The background of the slide features an aerial photograph of a busy shipping port. Numerous shipping containers in various colors (blue, white, red, green) are stacked in large piles. Yellow industrial cranes are visible between the stacks. The port is surrounded by roads with white dashed lines, and some numbers like '180' and '20' are visible on the ground. A dark blue diagonal band runs across the middle of the image.

Using deep learning on satellite imagery
to get a business edge



Apppsilon
DATA SCIENCE

2018-10-11 / SER / Warsaw

Damian Rodziewicz

co-founder

Passionate about Data Analysis and Programming

Previously worked at Accenture, UBS, Microsoft,
Domino Data Lab

Technology maniac

Loves psychology



What we do



Contributors to R community





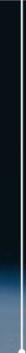
WHY SATELLITES?

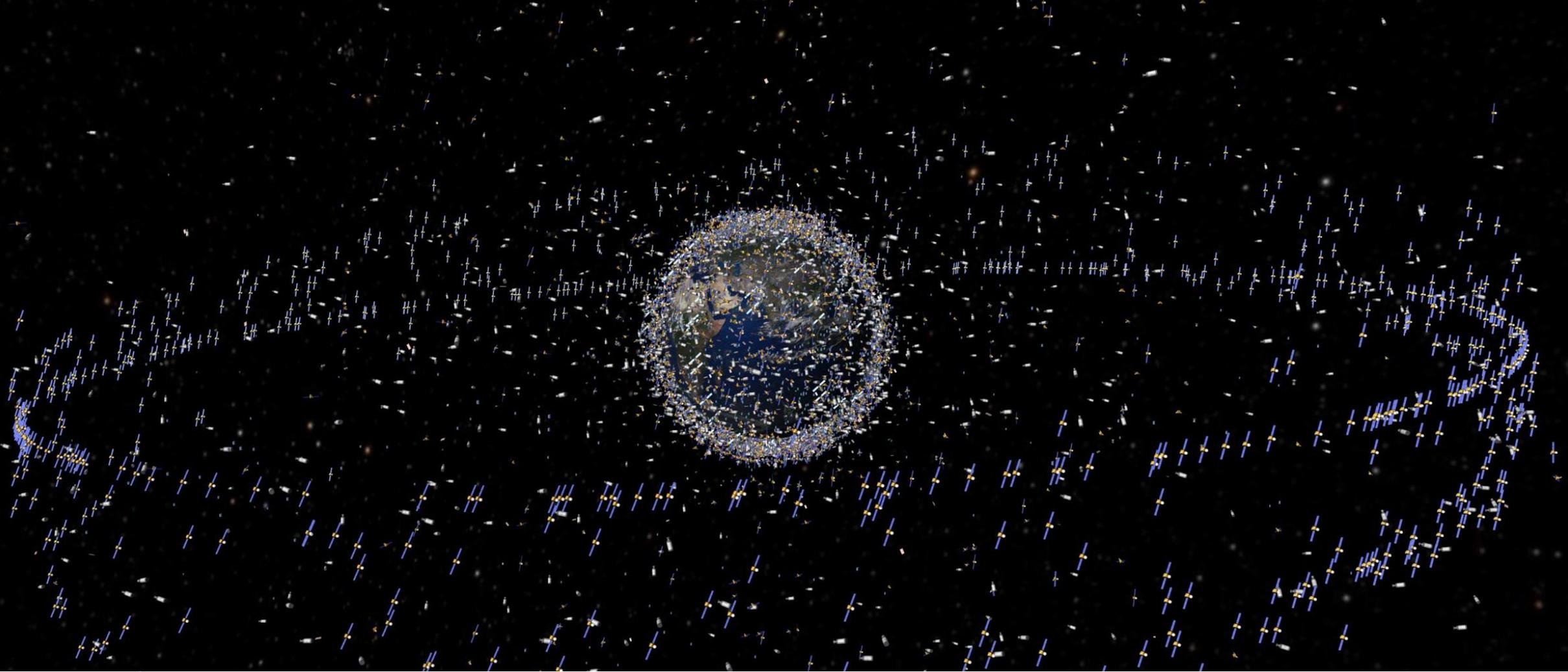
WHY SATELLITES?

Regular coverage of earth

Easily available

Time-travel





>4500

SATELLITES
IN SPACE

>600

IMAGERY
SATELLITES

25 cm

BEST
RESOLUTION

Types of available data

SATELLITE SYSTEMS

Public

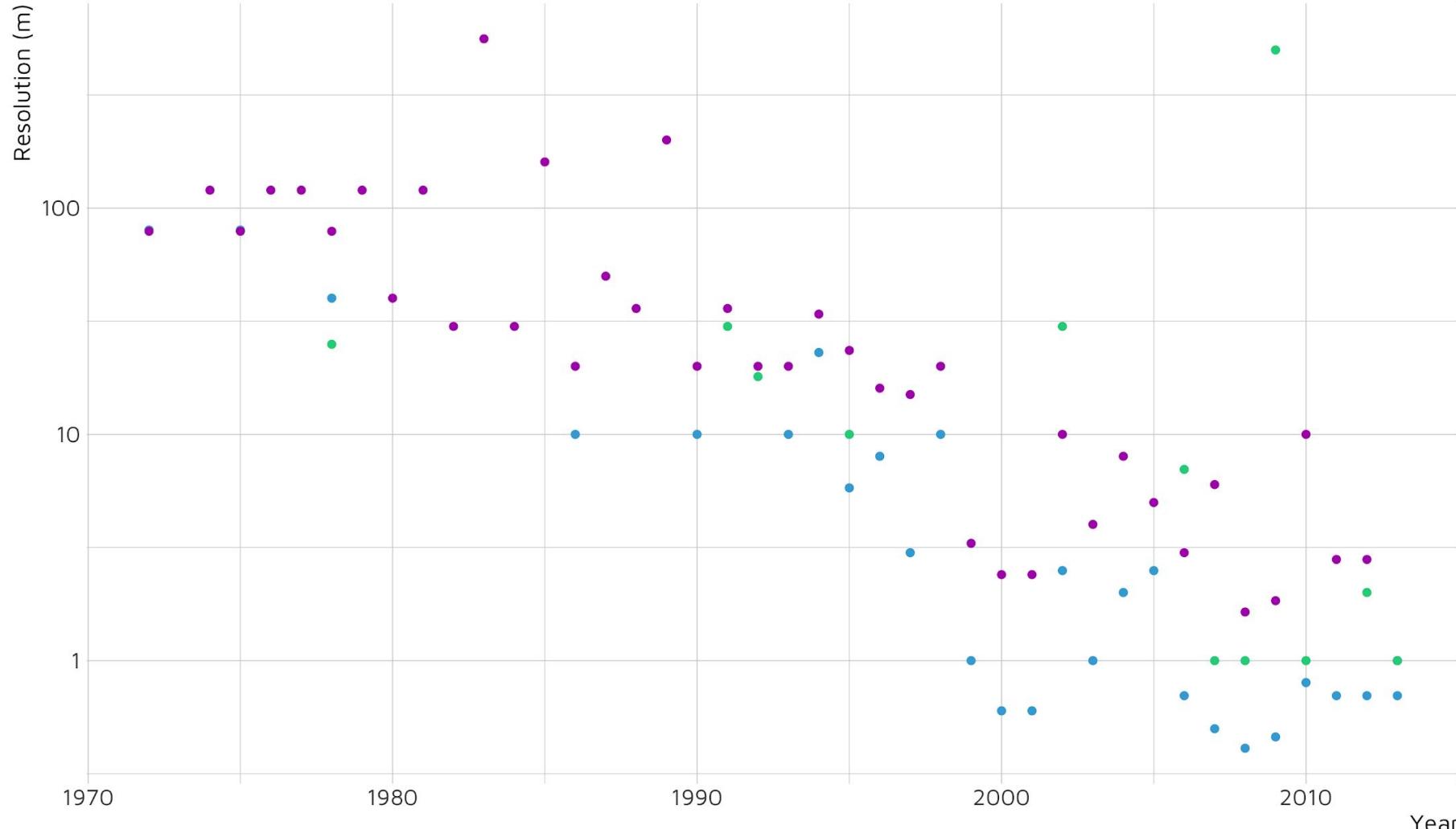
- Landsat
- Sentinel
- ...

