Google Technologies on Machine Learning

November 12 2016

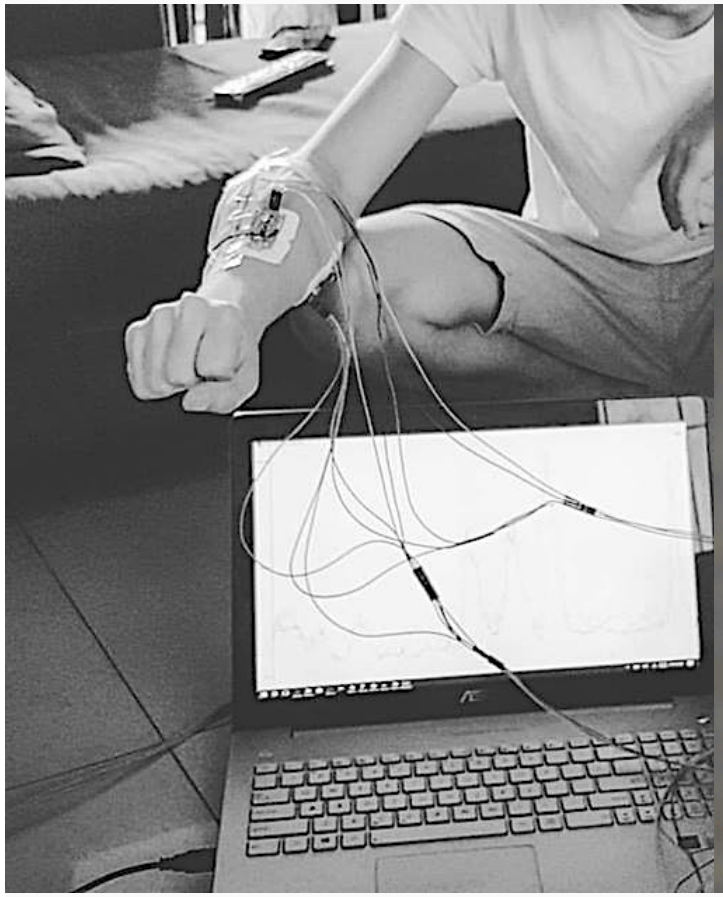
Outline

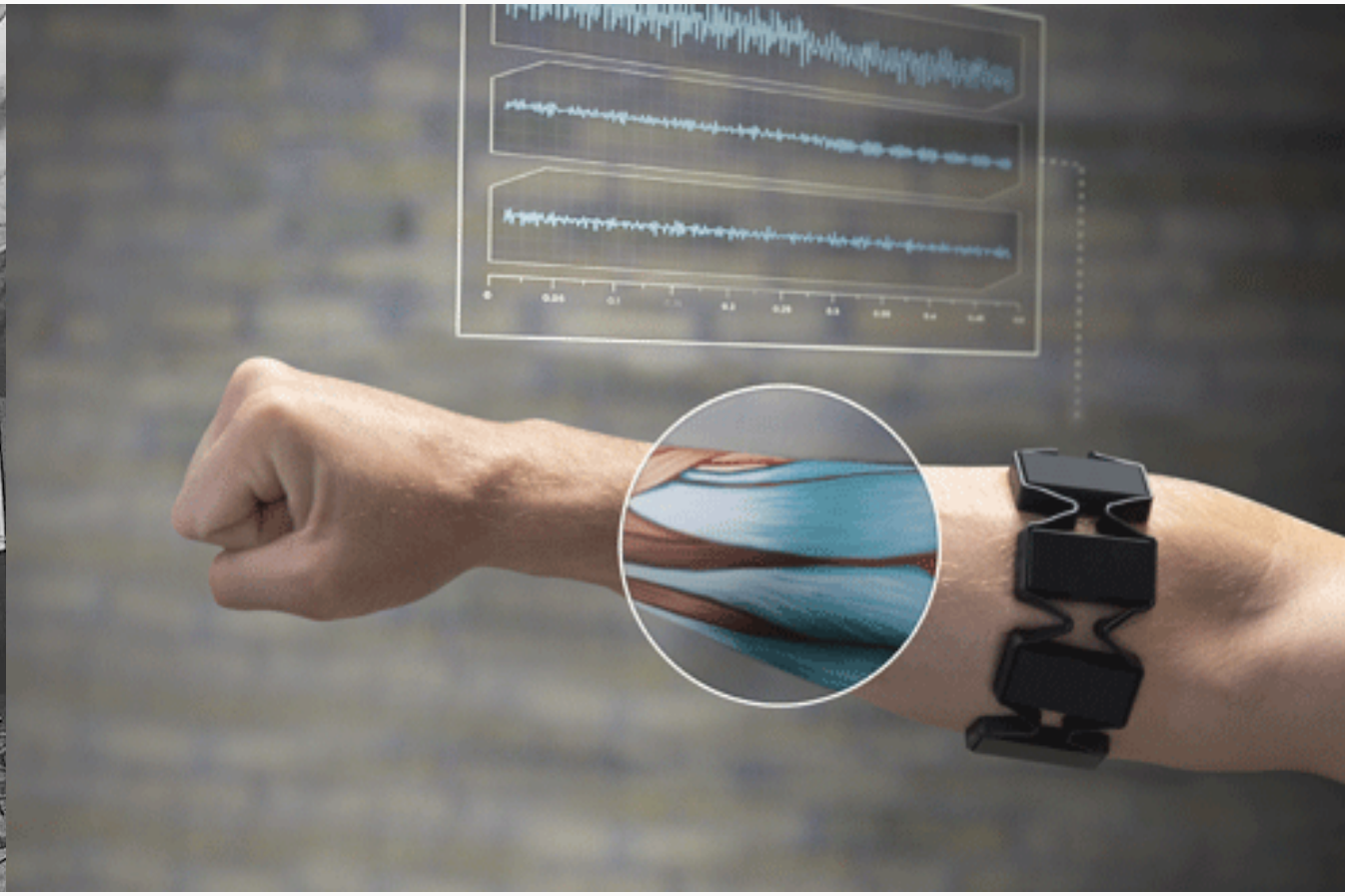
- Machine Learning
- Google Cloud Vision
- TensorFlow

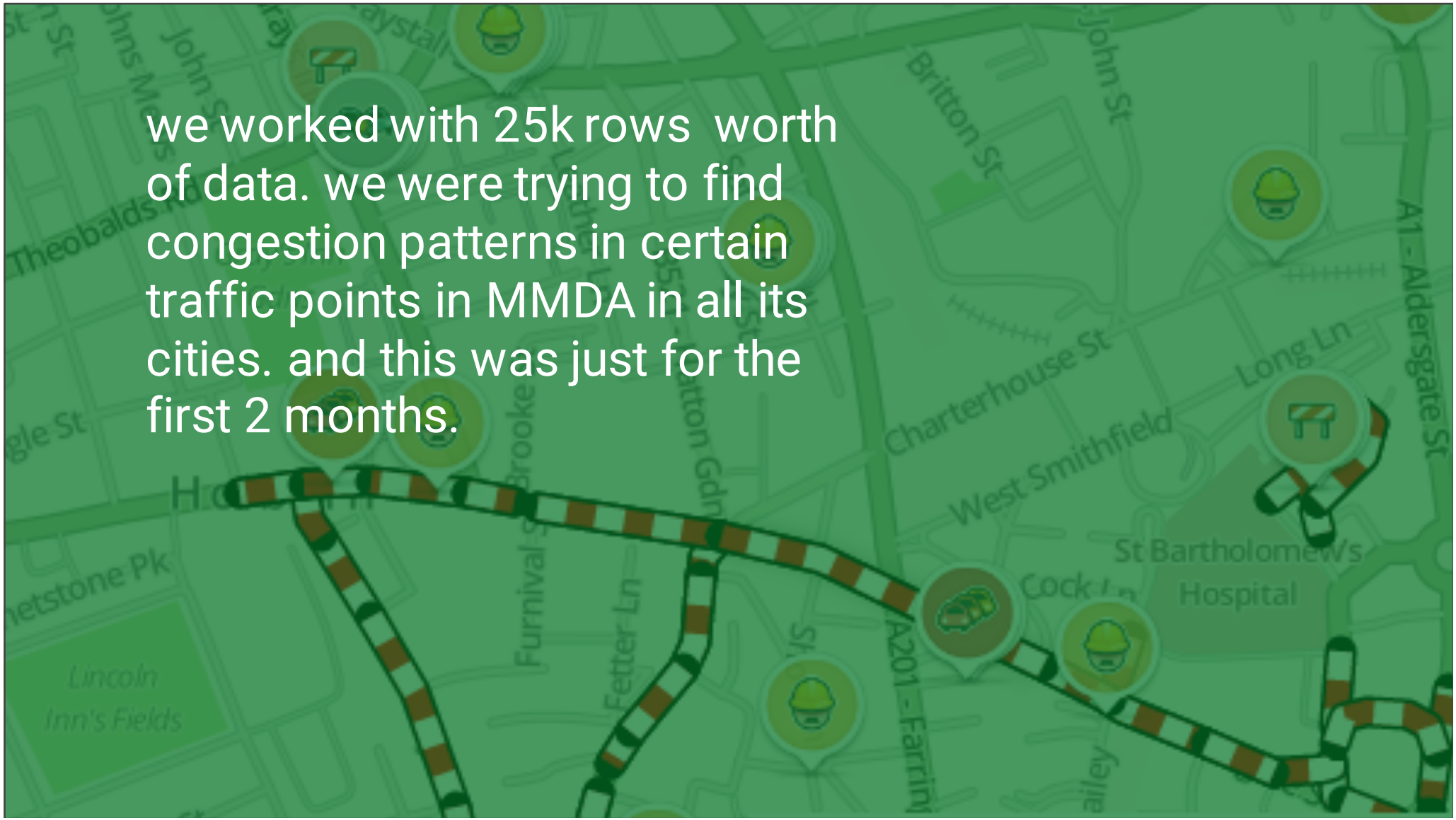
Hi, I’m **Jordan**!

