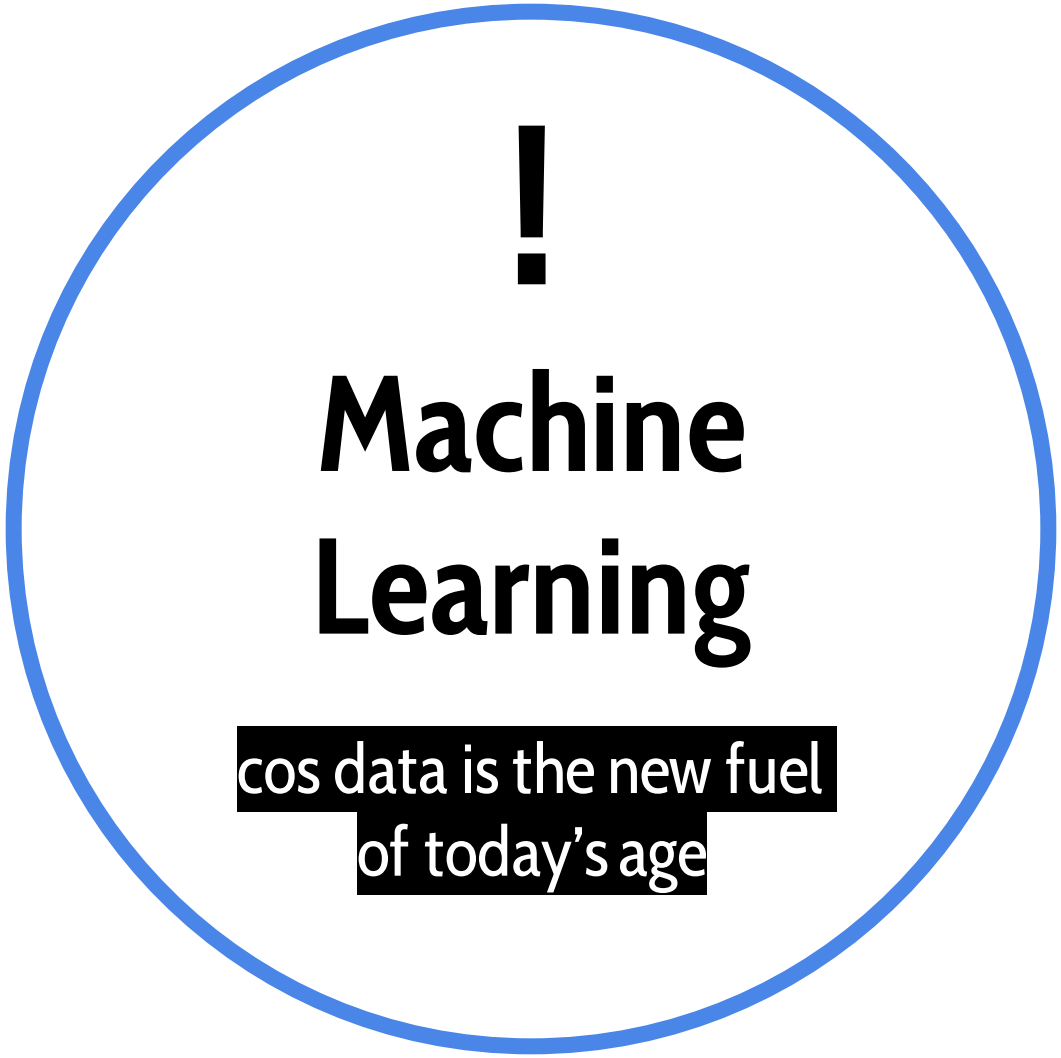
They embark on research by solving, coding and addressing the problem and using CS techniques

publish

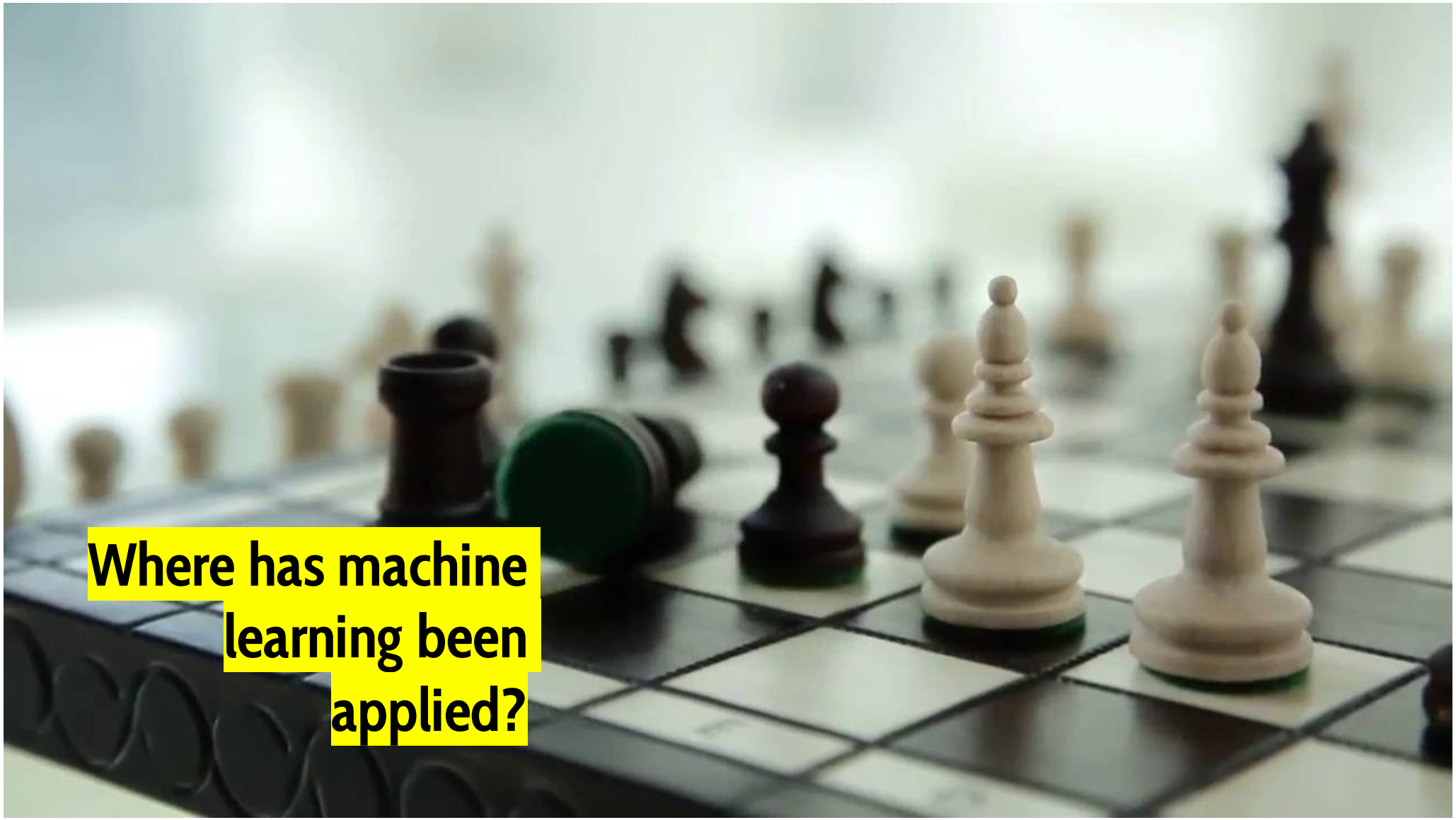
We travel around and publish papers based from our research results

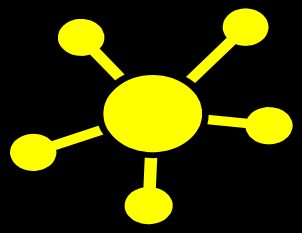
fun!

We have hackathons and teambuilding activities from time to time so we get to have fun as well!


!
Machine
Learning
cos data is the new fuel
of today's age

Machine Learning
A subfield of AI that gives computers the ability to learn without being explicitly programmed
-Arthur Samuel


Where has machine learning been applied?



agents!

1997
IBM's Deep Blue II defeated Gary Kasparov

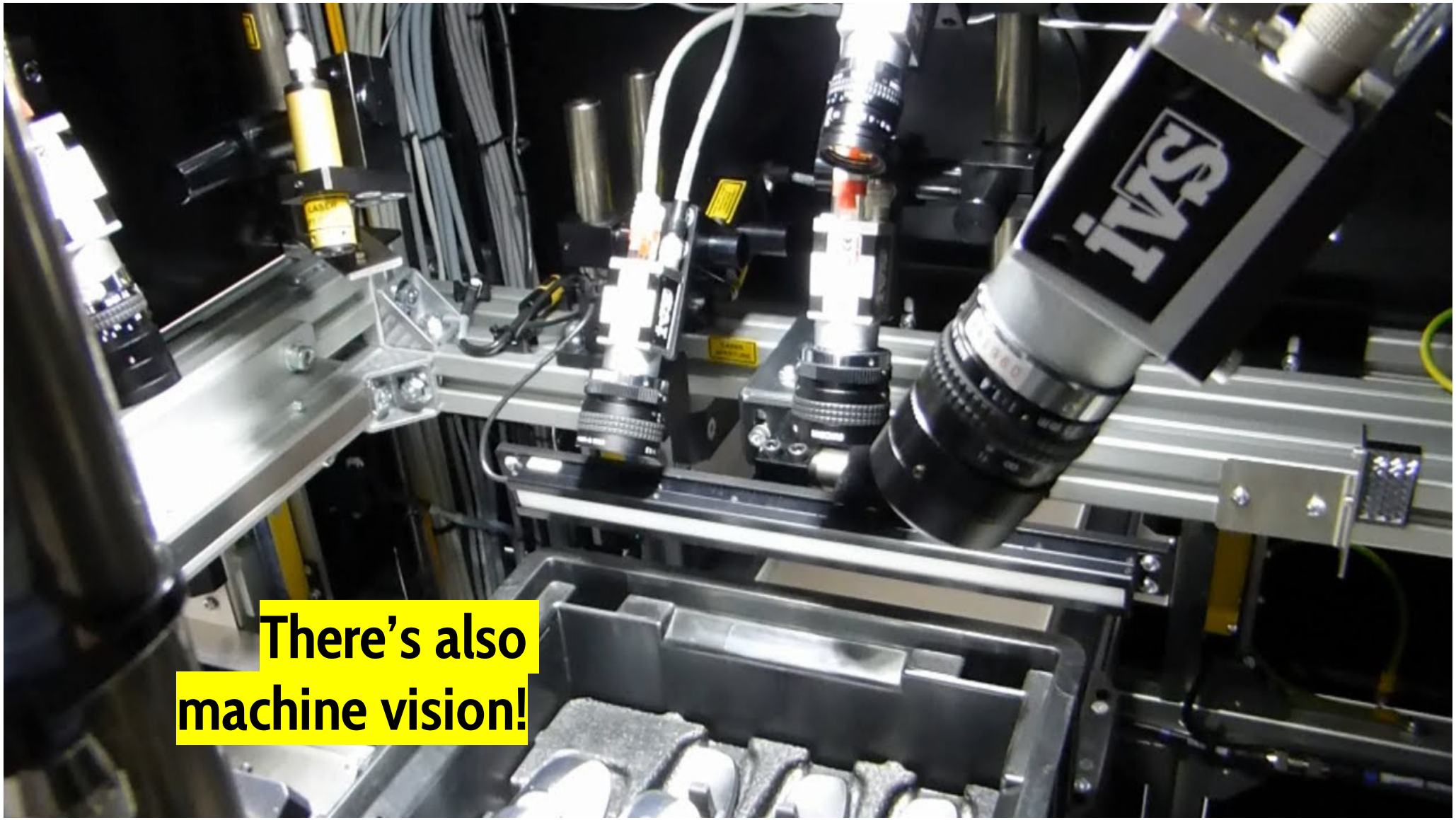
May 11th, 1997

Computer won world champion of chess

(Deep Blue) (Garry Kasparov)

(Reuters = Kyodo News)

2016
Google's
DeepMind
won in
AlphaGo


There’s also
machine vision!

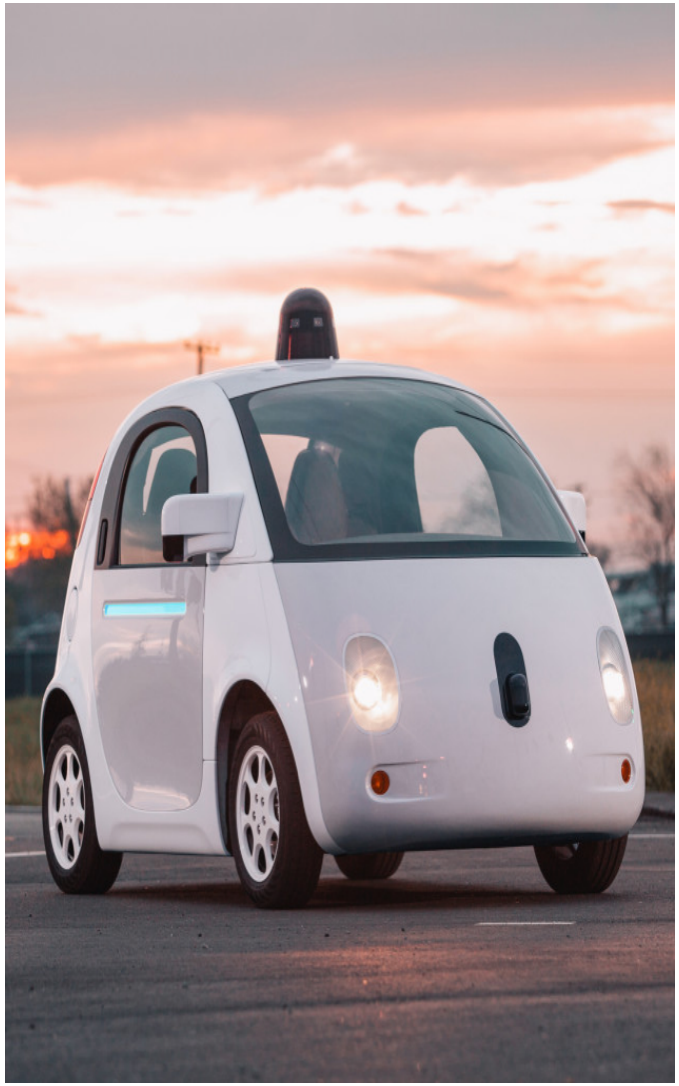
1994
There came ALVINN

ALVINN stands for: Autonomous Land Vehicle in Neural Networks

First vehicle to cross the US Coast in 6 days totally un-manned

2016
There's now Google Self Driving Car

It integrates Google Cloud, Google GPS, Video and Image Processing



So how can developers make use of machine learning?

