

Google Technologies on Machine Learning

November 12 2016



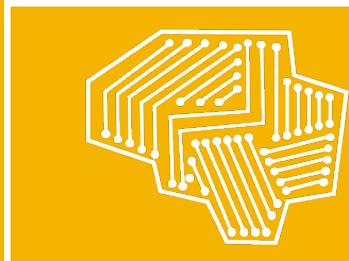
Outline

- Machine Learning
- Google Cloud Vision
- TensorFlow

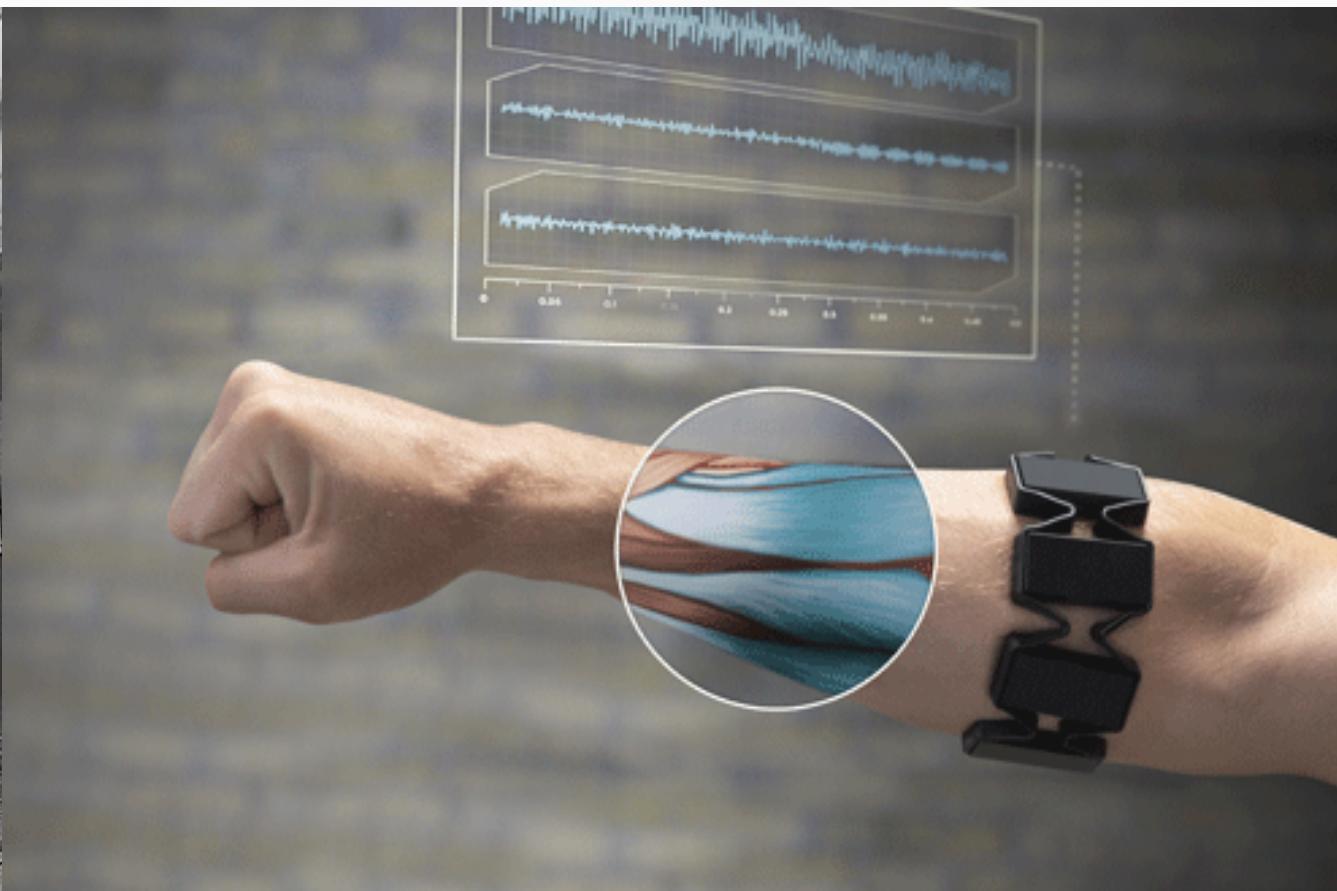
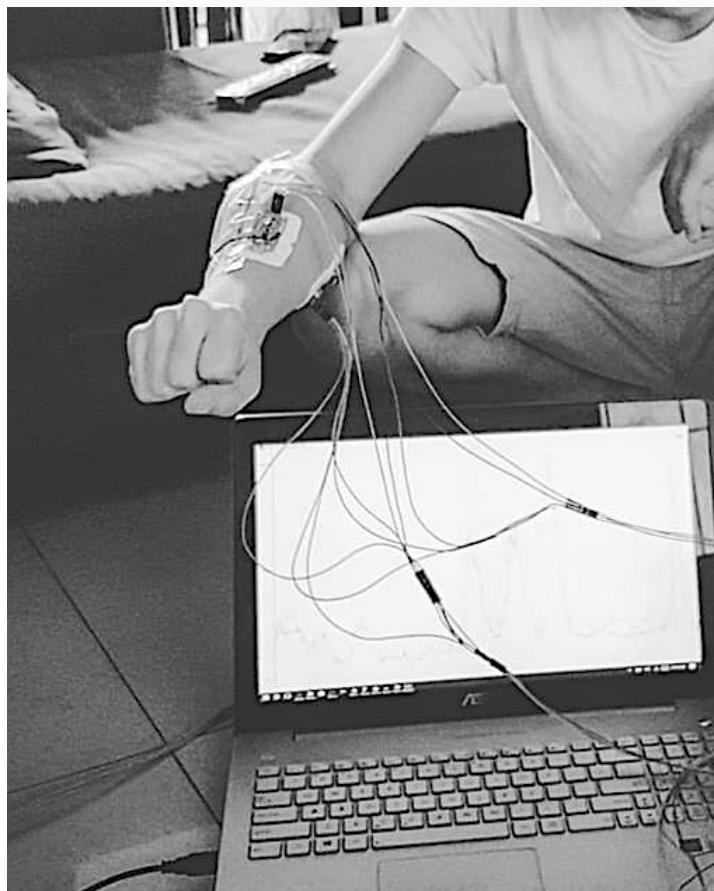