I’m part of a lab where we do research in machine learning and hci

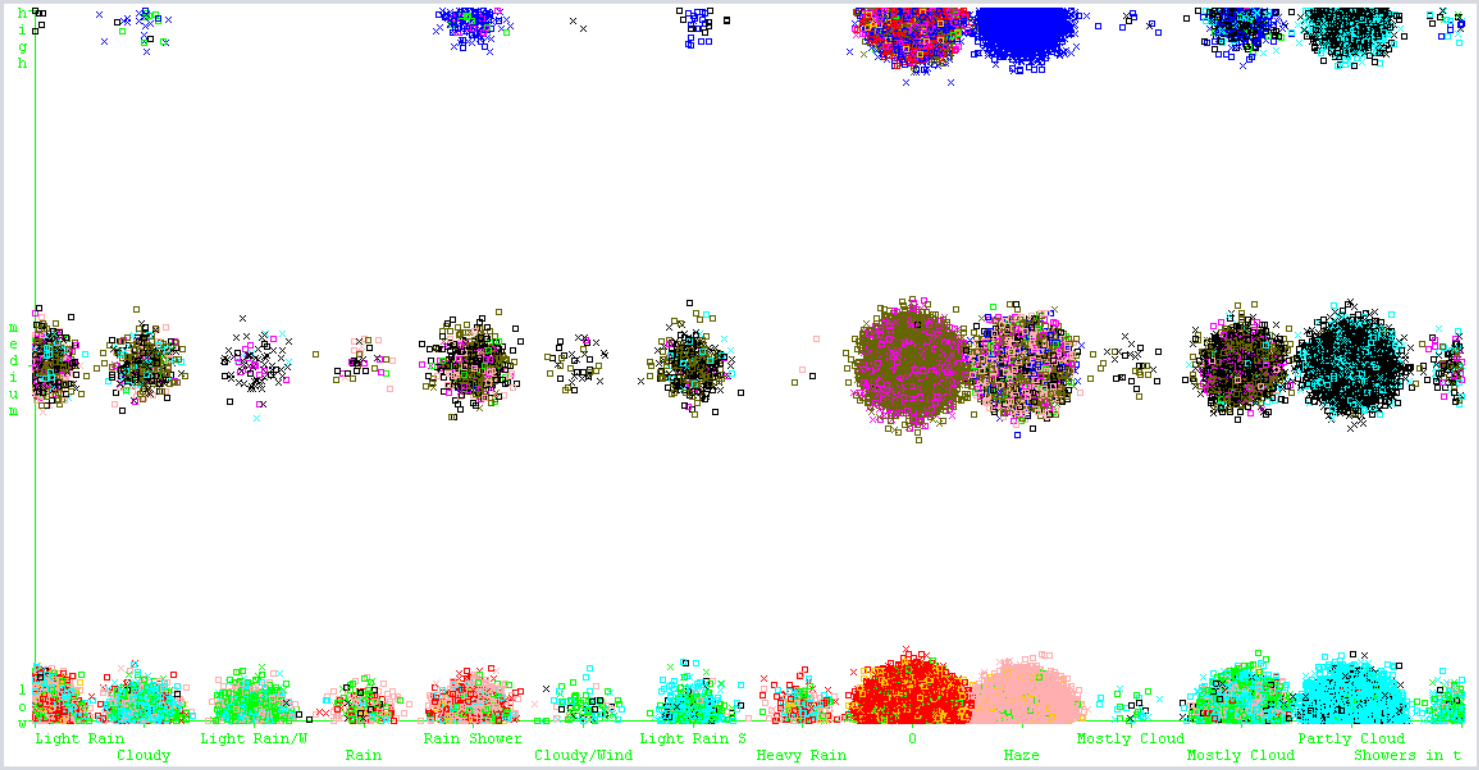
CENTER FOR
COMPLEXITY &
EMERGING
TECHNOLOGIES

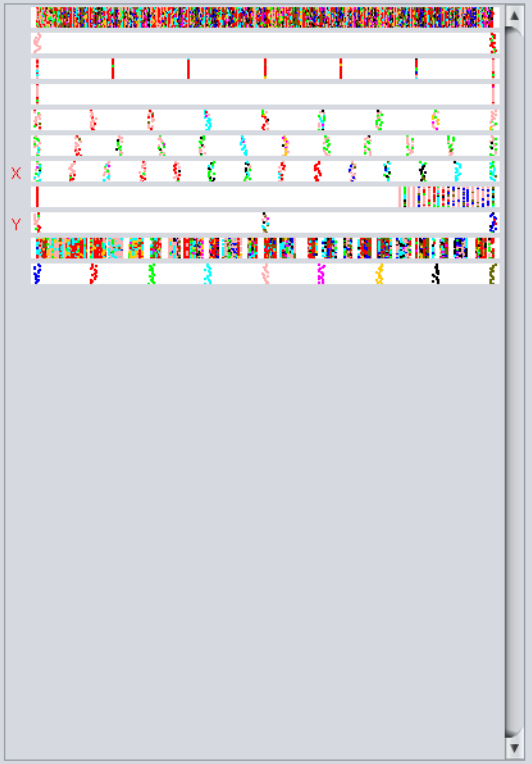





we worked with 25k rows worth of data. we were trying to find congestion patterns in certain traffic points in MMDA in all its cities. and this was just for the first 2 months.
Britton St
John St
Charterhouse St
Long Ln
West Smithfield
St Bartholomew's Hospital
A1 - Aldersgate St
A201 - Farring
Furnival St
Fetter Ln
Lincoln Inn's Fields