Commercial

- DigitalGlobe
- Planet Labs
- Airbus Defence & Space
- ImageSat
- ...

Types of available data

SPATIAL RESOLUTION



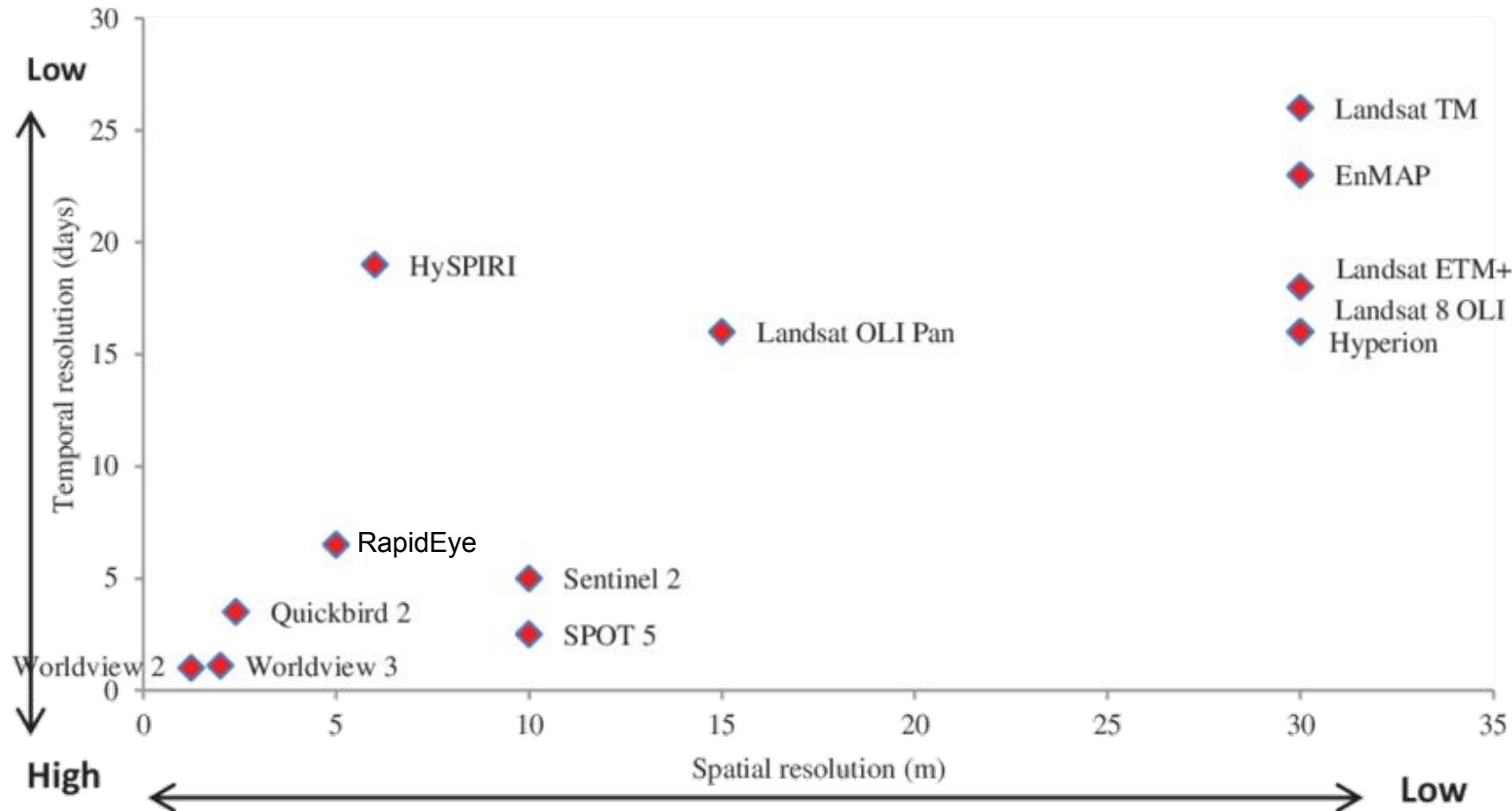
Pan (Panchromatic), MSS (Multispectral scanner) and SAR (Synthetic Aperture Radar)

provide highest resolution (in meters) for imaging sensors carried by each mission.

