PINT OF SCIENCE · CAMBRIDGE · 2026

Teaching a computer to spot a bush *(from space).*

SPEAKER

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TODAY'S STORY FEATURES

Shane and Anil.

SHANE

ANIL

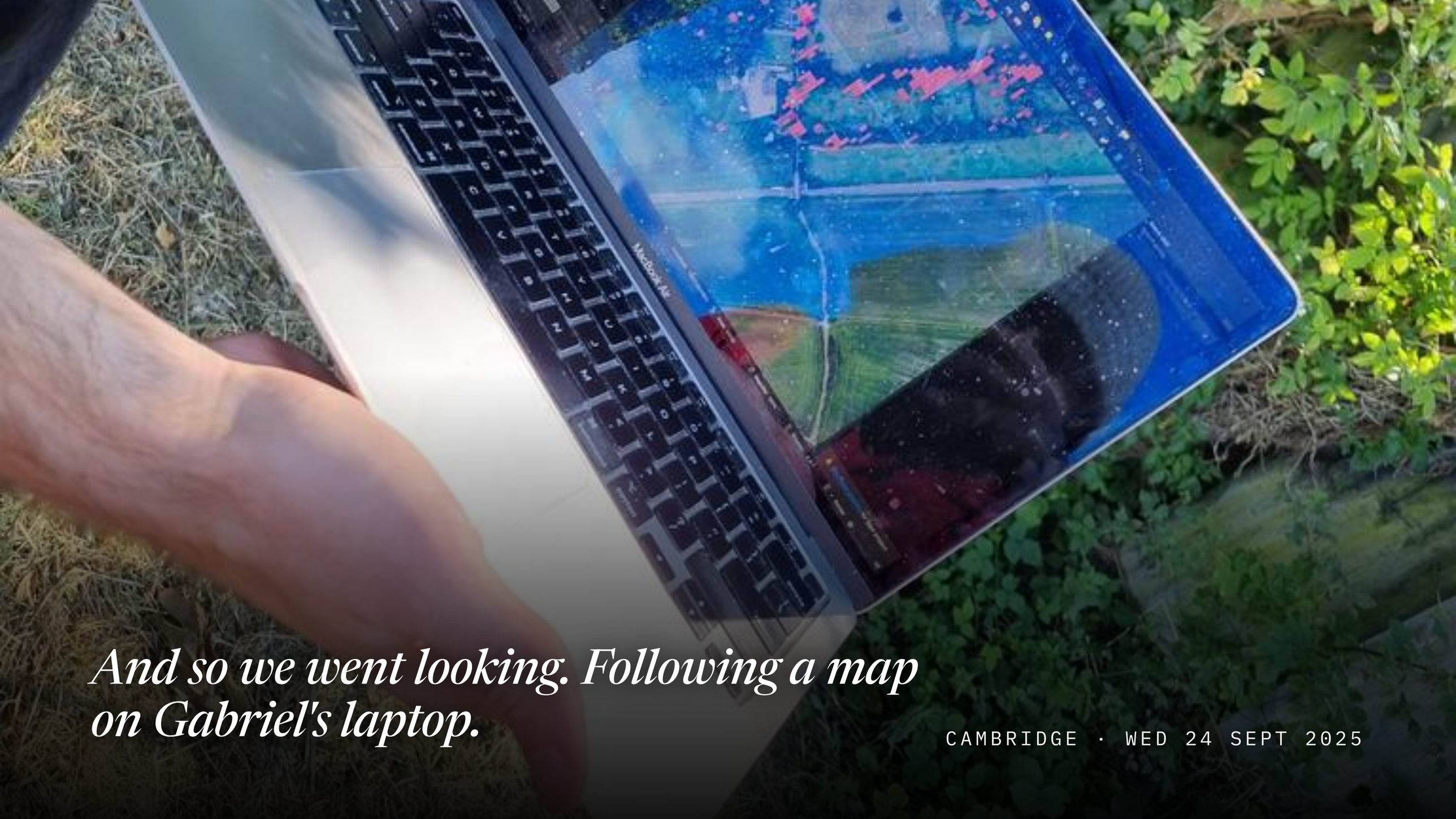
... and Gabriel.

CAMBRIDGE · BOAT RACE 2025


Our story starts with hedgehogs.
GABRIEL'S SUMMER · 2025

Can we find brambles? From space?

FIRST EXERCISE



And so we went looking. Following a map on Gabriel's laptop.