Plot: MASTER-weka.filters.unsupervised.attribute.Remove-R1,4_clustered

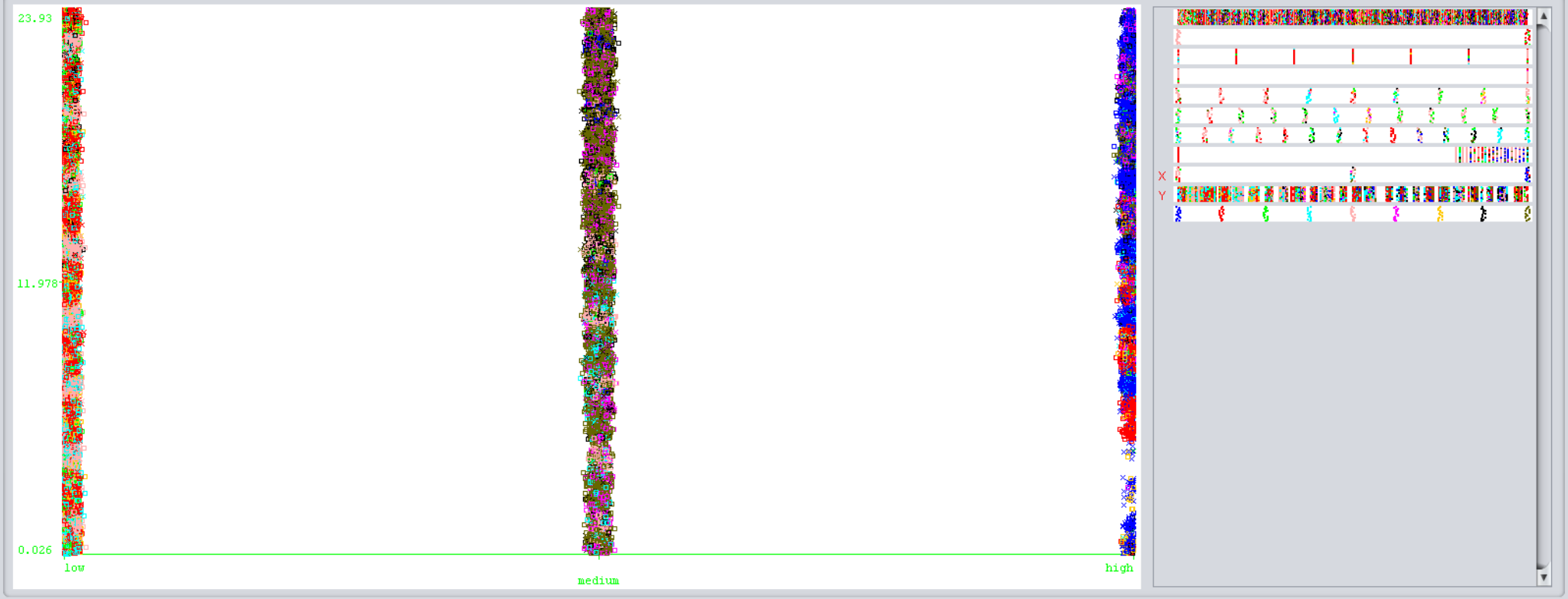




Class colour

cluster0 cluster1 cluster2 cluster3 cluster4 cluster5 cluster6 cluster7 cluster8

Plot: MASTER-weka.filters.unsupervised.attribute.Remove-R1,4_clustered



Class colour

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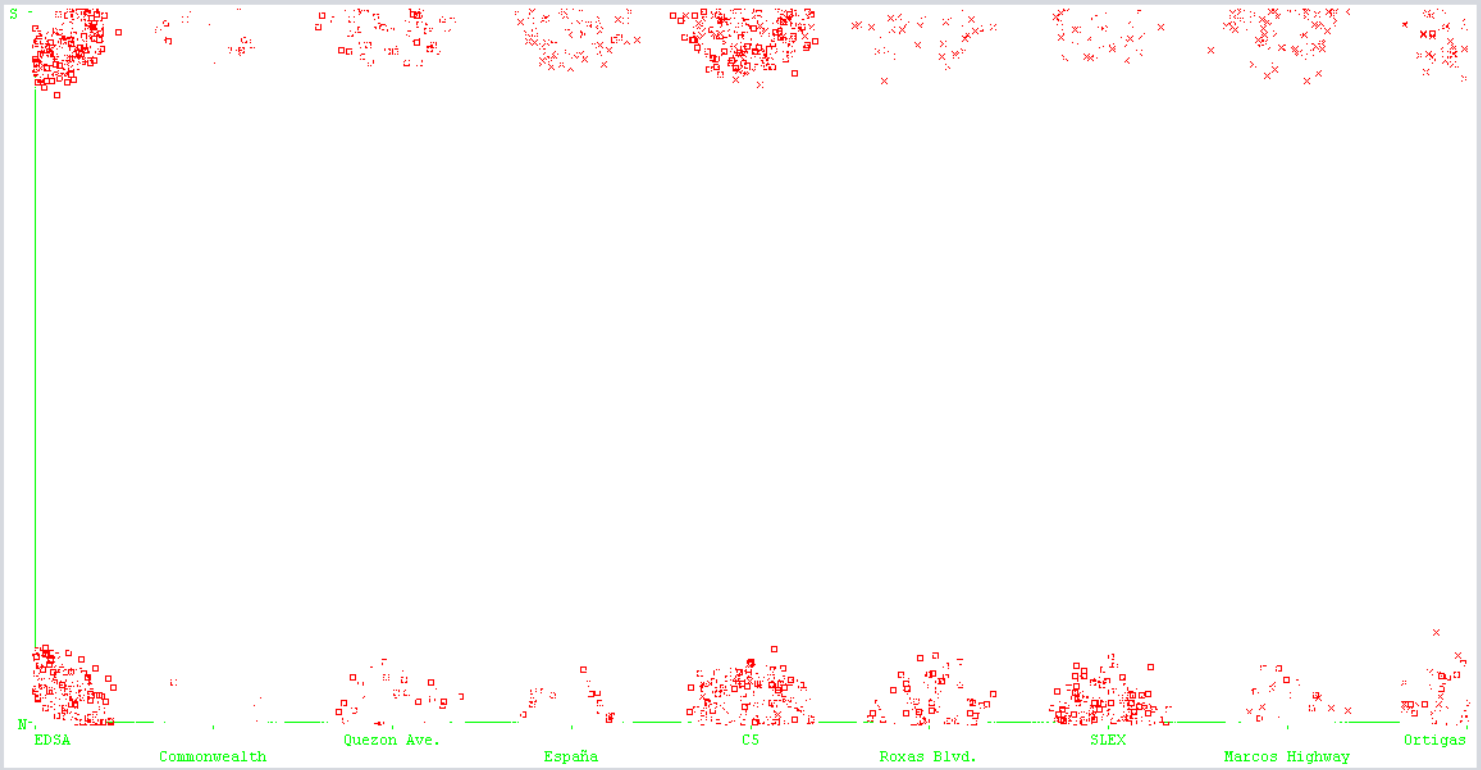
Plot: MASTER-weka.filters.unsupervised.attribute.Remove-R1,4_clustered



Class colour

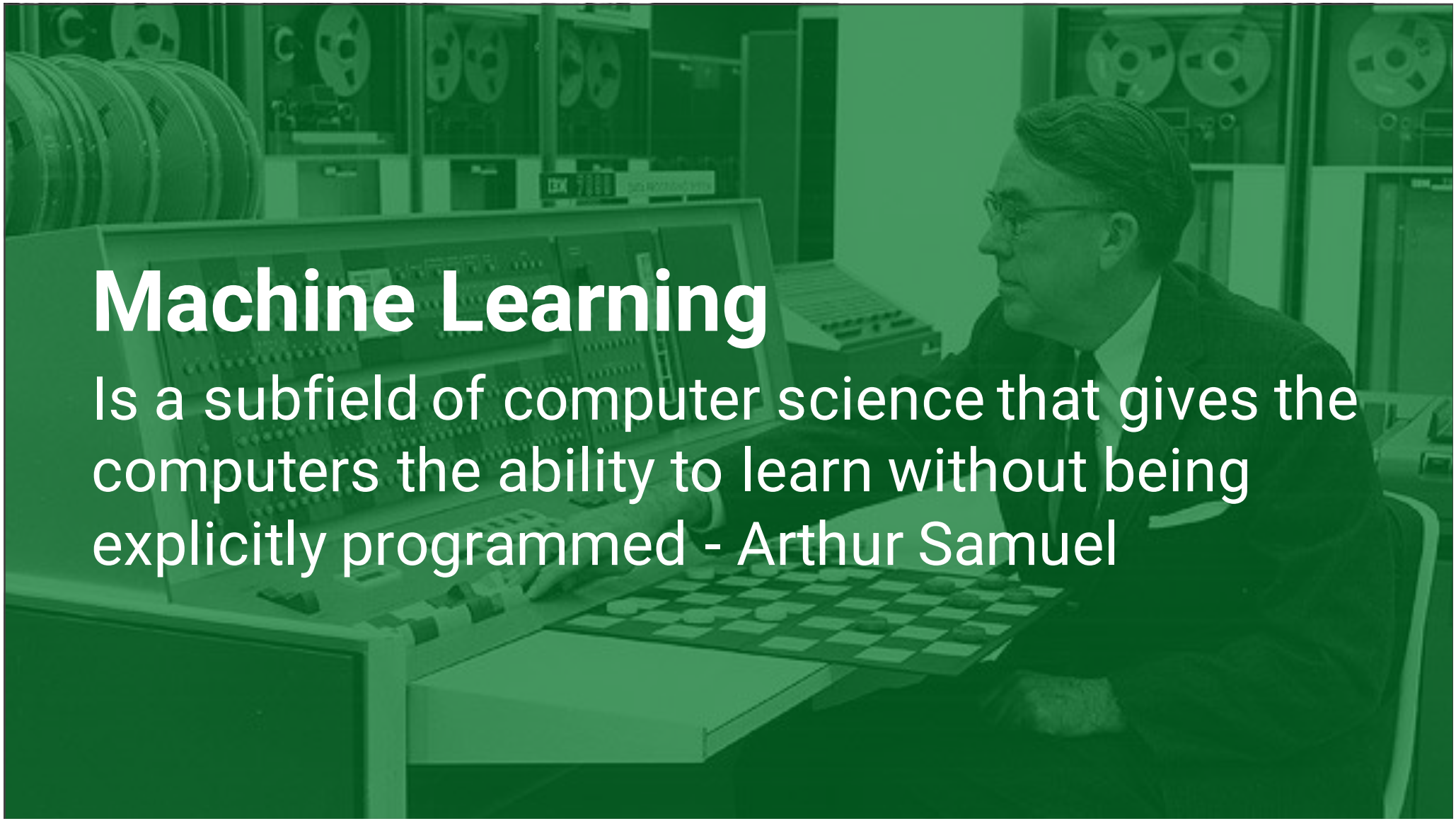
low medium high

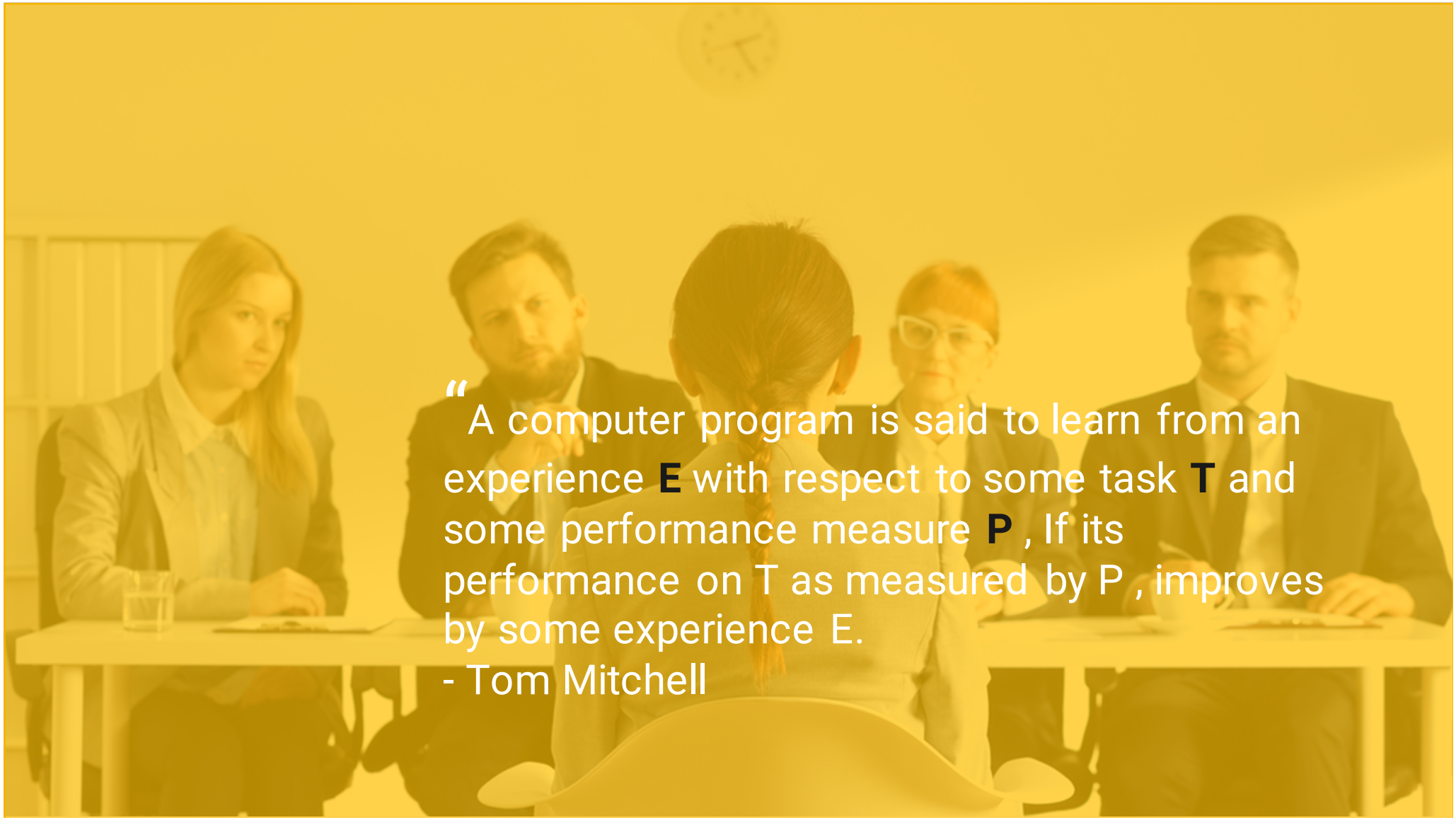
why Machine Learning?