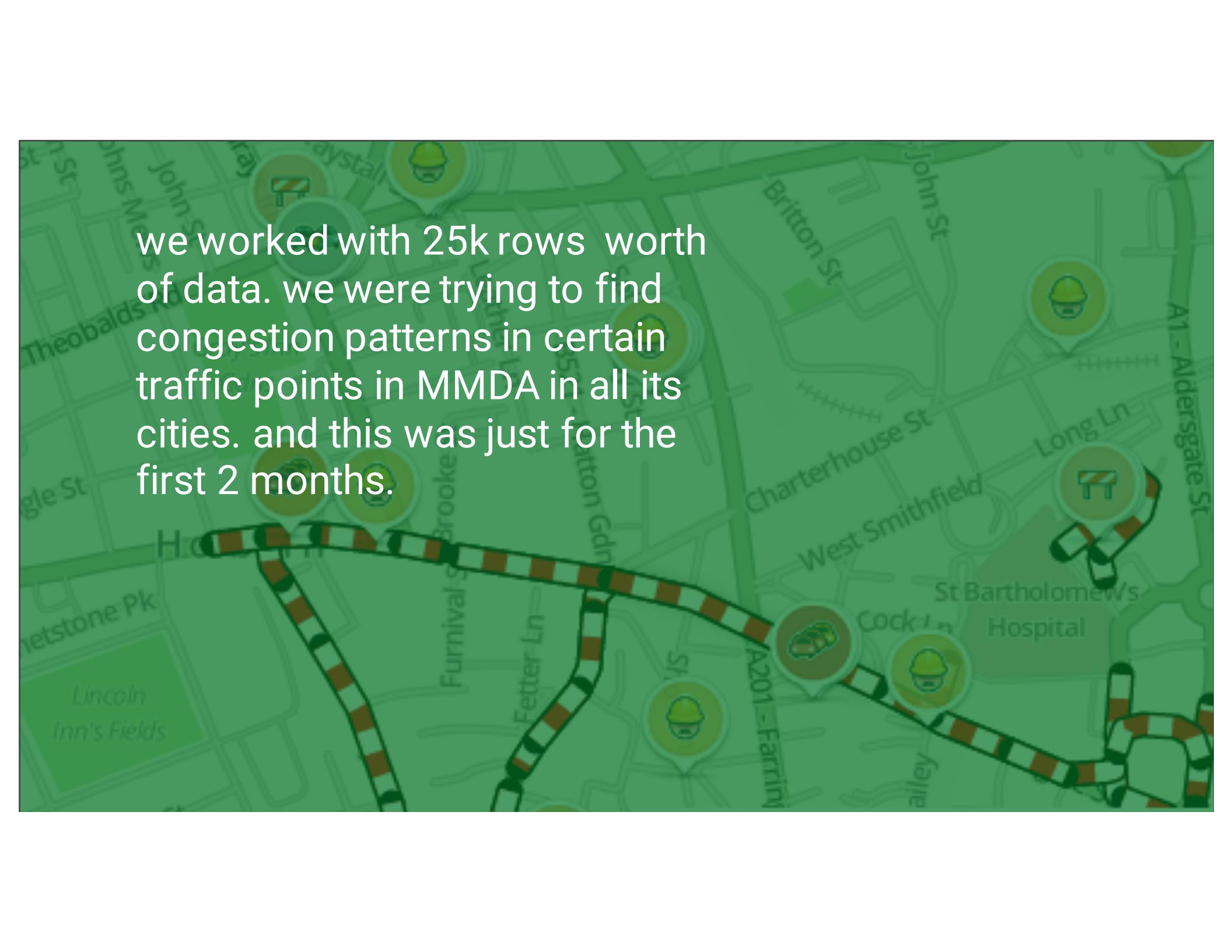
Hi, I'm **Jordan!**

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



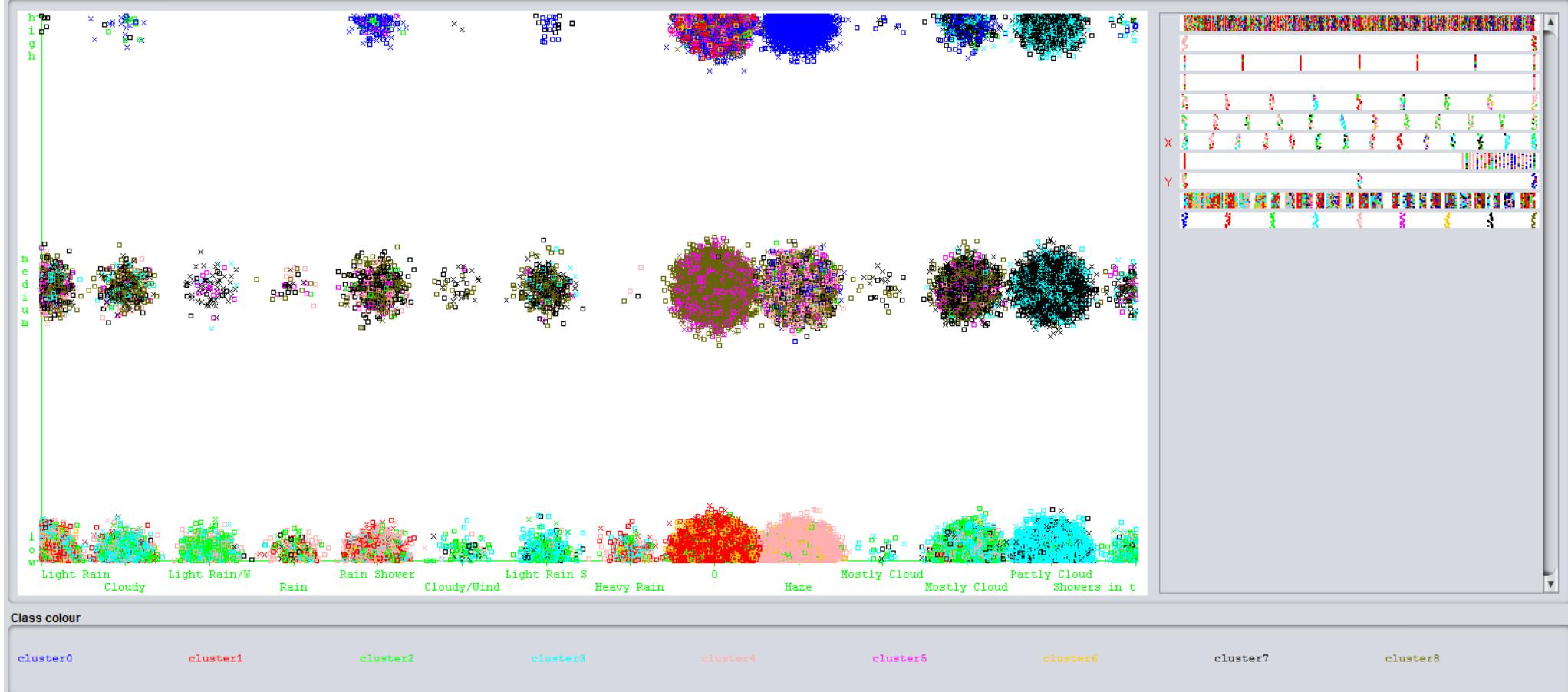
CENTER FOR
COMPLEXITY &
EMERGING
TECHNOLOGIES