Food for thought

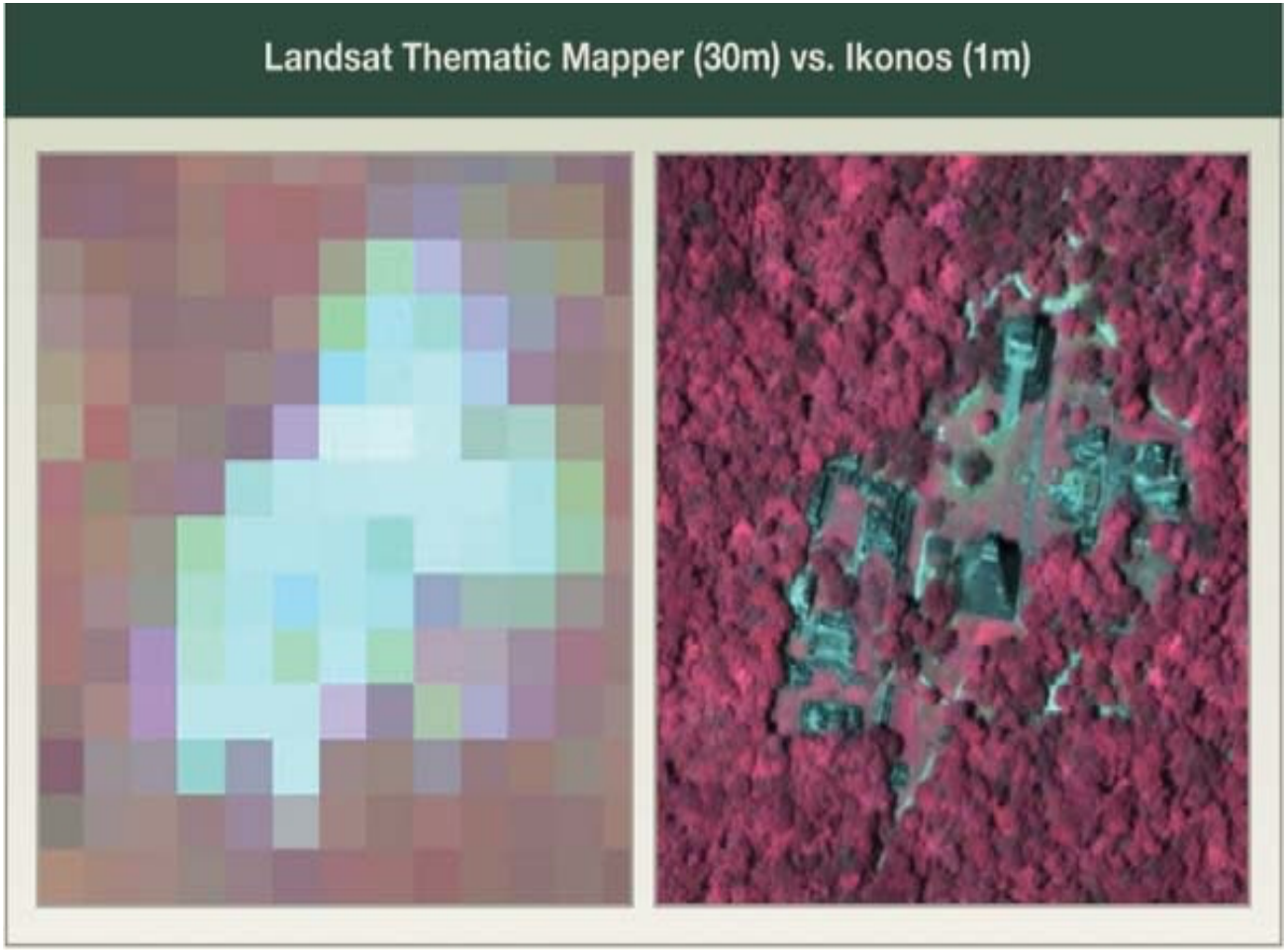
On everything!

The answer?

There’s now realtime translation


Drones!
They’re now a thing

NASA used satellites to find undiscovered Mayan ruins



Then a year ago
Diwata flew into
its orbit in space


Machine Learning enables us to use
technologies with intelligent code so we can
try out new interactions

