How to Use Satellite Data with Machine Learning in Insurance

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2019-06-14 / Zurich

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Damian Rodziewicz

Vice-president of the Board

- Passionate about Data Analysis and Programming
- Previously worked at Accenture, UBS, Microsoft, Domino Data Lab
- Technology maniac
- Loves psychology

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What we do

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Contributors to R community

WHY SATELLITES?

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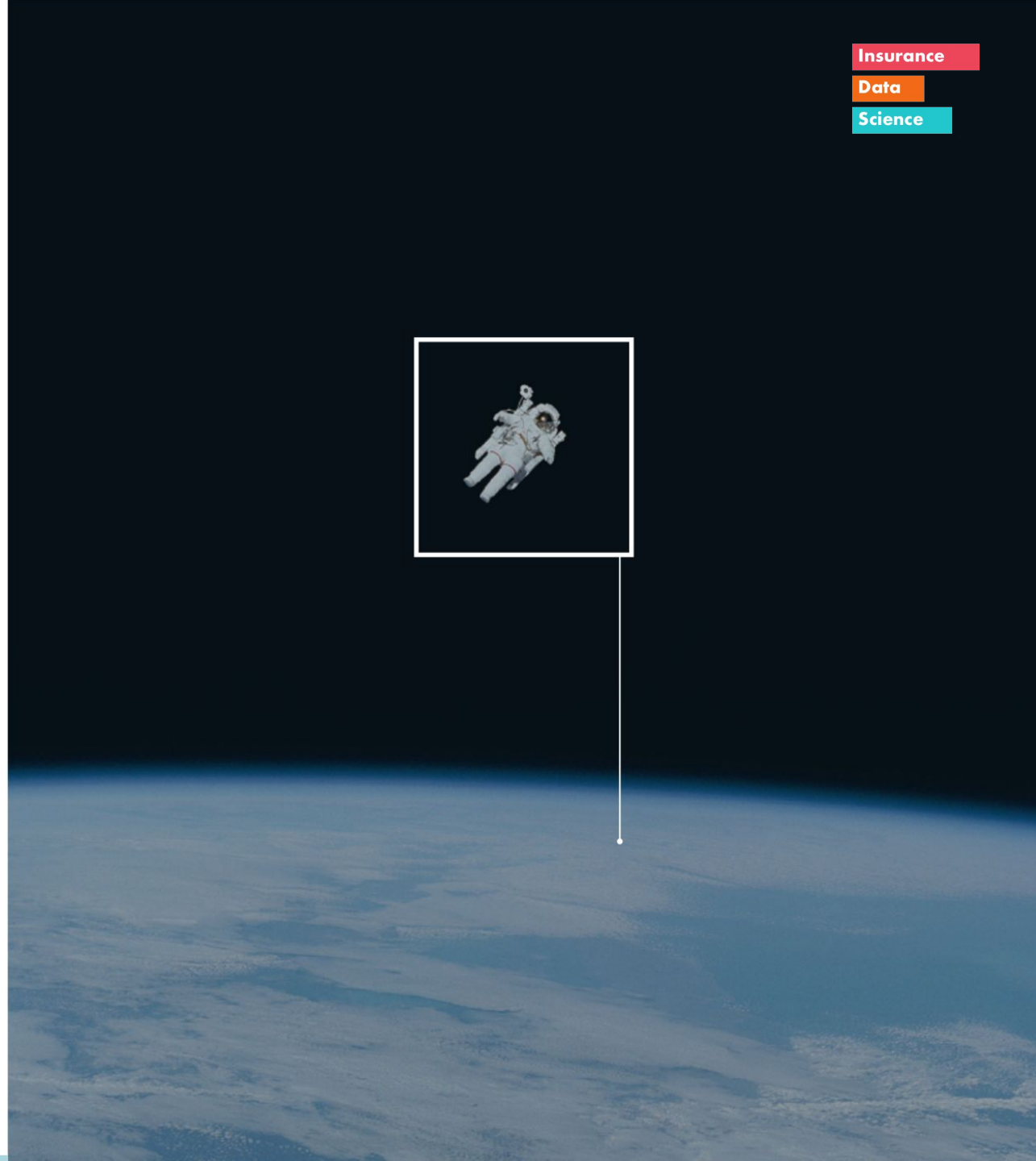
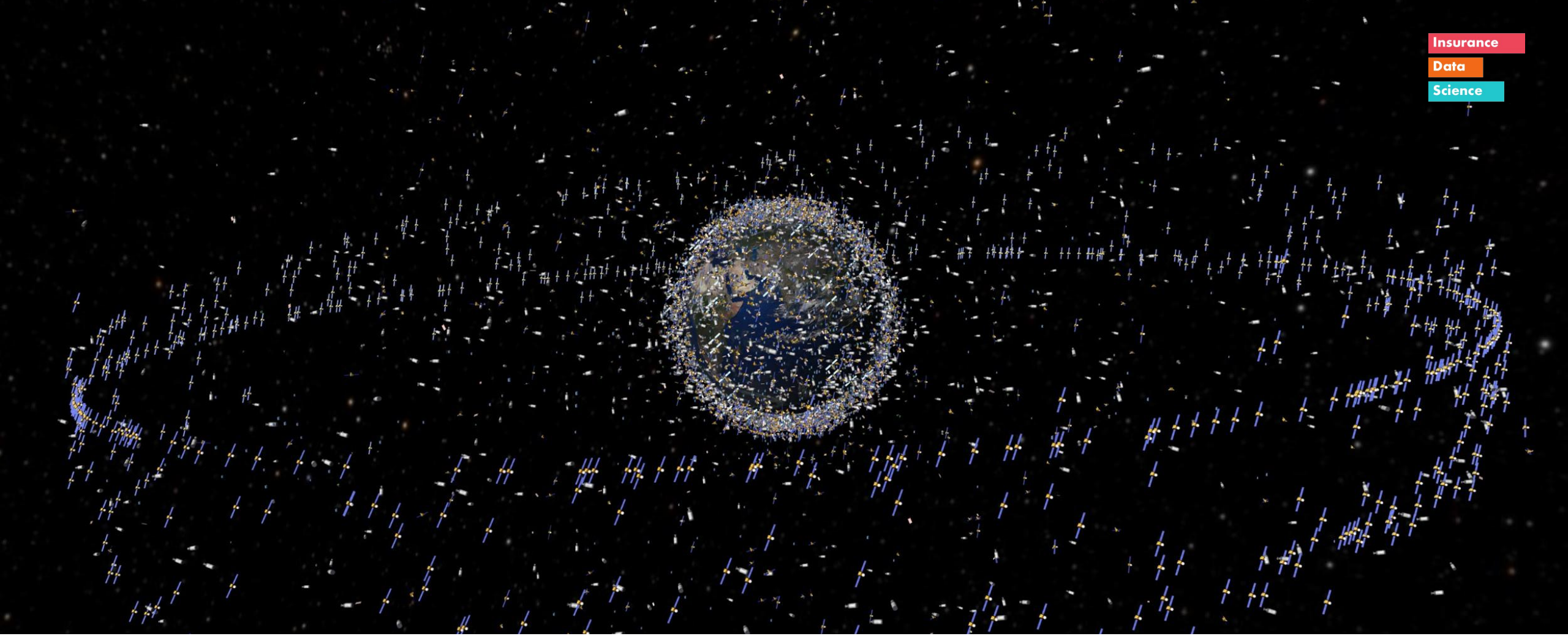
WHY SATELLITES?