Source: UCS Satellite Database

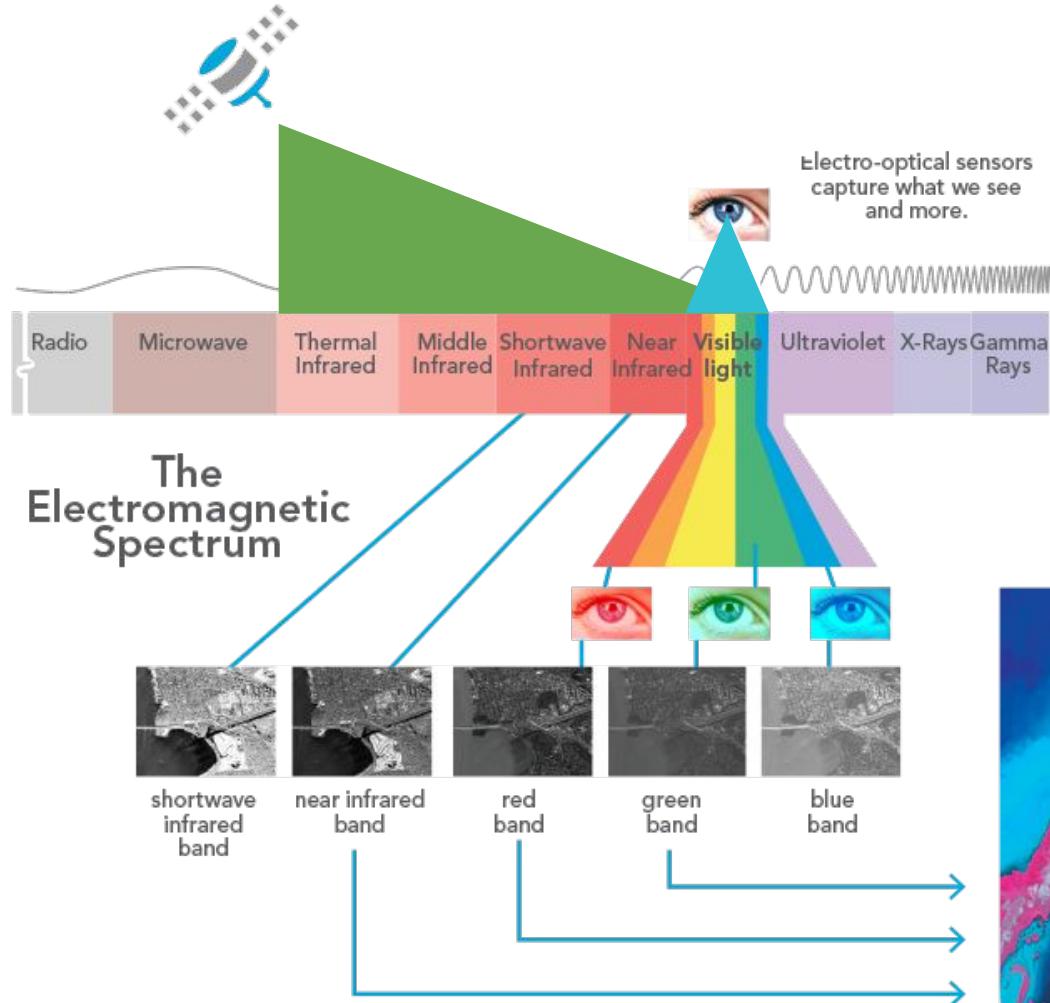
Types of available data

TEMPORAL RESOLUTION



Types of available data

SPECTRAL RESOLUTION



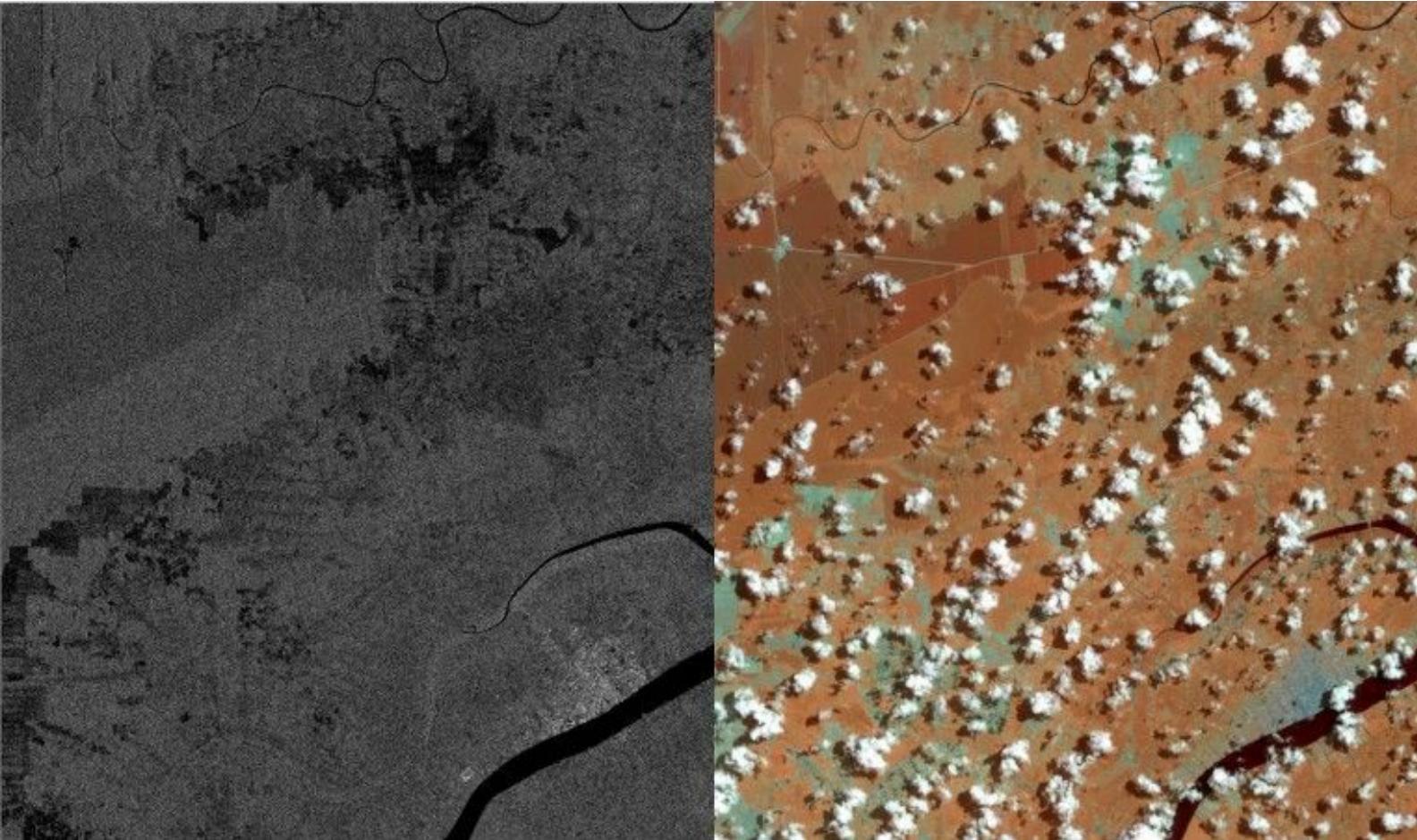
Visible light + much more

Near infra-red → NDVI



Types of available data

RADAR



Sumatra, Indonesia

(Left: © Copernicus Sentinel data (2015), right © U.S. Geological Survey.)
Source: <https://blog.conservation.org/2016/03/cloud-piercing-satellites-unleash-torrent-of-new-data-new-insights-into-planet-earth/>

Types of available data

CURRENT STATE OF THE ART



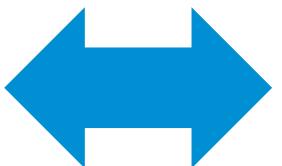
**25 cm
resolution**

**Twice
a day**

Types of available data

WHY HIGHER SPATIAL RESOLUTION ISN'T ALWAYS BETTER?

**spatial
resolution**



temporal and spectral
cost
consistency & availability
ease of processing

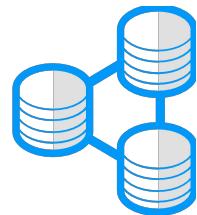
USING R FOR SATELLITE DATA

What shouldn't be done in R?

SATELLITE IMAGERY + R

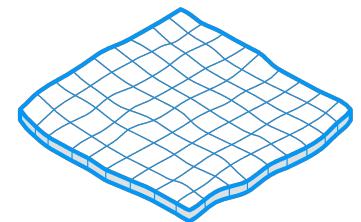
DATA PREPROCESSING

Preprocessing of large image files.



RESOURCE INTENSIVE

Parts of solution requiring lots of compute and memory resources.



Where R Shines?

SATELLITE IMAGERY + R

DASHBOARDS

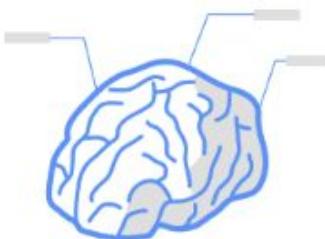
Display images and insights.

Decision support systems to actually get and apply insights.



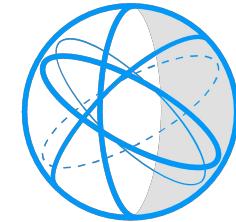
DEEP LEARNING

Deep neural network models on satellite data.



FORECASTING & ANALYSIS

Predictive models based on indicators calculated from spectral data.