developers **need** it

humans get **tired**, computers don't

tasks are getting **more complex**, they're harder to **simply code**


Machine Learning
Is a subfield of computer science that gives the computers the ability to learn without being explicitly programmed - Arthur Samuel


“A computer program is said to learn from an experience E with respect to some task T and some performance measure P , If its performance on T as measured by P , improves by some experience E.
- Tom Mitchell

Learning to Play Checkers

Task: playing checkers

Performance measure: percent of games won against opponents

Experience: playing practice games against itself

photo from cnews.com

Handwriting Recognition

Task: recognizing and classifying handwritten words within images

Performance measure: percent of words correctly classified

Experience: database of handwritten words with given classifications

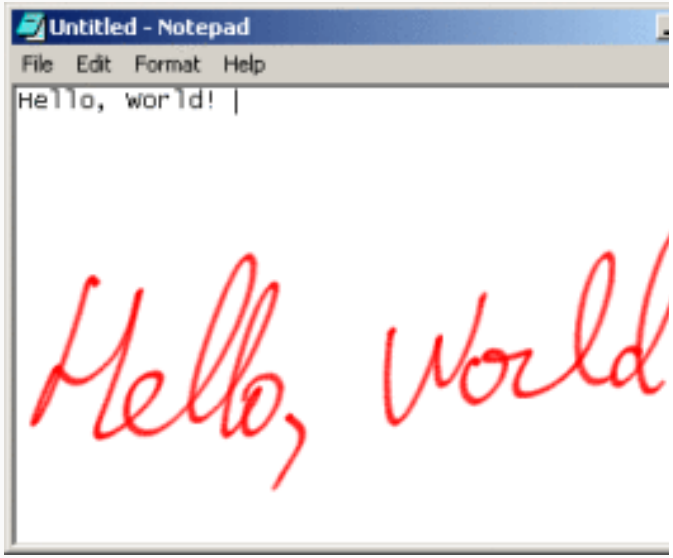


photo from gigaom.com

Robot Driving

Task: driving on public four-lane highways using vision sensors

Performance measure: average distance travelled before an error is encountered (judged by a human overseer)

Experience: sequences of images and steering commands recorded while observing a human driver

photo from MIT.edu

"A computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E."

Suppose your email program watches which emails you do or do not mark as spam, and based on that learns how to better filter spam. What is the task T in this setting?

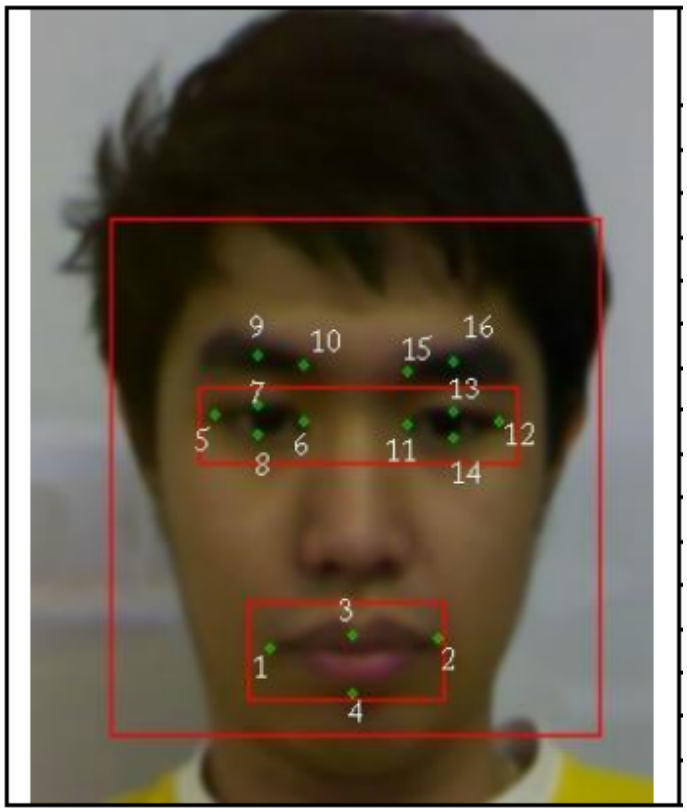
T A. Classifying emails as spam or not spam.

E B. Watching you label emails as spam or not spam.

P C. The number (or fraction) of emails correctly classified as spam/not spam.

D. None of the above—this is not a machine learning problem.

how do we teach the computer how a sad face looks like?



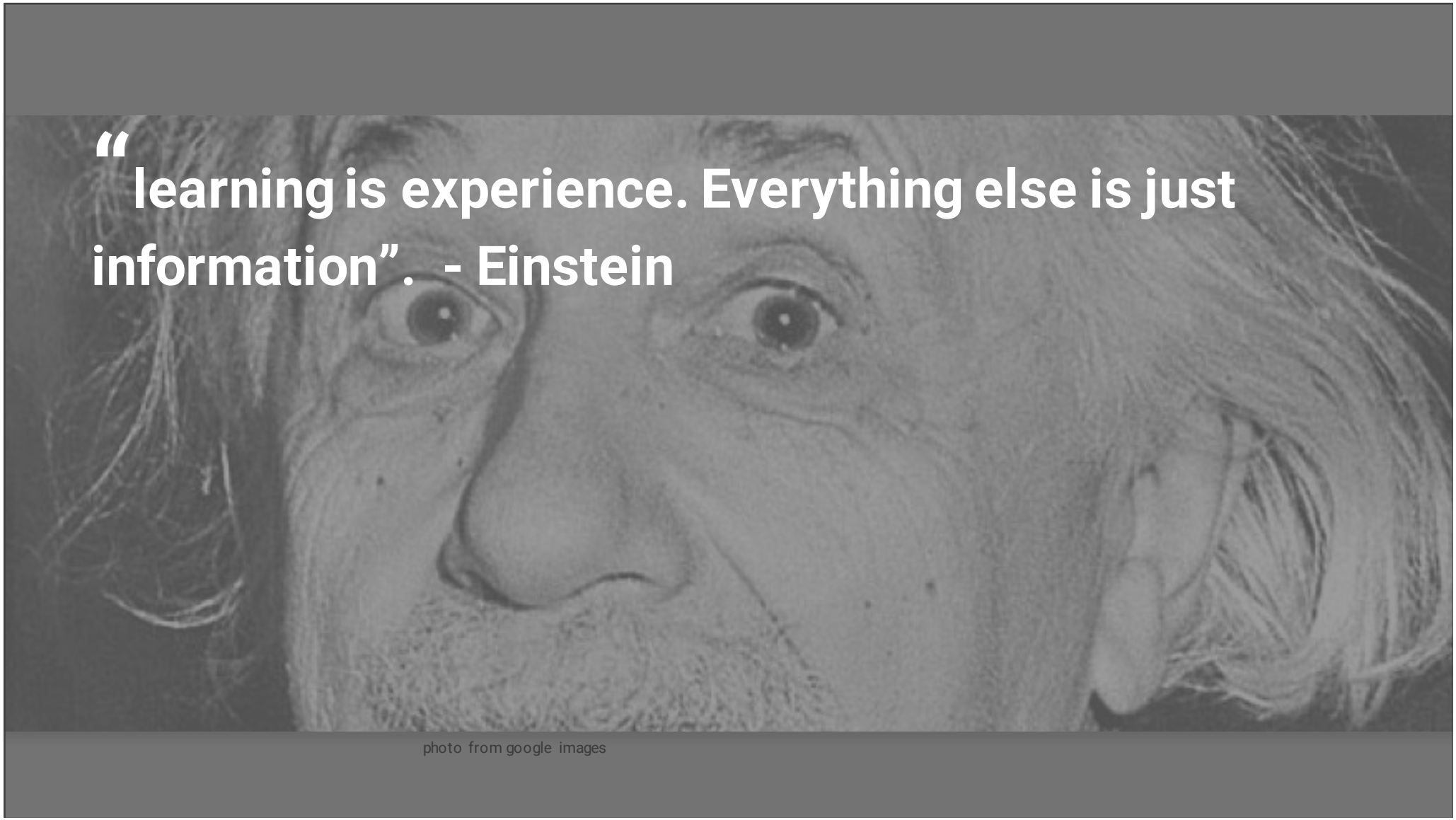
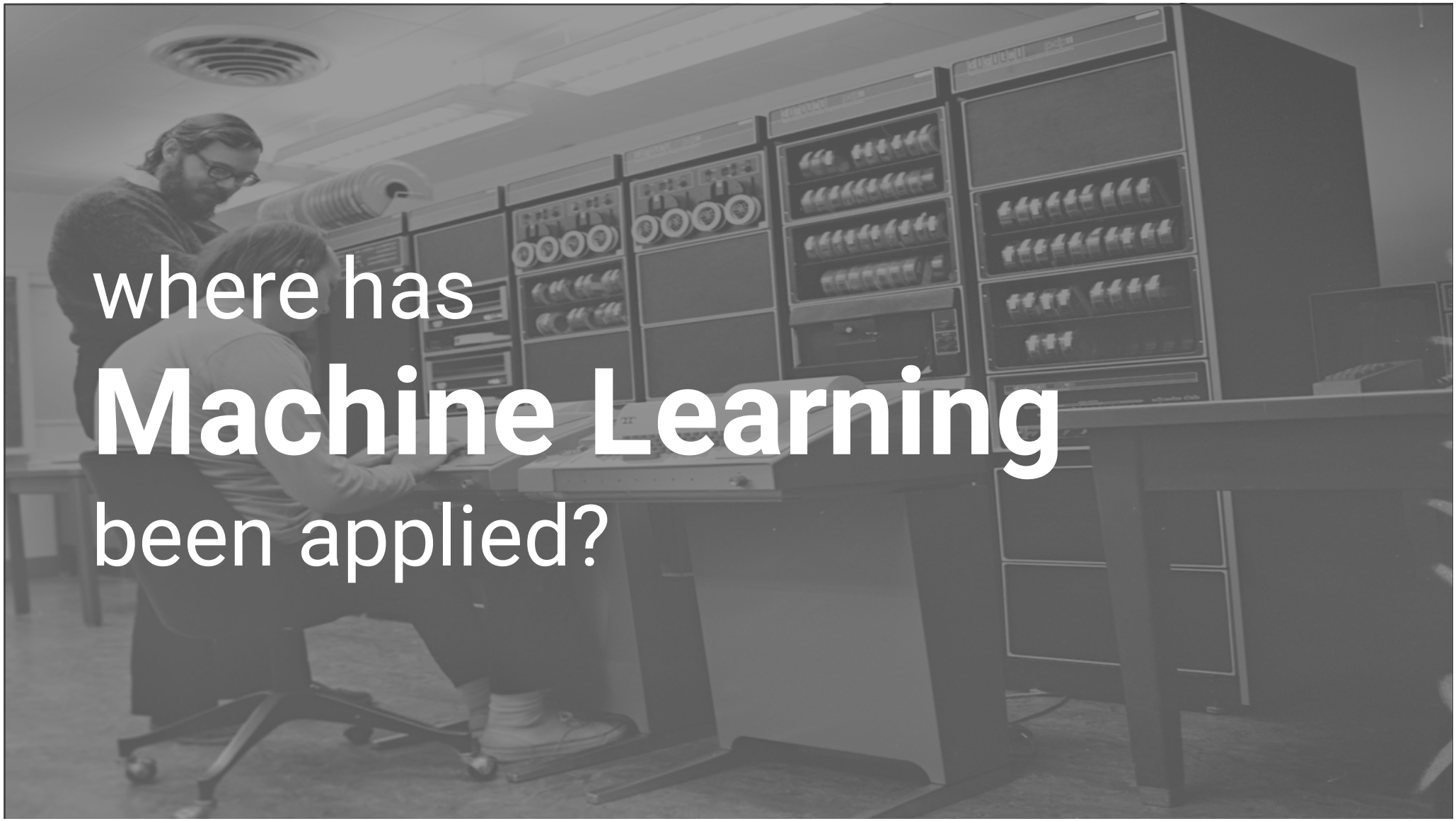