Regular coverage of earth

Easily available

Time-travel





>4500

SATELLITES
IN SPACE

>600

IMAGERY
SATELLITES

25 cm

BEST
RESOLUTION

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Types of available data

SATELLITE SYSTEMS

Public

- Landsat
- Sentinel
- ...

Commercial

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

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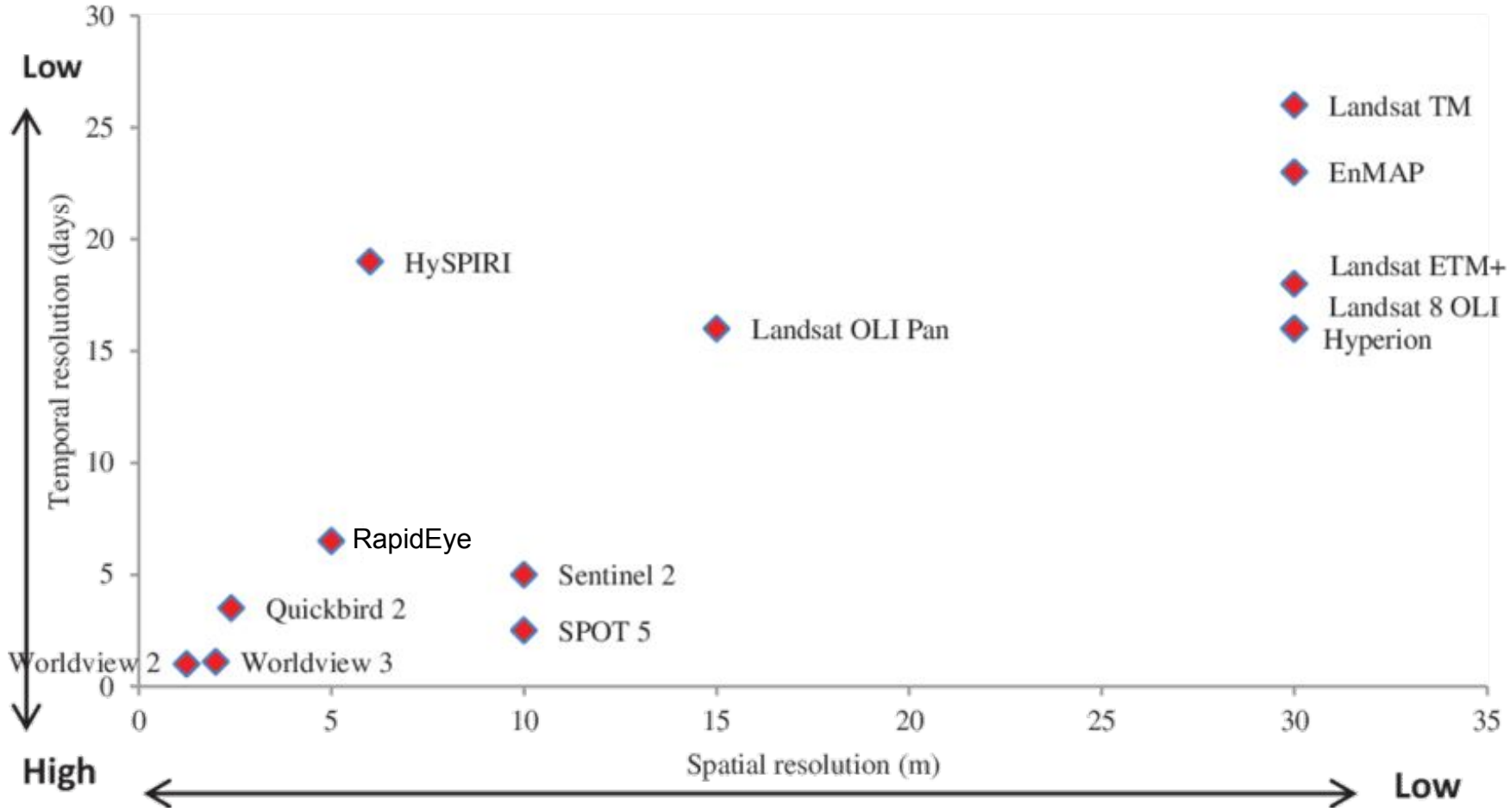
Types of available data

SPATIAL AND TEMPORAL RESOLUTION



Source: Chivasa, et al. Application of remote sensing in estimating maize grain yield in heterogeneous African agricultural landscapes: a review

