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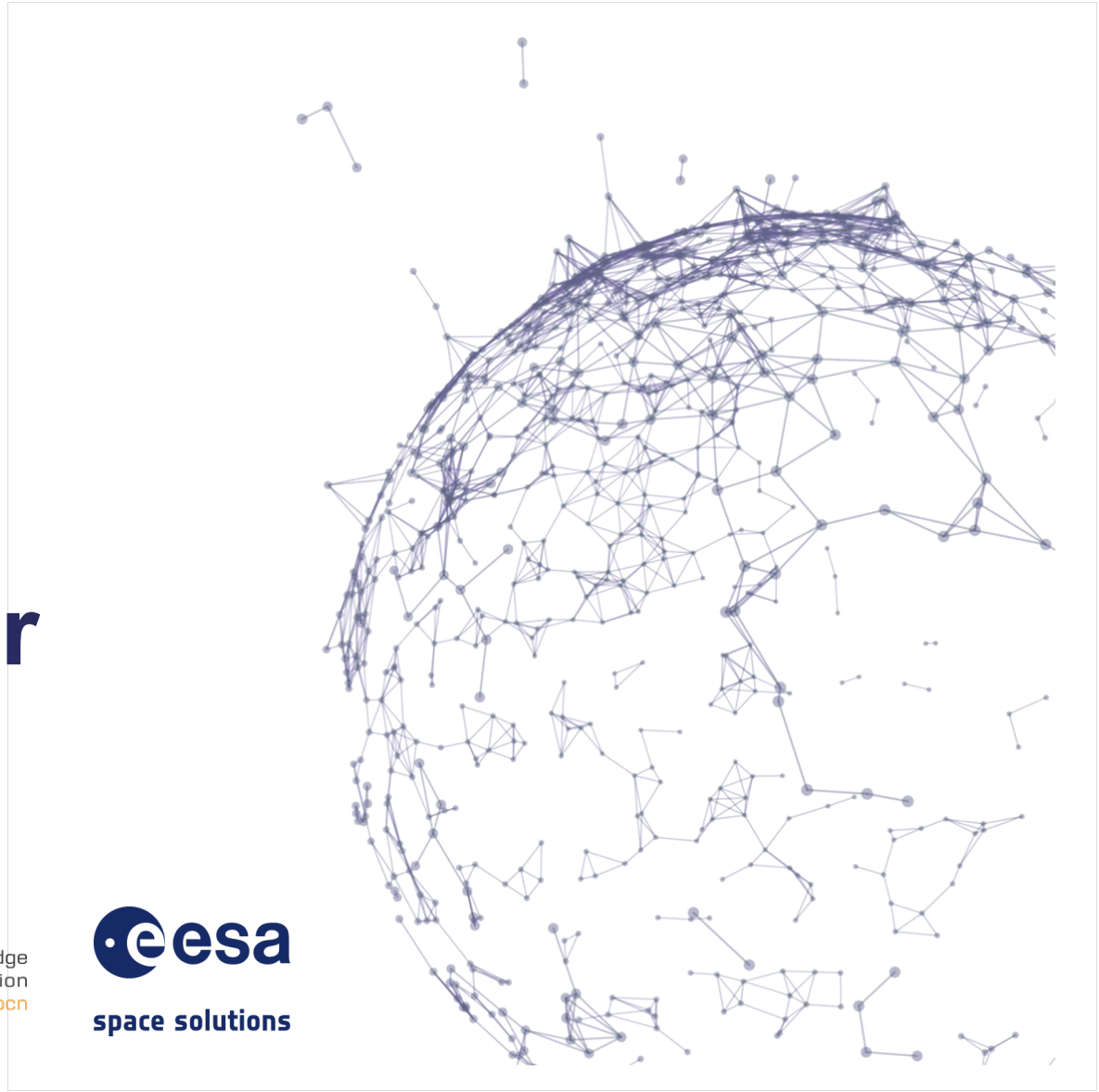
Complex data, made easy