Thru ML we can use EMG for better prosthetics

There are jobs that exist now but did not exist 5 years ago

21st century machine learning empowered jobs

Augmented reality designer

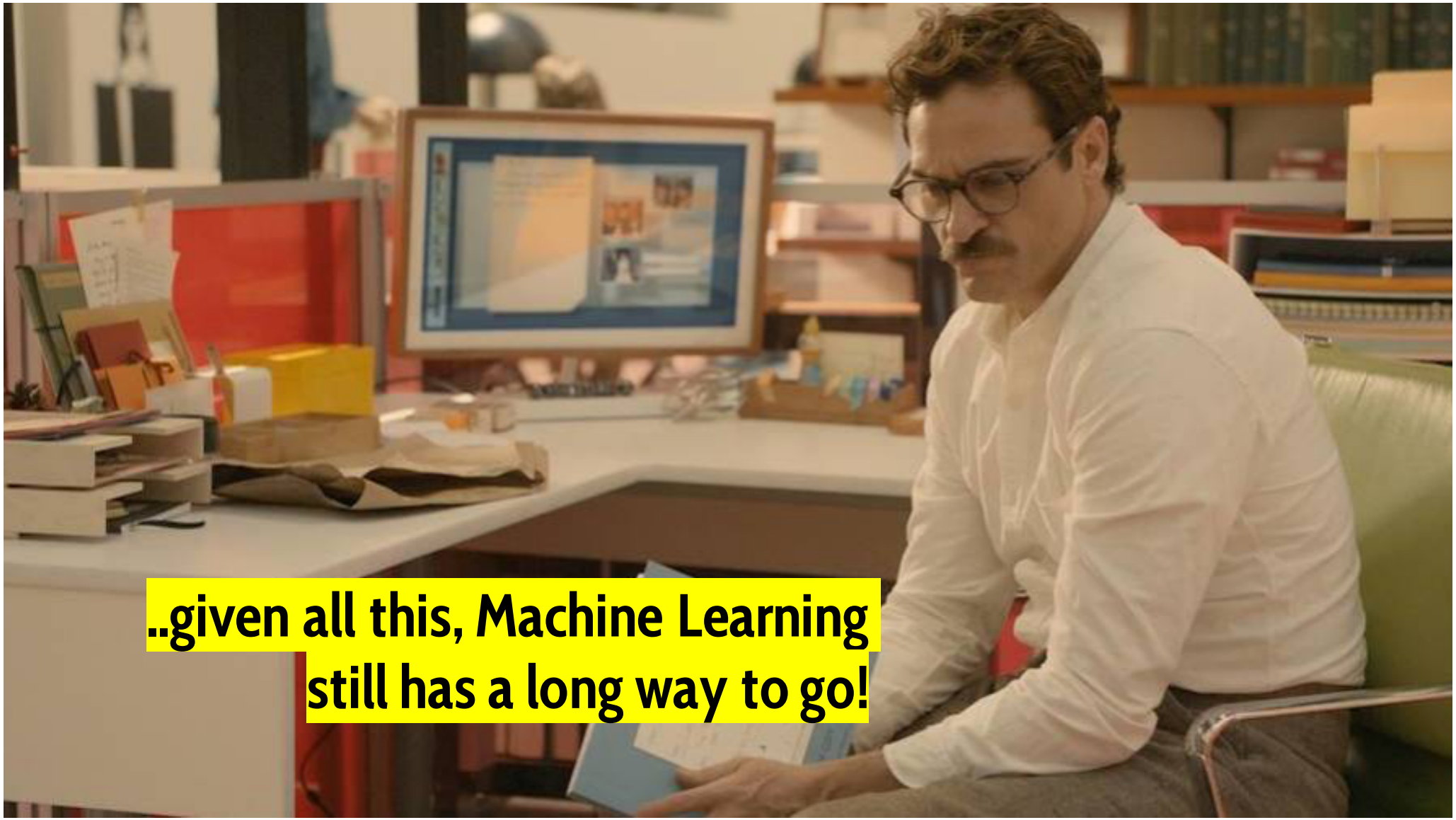
Virtual reality estate developer

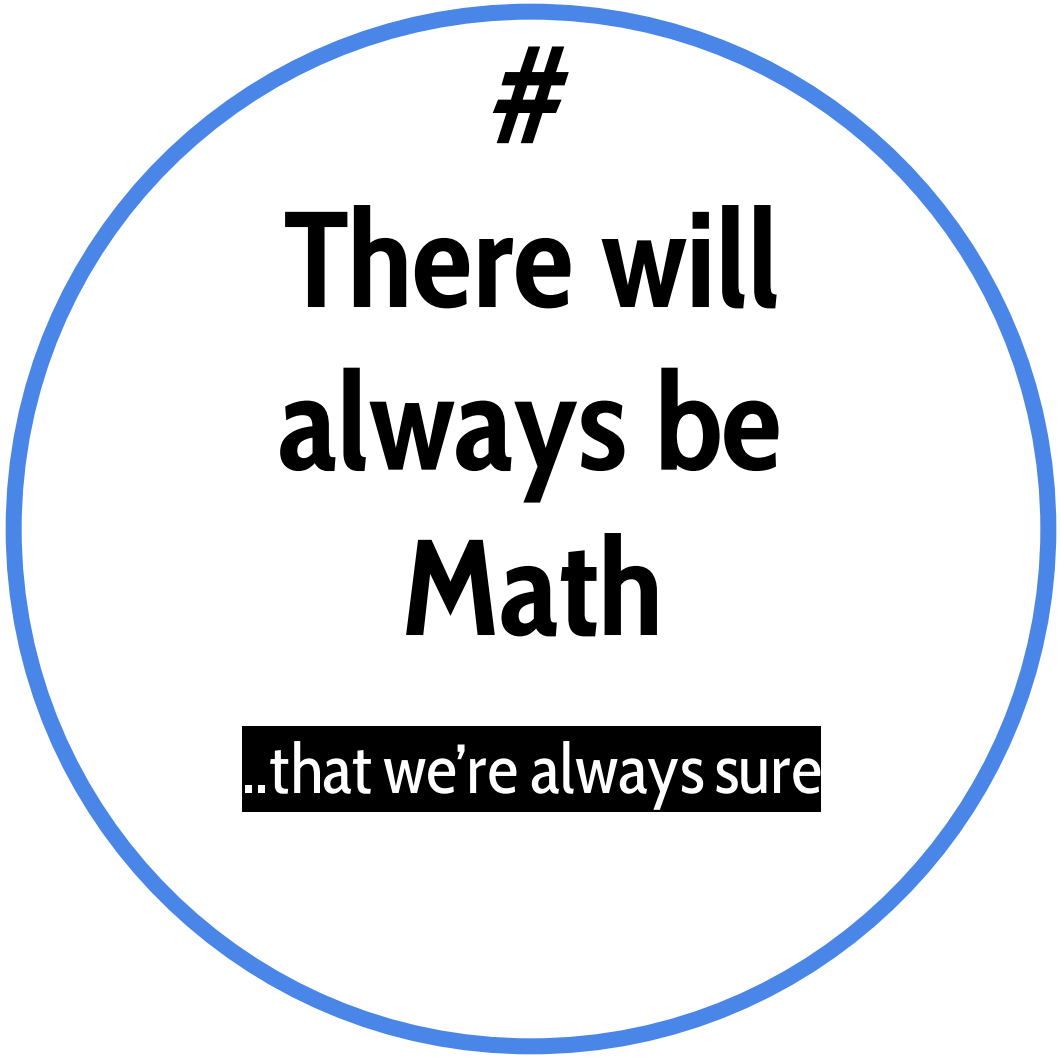
Artificial personality designer

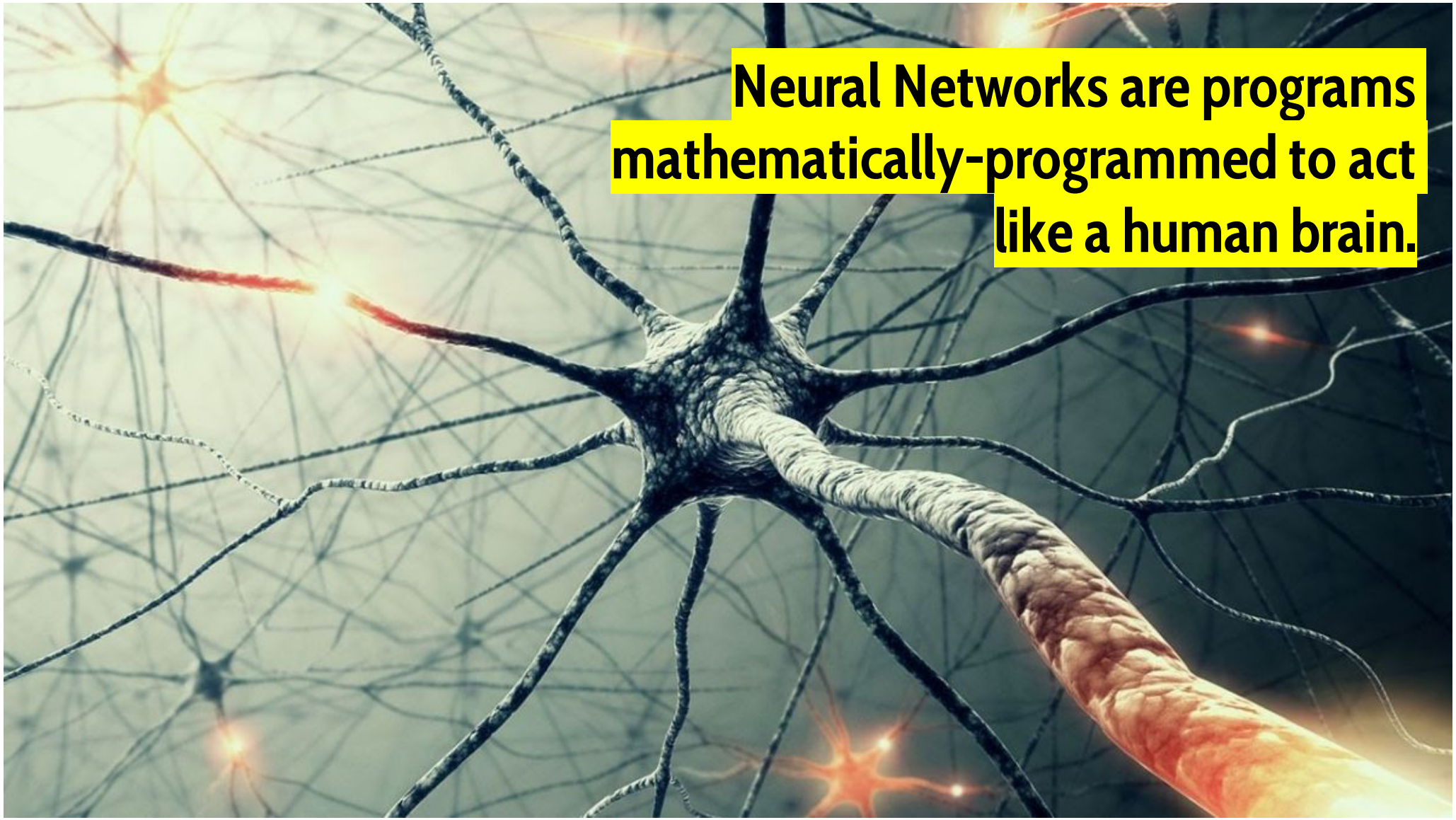
Data Scientist

Data Storyteller

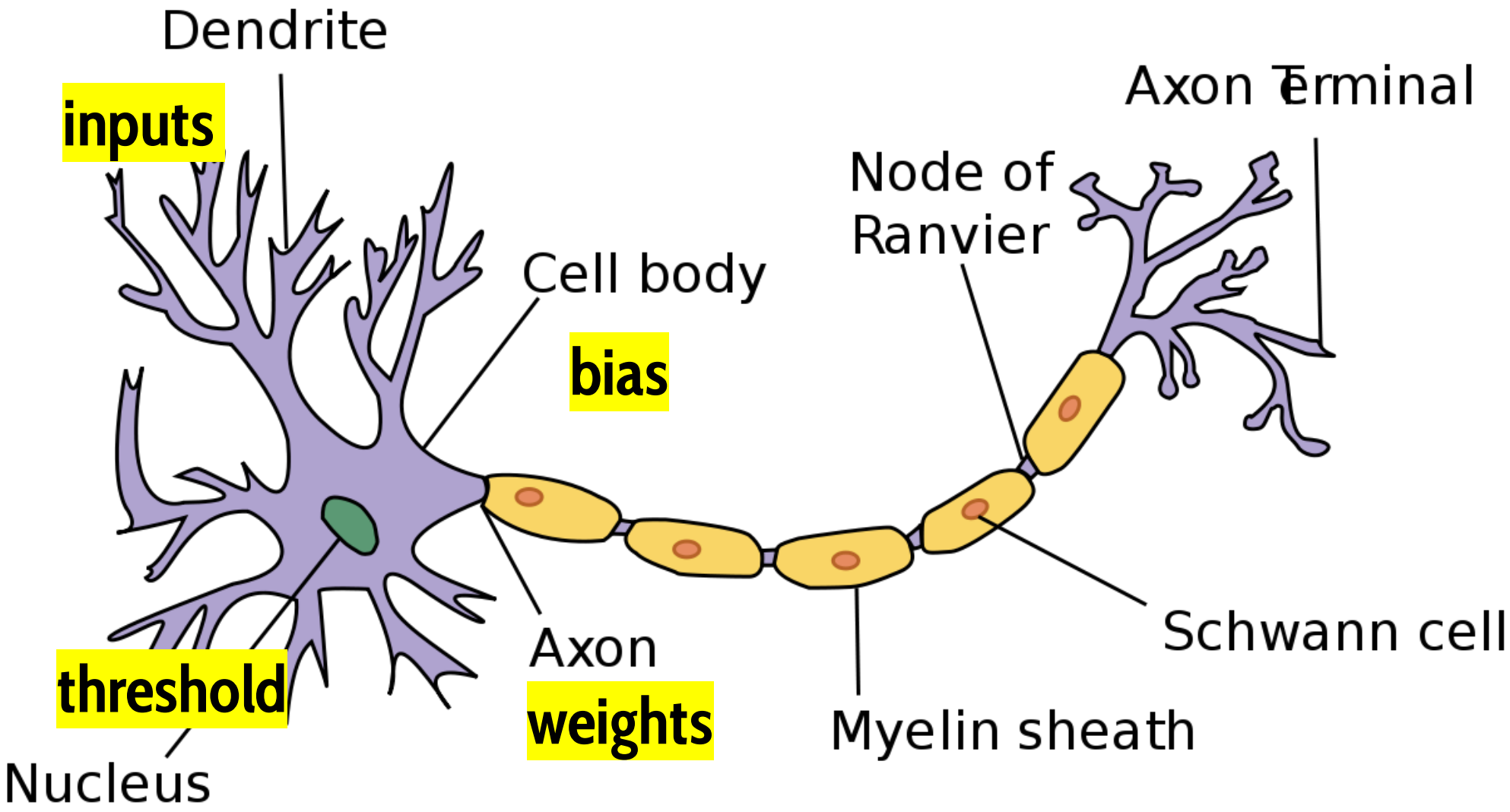
Robot process automator


..given all this, Machine Learning
still has a long way to go!

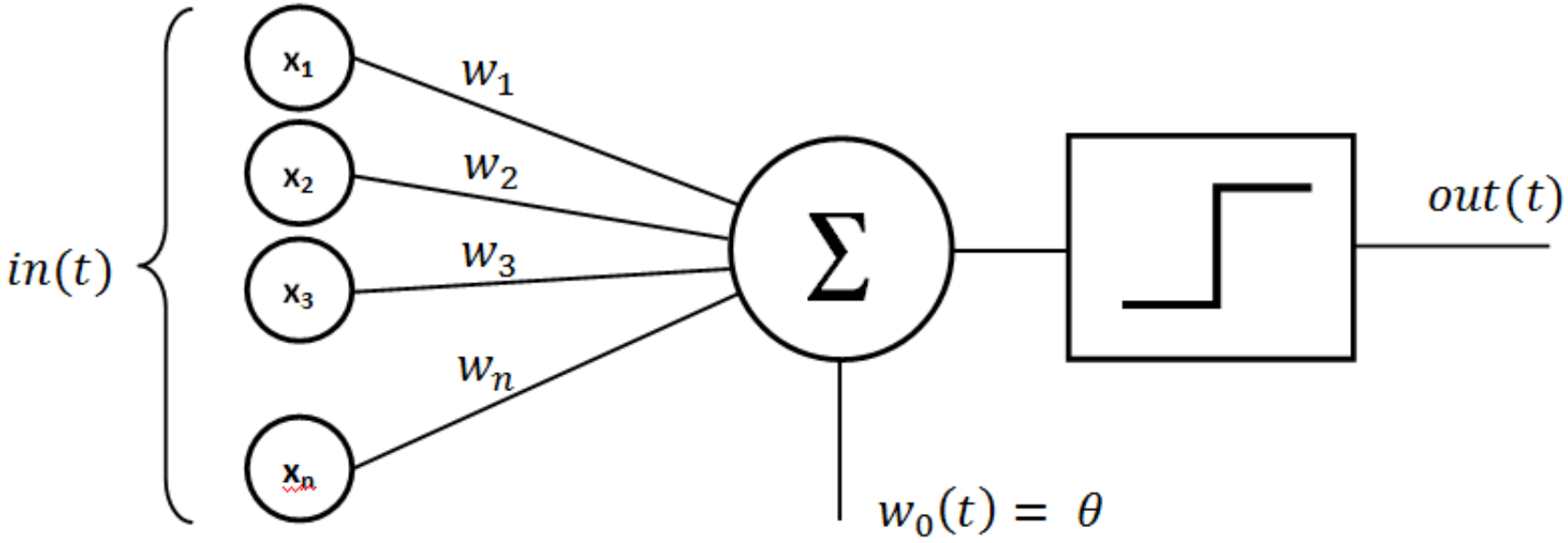

#
There will always be Math
..that we're always sure


Neural Networks are programs
mathematically-programmed to act
like a human brain.

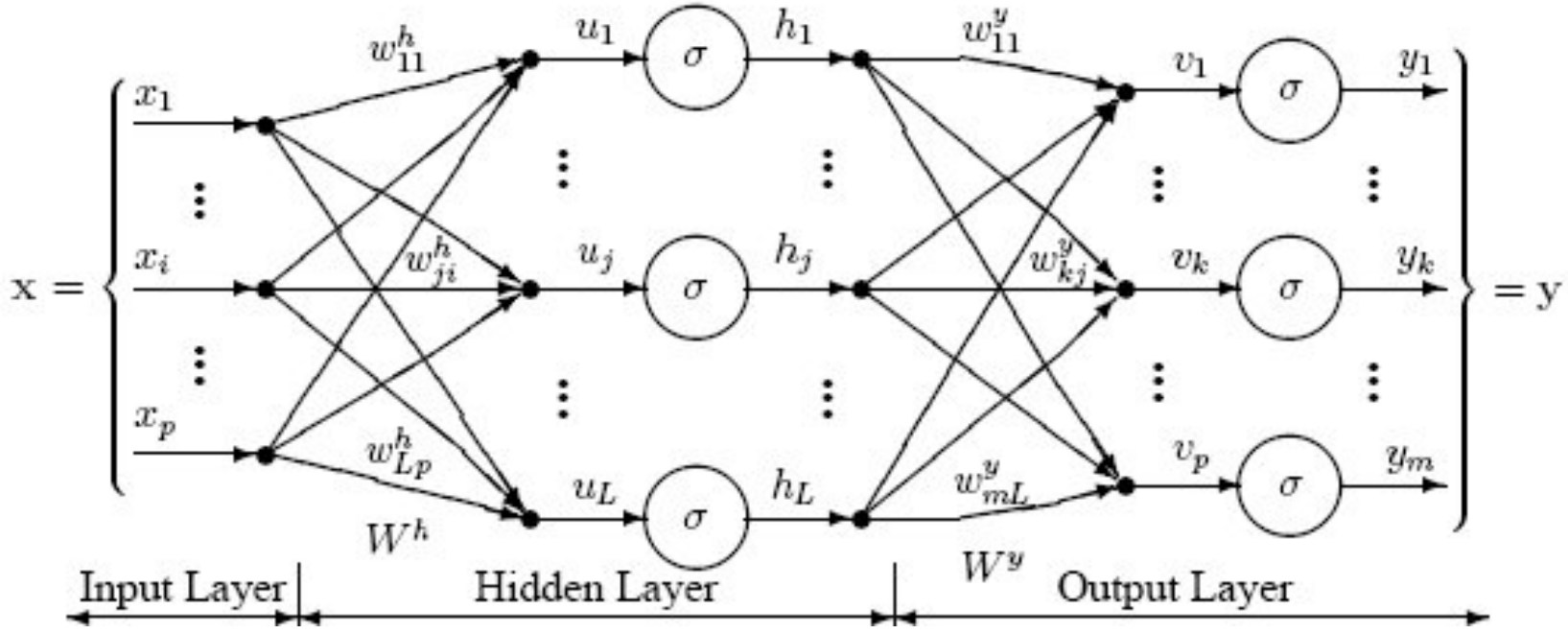
Our brains are so complex they're too difficult to understand.