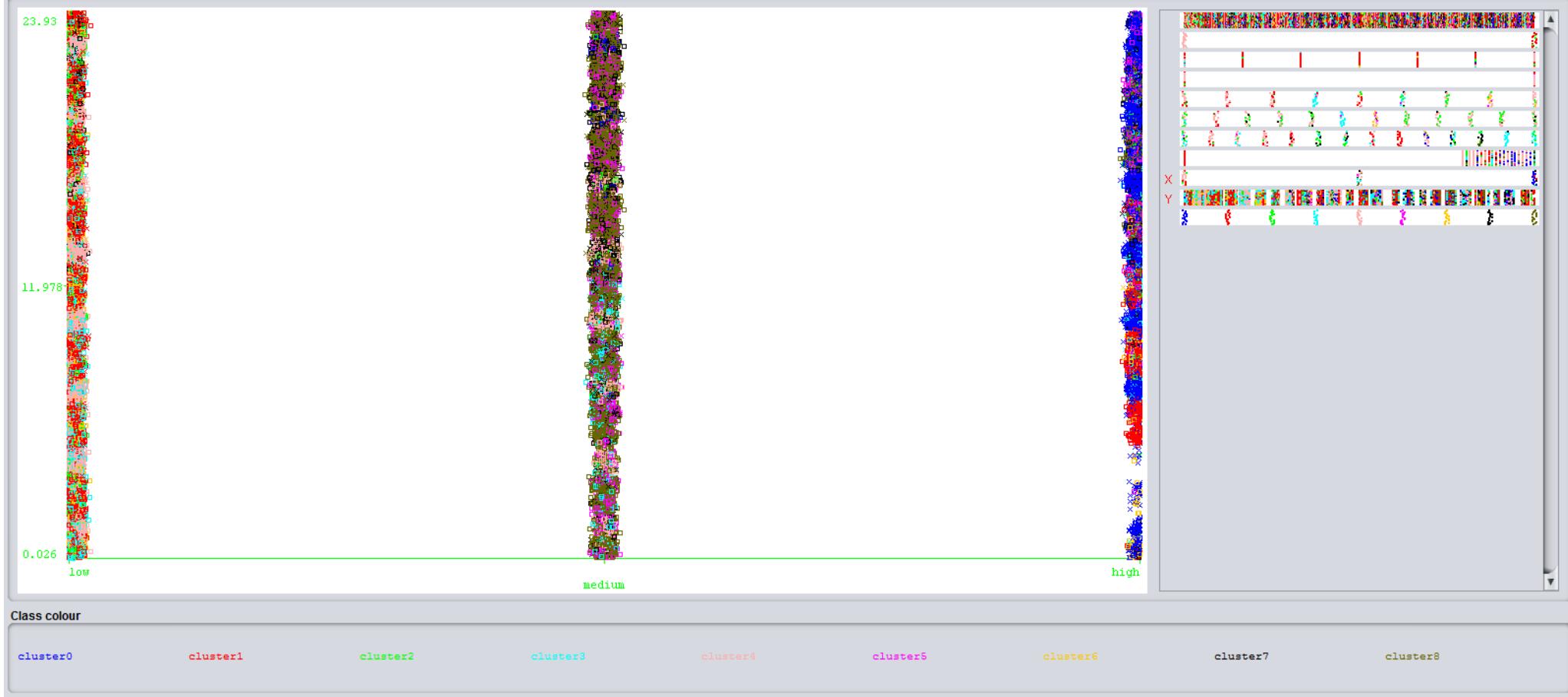


we worked with 25k rows worth of data. we were trying to find congestion patterns in certain traffic points in MMDA in all its cities. and this was just for the first 2 months.

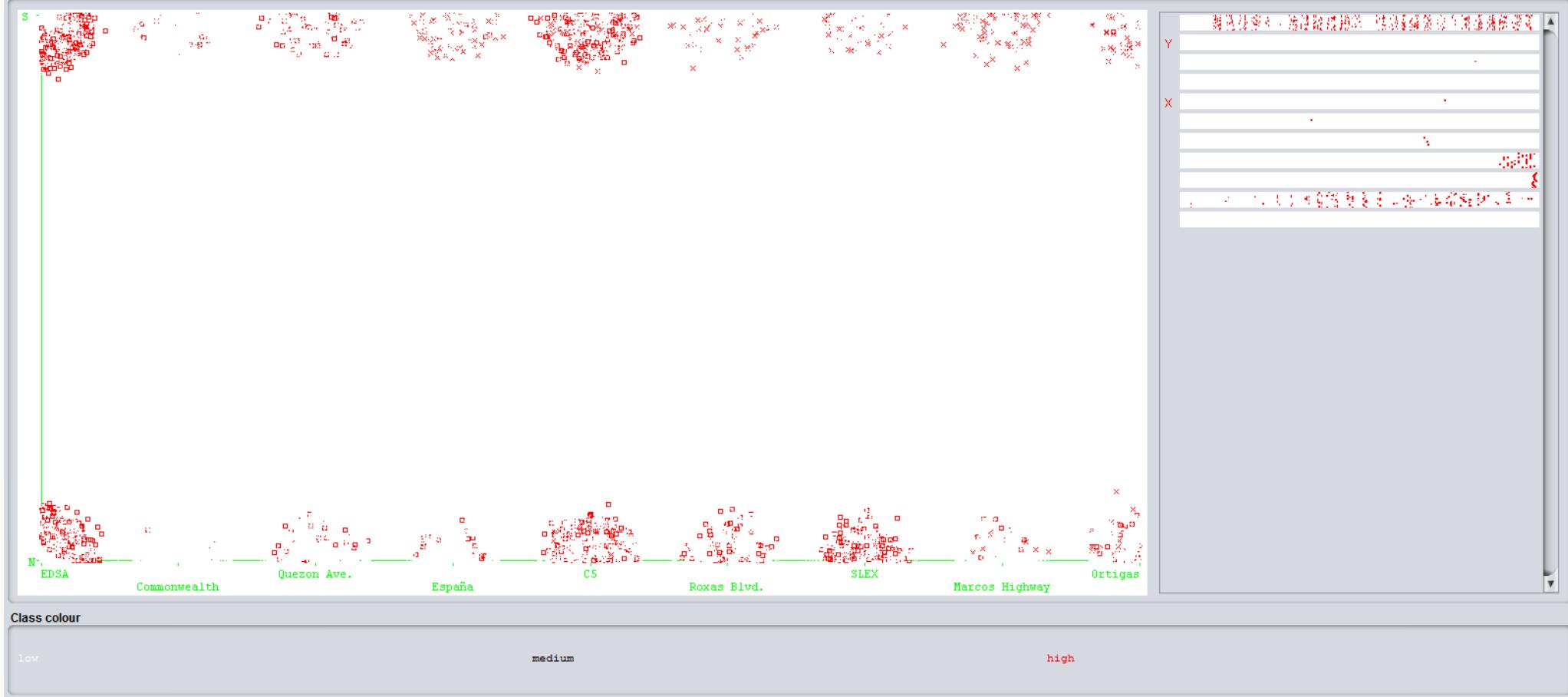
Plot: MASTER-weka.filters.unsupervised.attribute.Remove-R1,4_clustered