photo from google images


where has
Machine Learning
been applied?

intelligent agents

1997

Deep Blue

Deep Blue II defeated Gary Kasparov, long time Chess Grandmaster

May 11th, 1997

Computer won world champion of chess

(Deep Blue) (Garry Kasparov)

(Reuters = Kyodo News)

2016

Google DeepMind wins Alpha Go

machine vision

1994

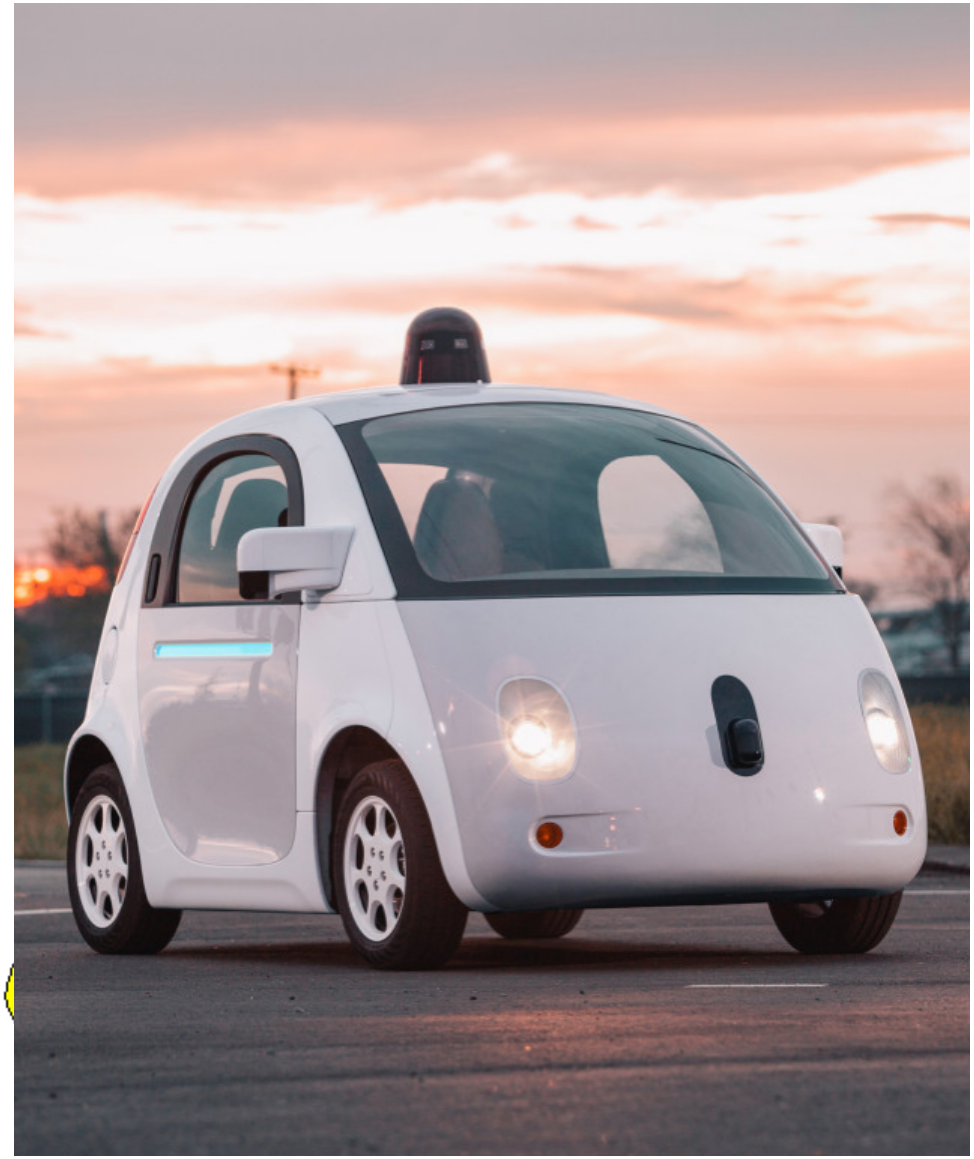
ALVINN

- Automated Land Vehicle with Neural Network
- First vehicle to cross the US Coast in 6 days totally unmanned

2016

Google Self Driving Car

- Integrates cloud, gps and video and image processing



so now we ask..

how can developers make use of machine learning?

On images

translation

Instantly translate foreign words into your preferred language

On surveying "drones"

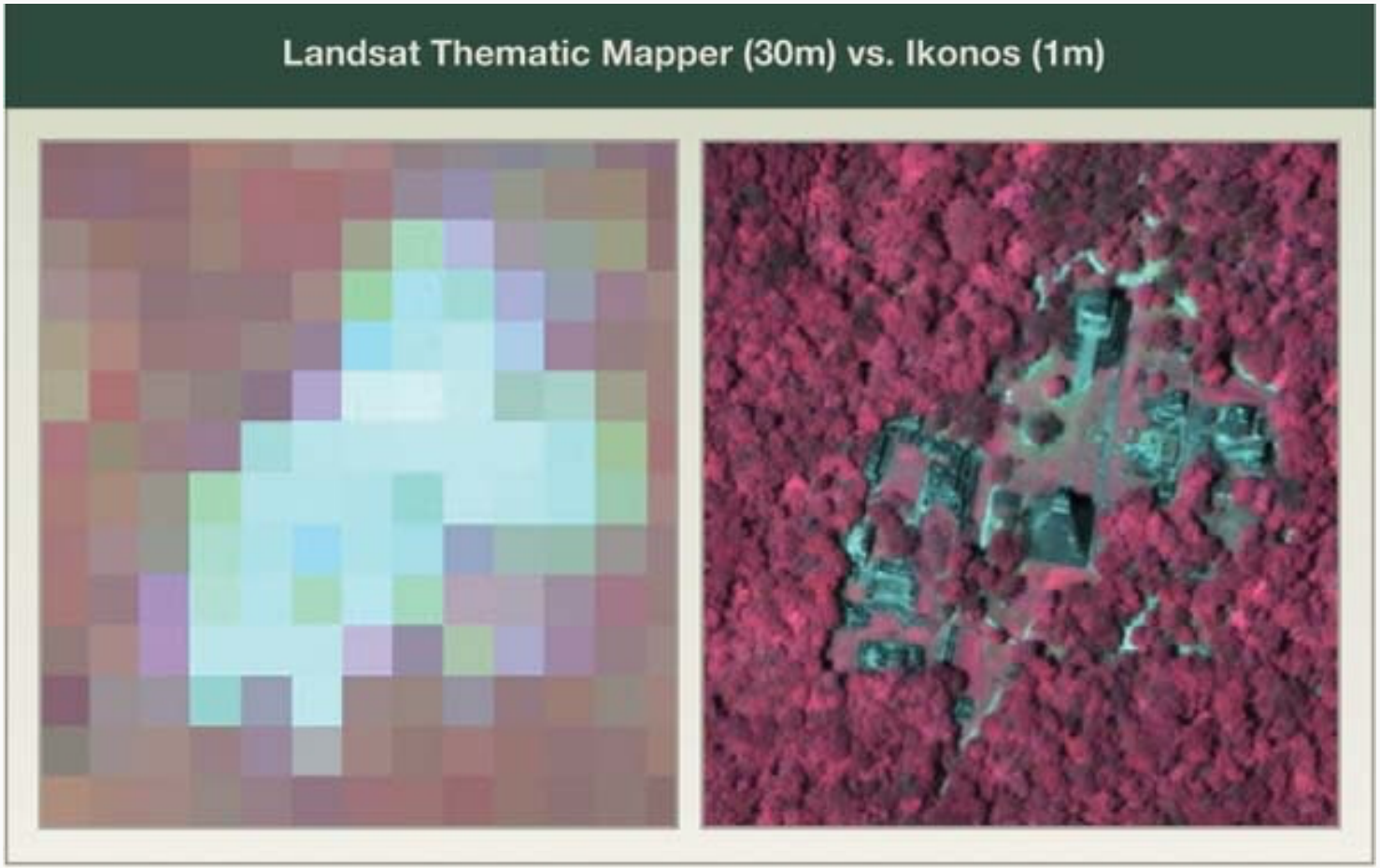
Like the ADARNA project for aerial surveying, remote navigation and monitoring