Satellite imagery analysis in Agriculture

PARCEL ID: OHIO, Corning

DATE: 18/05/18 19/05/18 20/05/18

SELECTED AREA

DATE: 2018/05/20 11:40:20

AREA: 7.3 ha

WATER AREA: 0 ha

CROPS DAMAGED: 7,5%

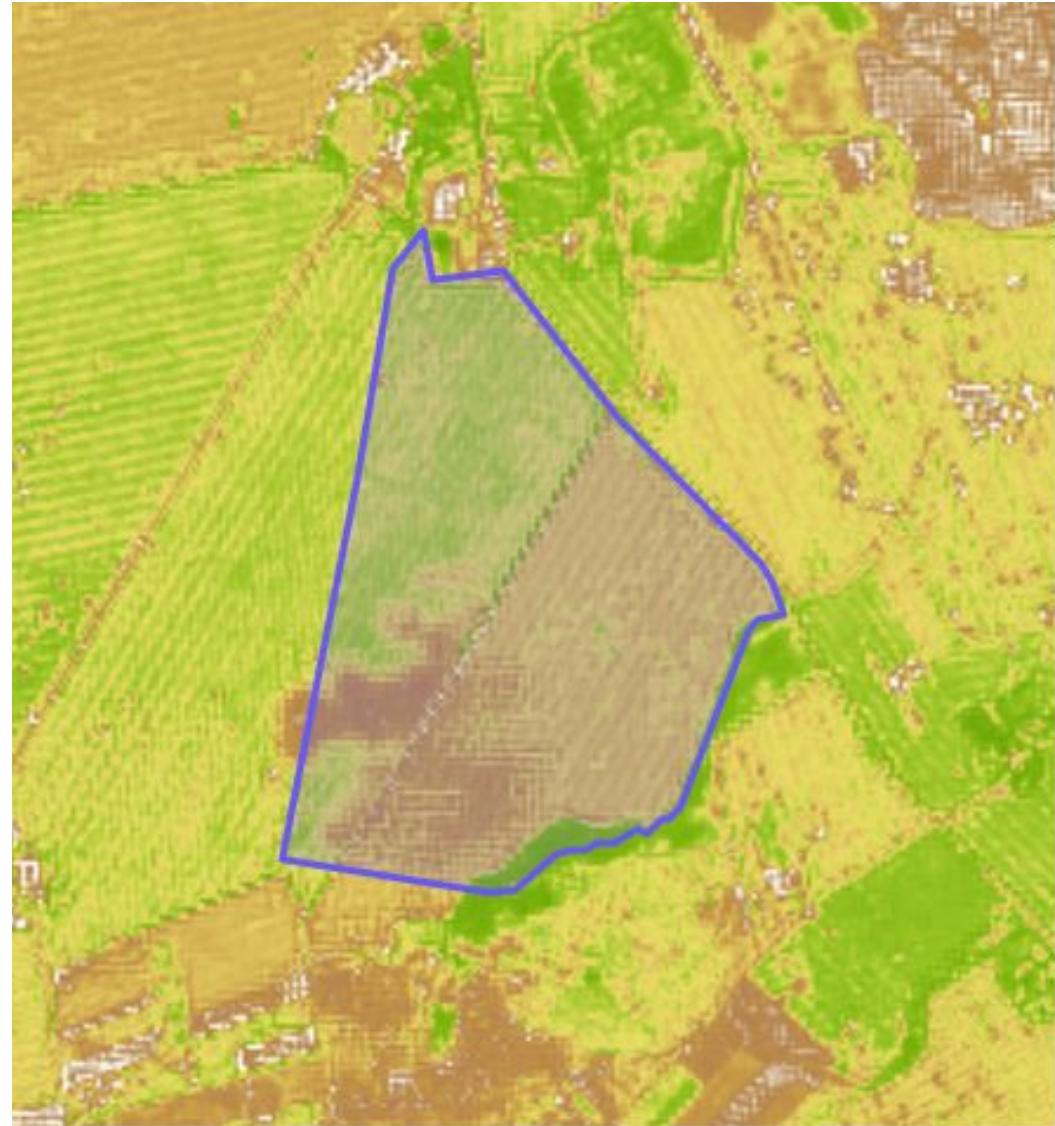


Standard
 Black & White

Area borders
 Water highlight
 NVDI