CAMBRIDGE · WED 24 SEPT 2025

A SMALL CLIFFHANGER

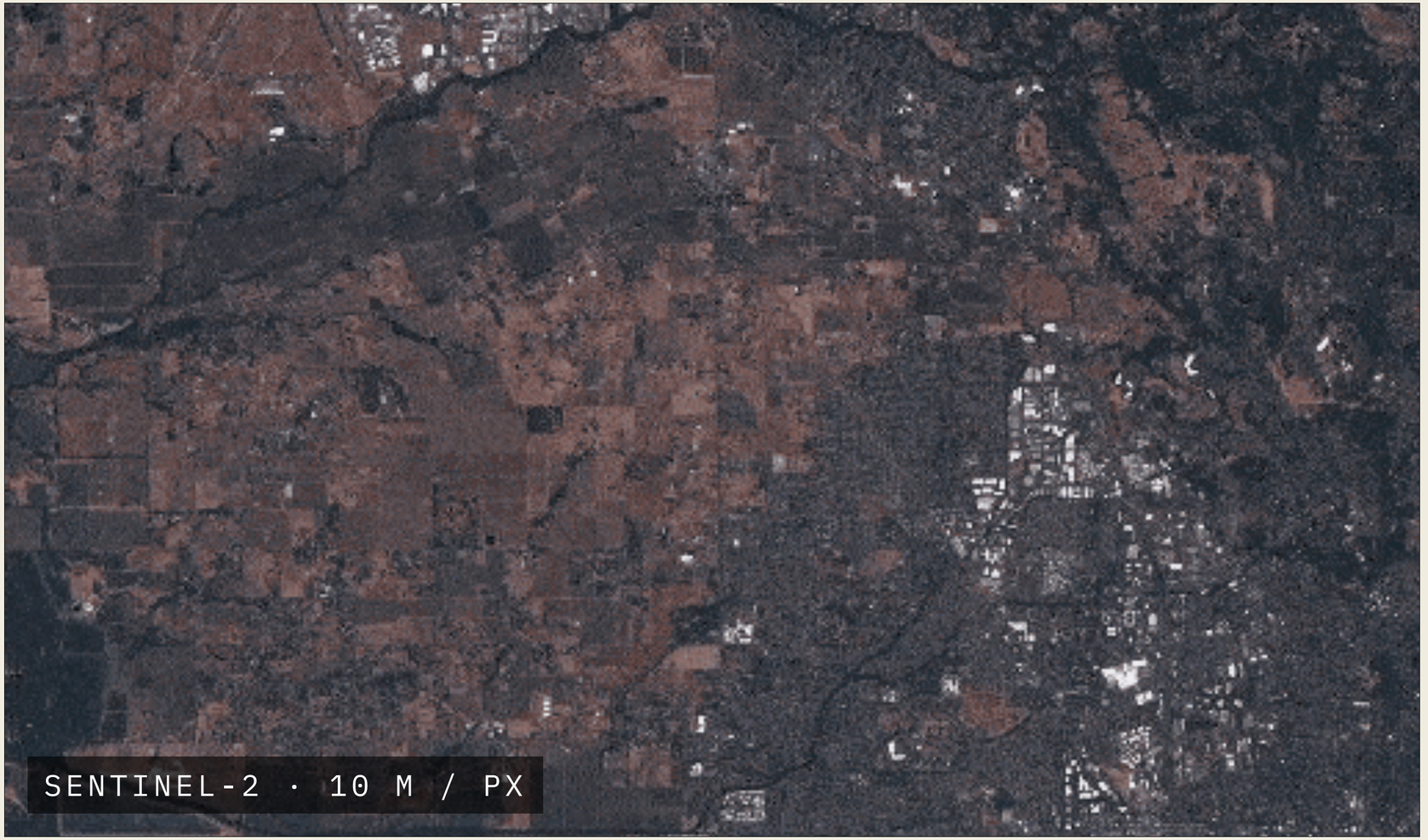
Did it work?
We'll get there.

But first: what does a satellite actually see from 800 km up?

QUESTION 01

What can a satellite *actually* see?

ROUGHLY WHAT THEY SEE, LOOKING DOWN.



PIXEL SIZE

10 m

≈ the width of this room.