Or better yet

Sky-catch drones

See what NASA did

Used Satellites to find Mayan ruins



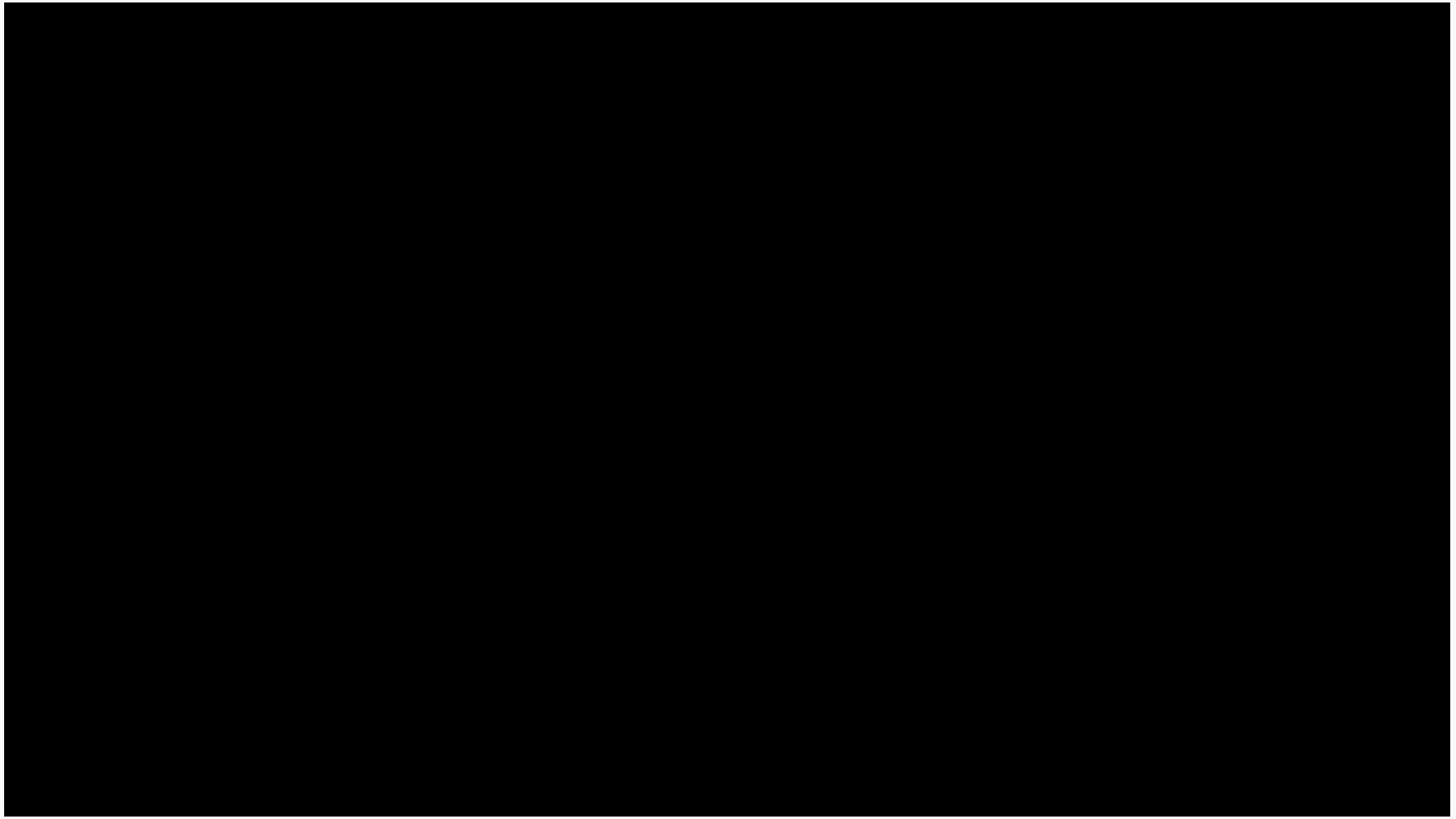
Remember the PH satellite?

Diwata?

Processing:

Machine learning can enable us to integrate **technologies** with **intelligent code** so we can try out new “interactions”

check out Myo




Myo has been integrated
with prosthetic arms
to allow smoother control


think of it:
There are jobs now that did not exist 5 years ago

Machine Learning

Empowered jobs

Augmented Reality designer

Artificial Personality Designer

Analytics managers

Embodied Conversational Agents

Data Scientist, Engineers

Google rode that wave of ML..


Cloud Vision API

Google Cloud Vision

It’s an API available for the Google Cloud Platform Service

It is one of Google’s ML frameworks/tools existing right now

Google
Cloud Platform

Powerful image analysis

uses **Machine Learning** to detect images

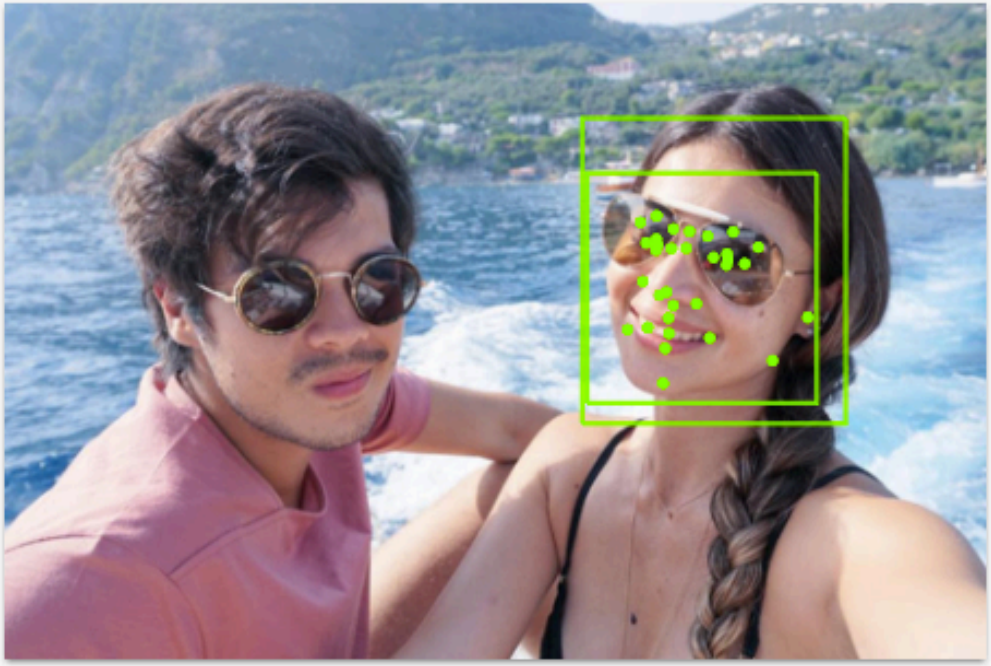
can find objects **within** images

it can **detect inappropriate** content

and can classify your **emotions** (image sentiment analysis)

face detection

Faces | Labels | Text | Colors | Safe Search | JSON Response



erwan-anne-101616.jpg

Joy	Very Likely
Sorrow	Very Unlikely
Anger	Very Unlikely
Surprise	Very Unlikely
Exposed	Very Unlikely
Blurred	Very Unlikely
Headwear	Very Unlikely

Roll: 12° Tilt: 0° Pan: -24°

Confidence 96%

image labelling

Faces | Labels | Text | Colors | Safe Search | JSON Response

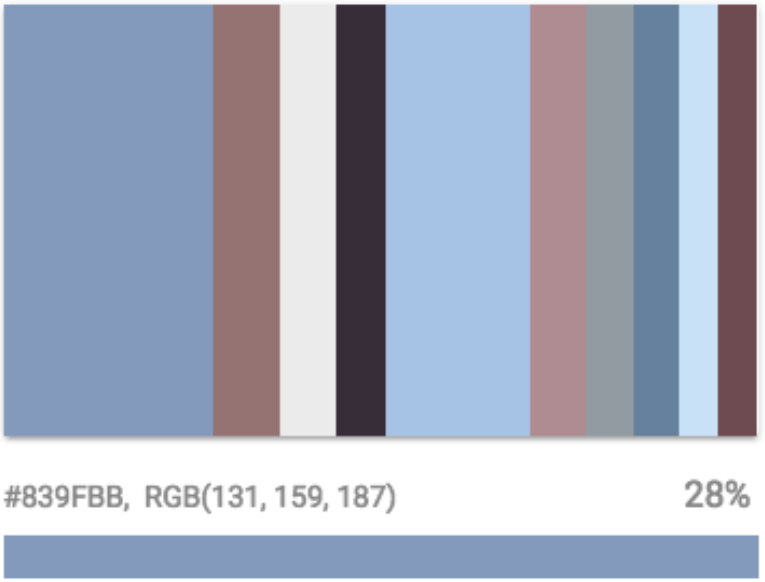
erwan-anne-101616.jpg

Vacation	81%
Beauty	80%
Sunglasses	79%
Smile	78%
Glasses	61%
Photo Shoot	58%
Model	54%
Spring Break	51%

color detection (esp for front end developers)

Faces | Labels | Text | **Colors** | Safe Search | JSON Response

erwan-anne-101616.jpg



#839FBB, RGB(131, 159, 187) 28%

searching for inappropriate content

Faces | Labels | Text | Colors | **Safe Search** | JSON Response

erwan-anne-101616.jpg

Adult	Very Unlikely
Spoof	Very Unlikely
Medical	Very Unlikely
Violence	Very Unlikely

Likeliness values are Unknown, Very Unlikely, Unlikely, Possible, Likely, and Very Likely

the best part (for developers)