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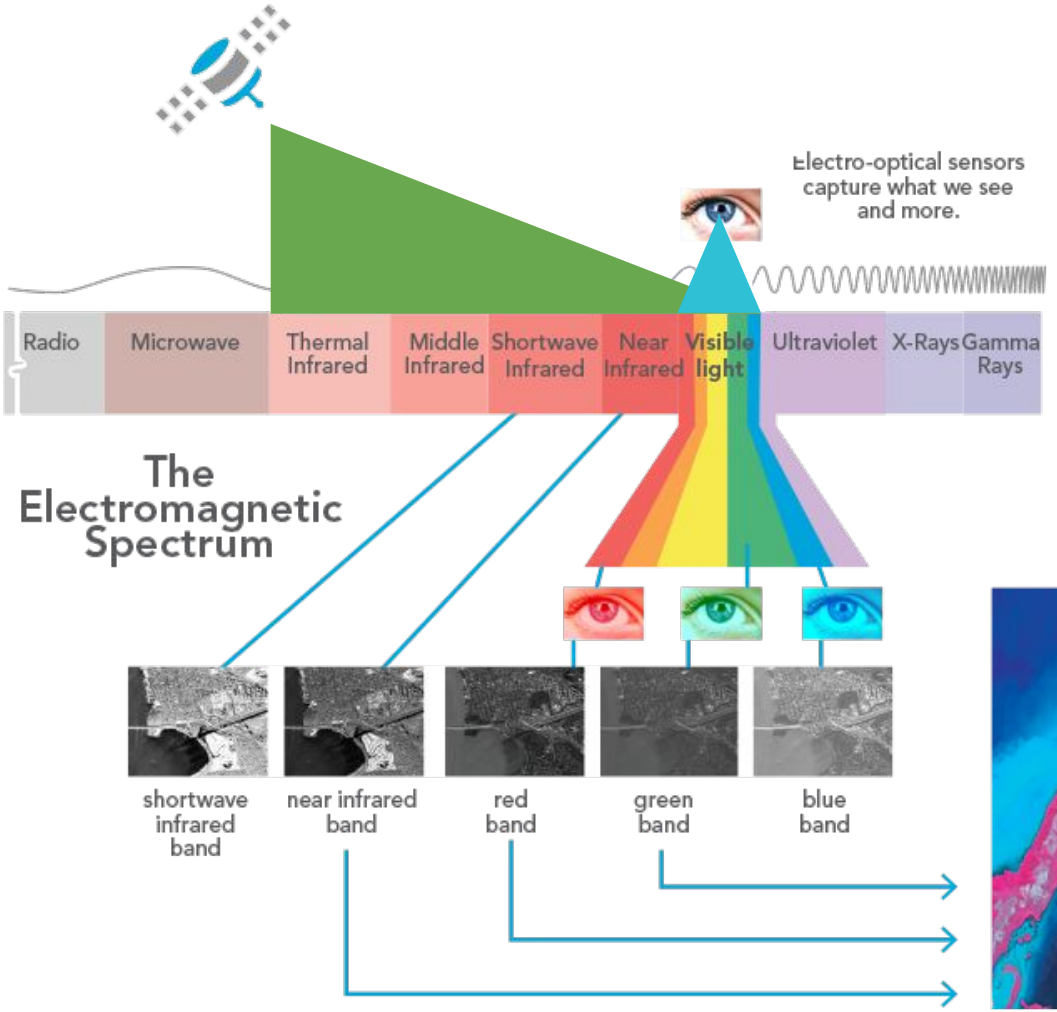
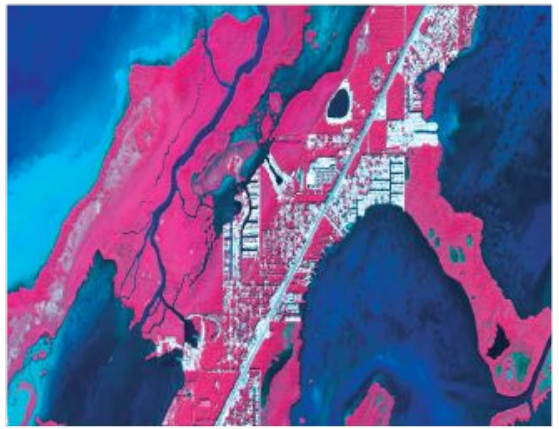
Types of available data