DL4EO: Deep Learning for Earth Observation

European Students Space Hackathon
October 8th-9th, 2021

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EUROAVIA

Kim bcn
Knowledge innovation marketbcn

esa space solutions

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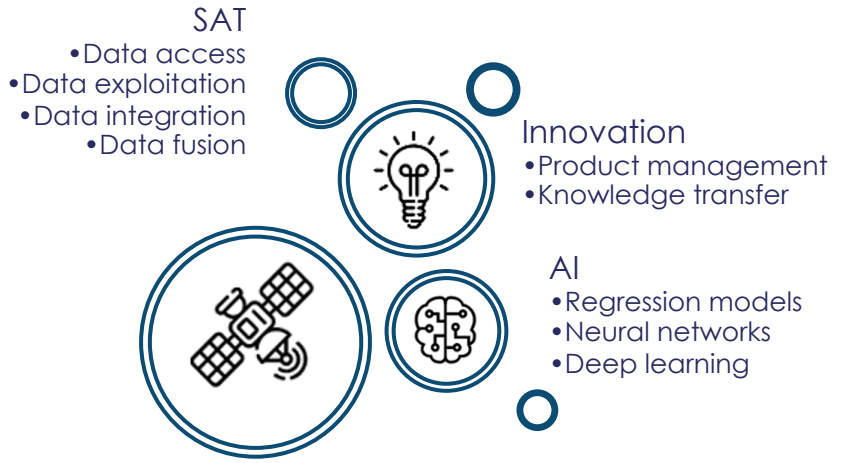

Our mission is to unlock the value of **Earth Observation data** leveraging the **power of AI** to absorb complexity and cost, providing **actionable knowledge** to our users.