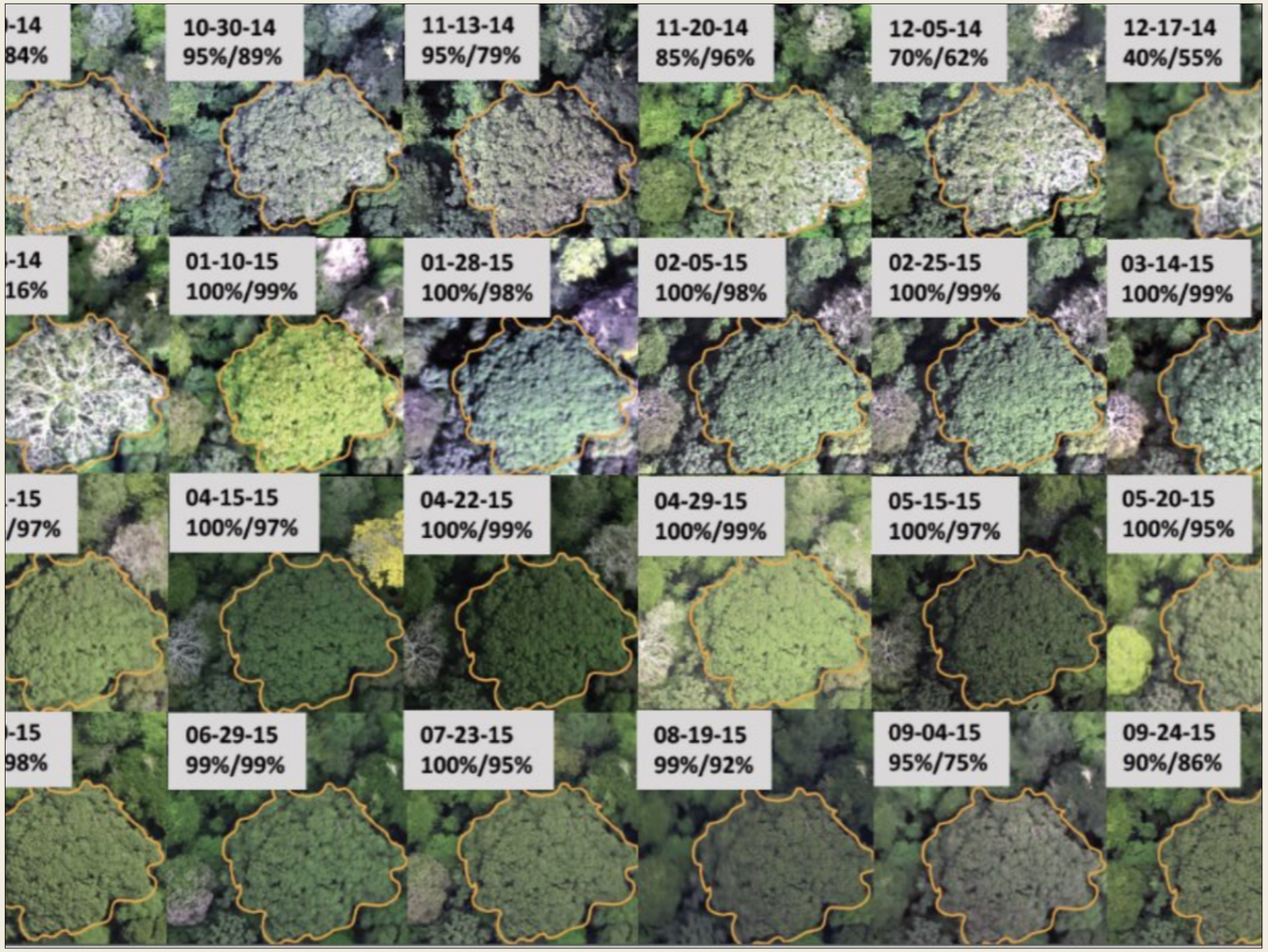
REVISIT

5 d

A new picture, every five days.

Average a year of pictures. Throw away the year.

EUROPE · CLOUD-FREE COMPOSITE



How colour changes *across the year* is itself a feature.

WHAT WE DO INSTEAD

Fingerprint.