SPECTRAL RESOLUTION





Visible light + much more

Near infra-red -> NDVI

Source: https://learn.arcgis.com/en/arcgis-imagery-book/chapter4/#learn-more

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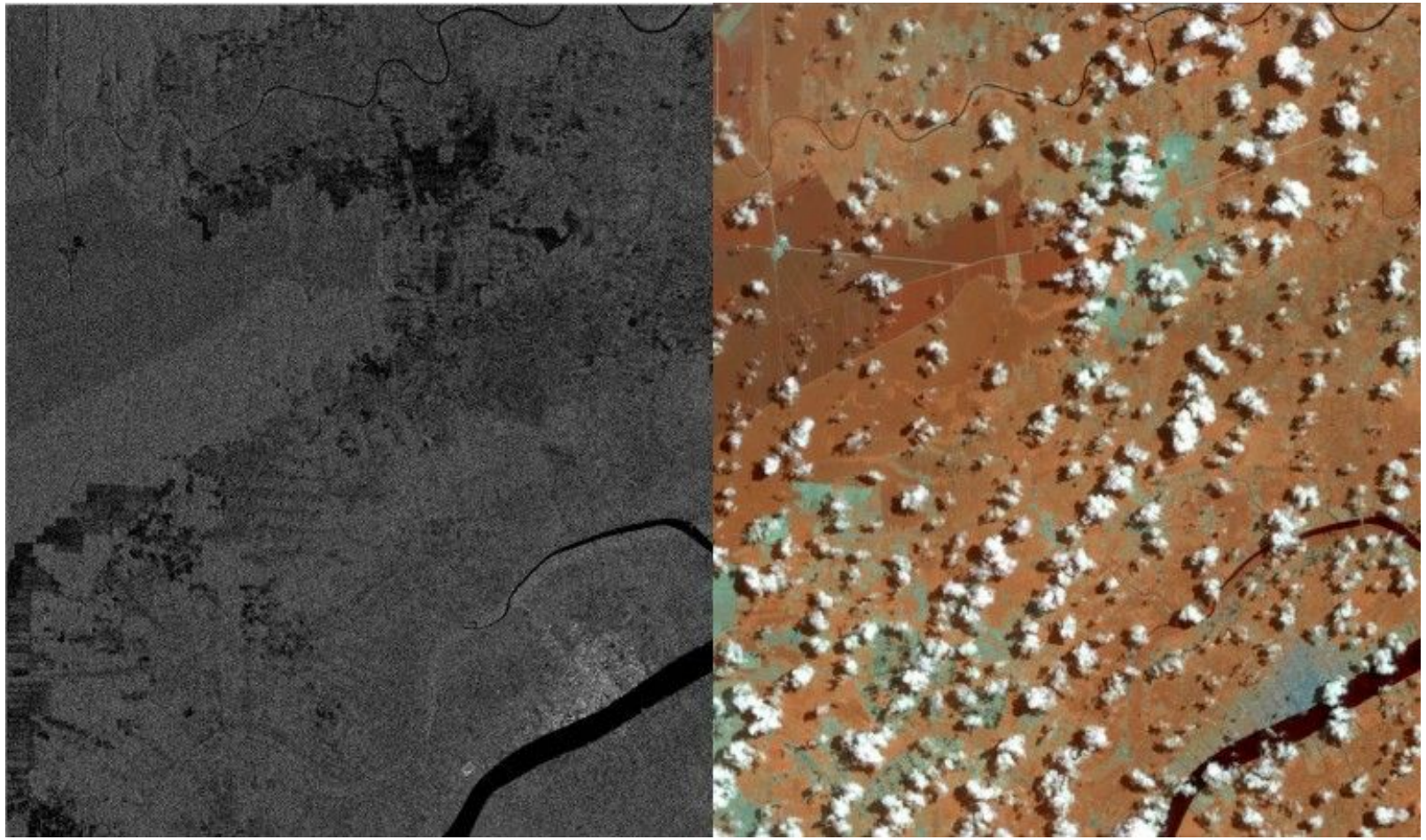
Types of available data

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/

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CURRENT STATE OF THE ART

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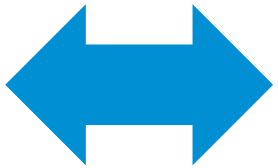
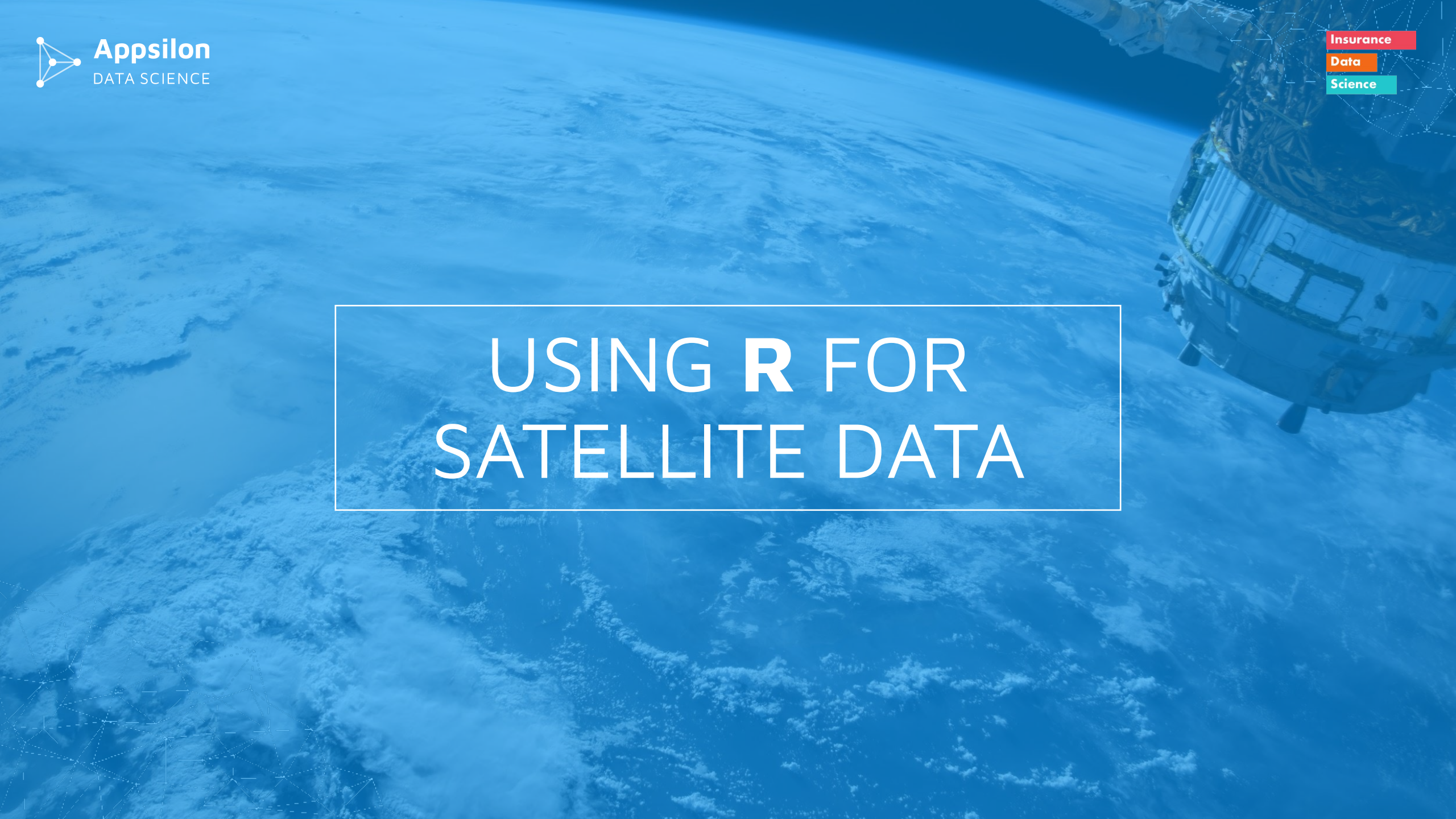
Types of available data