Complex data made easy

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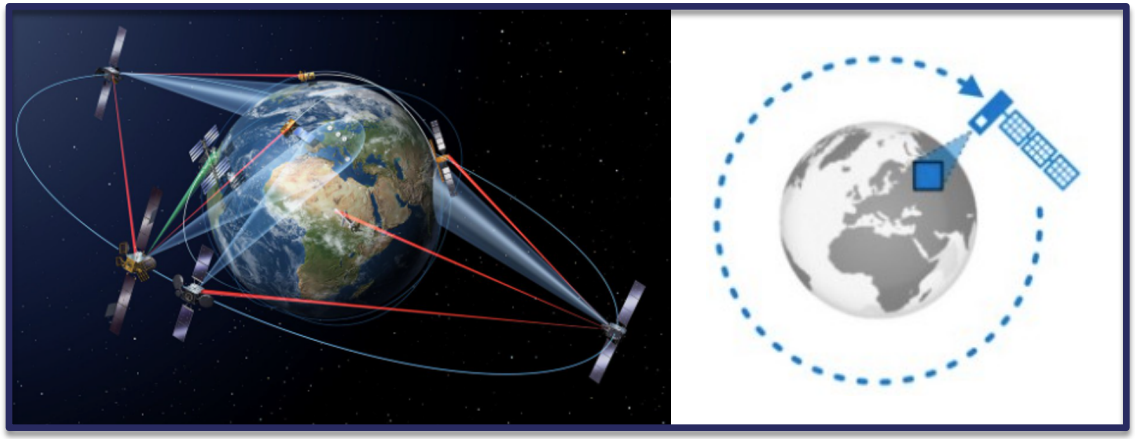
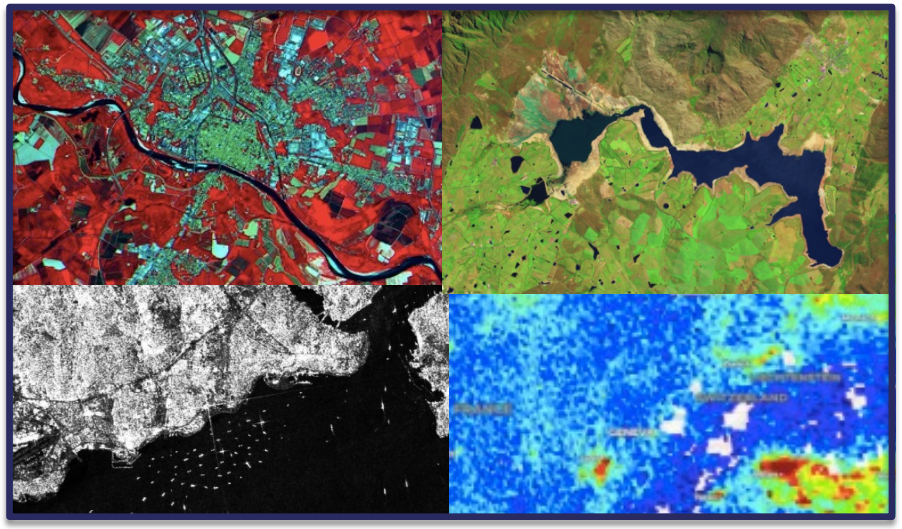
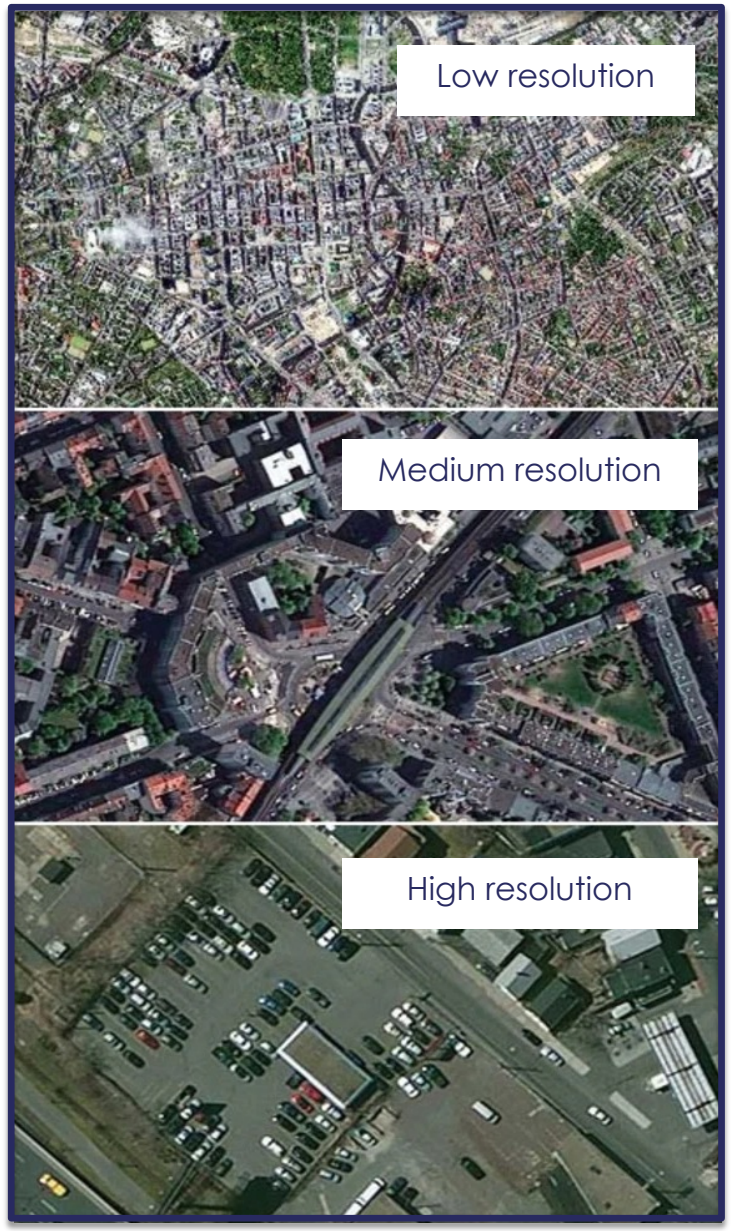
Global coverage, daily