Satellite

indicators visualization



Deep learning

SATELLITE IMAGERY + R



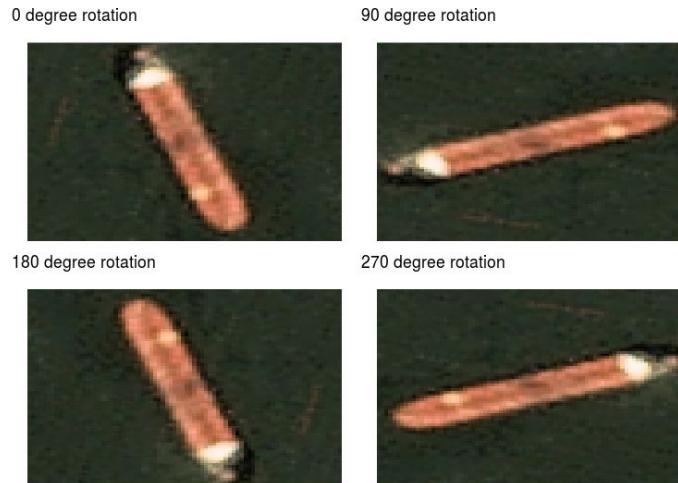
K Keras R

2800 images

Deep learning

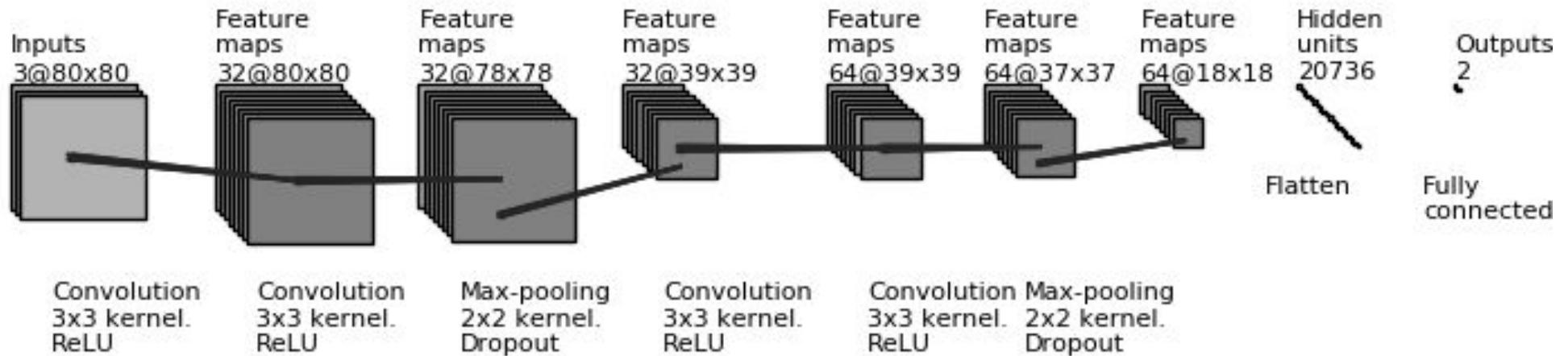
SATELLITE IMAGERY + R

data
augmentation



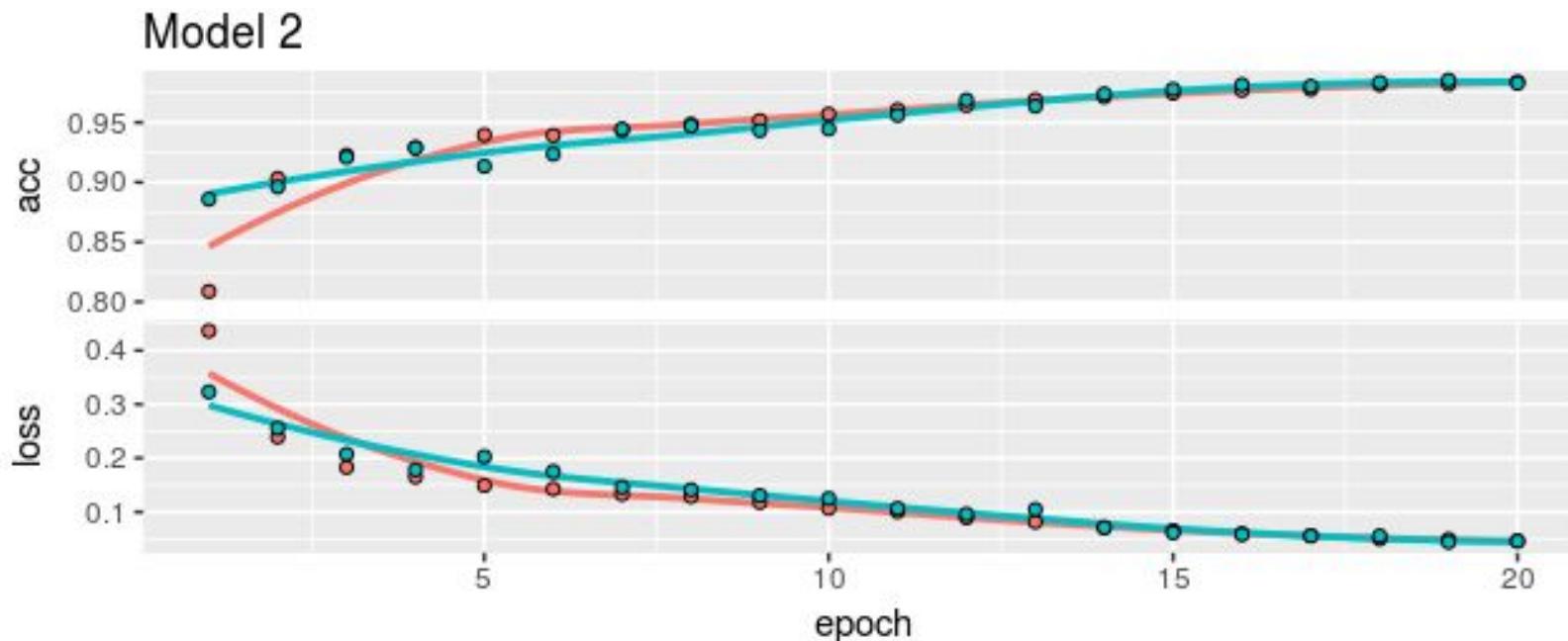
Deep learning