WHY HIGHER SPATIAL RESOLUTION ISN'T ALWAYS BETTER?

spatial
resolution



temporal and spectral
cost
consistency & availability
ease of processing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SATELLITE DATA

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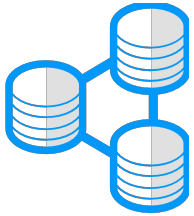
What shouldn't be done in R?

SATELLITE IMAGERY + R

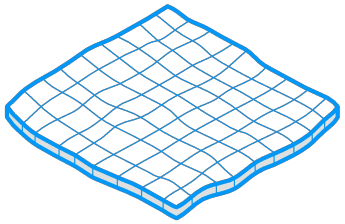
DATA PREPROCESSING

Preprocessing of large image files.



RESOURCE INTENSIVE

Parts of solution requiring lots of compute and memory resources.



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Where R Shines?

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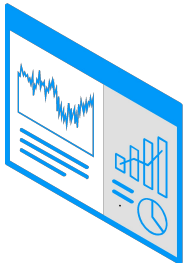
DASHBOARDS

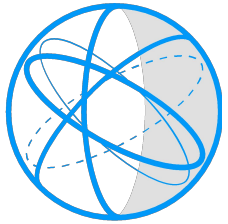
Display images and insights.

Decision support systems to actually get and apply insights.



FORECASTING & ANALYSIS

Predictive models based on indicators calculated from spectral data.



DEEP LEARNING

Deep neural network models on satellite data.

Keras

H_2O.ai

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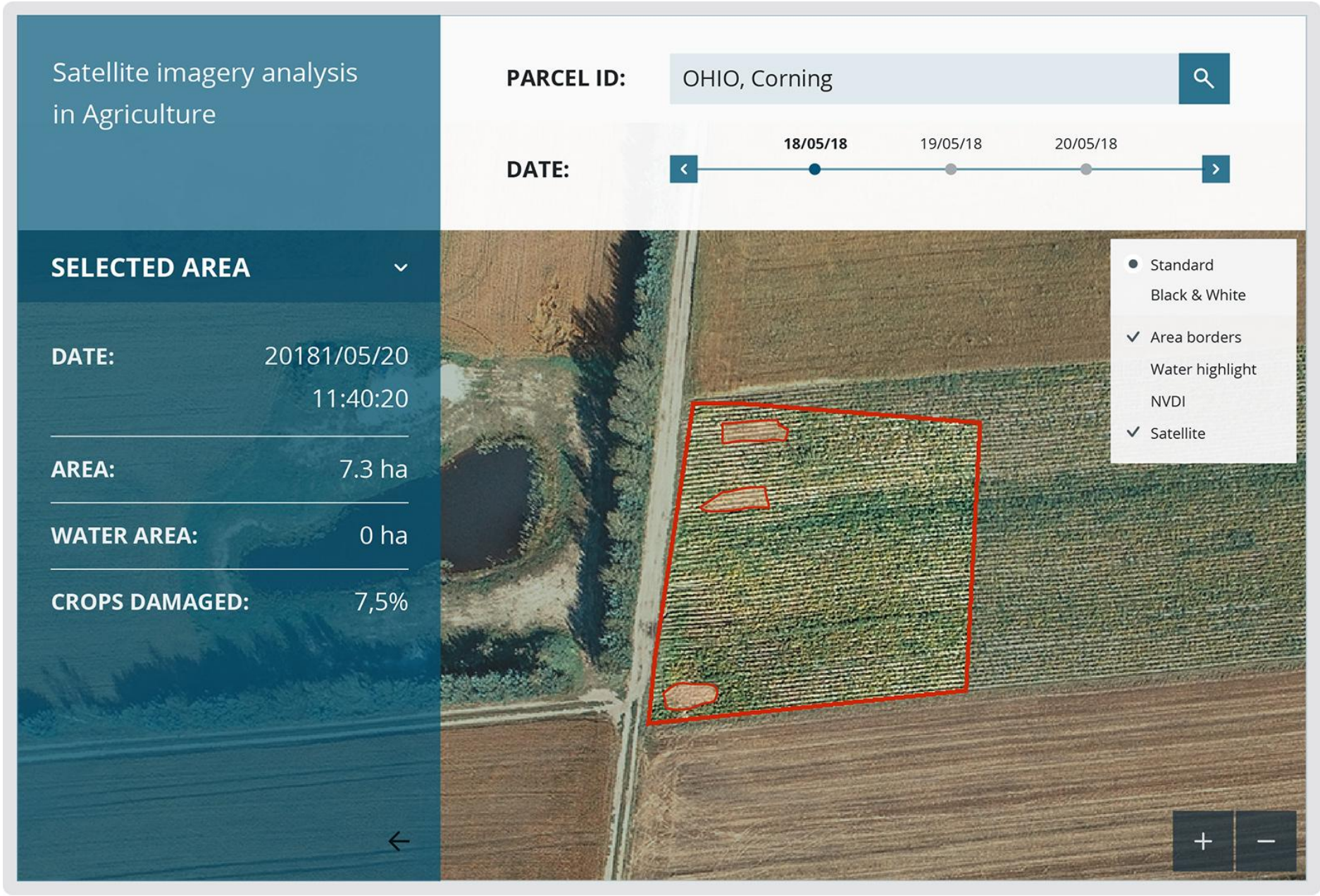