Dendrite
inputs
Axon Terminal
Node of Ranvier
Cell body
bias
threshold
Axon
weights
Schwann cell
Myelin sheath
Nucleus

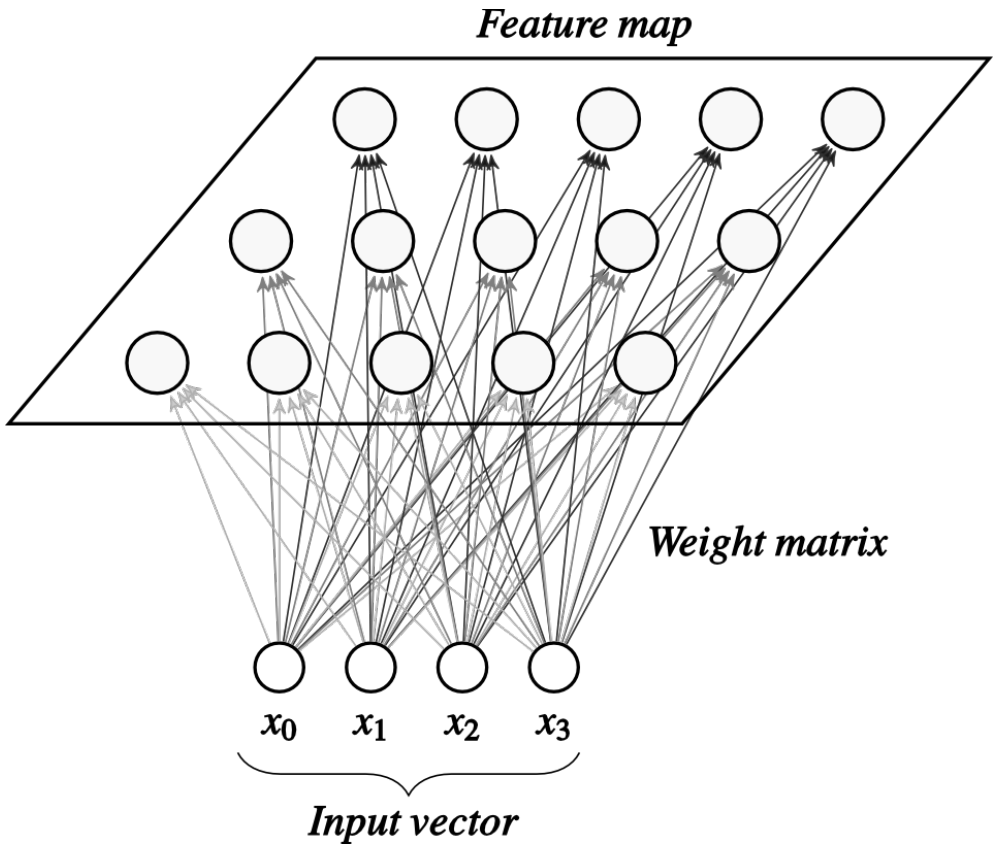
The Perceptron

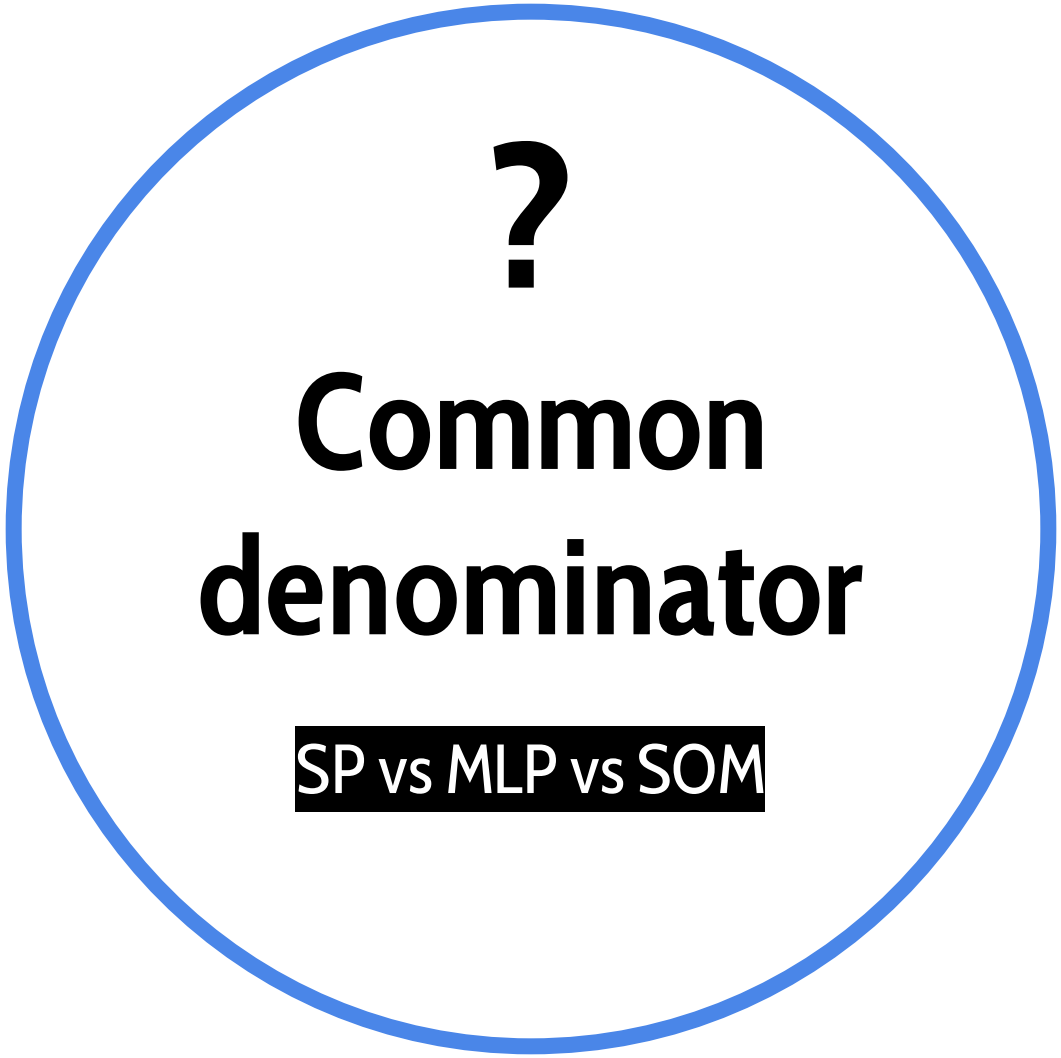


A MultiLayer Perceptron



Self-Organizing Maps (SOM)




?
Common denominator
SP vs MLP vs SOM

Hello Calculus, my old friend!

$$\frac{\partial E_p}{\partial Y_{ji}} = \frac{\partial E_p}{\partial net_{(j+1)1}} \frac{\partial net_{(j+1)1}}{\partial Y_{ji}} + \frac{\partial E_p}{\partial net_{(j+1)2}} \frac{\partial net_{(j+1)2}}{\partial Y_{ji}} + \ldots \quad (2.10)$$

$$= \sum_{a=1}^{N_{j+1}} \left[\frac{\partial E_p}{\partial net_{(j+1)a}} \frac{\partial net_{(j+1)a}}{\partial Y_{ji}} \right] (2.11)$$

$$= \sum_{a=1}^{N_{j+1}} \left[-\delta_{(j+1)a} \frac{\partial}{\partial Y_{ji}} (W_{(j+1)a0} Y_{j0} + \ldots + W_{(j+1)ai} Y_{ji} + \ldots) \right] (2.12)$$

$$= \sum_{a=1}^{N_{j+1}} \left[-\delta_{(j+1)a} \frac{\partial}{\partial Y_{ji}} (W_{(j+1)ai} Y_{ji}) \right] (2.13)$$

$$= \sum_{a=1}^{N_{j+1}} \left[-\delta_{(j+1)a} W_{(j+1)ai} \right]. (2.14)$$

Computational Creativity

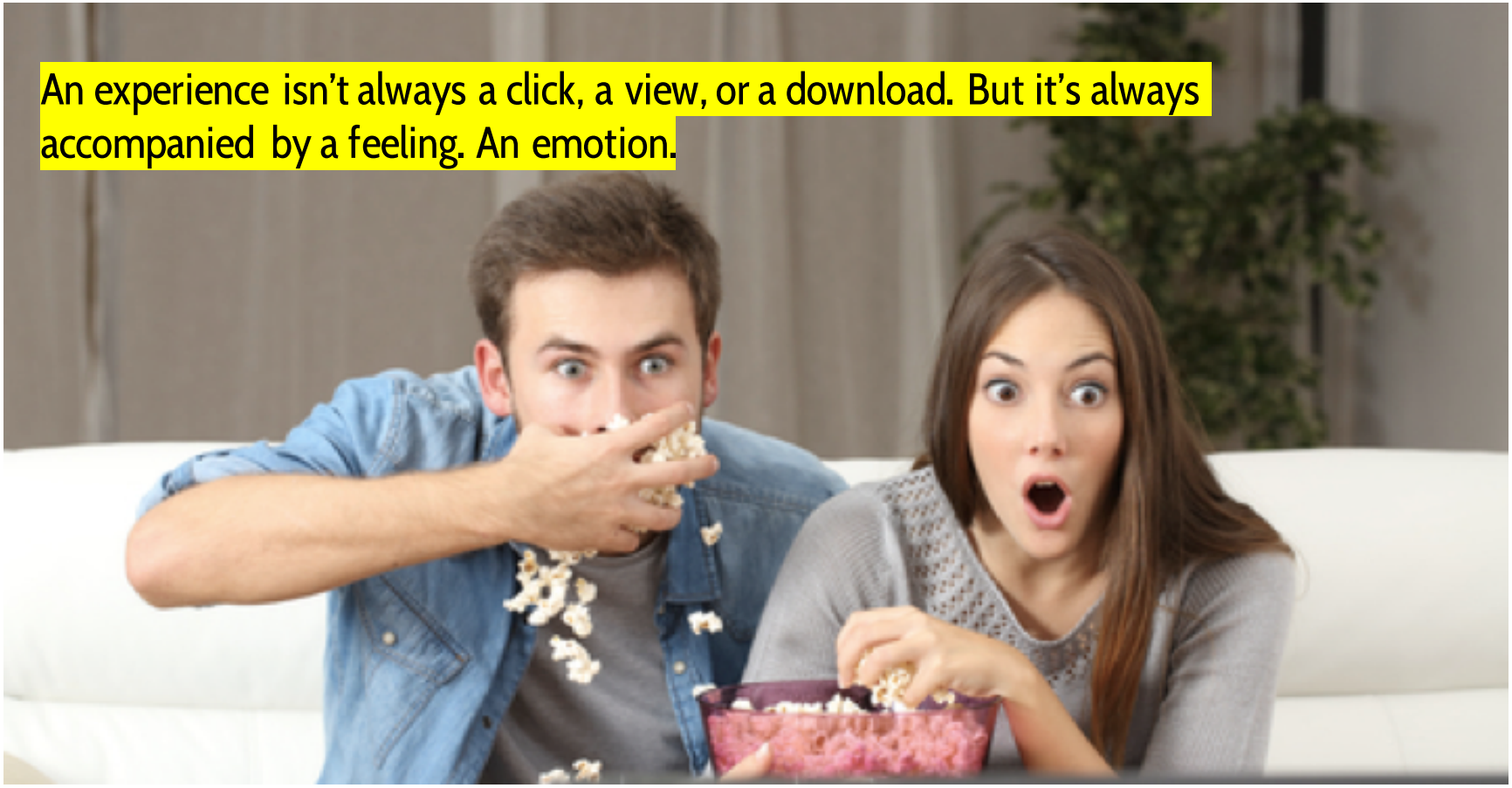
Aka artificial creativity or creative computing, is a multidisciplinary endeavour that is located at the intersection of the fields of artificial intelligence, cognitive psychology, philosophy, and the arts.

The goal of computational creativity is to model, simulate or replicate creativity using a computer, to achieve one of several ends

in partnership with

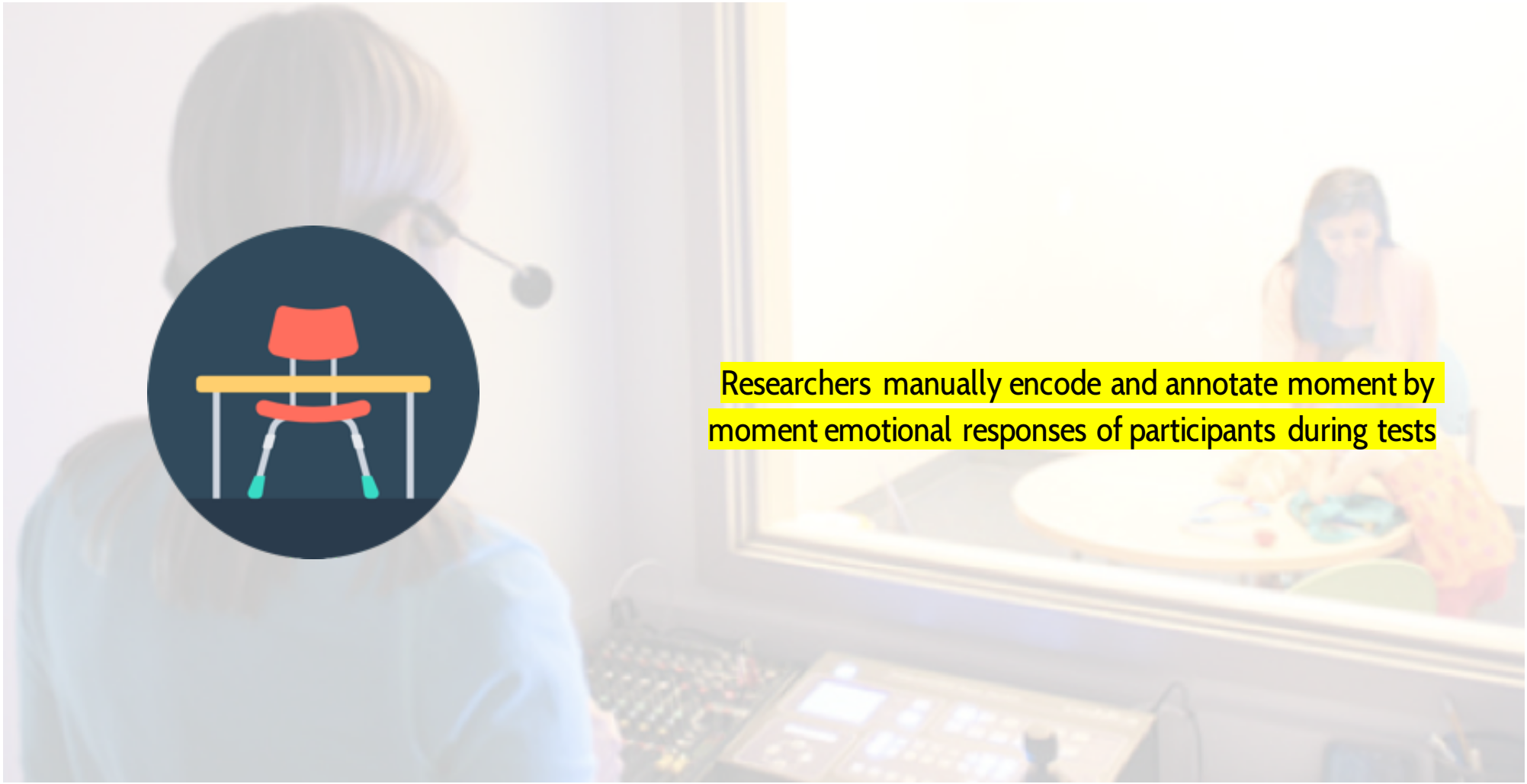
NUWORKS
INTERACTIVE

the team..