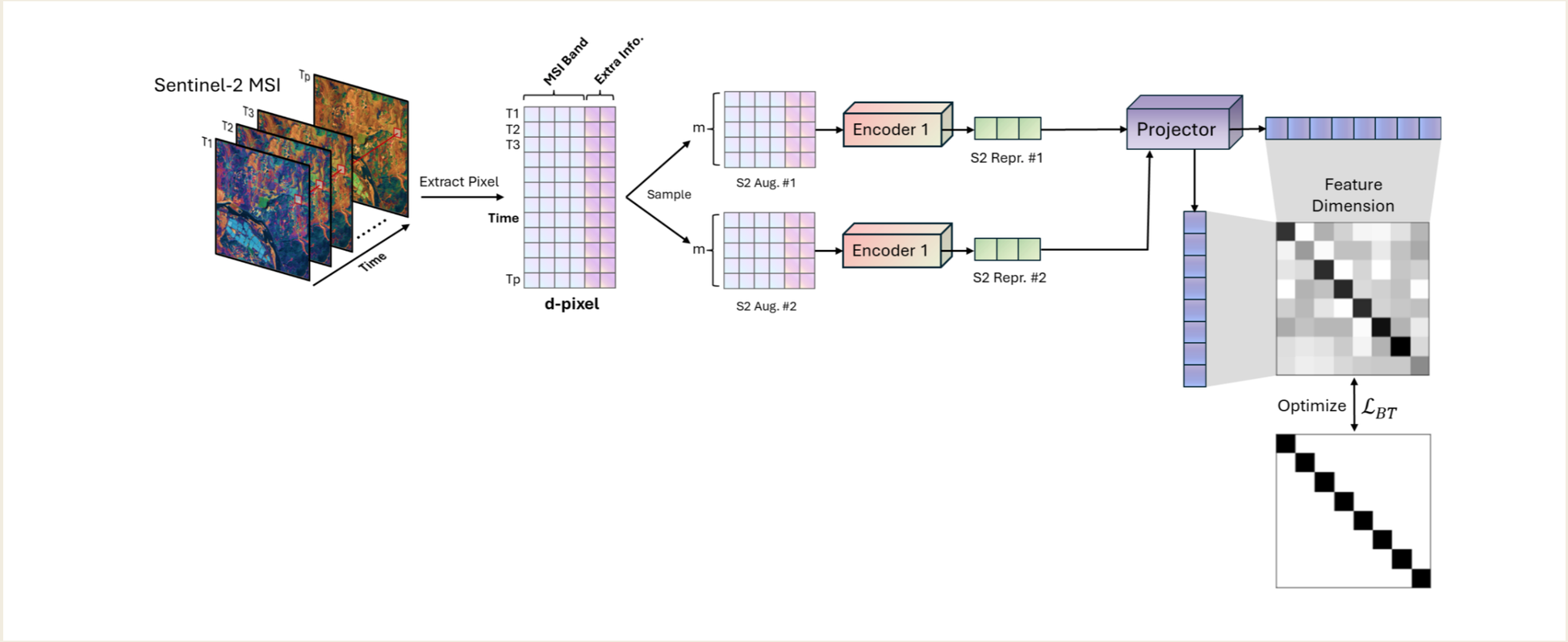
A YEAR OF PATCHES

→

A FINGERPRINT

Two views of the same patch.

Give me back the same fingerprint for both.