Multisource, variety of sensors



Closer & closer



DigitalGlobe data

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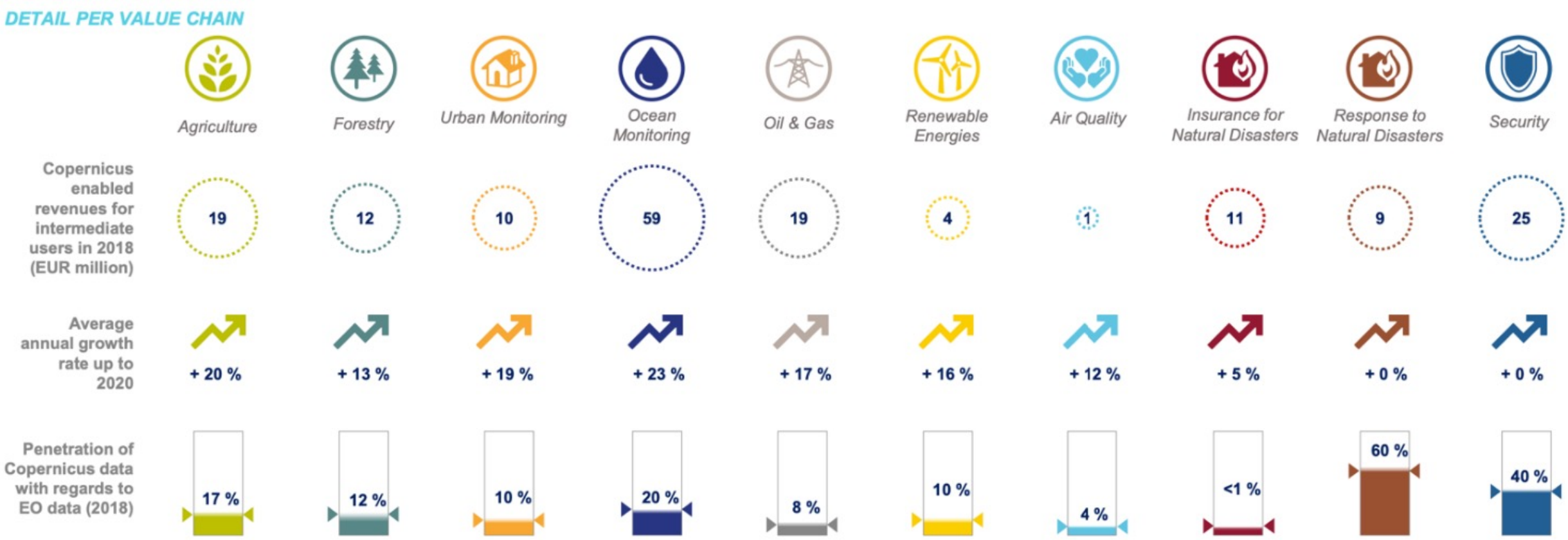
- Copernicus Market Report (Issue 2, February 2019).