An experience isn't always a click, a view, or a download. But it's always accompanied by a feeling. An emotion.

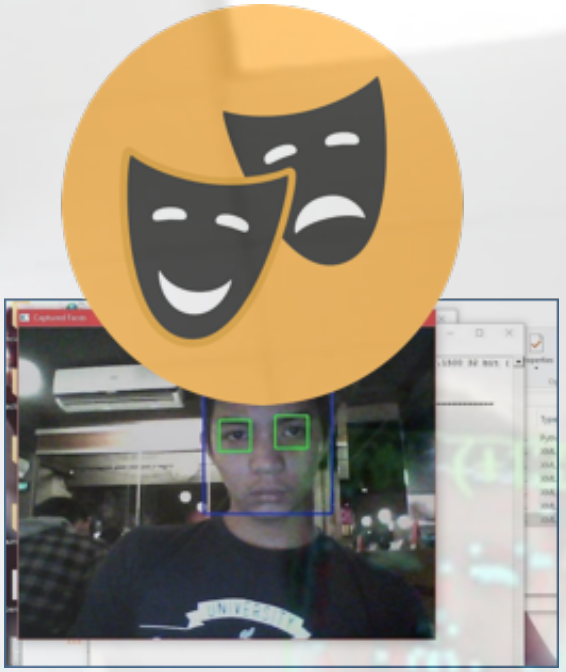
a computationally creative computer that reads human emotions and validate if a certain scene gives you the right “feels”

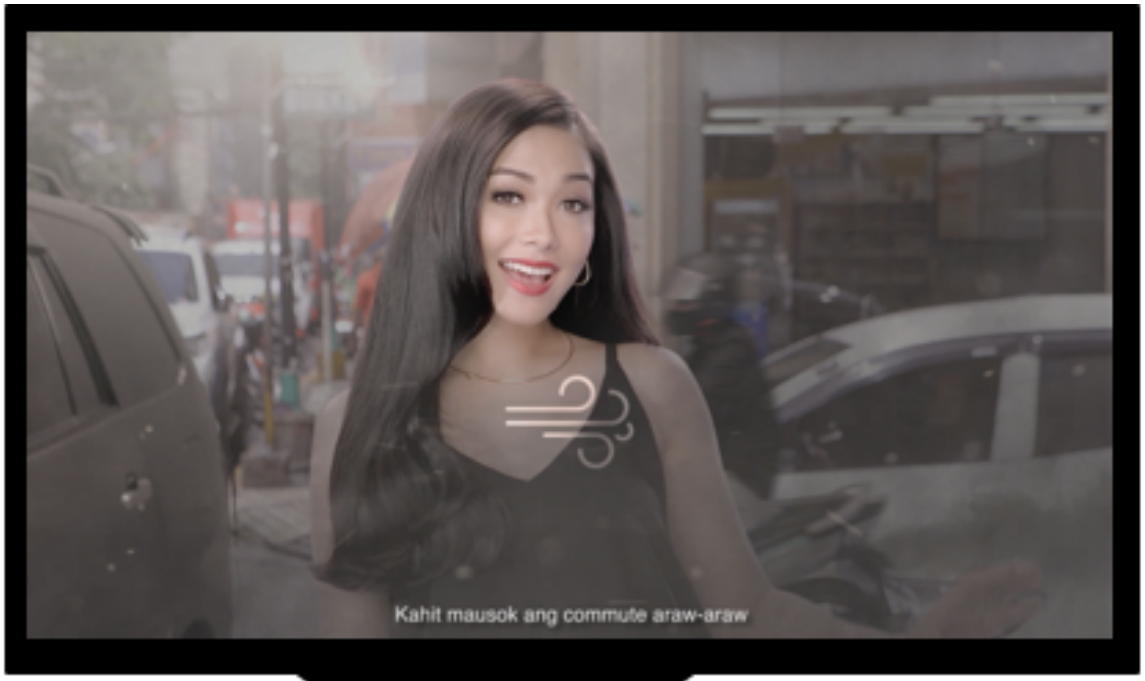

EMOTIV



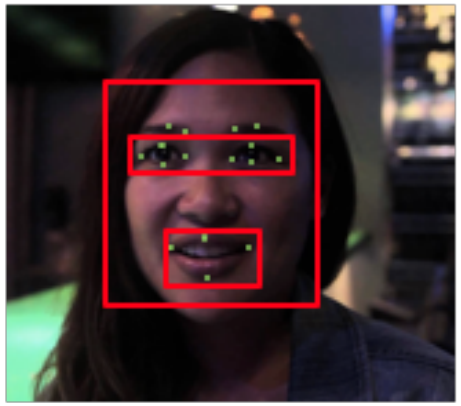
Researchers manually encode and annotate moment by moment emotional responses of participants during tests

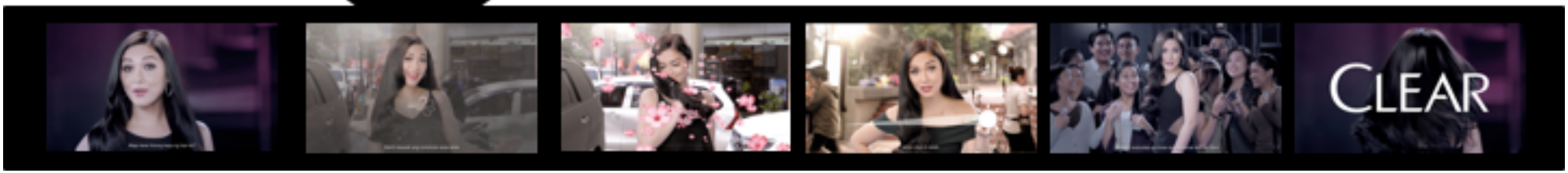
Use an emotion recognition software developed by a professor from the DLSU to quantitatively anecdote emotional changes through points in peoples faces



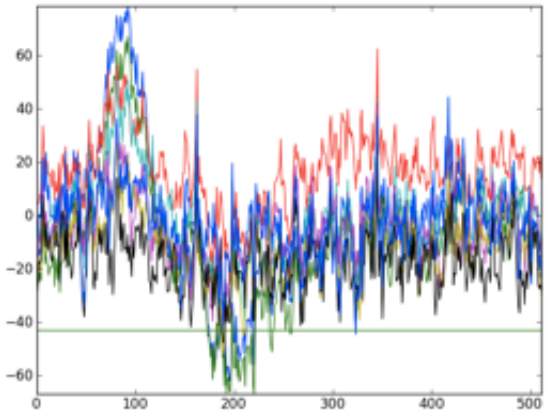


Emotion detection through facial recognition





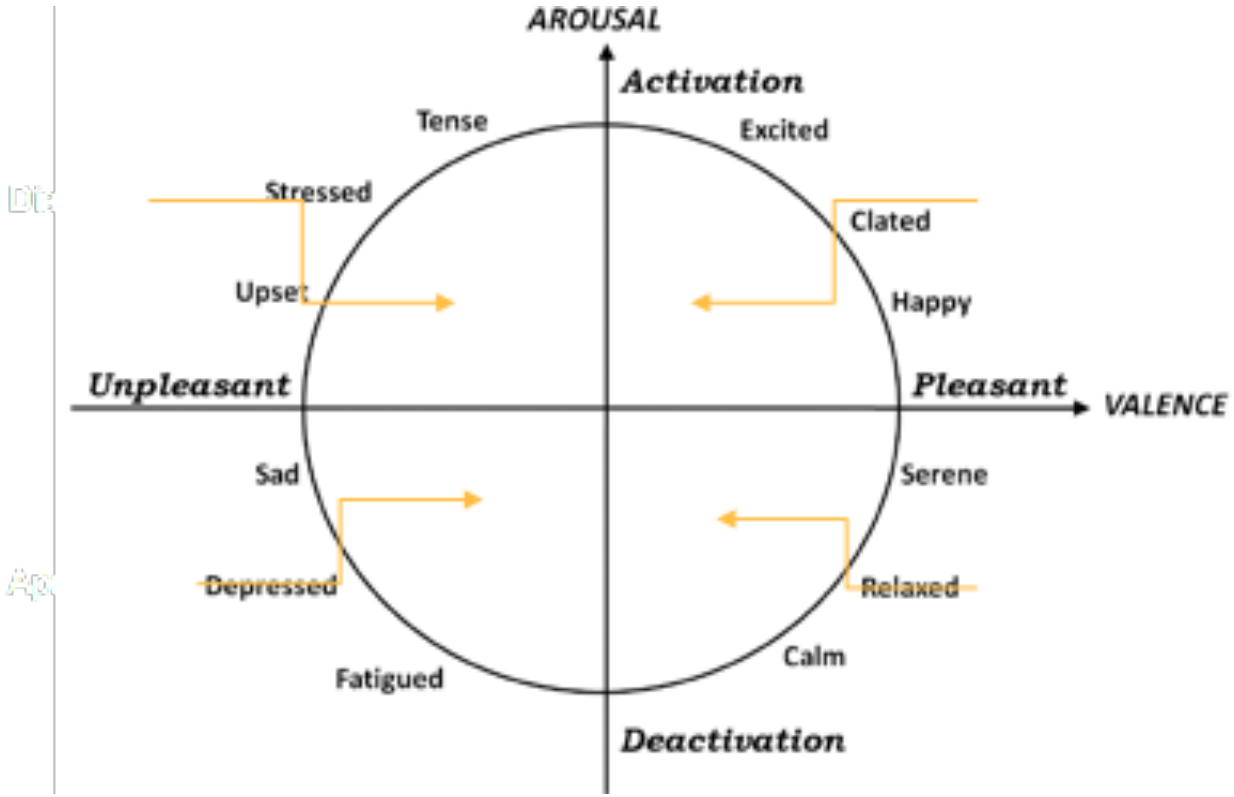

Use EEG headsets from Emotiv (Insight and Epoc) to read peoples emotions through the analysis of the signals that their brains emit



Raw EEG data readings are almost impossible to read or get insights from as our brains our complex.

Emotion: Filipino Happy

Building emotions



data collection by watching emotion-enducing videos

actual data collection

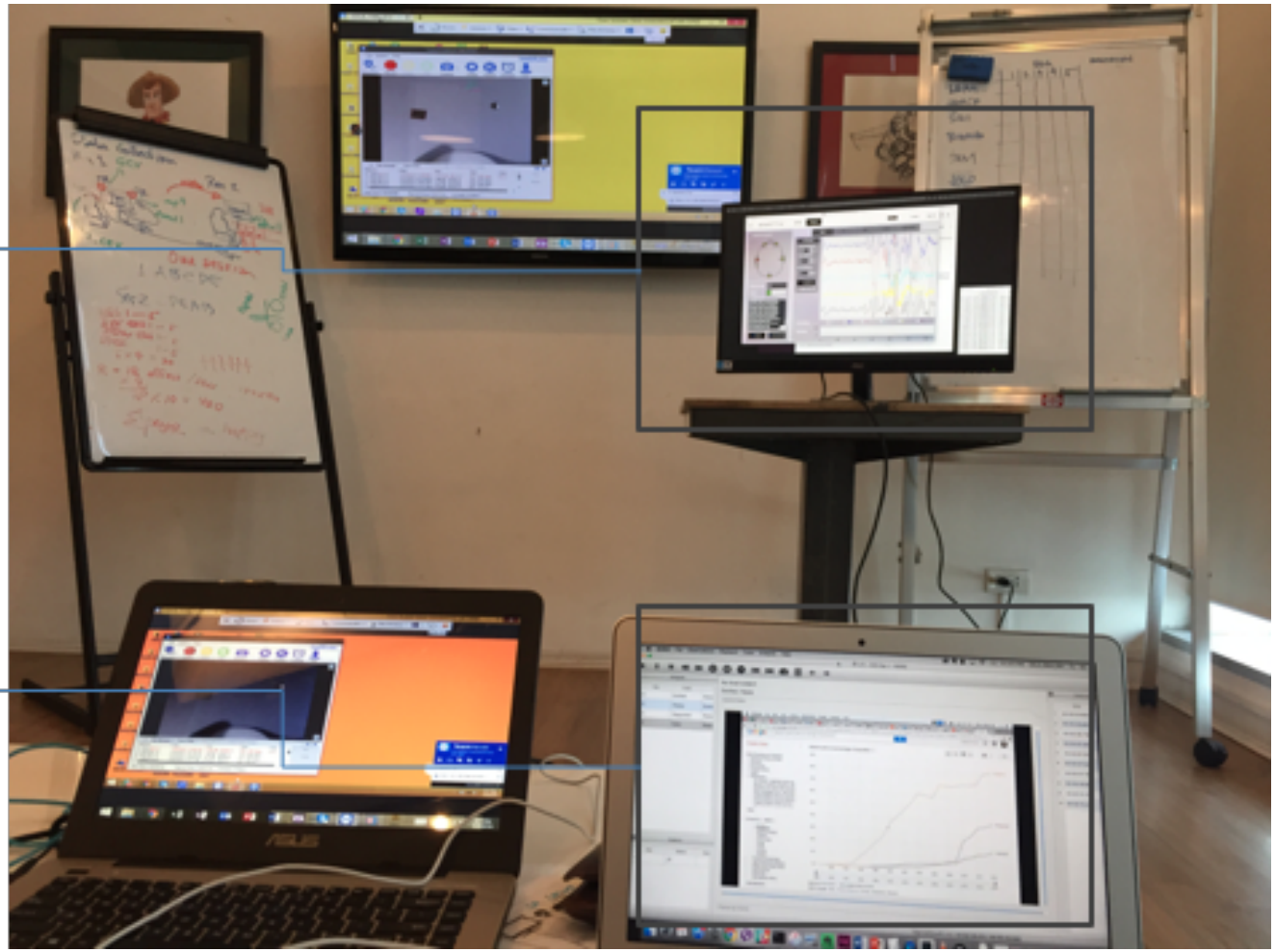
Tools Used in Model Creation Initial Data Collection:

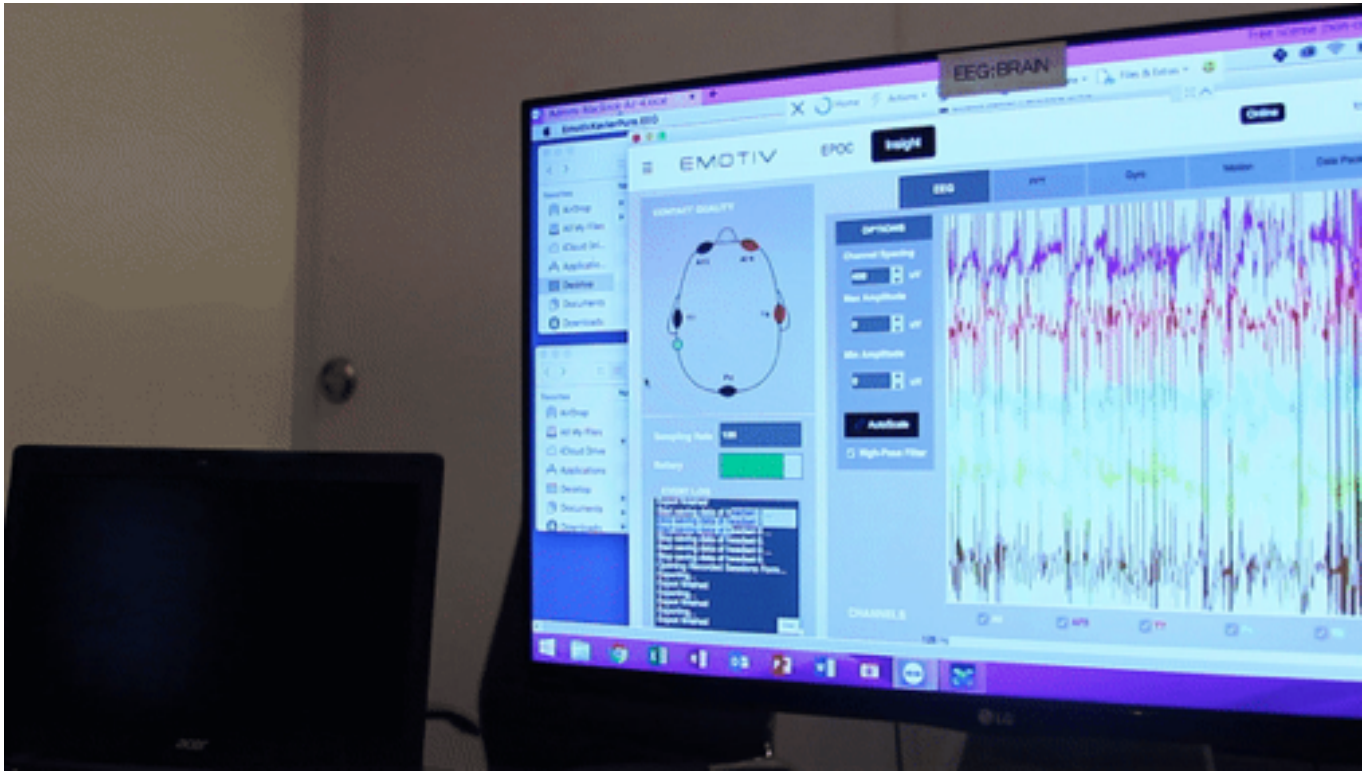
Emotiv Xavier – Output for raw EEG visualization

NuWorks EEG Reader/Interpreter – Data reader in partnership with DLSU COMET

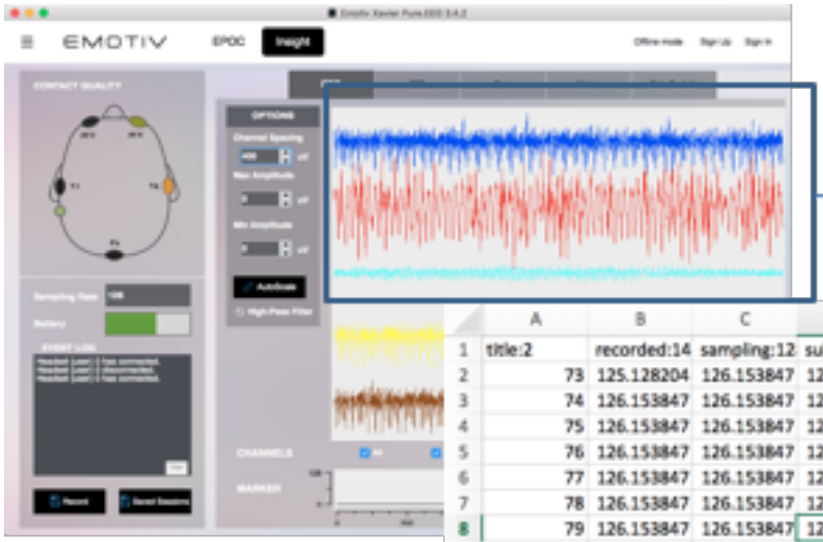
BORIS – **B**ehavioral **O**bservation **R**esearch Interactive **S**oftware from the University of Turin, Italy.