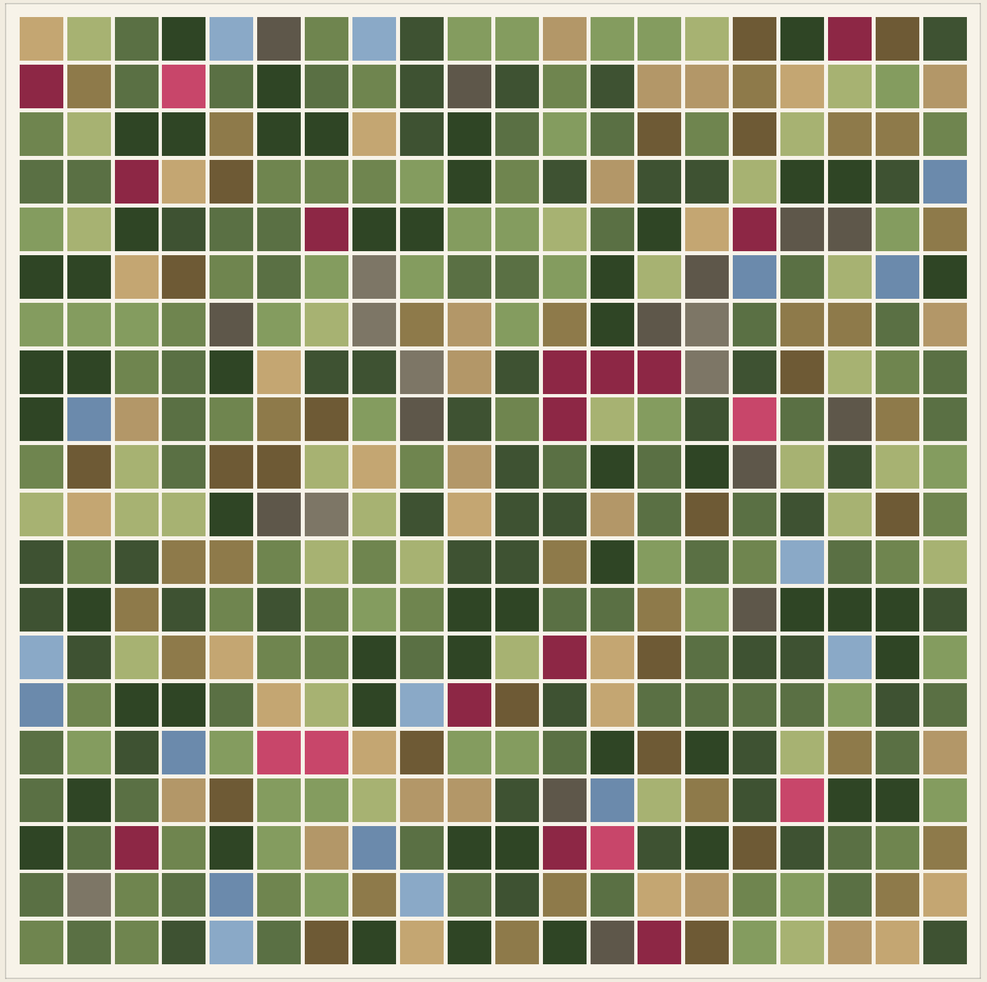
HOW MUCH WE SHOWED IT

800*M*

10-metre patches of Earth.
No labels. Just patches.

PULLED FROM	every continent, every biome
PER PATCH	a year of Sentinel-1 & Sentinel-2
LABELS USED	zero

800,000,000 OF THESE



EACH SQUARE HERE ≈ 2 MILLION PATCHES.

Where we trained it. Dawn in Cambridge, plus AMD compute, and other places.

SADIQ & FRANK

THE OUTPUT

128 numbers per patch. Every 10 m. Whole world. Every year since 2017.

ONE 10 M PATCH

```
+0.412   +0.218   +0.602   +0.951
−0.087   −0.776   +0.279   −0.366
+1.203   +0.945   −0.041   +0.227
+0.554   +0.131   +0.815   +0.578
−0.913   −0.388   −0.220   −0.612
+0.034   +0.396   +1.046   +0.142
+0.728   +0.012   +0.354   +0.806

… + 100 more numbers
```