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



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



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

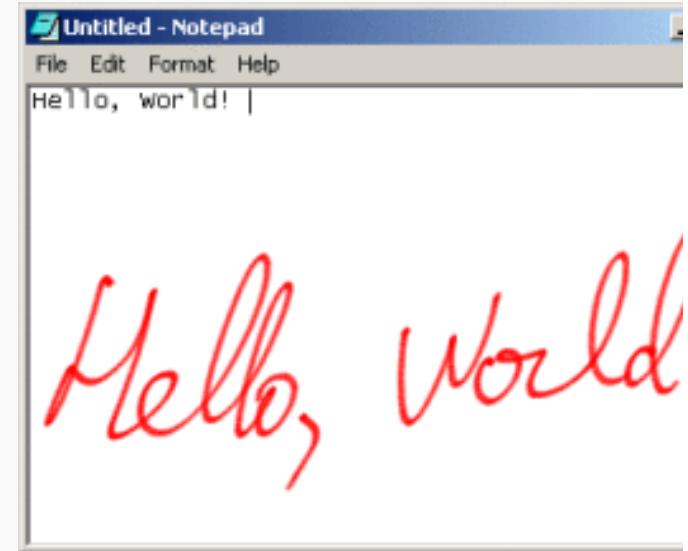


photo from gigaom.com

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

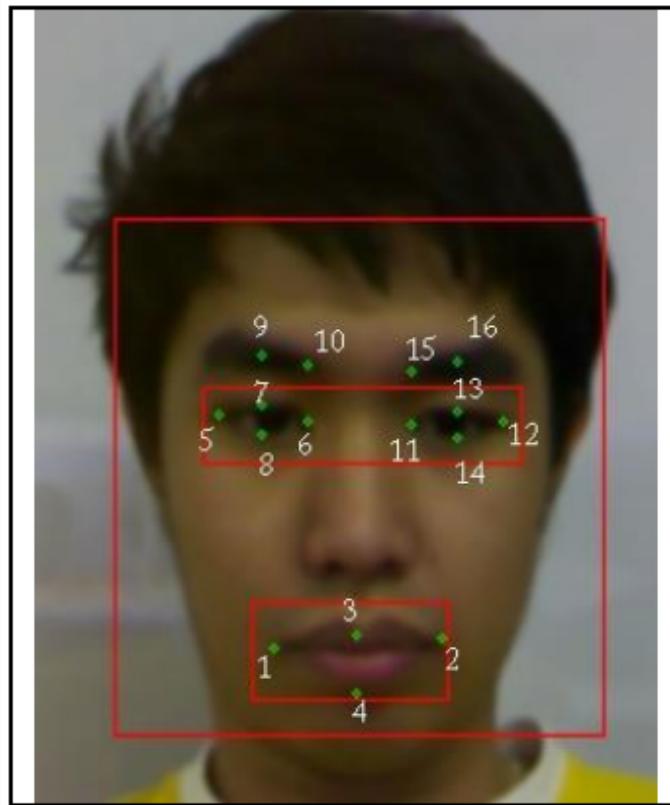


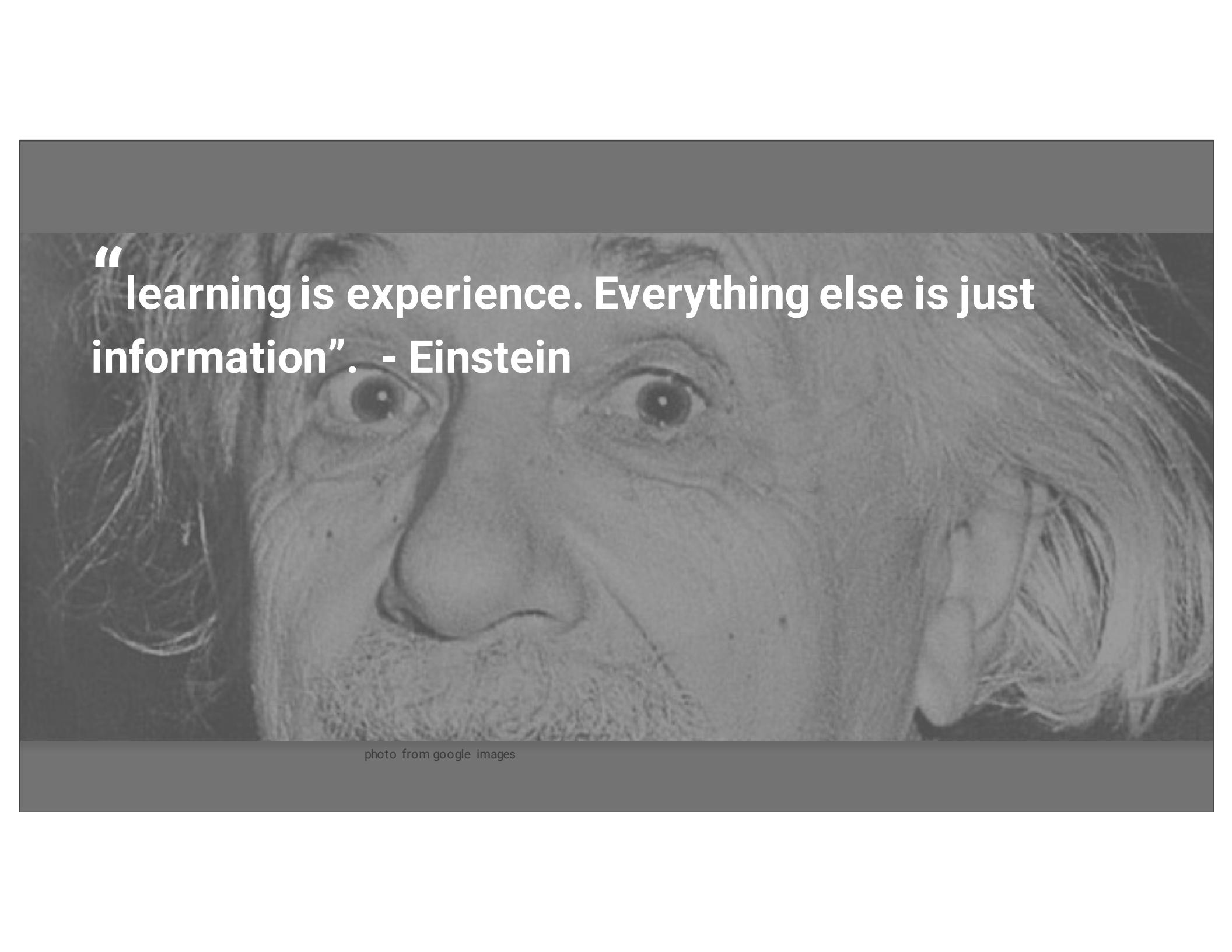
“A computer program is said to learn from experience E with respect to some task T and some performance measure P , if its performance on T , as measured by P , improves with experience E .”

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?





“learning is experience. Everything else is just information”. - Einstein

photo from google images

A black and white photograph of a man with a beard and glasses, wearing a dark sweater over a light shirt, sitting at a desk in a server room. He is looking down at a laptop. Behind him are several tall server racks filled with hard drives and other hardware. A ceiling vent is visible above him.