SATELLITE IMAGERY + R



Deep learning

SATELLITE IMAGERY + R



data
—●— training
—●— validation

98%
accuracy

Architecture of complete solution

SATELLITE IMAGERY + R

Satellite images library / service



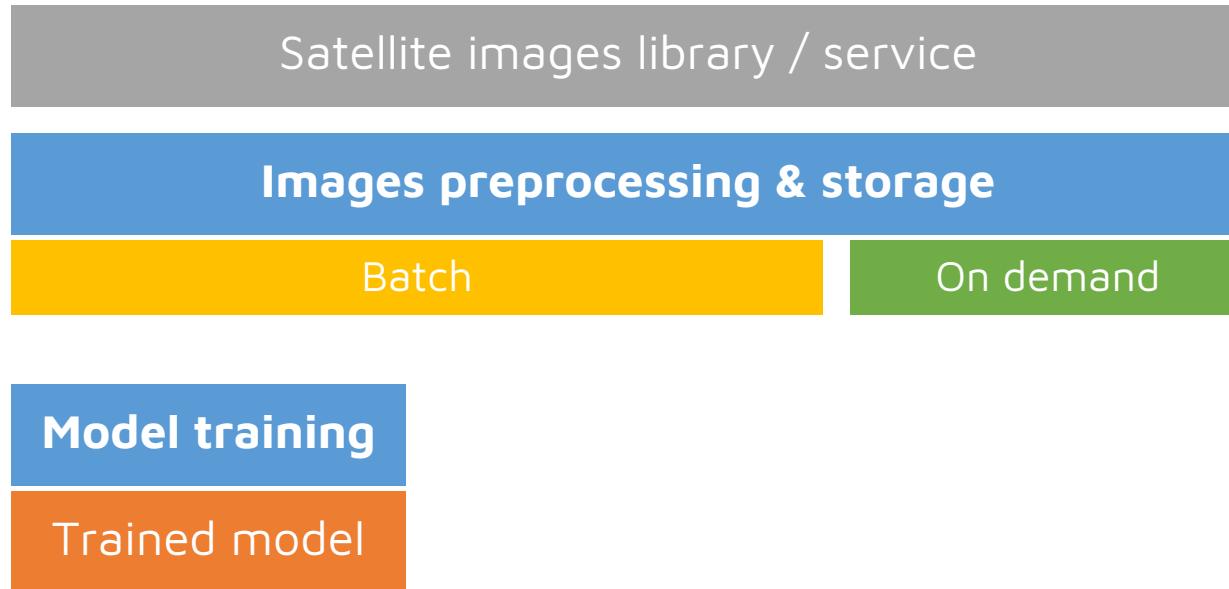
Architecture of complete solution

SATELLITE IMAGERY + R