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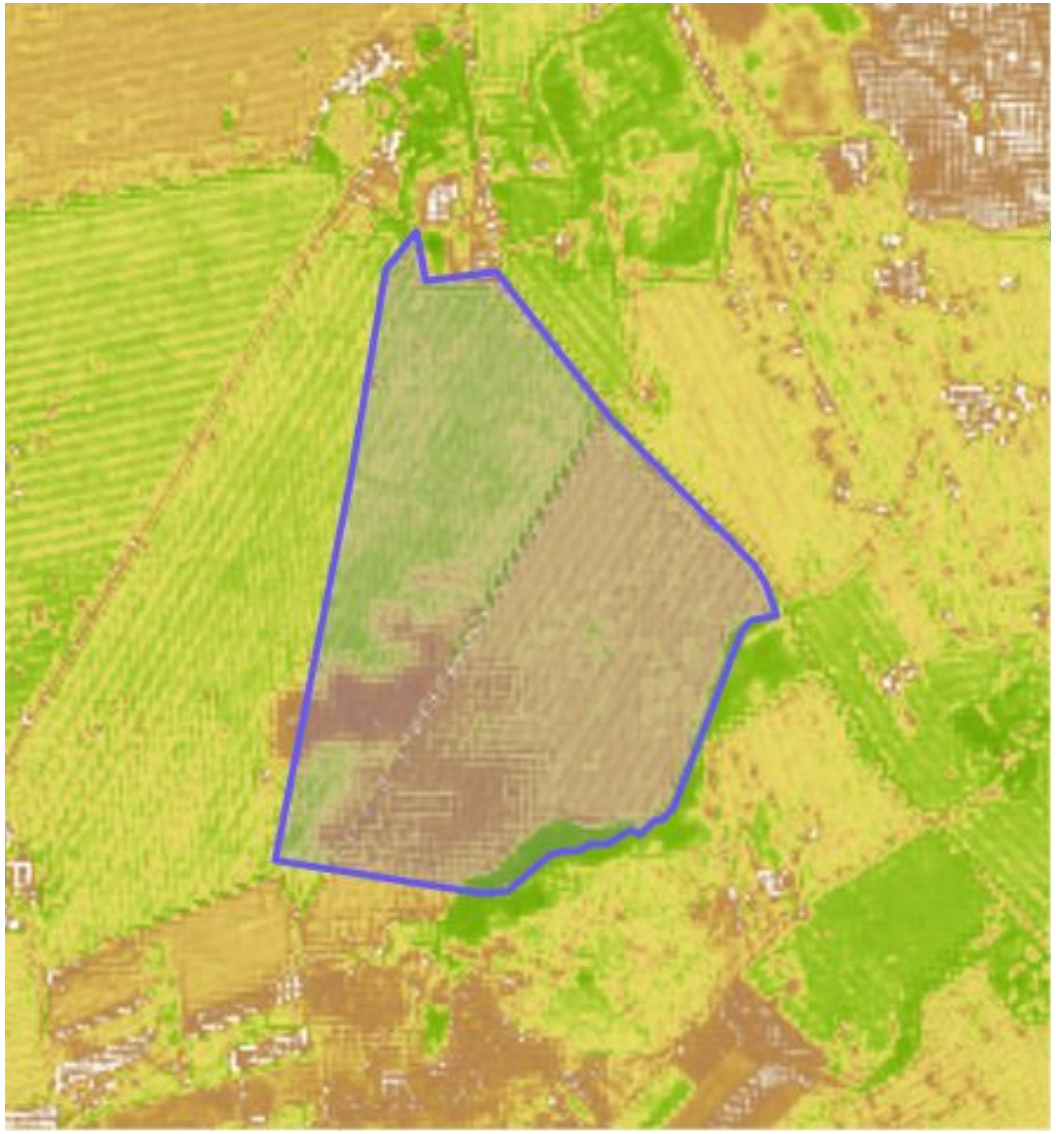
indicators

visualization



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Deep learning

SATELLITE IMAGERY + R

Keras

2800 images

Source: https://appsilondatascience.com/blog/rstats/2018/01/16/keras.html
Dataset: Kaggle, Ships in Satellite Imagery

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Deep learning

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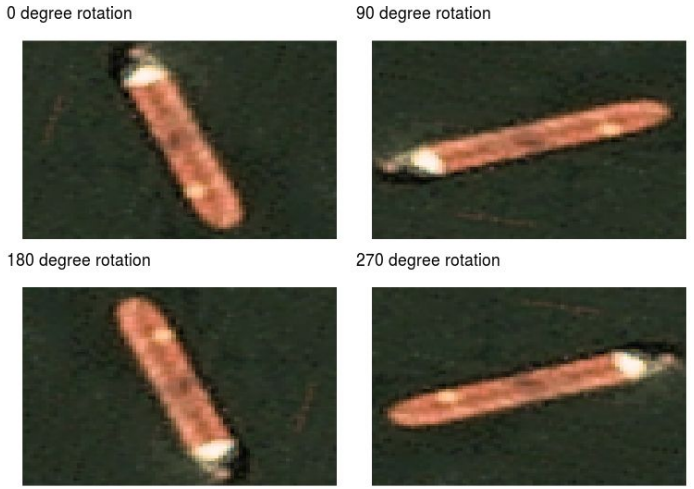
data
augmentation