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

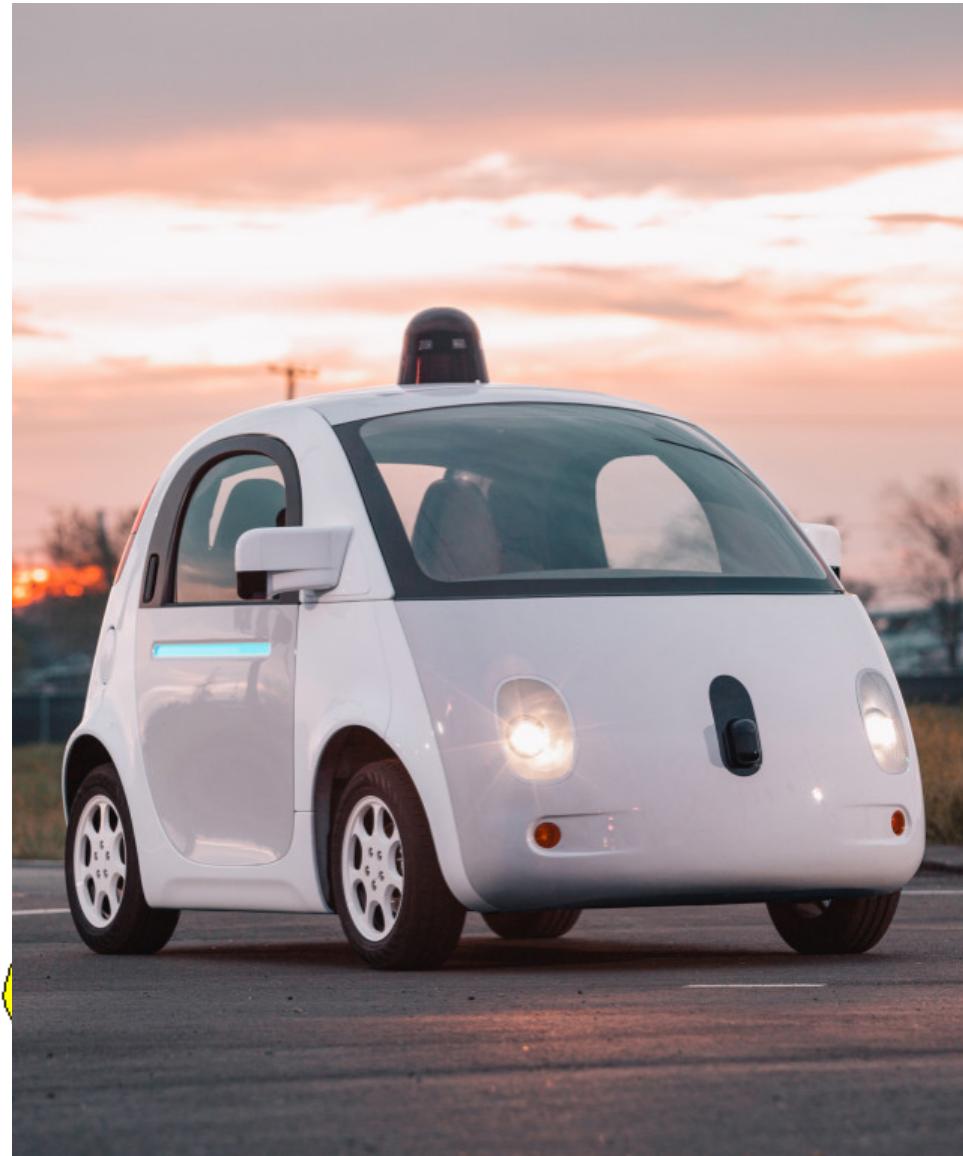
- Automated Land Vehicle with Neural Network
- First vehicle to cross the US Coast in 6 days totally unmanned



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



The ADARNA Project
Computer Technology Department
College of Computer Studies
De La Salle University

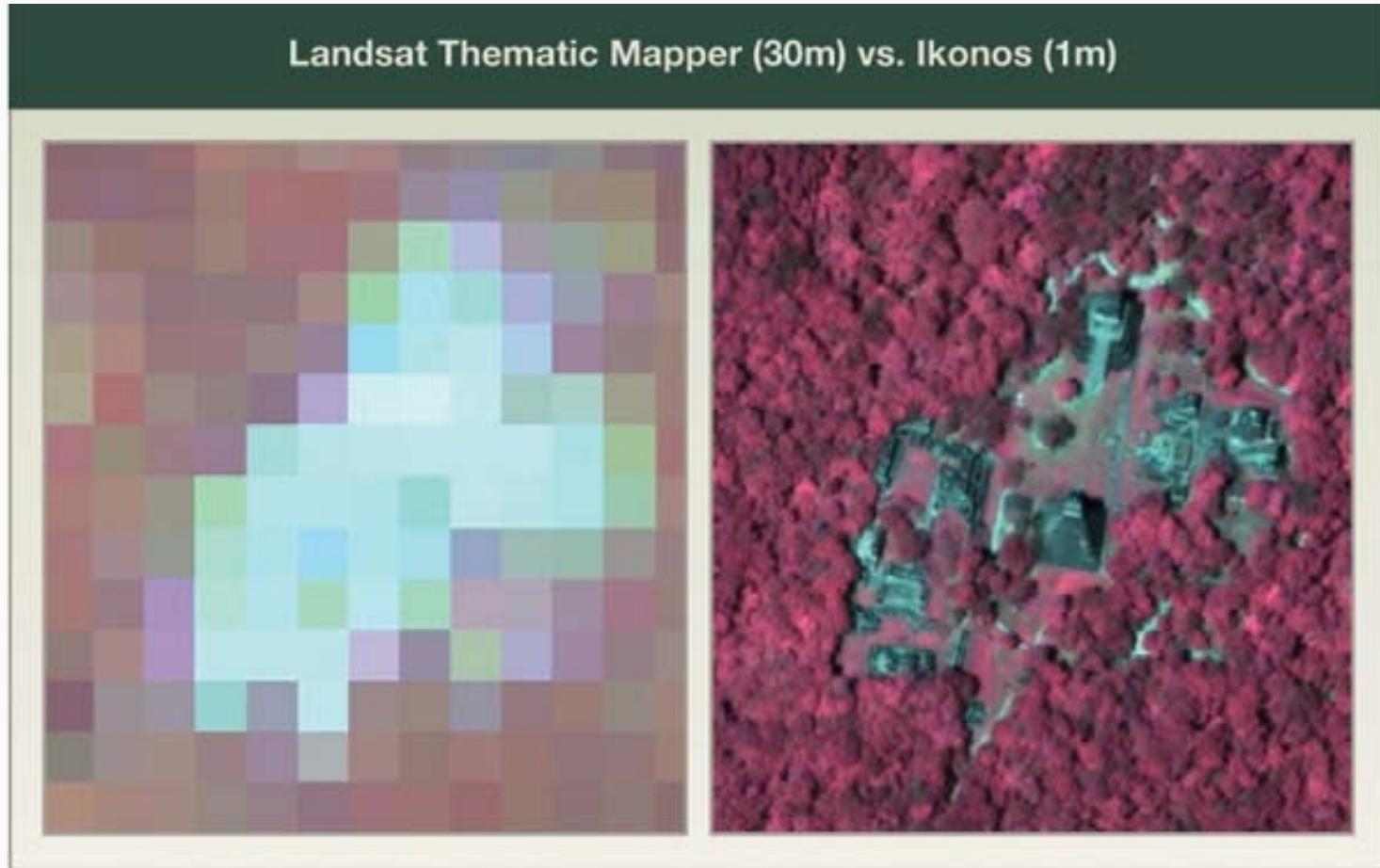
Or better yet

Sky-catch drones



See what NASA did

Used Satellites to find Mayan ruins



Remember the PH satellite?