An event logging software for video/audio coding that is open-source





Live data gathering in process

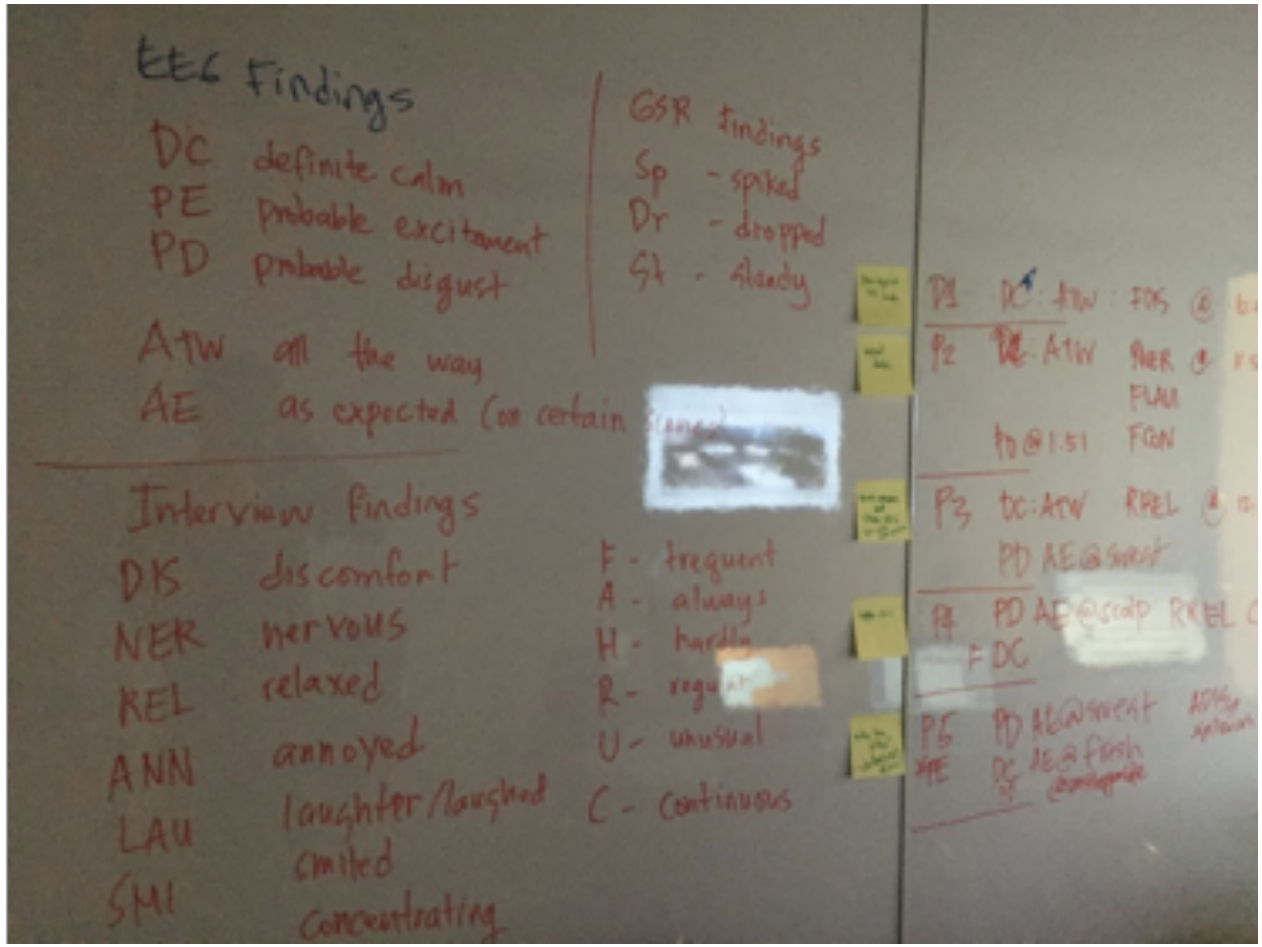


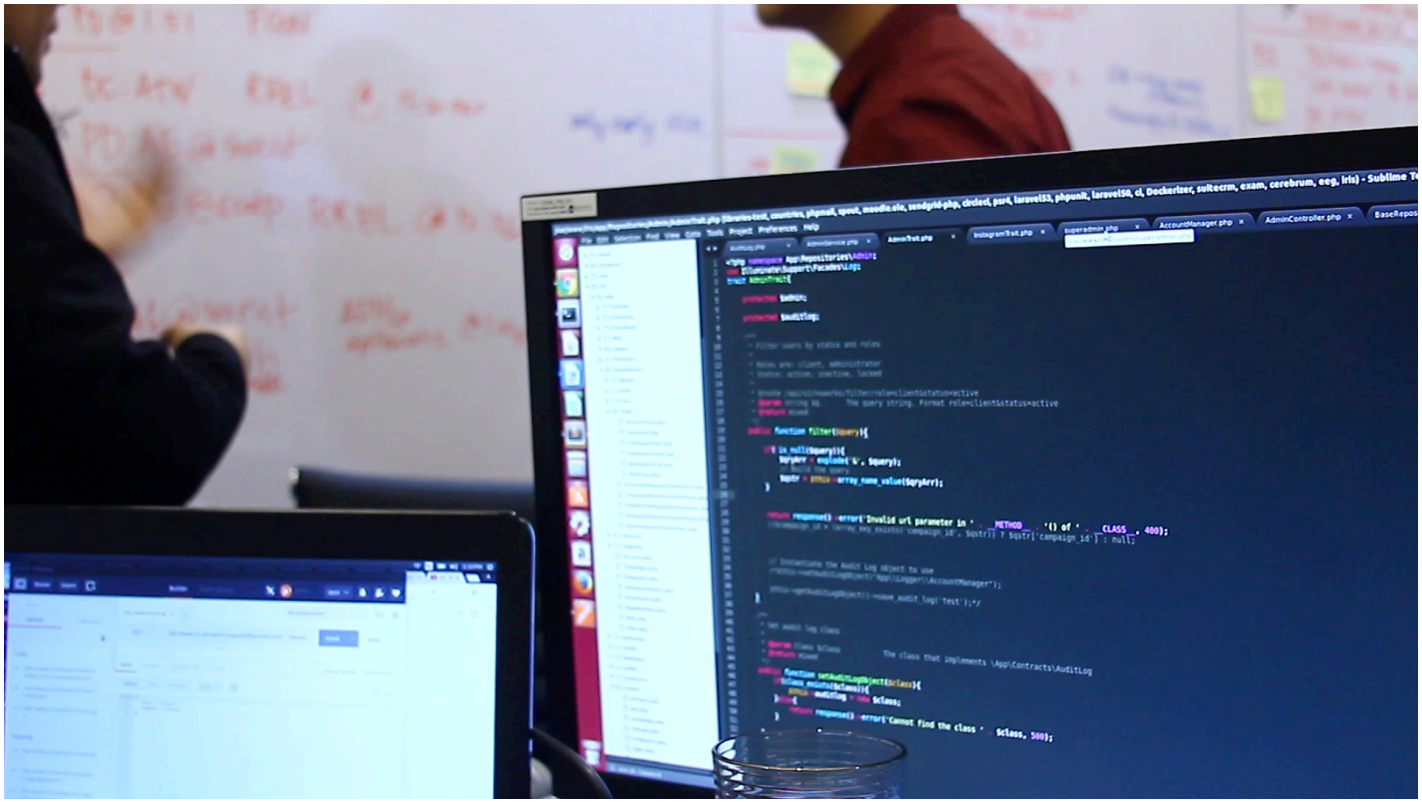
Raw visualization of EEG signals

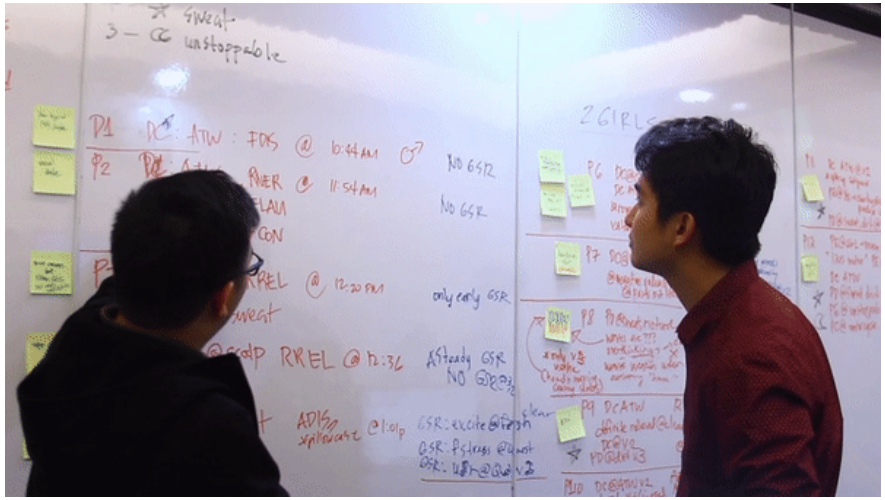
Raw data outputs of EEG Signals

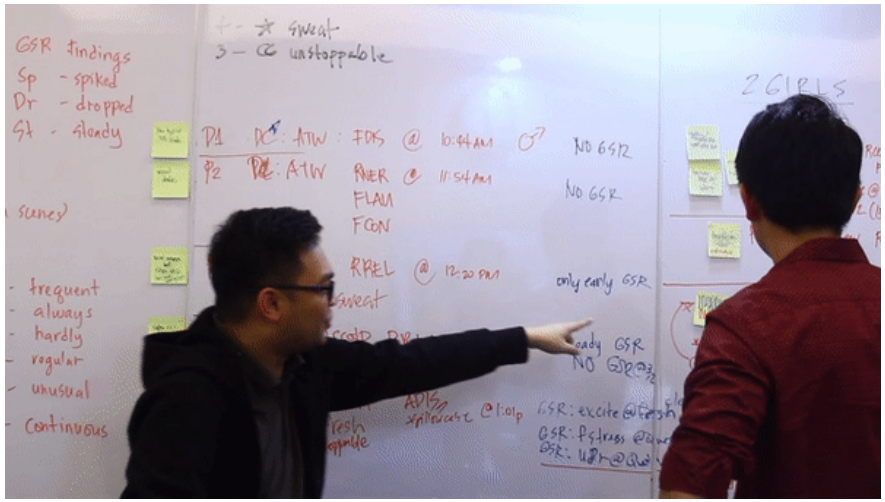
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	title:2	recorded:14	sampling:12	subject:16	labels:COUN	chan:12	units:emotiv							
2	73	125.128204	126.153847	127.179482	56.9230766	145.128204	118.974358	70.2564087	153.846146	167.179489	27873	869.230774		
3	74	126.153847	126.153847	127.179482	57.9487152	143.07692	120	70.2564087	152.820511	168.205124	27873	877.435852		
4	75	126.153847	126.153847	127.179482	56.9230766	145.128204	118.974358	69.2307663	153.846146	168.205124	27873	885.128174		
5	76	126.153847	126.153847	127.179482	56.9230766	146.153839	118.974358	70.2564087	156.92308	169.230759	27873	893.333313		
6	77	126.153847	126.153847	127.179482	57.9487152	144.102554	118.974358	70.2564087	156.92308	169.230759	27873	901.025635		
7	78	126.153847	126.153847	127.179482	56.9230766	145.128204	118.974358	70.2564087	150.256409	168.205124	27873	908.717957		
8	79	126.153847	126.153847	127.179482	56.9230766	143.07692	120	69.2307663	154.871796	168.205124	27873	916.923035		
9	80	126.153847	126.153847	127.179482	55.8974342	145.128204	118.974358	69.2307663	151.794861	168.205124	27873	924.615356		
10	81	126.153847	126.153847	127.179482	55.8974342	144.102554	118.974358	70.2564087	157.948715	168.205124	27873	932.307678		
11	82	126.153847	126.153847	127.179482	56.9230766	144.102554	118.974358	70.2564087	157.948715	168.205124	27873	940.512817		
12	83	126.153847	126.153847	127.179482	55.8974342	146.153839	118.974358	69.2307663	160	167.179489	27873	948.205078		
13	84	126.153847	126.153847	127.179482	55.8974342	146.153839	118.974358	70.2564087	152.820511	169.230759	27873	955.8974		
14	85	126.153847	126.153847	126.153847	56.9230766	145.128204	120	67.1794891	151.794861	169.230759	27873	964.102539		
15	86	126.153847	126.153847	126.153847	55.8974342	145.128204	118.974358	70.2564087	152.820511	168.205124	27873	971.794861		
16	87	126.153847	126.153847	126.153847	54.8717918	145.128204	120	70.2564087	152.820511	168.205124	27873	980		
17	88	126.153847	126.153847	126.153847	55.8974342	143.07692	120	69.2307663	152.820511	168.205124	27873	987.692261		
18	89	126.153847	126.153847	126.153847	55.8974342	144.102554	120	69.2307663	153.846146	168.205124	27873	995.384583		
19	90	126.153847	126.153847	126.153847	56.9230766	143.07692	120	69.2307663	152.820511	169.230759	27874	3.58974361		
20	91	126.153847	126.153847	126.153847	56.9230766	144.102554	118.974358	69.2307663	152.820511	169.230759	27874	11.2820511		
21	92	126.153847	125.128204	126.153847	57.9487152	143.07692	118.974358	70.2564087	153.846146	168.205124	27874	18.9743576		
22	93	126.153847	125.128204	126.153847	57.9487152	145.128204	118.974358	69.2307663	152.820511	168.205124	27874	27.1794872		
23	94	126.153847	126.153847	126.153847	57.9487152	144.102554	118.974358	69.2307663	150.769226	169.230759	27874	34.8717957		

Control room manually annotates participants activities and states while looking at EEG signal spikes






sweat
3 – unstoppable
2 GIRLS
P1 DC: ATW : FDS @ 10:44 AM
NO GSR
P2 DC: ATW RNER @ 11:54 AM
NO GSR
FLAM
FCON
RREL @ 12:20 PM
only early GSR
RREL @ 12:36
ADIS
@ 1:01p


GSR findings
Sp - spiked
Dr - dropped
St - steady
scenes)
- frequent
- always
- hardly
- regular
- unusual
- continuous
sweat
3 – unstoppable
2 GIRLS
P1 DC: ATW : FDS @ 10:44 AM
NO GSR
P2 DC: ATW RNER @ 11:54 AM
NO GSR
FLAM
FCON
RREL @ 12:20 PM
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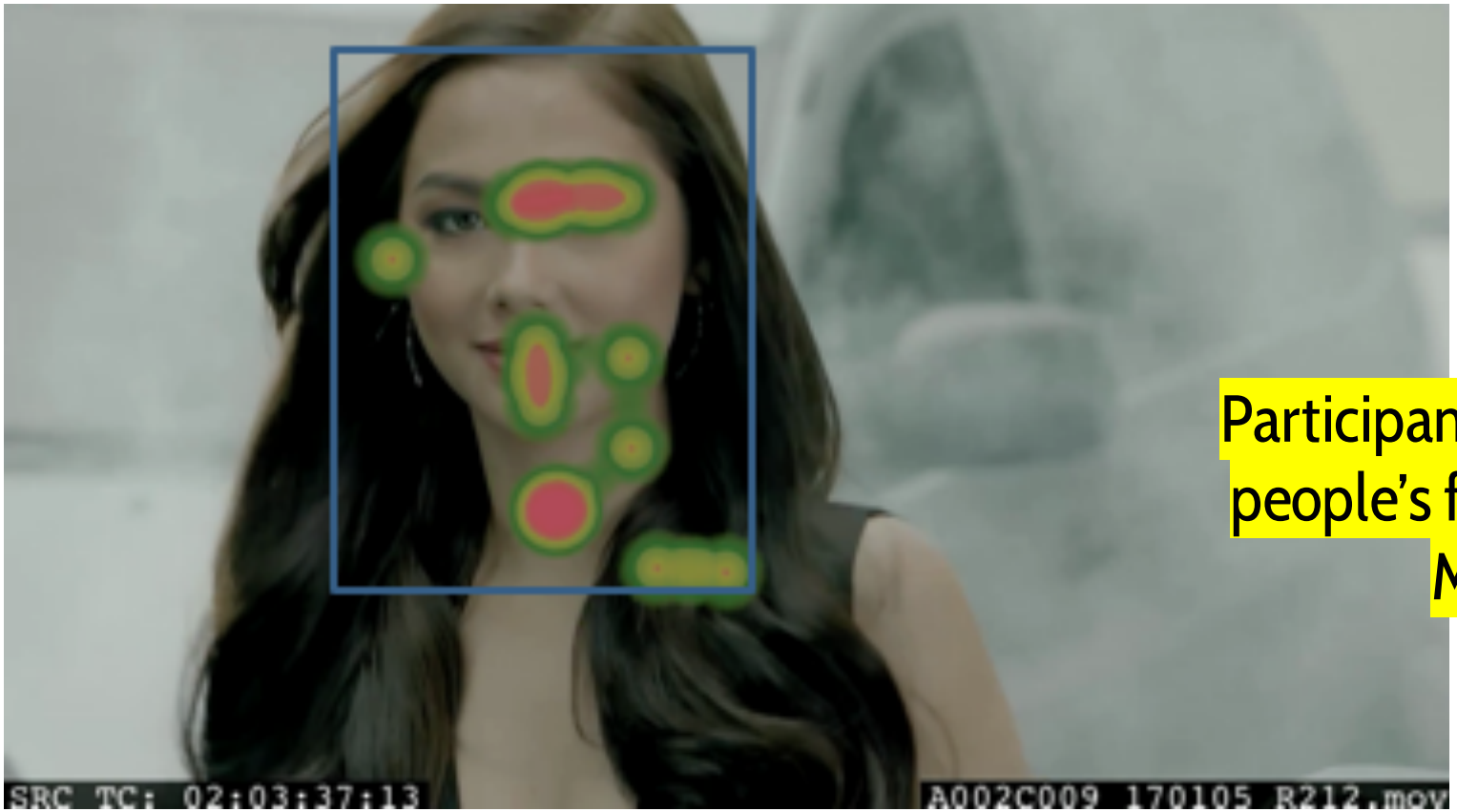
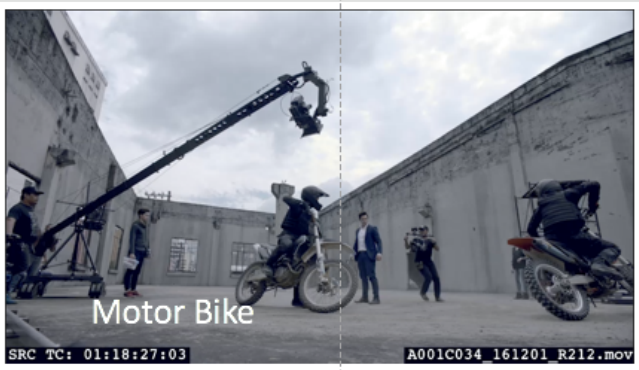


Participants, are drawn to people's faces, especially Maja in this case.

Most of the participants zero in on the scalp space created when the actors pull their hair back.

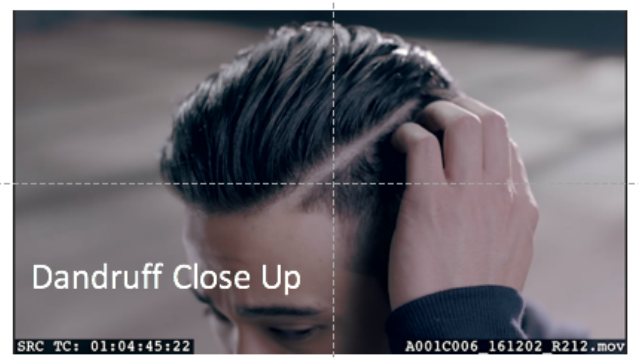
Attention was temporarily drawn out of Maja to the smoke during the traffic scene which is good.


Bedroom
SRC TC: 03:13:47:19
A003C019_161202_R212.mov


Motor Bike
SRC TC: 01:18:27:03
A001C034_161201_R212.mov

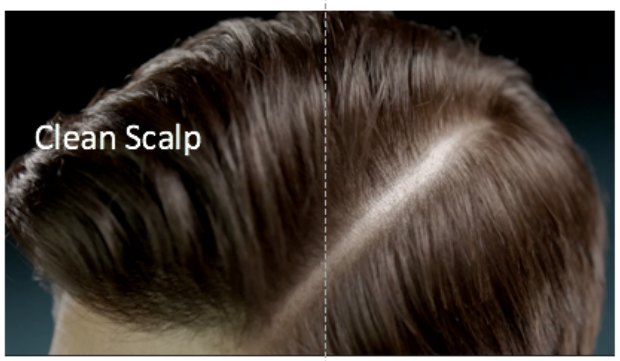

Dancing
SRC TC: 02:01:18:08
A002C001_161202_R212.mov

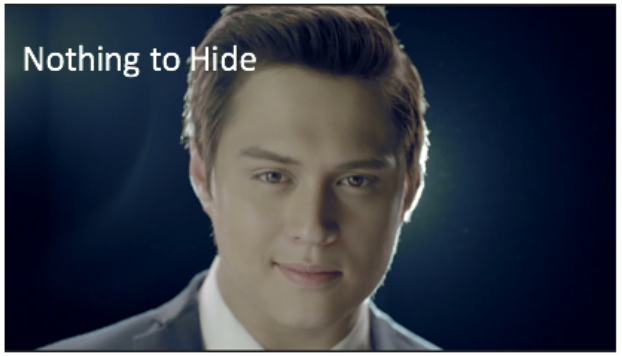

Dandruff Guy
SRC TC: 01:31:49:16
B001C015_161202_R20B.mov


Dandruff Close Up
SRC TC: 01:04:45:22
A001C006_161202_R212.mov


CLEAR
DANDRUFF-PROOF
YOUR STYLE
No visible flakes with regular use


Party / Singing
SRC TC: 03:13:01:16
A003C004_161201_R212.mov


Clean Scalp


Nothing to Hide

Avg. valence: 1.02 (high)

Avg. arousal: 0.498 (low)

Affect: Definitely Calm

Pocket recommendation: as is

notes* EEG values on arousal remained steady for almost 50% of Day1 respondents.