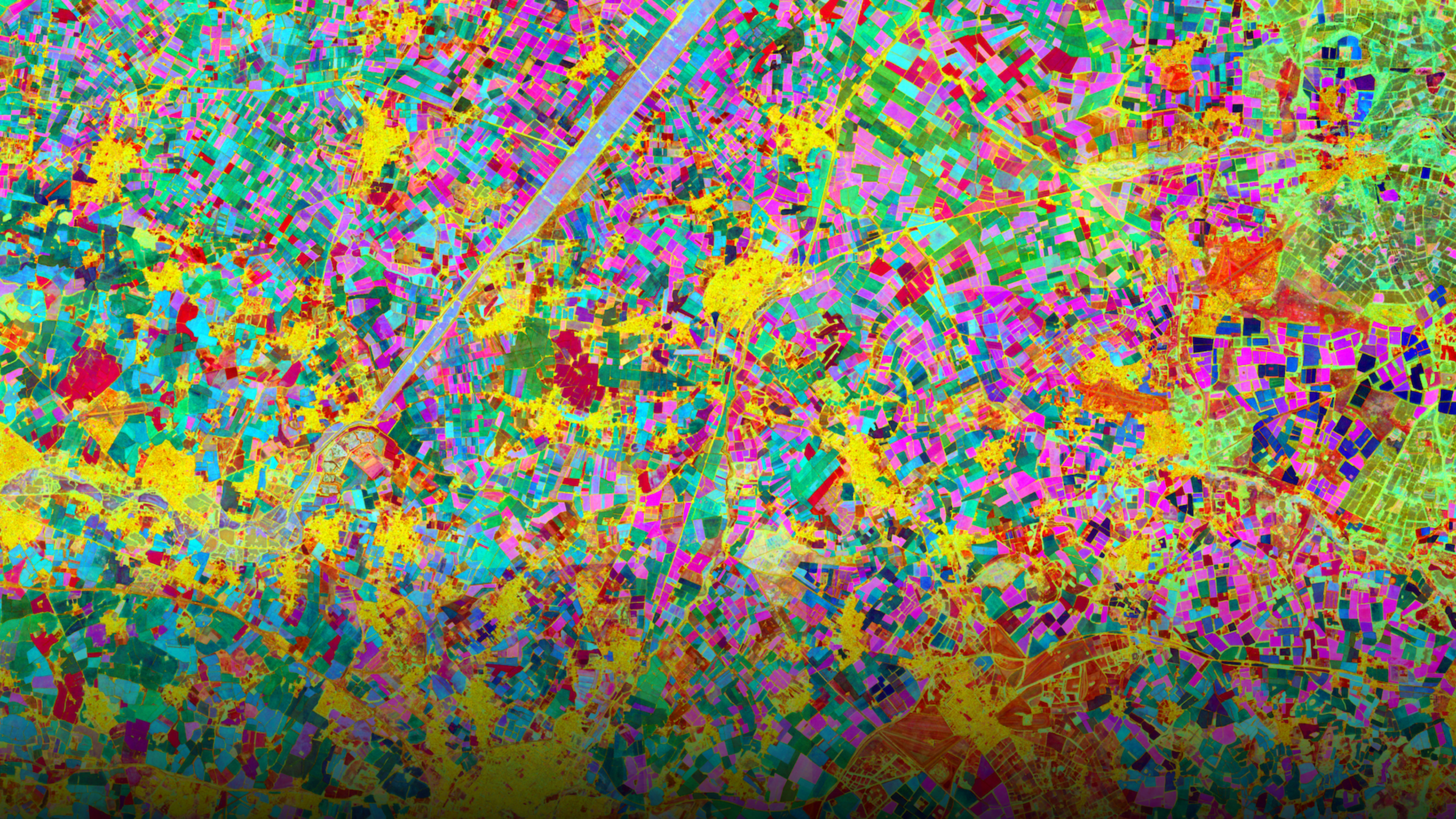
EARTH · LAND SURFACE · 10 M PIXELS

1,500,000,000,000

10-metre patches on Earth's land surface.

BACKGROUND: A SLICE OF THE ACTUAL FINGERPRINTS, RENDERED AS COLOUR.

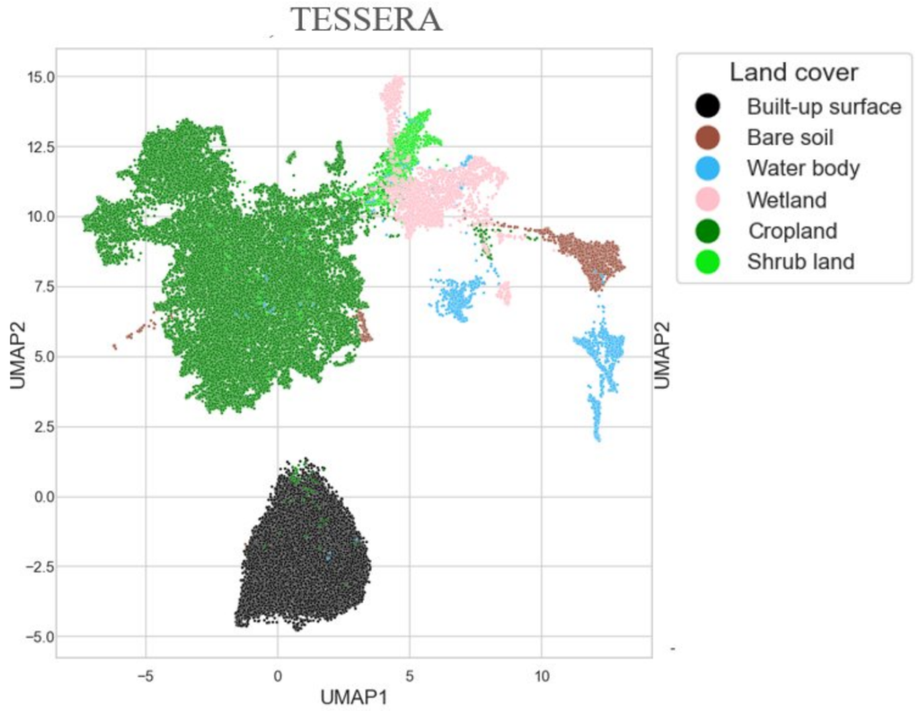

Anyone recognise this place?
FINGERPRINTS · 128 → 3 → RGB



PLOT THE FINGERPRINTS. SEE WHERE THEY FALL.

Nobody told it those categories *exist*.