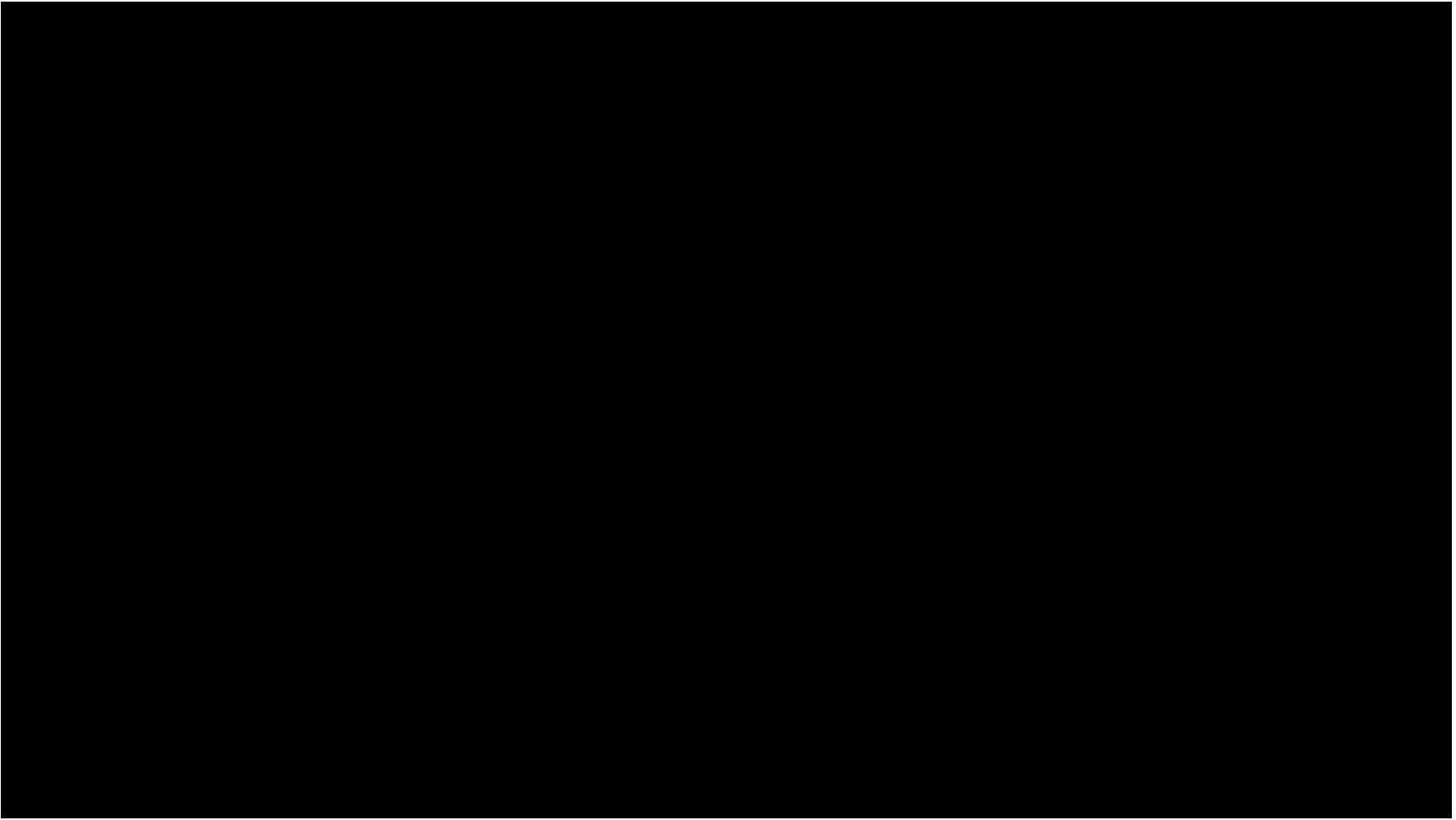
Diwata?



Processing:

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

check out Myo



A man with a mustache and glasses is shown from the chest up. He is wearing a dark blue polo shirt with a yellow logo on the left chest. A Myo armband is attached to his right forearm. A robotic arm is attached to his hand, and it is pointing upwards. The background is blurred, showing some white lights.

Myo has been integrated
with prosthetic arms
to allow smoother control

A man with a shaved head and a goatee is lying on his back on a bed. He is wearing a light-colored, ribbed, short-sleeved shirt. His eyes are closed, and he has a contemplative or tired expression. The background is a plain, light-colored wall.

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



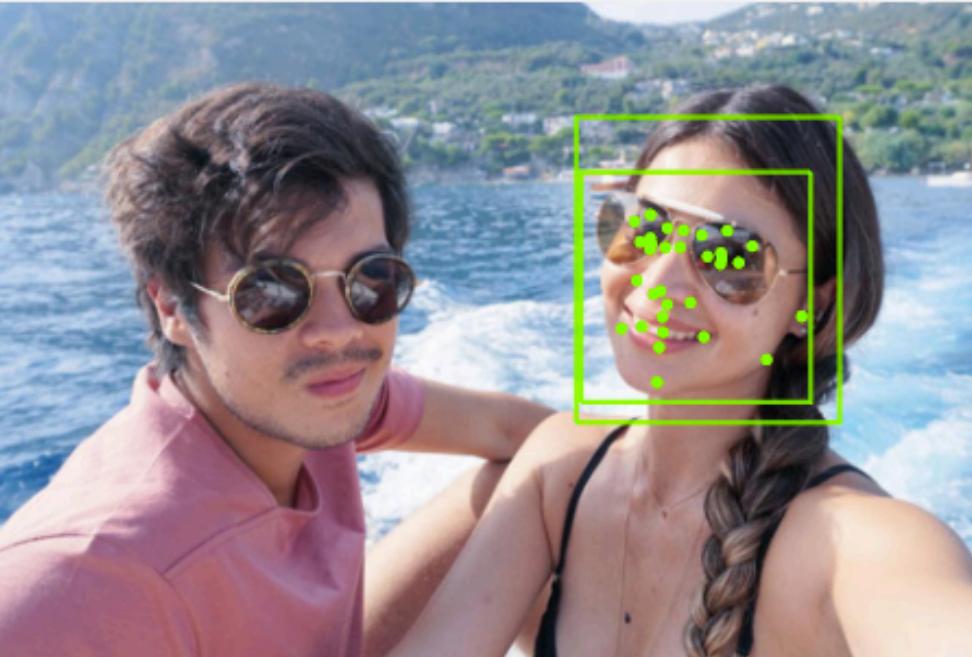
uses **Machine Learning** to detect images

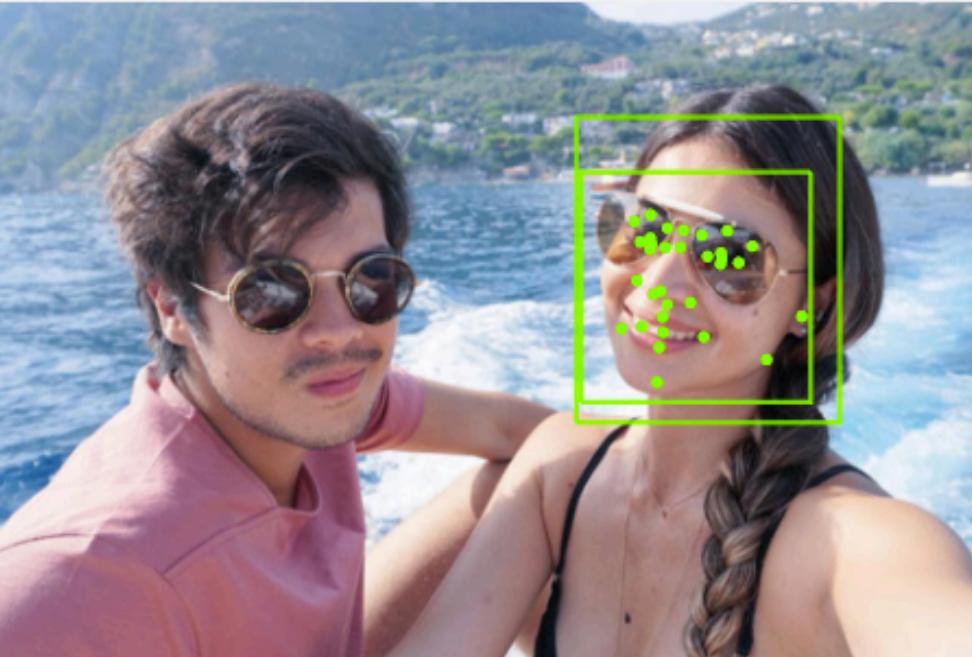
can find objects **within** images

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 | | | | | |
| | | | | | |



The image shows a man and a woman on a boat. The woman is wearing sunglasses and has a green bounding box drawn around her face. Several green dots are placed on her nose, mouth, and eyes, likely indicating detected facial features.