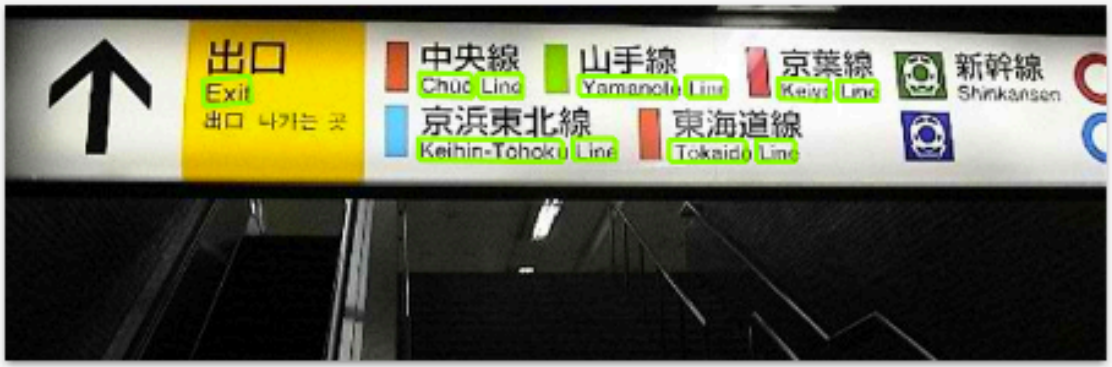
Faces | Labels | Text | Colors | Safe Search | JSON Response

erwan-anne-101616.jpg


```
{
  "faceAnnotations": [
    {
      "boundingPoly": {
        "vertices": [
          {
            "x": 560,
            "y": 112
          },
          {
            "x": 815,
            "y": 112
          },
          {
            "x": 815,
            "y": 407
          },
          {
            "x": 560,
            "y": 407
          }
        ]
      },
```

you can use it too to read translate text in an image

Labels | Text | Colors | Safe Search | JSON Response



tokyotrain.jpg

" Exit Chuo Line Yamanole Linc Keiyo Line Keihin-Tohoku Line Tokaido Line "

TRY NATURAL LANGUAGE API

the best part about google cloud vision is it is **still continuously** learning

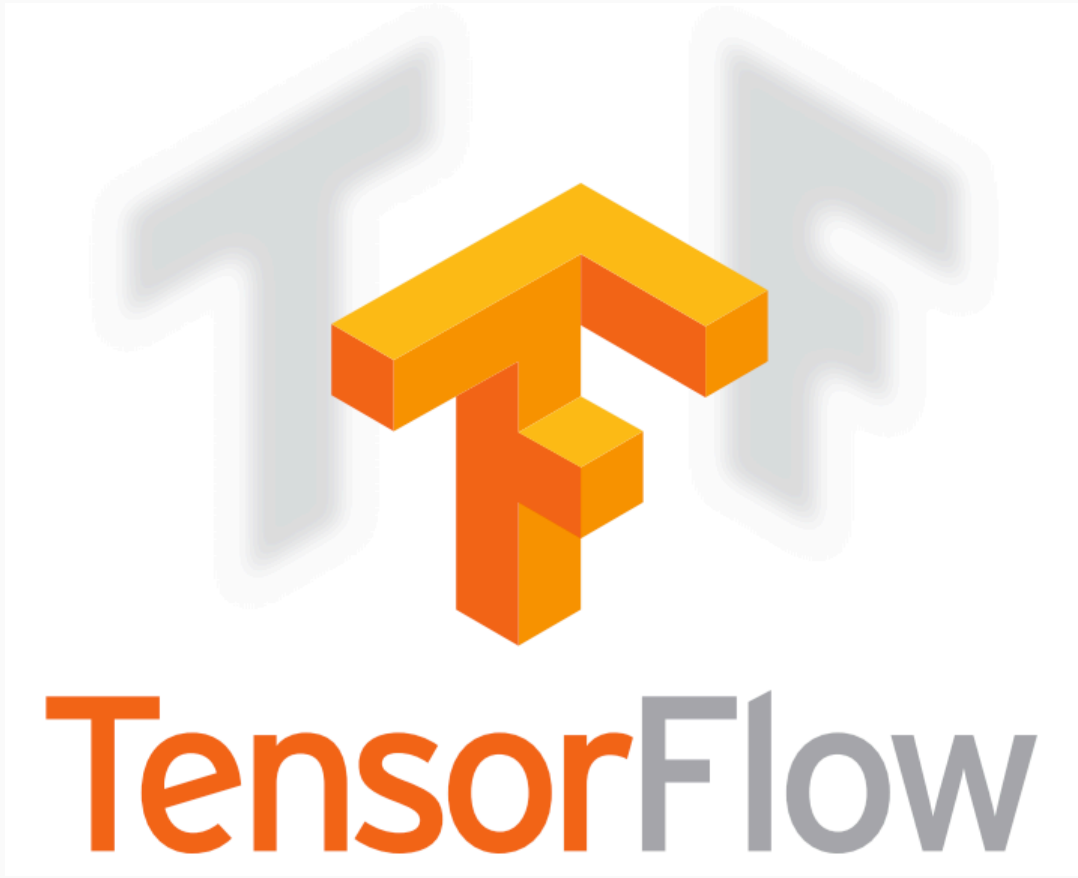
Cloud Vision API

https://cloud.google.com/vision/

" We have drones that take **thousands of photos per flight**. We find that Google **Cloud Vision API is the best way** to turn those huge number of photos, automatically produced, into **meaningful insight**. "

— Tomoaki Kobayakawa

General Manager, Aerosense Inc.

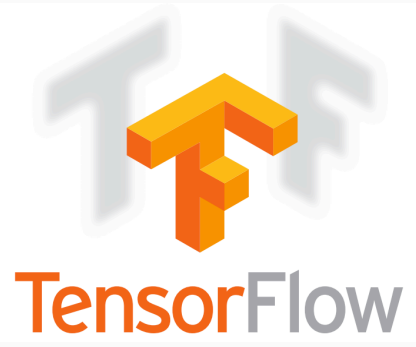

TensorFlow

TensorFlow

It is an **open source** library for machine intelligence.

Nodes in a graph use multi dimensional arrays aka **tensors** that communicate with each other.

In short, TensorFlow uses **Neural Networks** (programs that are patterned to behave like the brain).



TensorFlow Playground

Tinker With a **Neural Network** Right Here in Your Browser.
Don't Worry, You Can't Break It. We Promise.

Iterations 000,000 | Learning rate 0.03 | Activation Tanh | Regularization None | Regularization rate 0 | Problem type Classification

DATA

Which dataset do you want to use?

Ratio of training to test data: 50%

Noise: 0

FEATURES

Which properties do you want to feed in?

X_1
X_2
X_1^2
X_2^2

2 HIDDEN LAYERS

4 neurons | 2 neurons

*The outputs are mixed with varying **weights**, shown by the thickness of the lines.*

OUTPUT

Test loss 0.500
Training loss 0.505

http://playground.tensorflow.org

TensorFlow for Poets

Did you find a mistake? Please file a bug.

1. Introduction

TensorFlow is a an open source library for numerical computation, specializing in machine learning applications. In this codelab, you will learn how to install and run TensorFlow on a single machine, and will train a simple classifier to classify images of flowers.

What are we going to be building?

In this lab, we will be using transfer learning, which means we are starting with a model that has been already trained on another problem. We will then be retraining it on a similar problem. Deep learning from scratch can take days, but transfer learning can be done in short order.

We are going to use the Inception v3 network. Inception v3 is a trained for the ImageNet Large Visual Recognition Challenge using the data from 2012, and it can differentiate between 1,000 different classes, like Dalmatian or dishwasher. We will use this same network, but retrain it to tell apart a small number of classes based on our own examples.

What you will learn

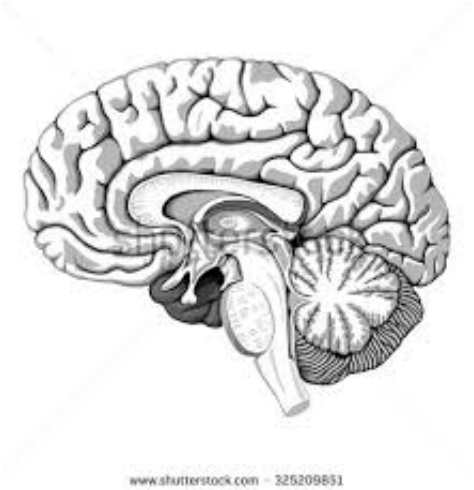
- How to install and run TensorFlow Docker images
- How to use Bazel and Python to train an image classifier

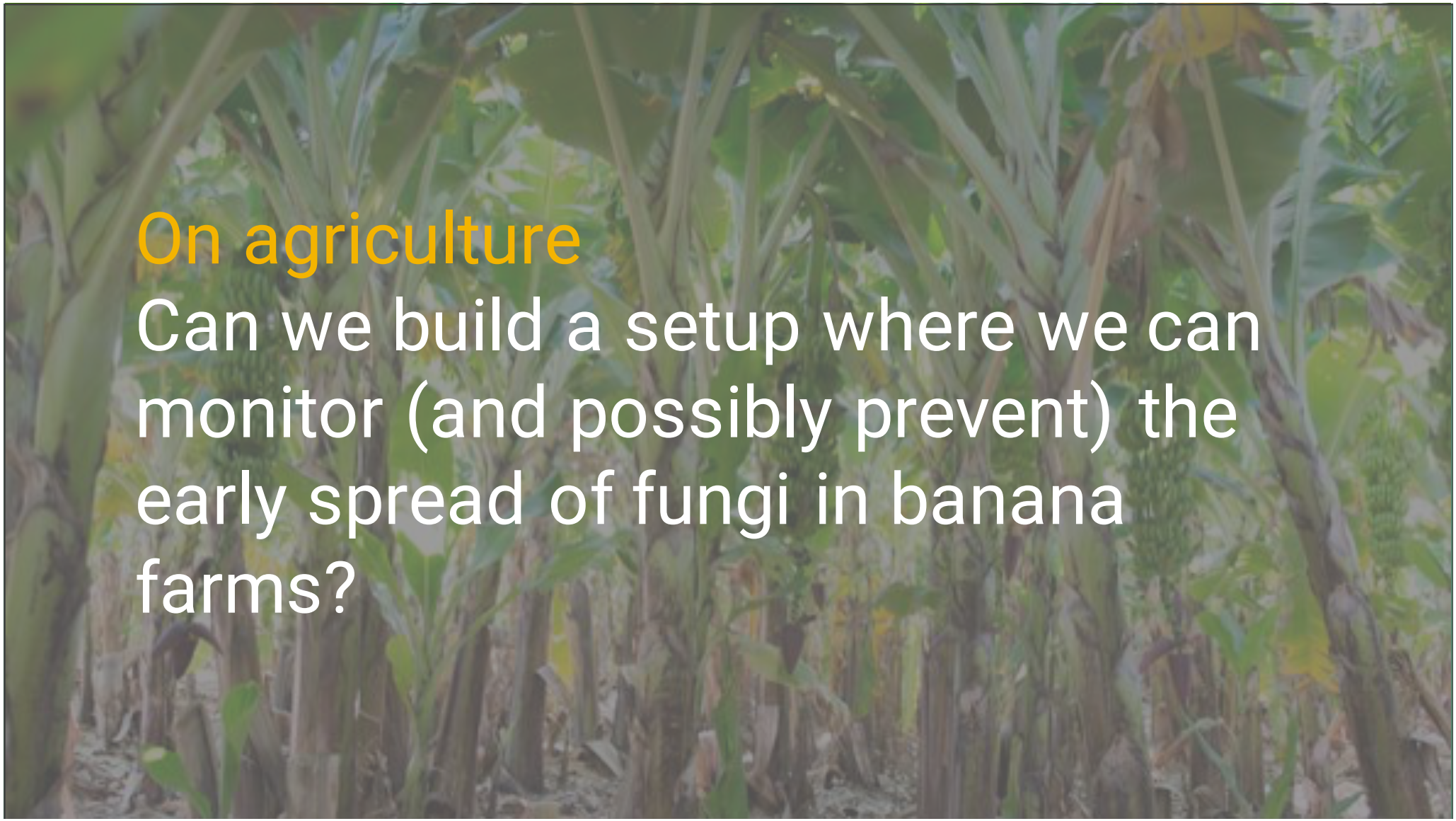
https://codelabs.developers.google.com/codelabs/tensorflow-for-poets/