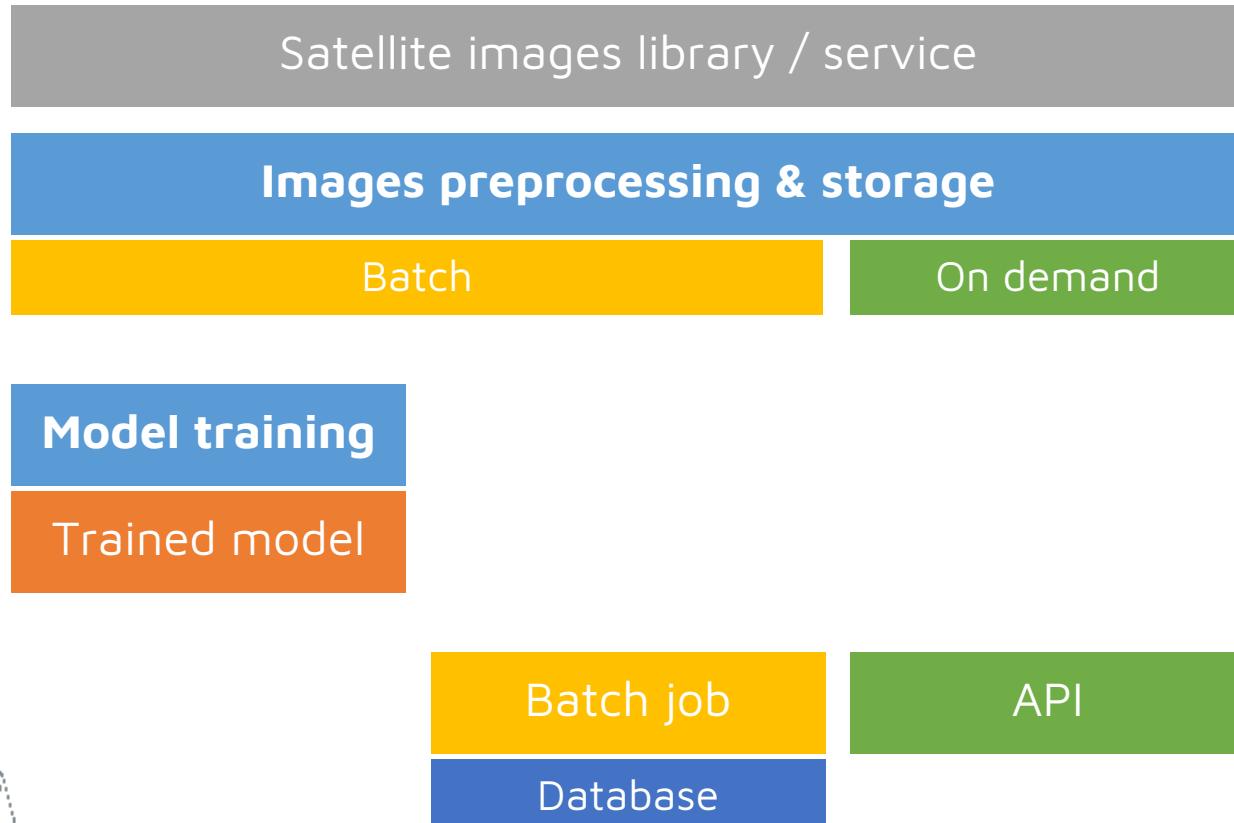
Architecture of complete solution

SATELLITE IMAGERY + R



Architecture of complete solution

SATELLITE IMAGERY + R

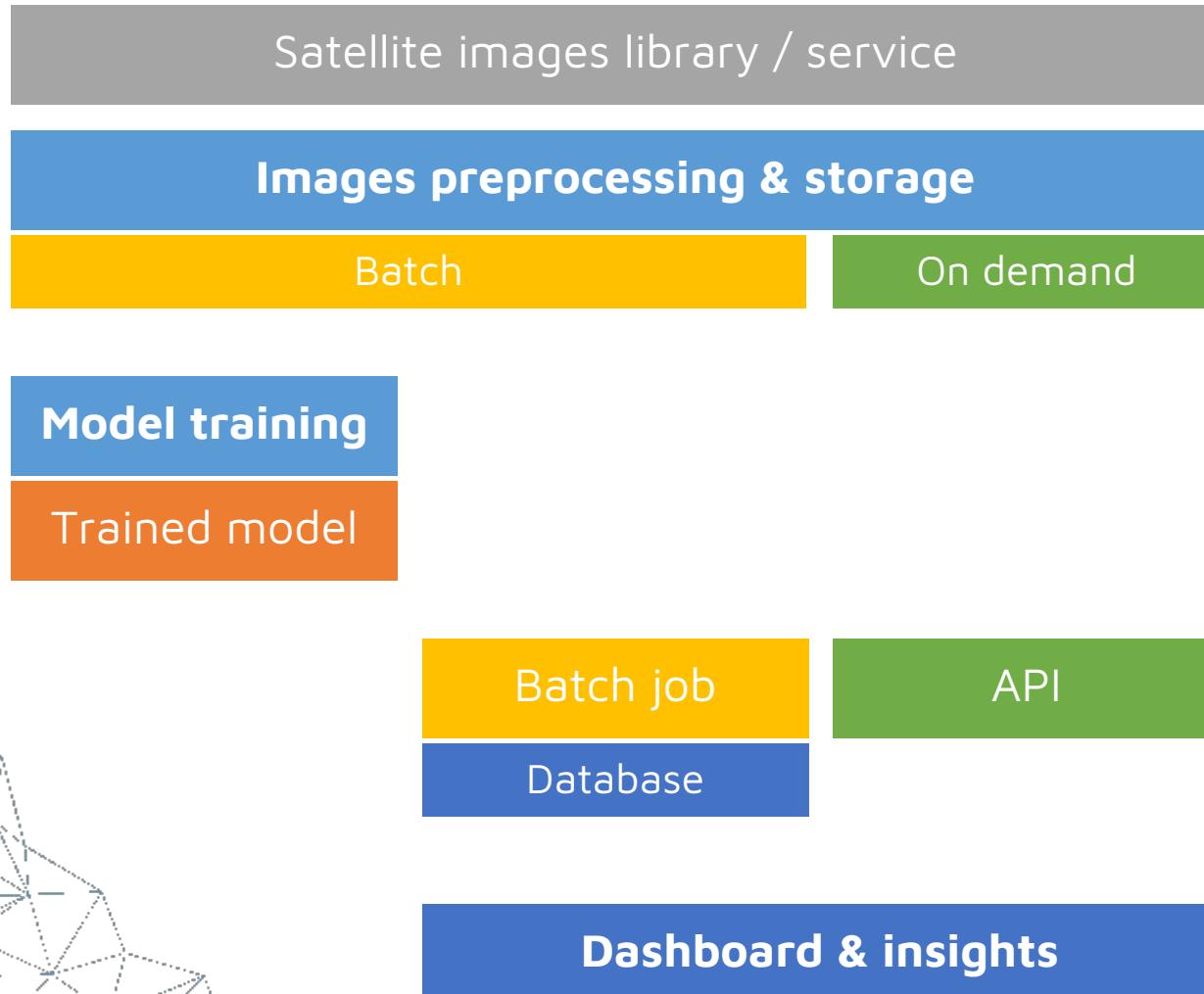


R Keras



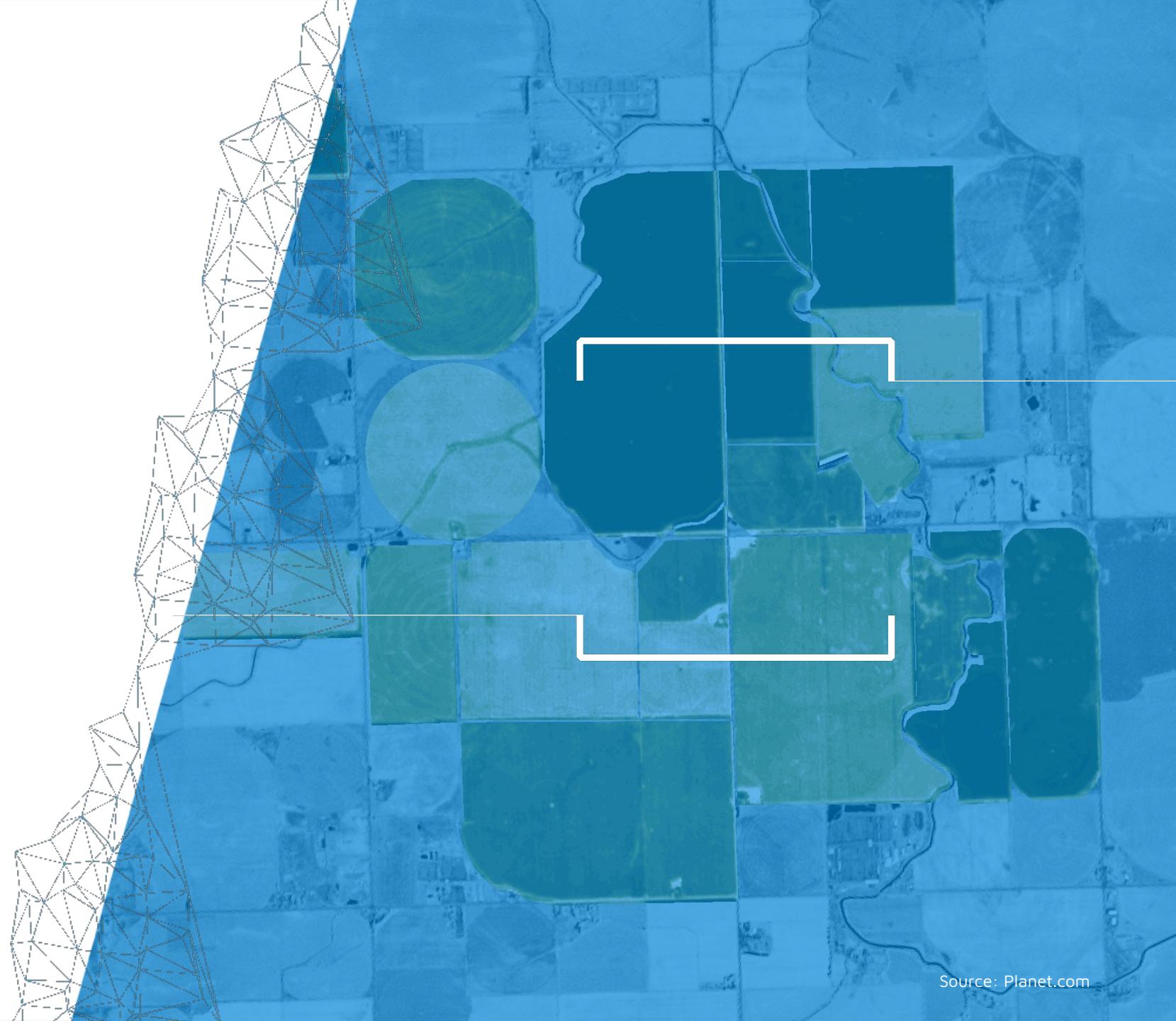
Architecture of complete solution