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

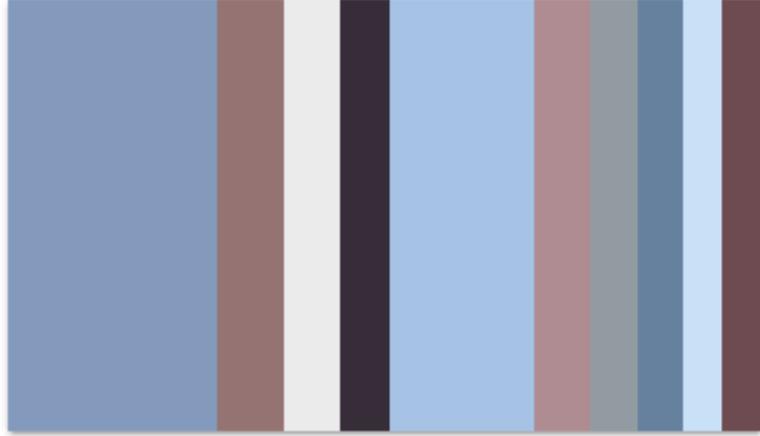
| Faces | Labels | Text | Colors | Safe Search | JSON Response | | | | | | | | | | | | | | | | |
|--|--------|------|--------|-------------|---------------|----------|-----|--------|-----|------------|-----|-------|-----|---------|-----|-------------|-----|-------|-----|--------------|-----|
|  | | | | | | | | | | | | | | | | | | | | | |
| <p>erwan-anne-101616.jpg</p> | | | | | | | | | | | | | | | | | | | | | |
| <table><tbody><tr><td>Vacation</td><td>81%</td></tr><tr><td>Beauty</td><td>80%</td></tr><tr><td>Sunglasses</td><td>79%</td></tr><tr><td>Smile</td><td>78%</td></tr><tr><td>Glasses</td><td>61%</td></tr><tr><td>Photo Shoot</td><td>58%</td></tr><tr><td>Model</td><td>54%</td></tr><tr><td>Spring Break</td><td>51%</td></tr></tbody></table> | | | | | | Vacation | 81% | Beauty | 80% | Sunglasses | 79% | Smile | 78% | Glasses | 61% | Photo Shoot | 58% | Model | 54% | Spring Break | 51% |
| Vacation | 81% | | | | | | | | | | | | | | | | | | | | |
| Beauty | 80% | | | | | | | | | | | | | | | | | | | | |
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| 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 |
|--|--------|------|--------|-------------|---------------|
|  A photograph of a man and a woman wearing sunglasses, smiling and posing together on a boat. They are wearing casual summer clothing. The background shows a scenic coastal town and water. | | | | | |
| | | | | | |

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 |
|--|--------|------|--------|-------------|--|
|  | | | | | <pre>{ "faceAnnotations": [{ "boundingPoly": { "vertices": [{ "x": 560, "y": 112 }, { "x": 815, "y": 112 }, { "x": 815, "y": 407 }, { "x": 560, "y": 407 }] } }] }</pre> |

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

Labels Text Colors Safe Search JSON Response

出口
Exit
出口 나가는 곳

中央線 Chuo Line 山手線 Yamanote Line 京葉線 Keiyo Line 新幹線 Shinkansen

京浜東北線 Keihin-Tohoku Line 東海道線 Tokaido Line

tokyotrain.jpg

" Exit Chuo Line Yamanote Line
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

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

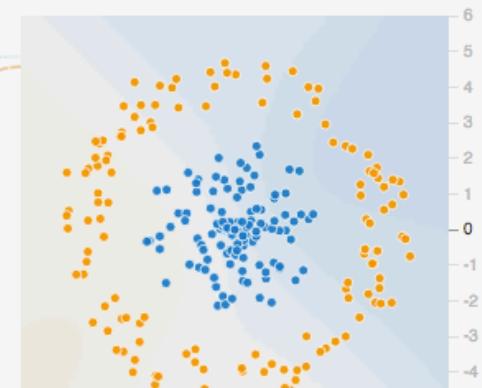


2 neurons

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

OUTPUT

Test loss 0.500
Training loss 0.505





TensorFlow

<http://playground.tensorflow.org>

TensorFlow for Poets

1 Introduction

2 Setting Up

3 Installing and Running the TensorFlow Docker Image

4 Retrieving the images

5 (Re)training Inception

6 Using the Retrained Model

7 Optional Step: Trying Other Hyperparameters

8 Optional Step: Training on Your Own Categories

9 Next Steps

Did you find a mistake? [Please file a bug.](#)

← TensorFlow For Poets

⌚ 47 min remaining

1. Introduction

[TensorFlow](#) is 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 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



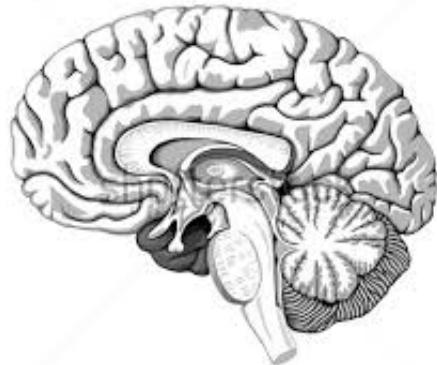


TensorFlow

<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.