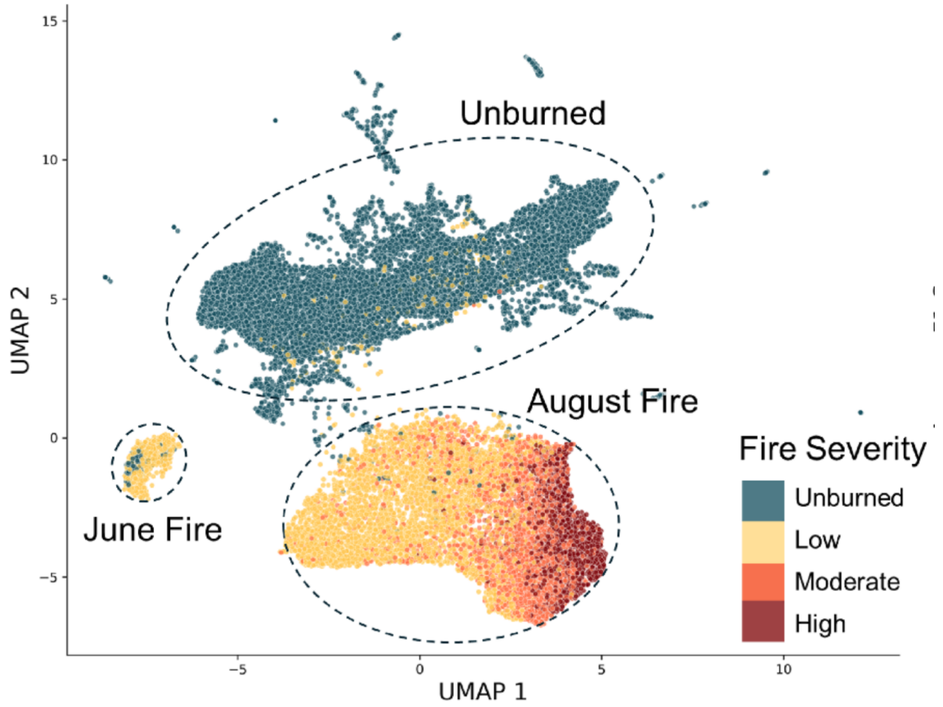
UMAP · SENEGAL · LAND COVER



SAME TRICK · DIFFERENT QUESTION

It also pulls apart *burn severity*.

UMAP · CALIFORNIA · FIRE SEVERITY



01 Satellites see a lot. It's pretty noisy.

02 What matters is the time series. Not any single picture.

03 An AI can learn abstract features straight from that.

Right. Back to *that walk*.

THE WHOLE THING · TOOK AN AFTERNOON

01

Bramble photos with GPS pins.

INATURALIST · ~500 EXAMPLES

→

02

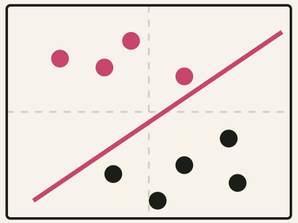
Look up the fingerprint at each pin.

128 NUMBERS · ALREADY MADE

→

03

Train the simplest classifier you can imagine.



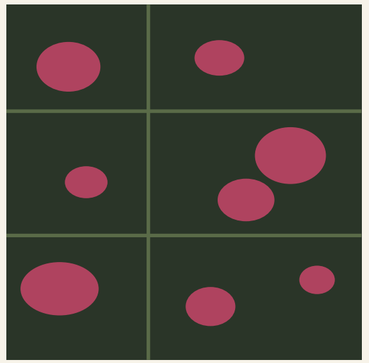
bramble vs. not

LOGISTIC REGRESSION

→

04

Ask it about everywhere else.



A BRAMBLE MAP

WHY THIS WORKS WITH SO LITTLE DATA

30×

fewer labels than starting from scratch.

We picked the pinkest spots. Went for a walk.

WED 24 SEPT · 09:24

Twenty seconds in.

FIND 01 · 10:04

Then this.

FIND 02 · 11:16

In an empty plot in a housing estate. We'd never have thought to look here.

FIND 03 · 14:17

And finally, this.