SATELLITE IMAGERY + R

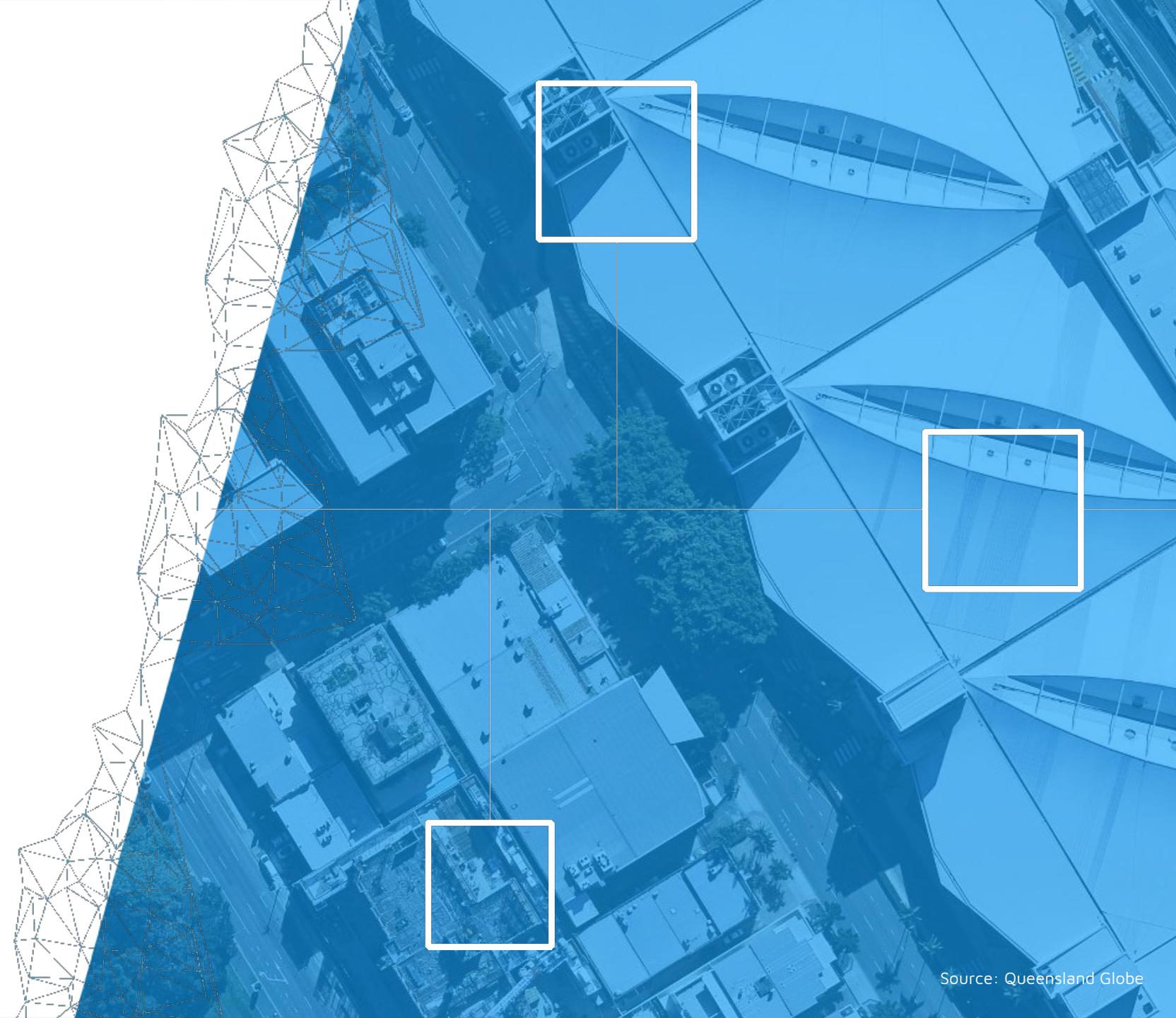


APPLICATIONS

Agriculture



Real estate



Source: Queensland Globe

Finance & insurance



Use R for satellite imagery analysis

Thank you

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✉️ damian@apppsilon.com

apppsilon.com