www.shutterstock.com - 325209851

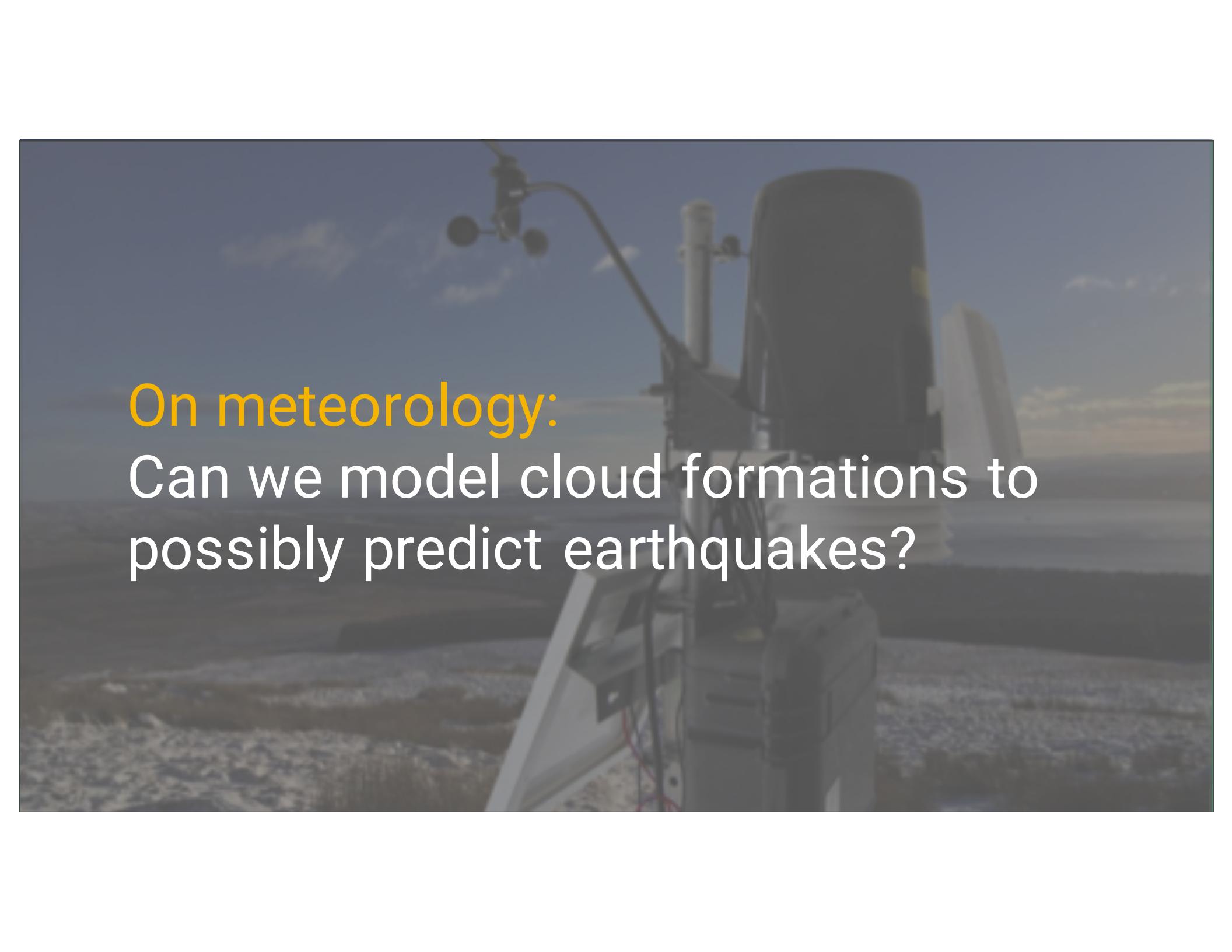
A photograph of a banana plantation. The foreground and middle ground are filled with tall, green banana plants. Their long, slender leaves have prominent veins and some show signs of aging or damage. The plants are closely packed, creating a textured, vertical pattern across the frame.

On agriculture

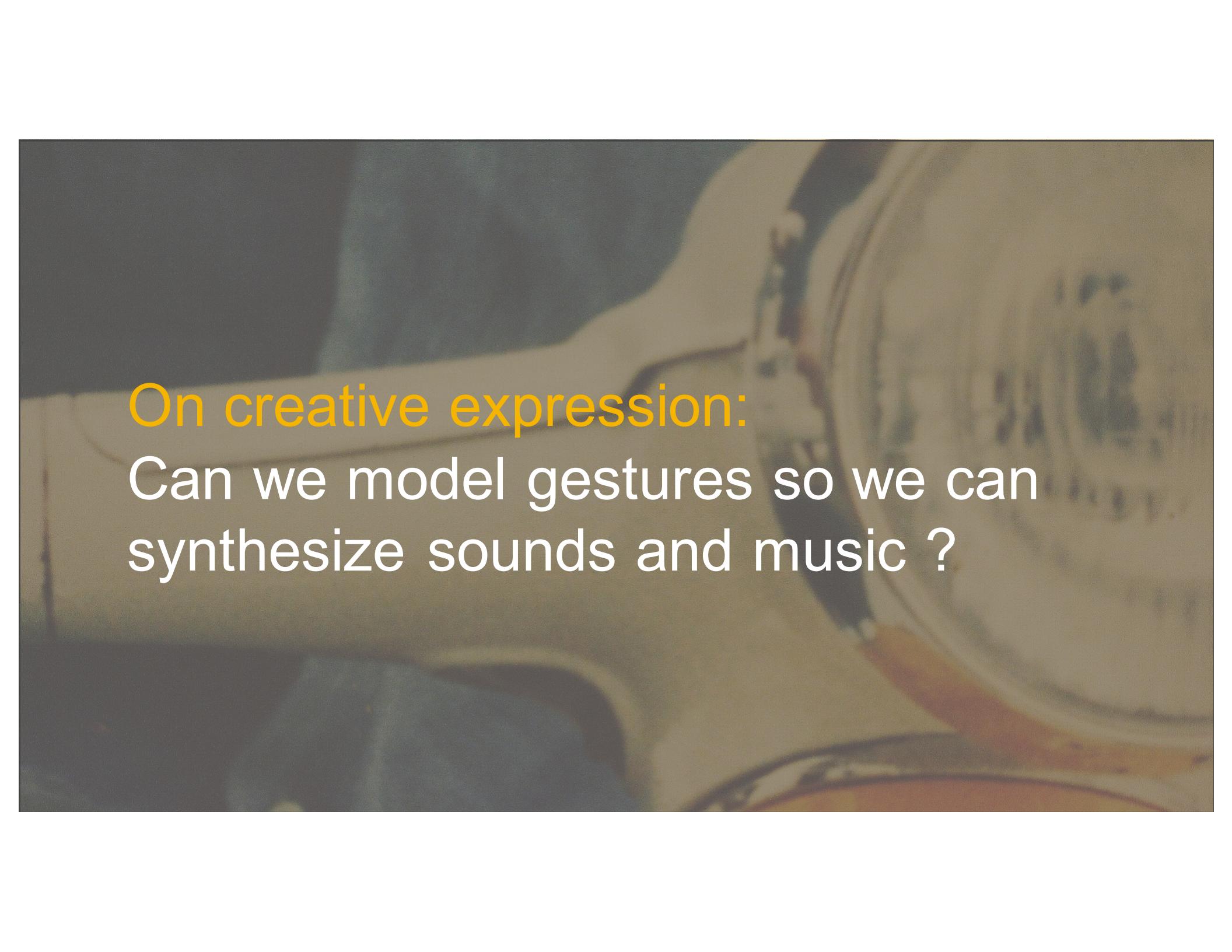
Can we build a setup where we can monitor (and possibly prevent) the early spread of fungi in banana farms?

The background of the slide is a blurred photograph of a data center. It shows several rows of server racks filled with computer hardware. The lights from the equipment create a colorful, glowing effect against the dark, metallic surfaces of the racks.

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

A photograph of a weather station mast standing in a field. The mast is dark grey and has several components attached: a wind vane and anemometer at the top, followed by a vertical pipe, and a large cylindrical sensor or antenna below that. The background shows a hilly landscape under a blue sky with scattered white clouds.

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

A close-up, slightly blurred photograph of a person's hand and forearm. The hand is resting on the neck of a guitar, with fingers partially visible. The background is dark and out of focus.

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:

jordan.deja@dlsu.edu.ph

@jordandoinwork