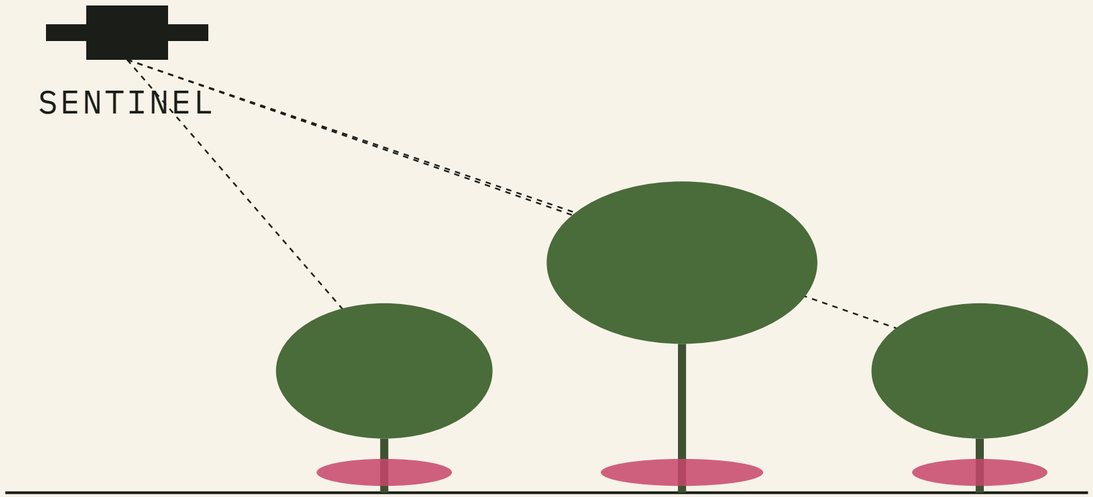
FIND 04 · 14:02

Ended up somewhere with lots of brambles...

BRAMBLEFIELDS LNR

LIMITATIONS

We only see reflected photons. Block them, and we're blind.



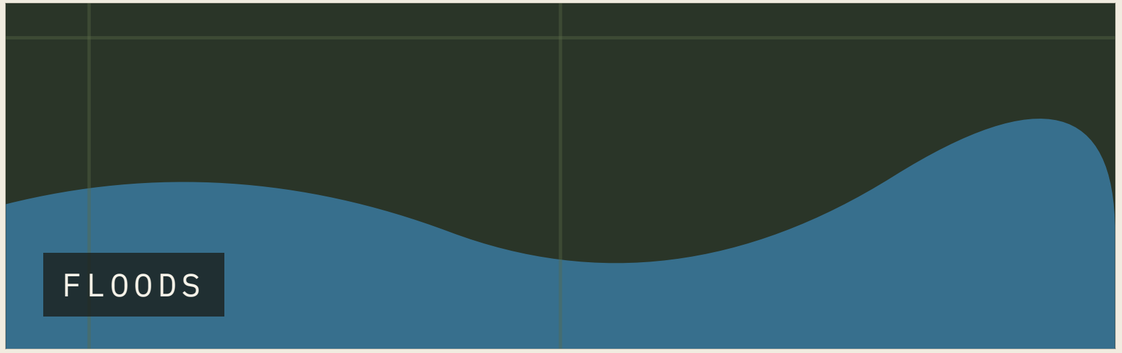
BRAMBLE · HIDDEN UNDER CANOPY

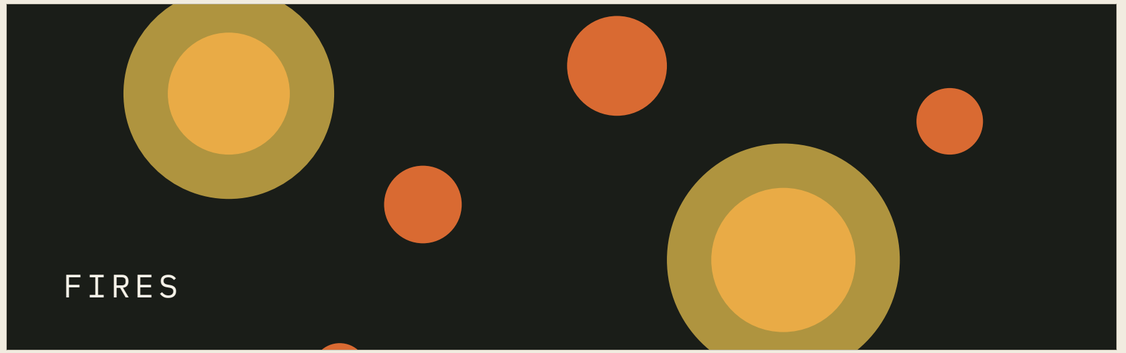
Anything between us and the ground blocks the signal. Clouds, smoke, a tree canopy.

Knowing what we can't see is itself useful.

THE FINGERPRINTS ARE MADE ONCE · THEN THEY'RE FREE

Other researchers are asking other questions.





01 Take a year of satellite photos of Earth.

02 Squeeze them into a sequence per 10 m square.

03 Train a model to learn a *fingerprint* for each.

04 Match a little ground-truth to those fingerprints.

THANKS & LINKS

Thank you.

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PAPERS, ARTICLES & GUIDES

geotessera.org

HOMEPAGE

toao.com

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