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Deep learning

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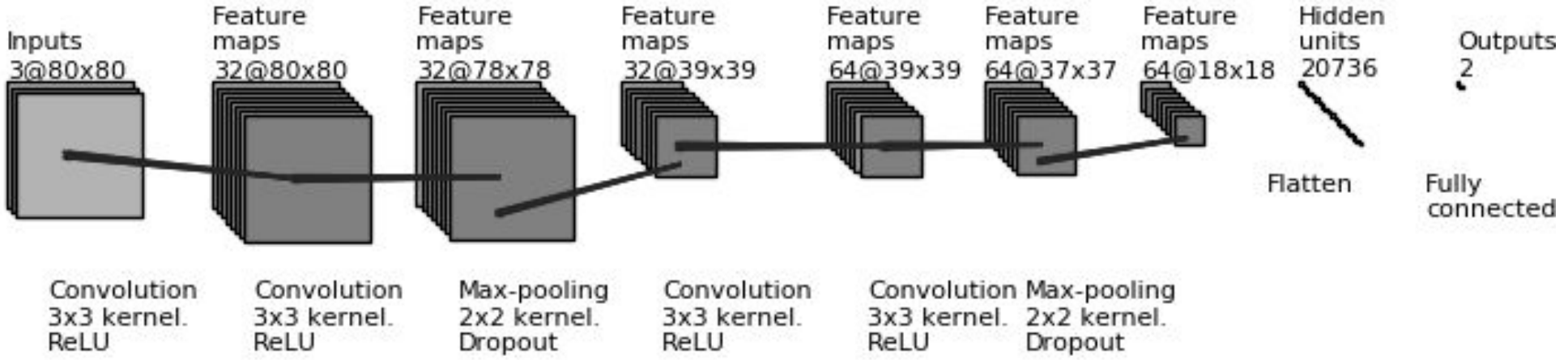

K Keras R

Source: https://appsilondatascience.com/blog/rstats/2018/01/16/keras.html
Dataset: Kaggle, Ships in Satellite Imagery

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Architecture of complete solution

SATELLITE IMAGERY + R

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Satellite images library / service

Google Earth Engine
aws
DigitalGlobe
planet.

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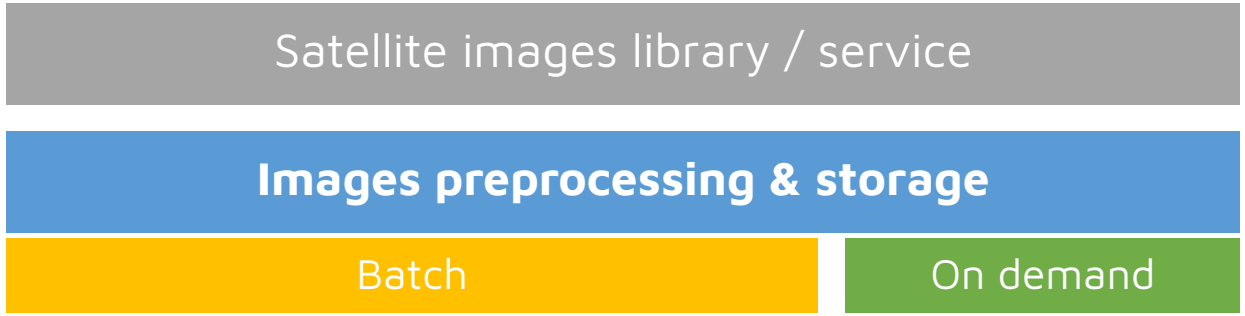
Architecture of complete solution

SATELLITE IMAGERY + R



Google Earth Engine
aws
DigitalGlobe
planet.

Google Cloud
aws
Google Earth Engine

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Architecture of complete solution

SATELLITE IMAGERY + R

Satellite images library / service

Google Earth Engine aws DigitalGlobe planet.

Images preprocessing & storage

Batch On demand

Google Cloud aws Google Earth Engine

Model training

Trained model

R K Keras

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Architecture of complete solution

SATELLITE IMAGERY + R

Satellite images library / service

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Batch | On demand

Google Cloud · aws · Google Earth Engine

Model training

Trained model

R · K Keras

Batch job | API

Database

R

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Architecture of complete solution

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Satellite images library / service

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Model training

Trained model

R · K Keras

Batch job | API

Database

R

Dashboard & insights

R · Shiny

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APPLICATIONS

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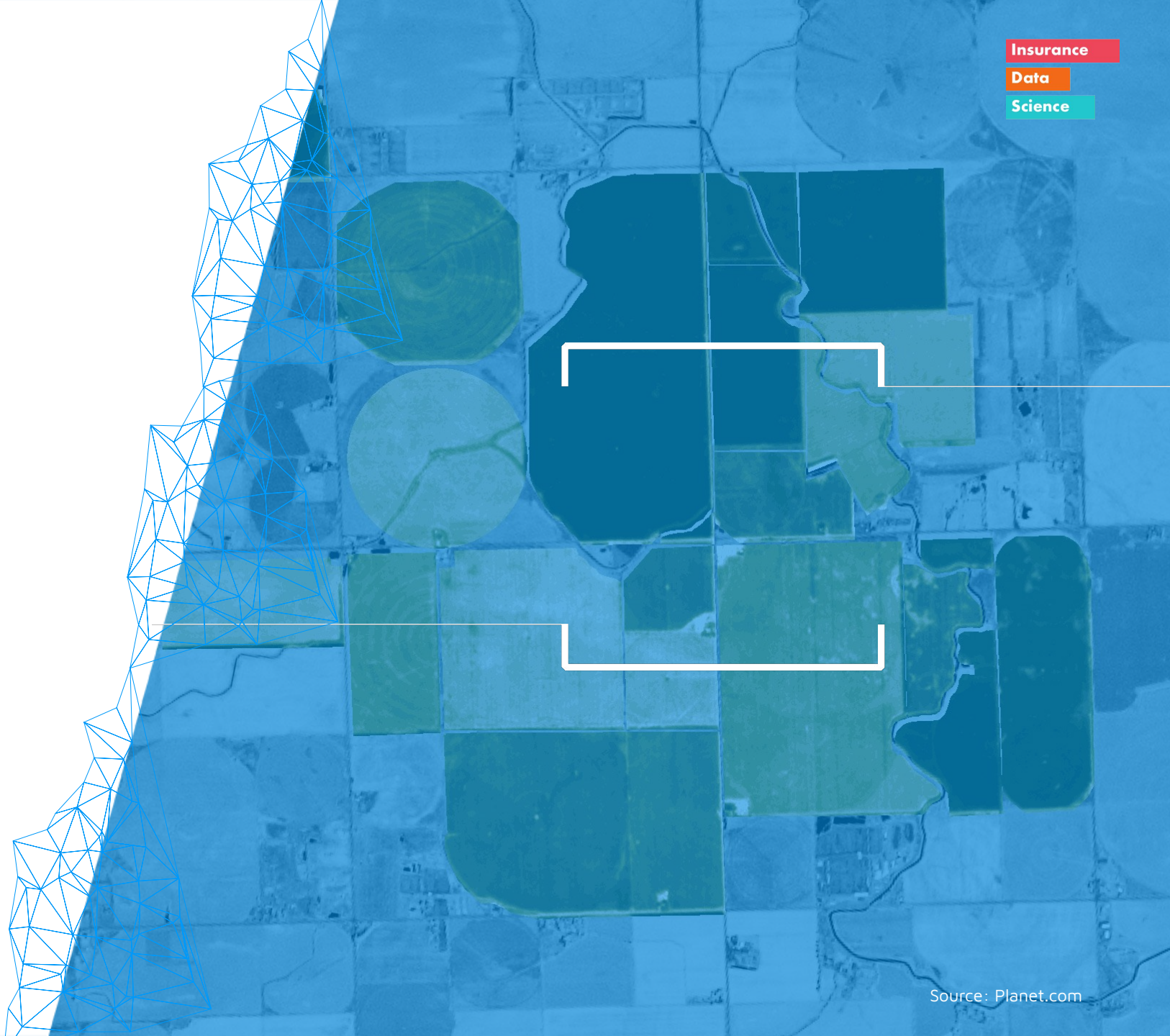
Agriculture