Avg. Valence: 1.024 (high)

Avg. arousal: 0.512 (high)

Affect: Possible Excitement

Pocket recommendation: keep

Notes: confirms interest for bicycles

EEG values display 30% spike of values on arousal for the next 3 seconds from this scene

Avg valence:1.01 (high)

Avg arousal: 0.481 (low)

Affect: Definite Calm

Pocket recommendation: dont

Notes: EEG values 2 seconds before and 2 seconds after hardly changed (also for most selected scenes from 15s videos)

Avg. Valence: 0.954 (low)

Avg. Arousal: 0.492 (low)

Affect: Probable Disgust

Pocket recommendation: keep

Notes: for an average of 11 users, up to 2 seconds after this scene, valence has increased (meaning relieving/relaxing scenes came after)

Avg. Valence: 0.998 (low)

Avg. Arousal: 0.5101 (high)

Affect: Probable Disgust

Pocket recommendation: keep

Avg. valence: 1.0004 (high)

Avg. arousal: 0.56 (high)

Affect: Probable excitement

Pocket recommendation: Keep

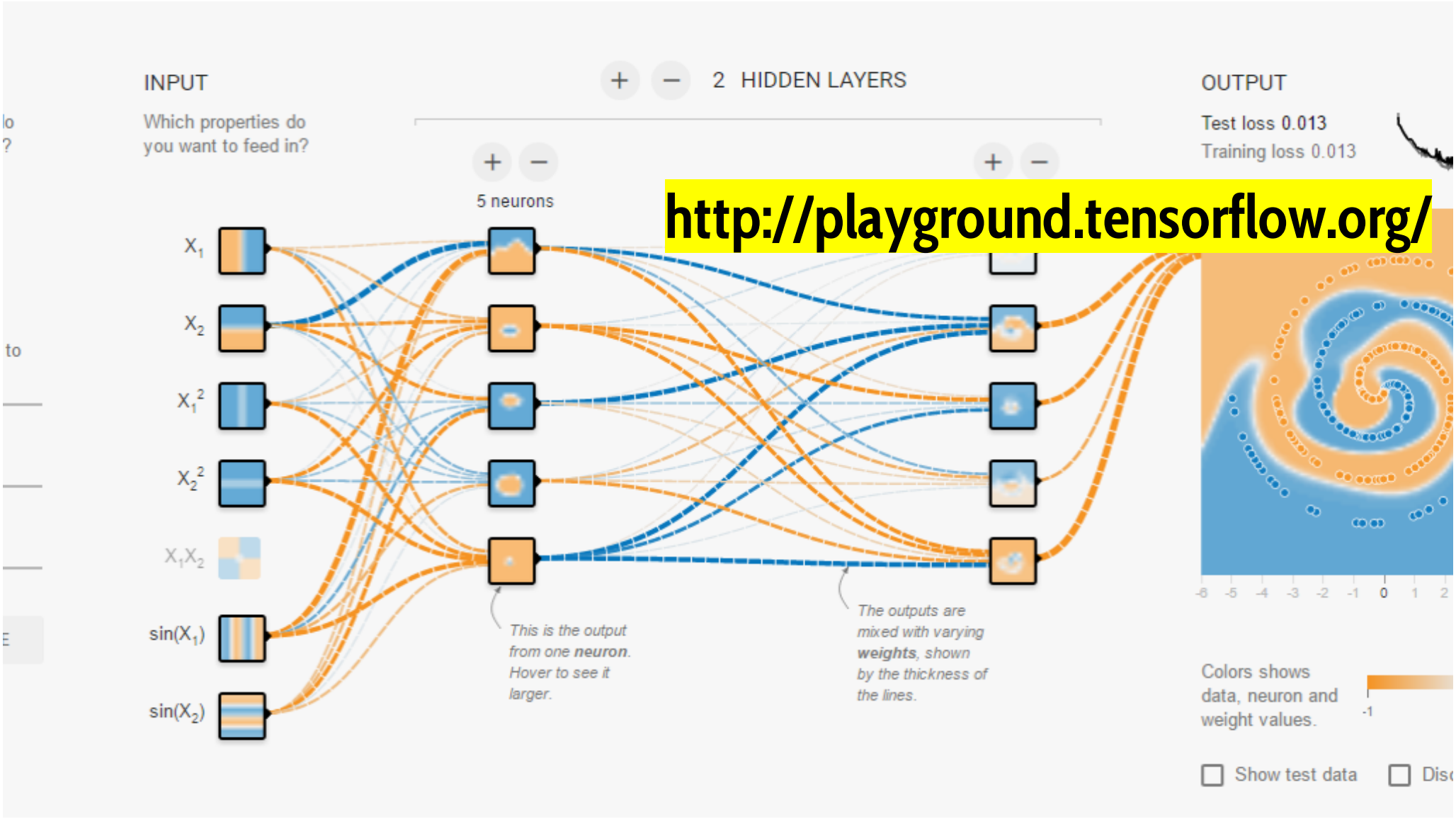
*notes: “unstoppable”

Maybe eye tracking can see if it is focused on face

The output?

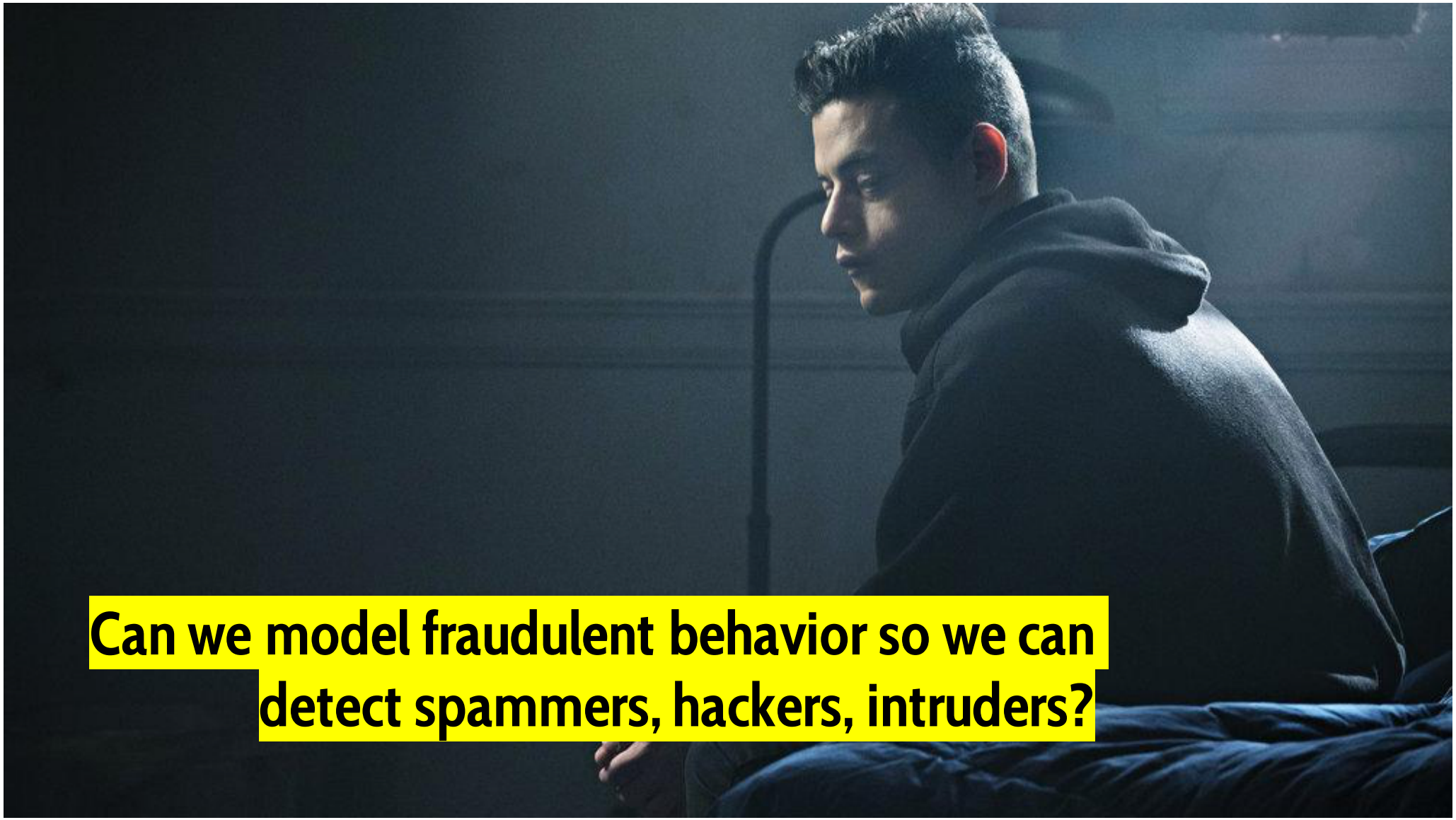
Thankfully there's TensorFlow or else we'll have to code with all the math

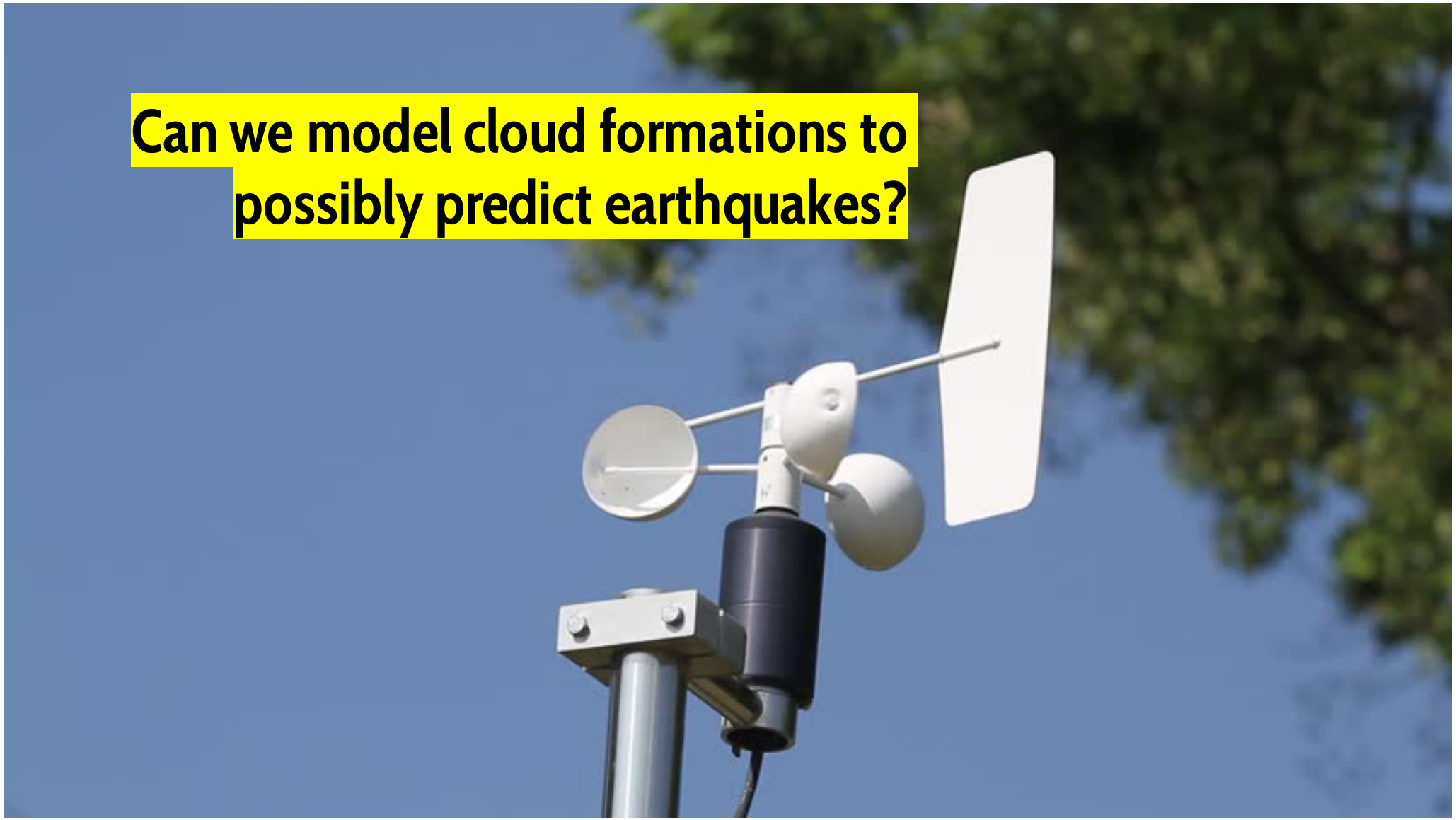
T or F?


INPUT
Which properties do you want to feed in?
2 HIDDEN LAYERS
5 neurons
OUTPUT
Test loss 0.013
Training loss 0.013
http://playground.tensorflow.org/
X1
X2
X1²
X2²
X1X2
sin(X1)
sin(X2)
This is the output from one neuron. Hover to see it larger.
The outputs are mixed with varying weights, shown by the thickness of the lines.
-6 -5 -4 -3 -2 -1 0 1 2
Colors shows data, neuron and weight values.
-1
Show test data

some Machine Learning-empowered research problems being investigated right now


Can we prevent the spread of fungi
in banana trees?


Can we model fraudulent behavior so we can
detect spammers, hackers, intruders?


Can we model cloud formations to
possibly predict earthquakes?


Can we model gestures so we can synthesize music on live performances?


can we create agents that mimic children with autism to help them speak better?


we can now make AI bots that can read human player moves. can we make affective bots that adust their difficulty based on user feelings?

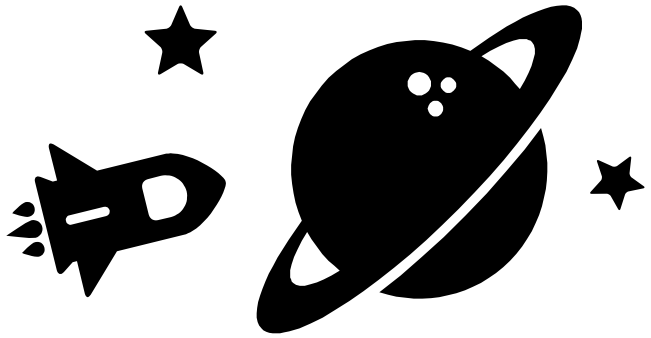

can we use VR to help teach Filipino learners about history without compromising safety?

can we use an agent to help artists/doodlers avoid repetitive strokes?


can we create a simulation of the city so that we can help urban planners?


Planes dont flap their wings to fly,
but birds dont take off from trees
either...


A car can run faster than a cheetah
but it can never climb a tree..



Thank you for listening!