reflection:

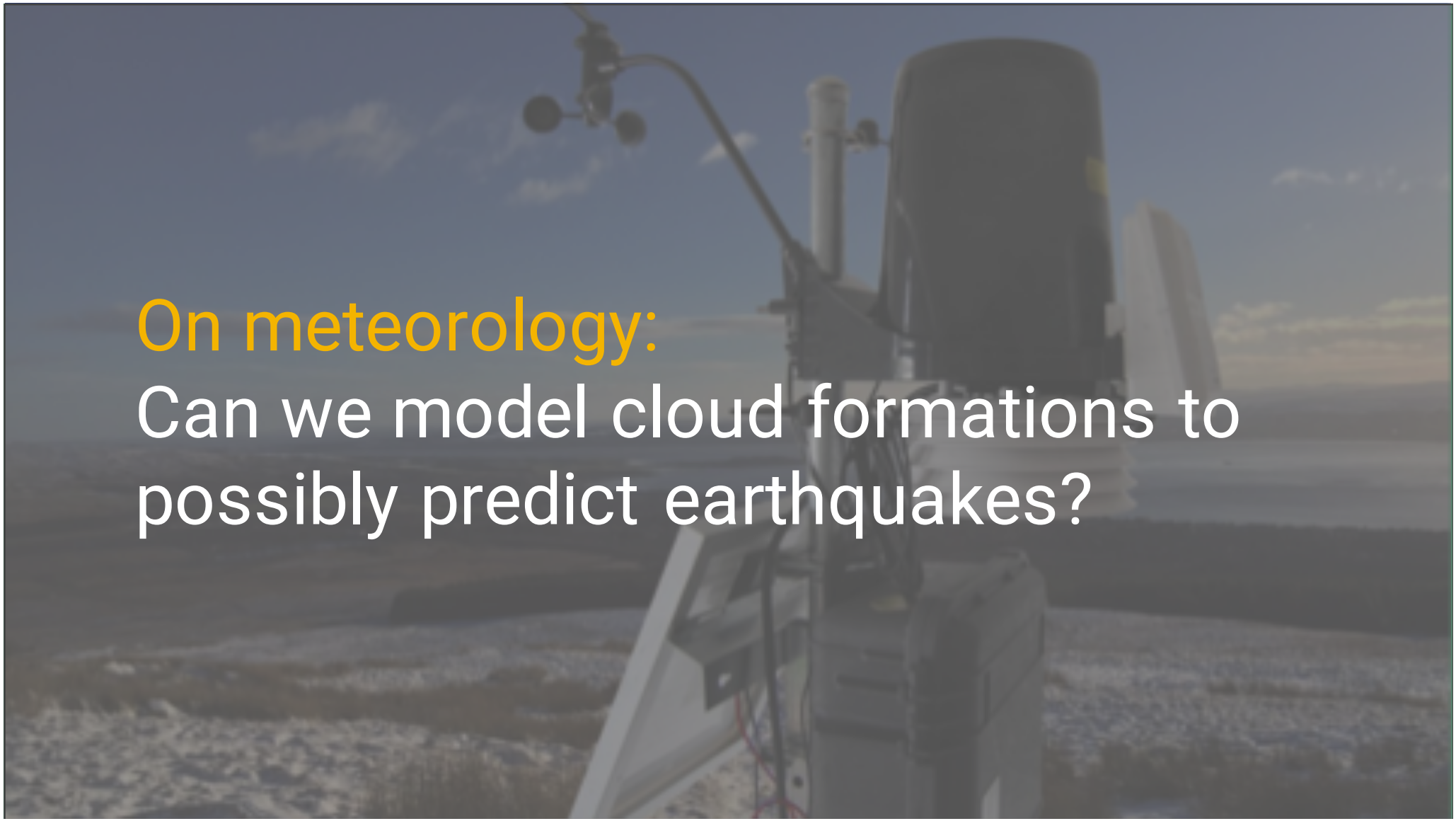
but Machine Learning still has a long way to go

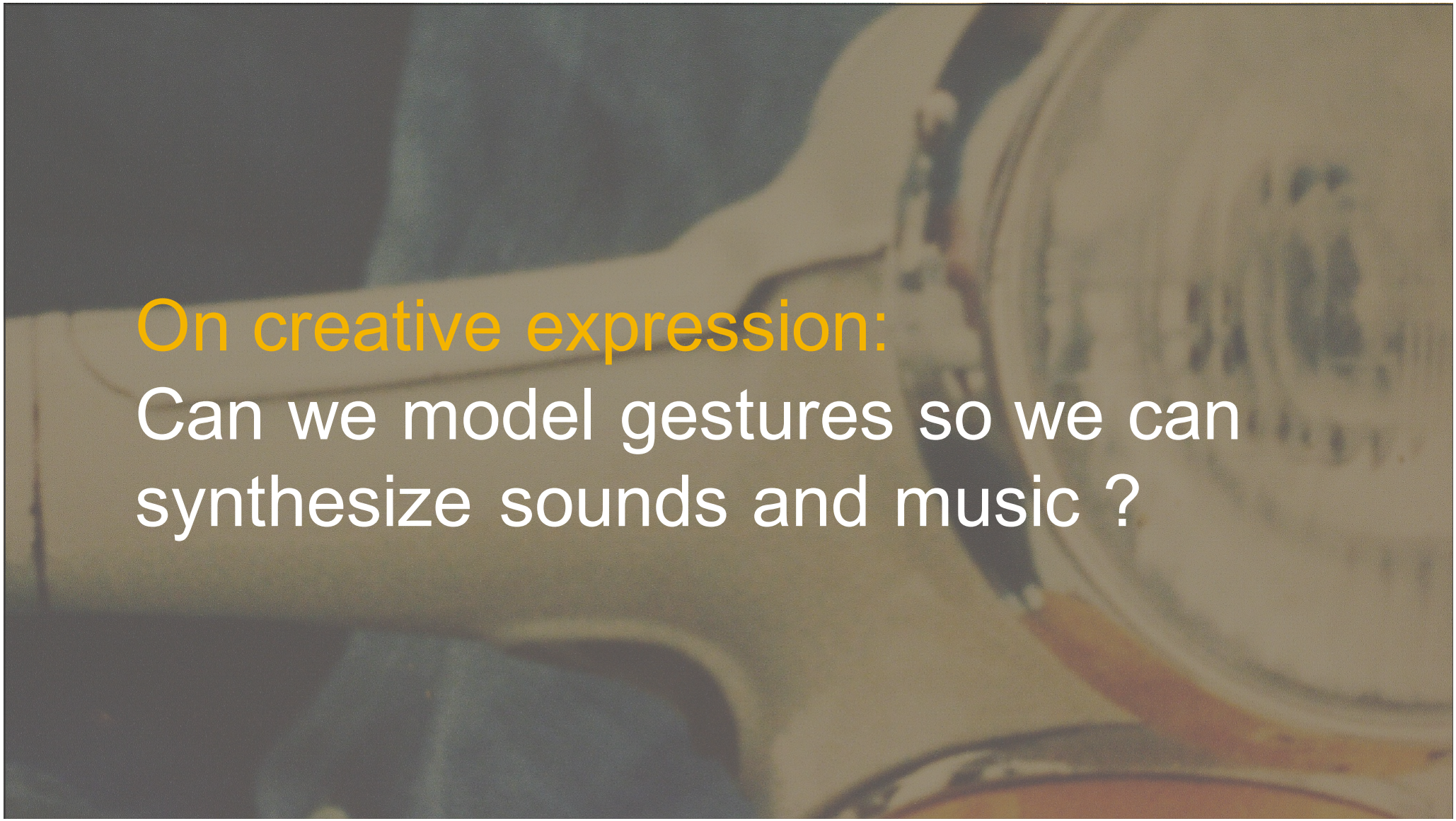
our brains are so complex they’re too difficult to understand. but they’re powerful like that.




On agriculture
Can we build a setup where we can monitor (and possibly prevent) the early spread of fungi in banana farms?


On network security:
Can we model fraudulent acts so we can detect spammers, intruders, hackers?


On meteorology:
Can we model cloud formations to possibly predict earthquakes?


On creative expression:
Can we model gestures so we can synthesize sounds and music ?

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!
For your questions, partnerships and other concerns you may contact me via:
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@jordandoinwork
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