Source: Planet.com

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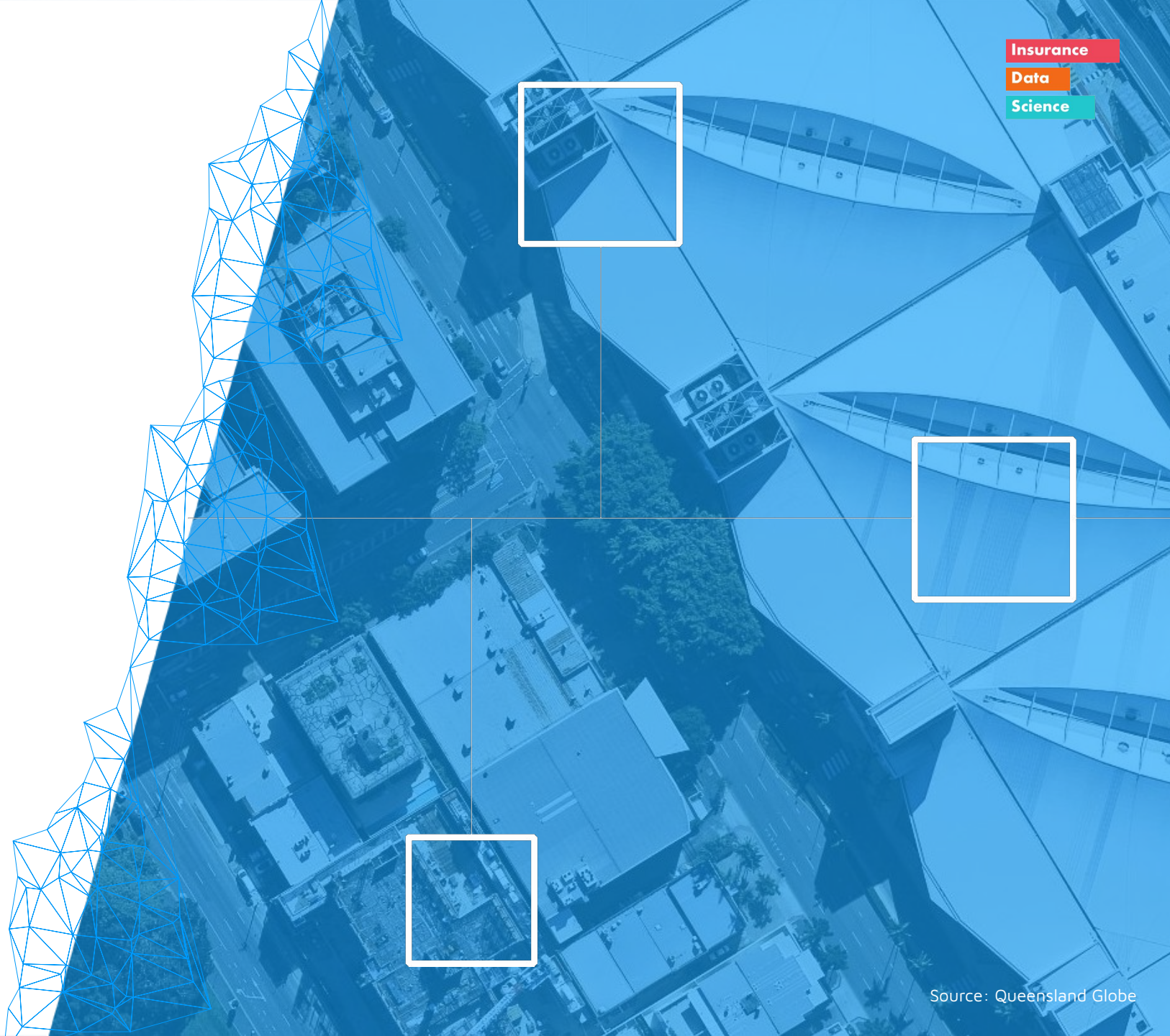
Quality of life



Source: Queensland Globe

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Use R for satellite imagery analysis

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Thank you

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