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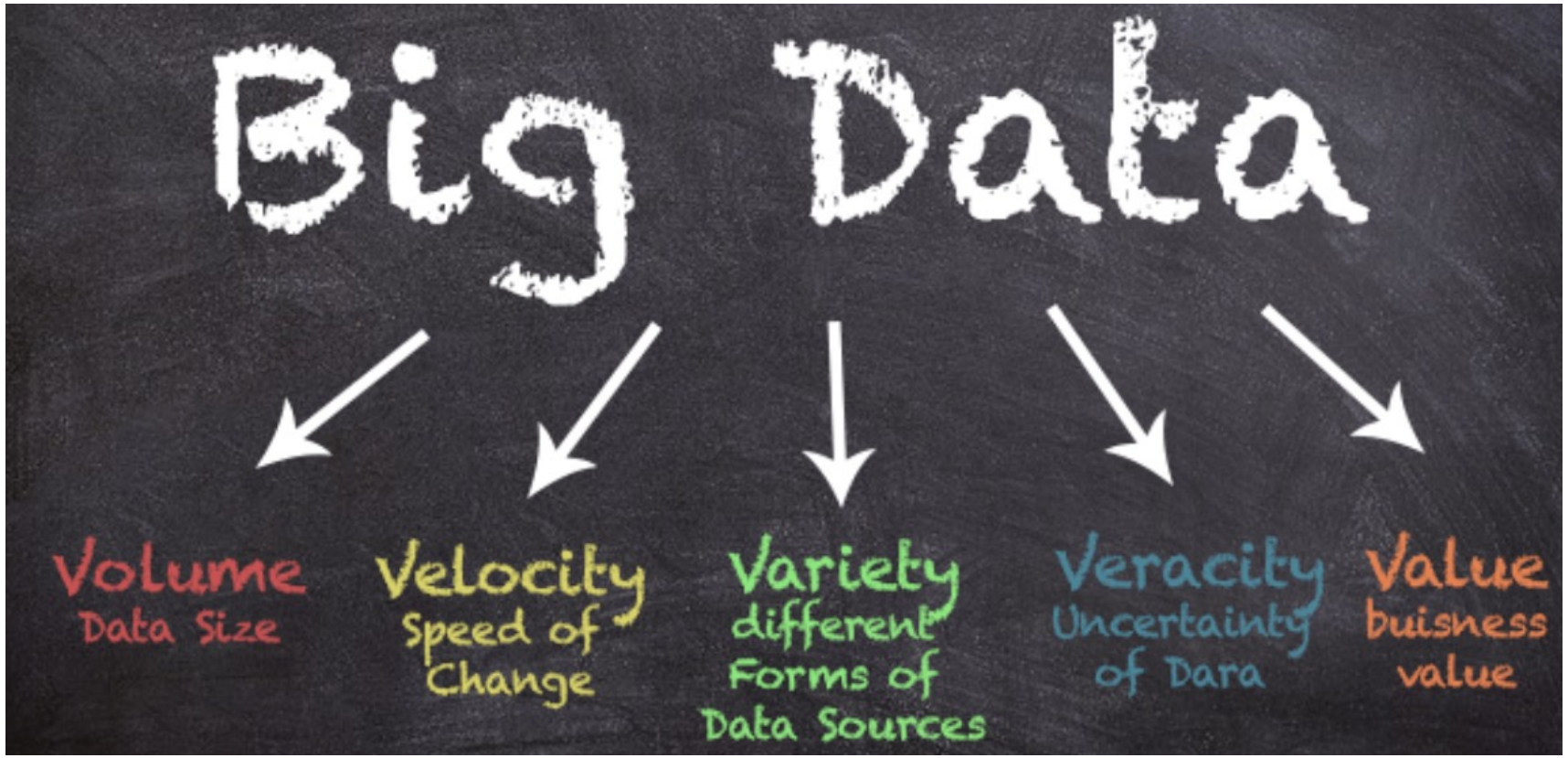
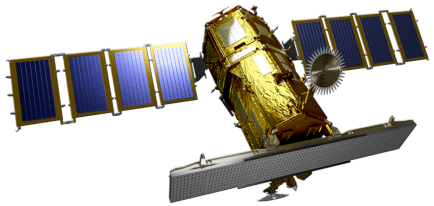
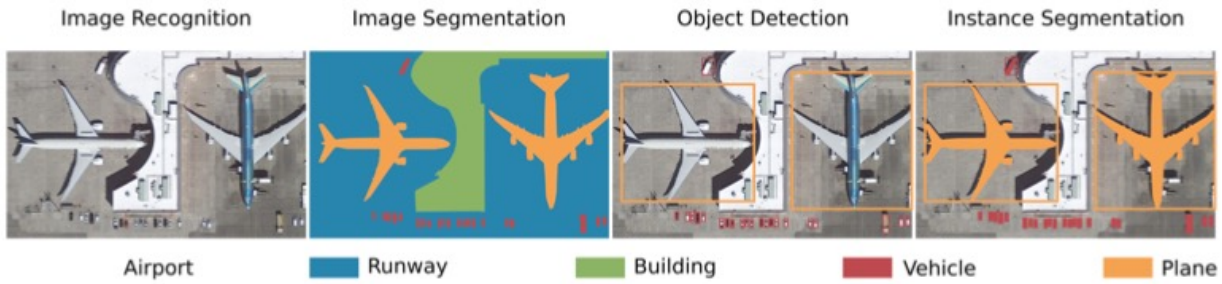

Big Data
Volume
Data Size
Velocity
Speed of
Change
Variety
different
Forms of
Data Sources
Veracity
Uncertainty
of Dara
Value
buisness
value

DL4EO

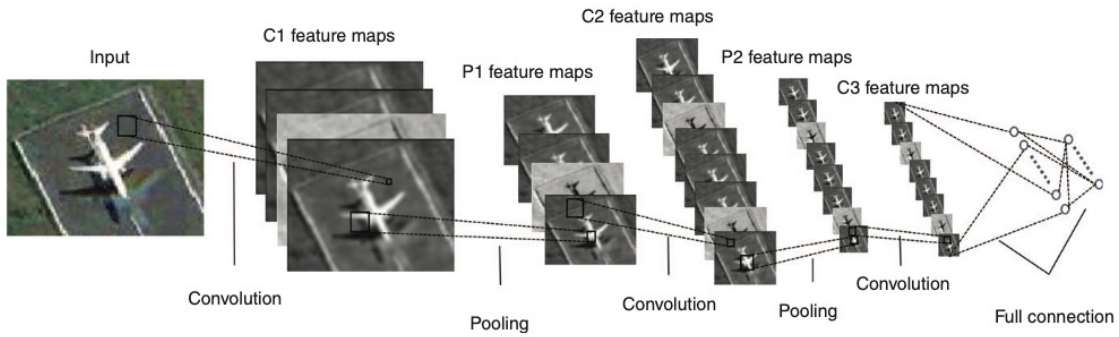


PyTorch

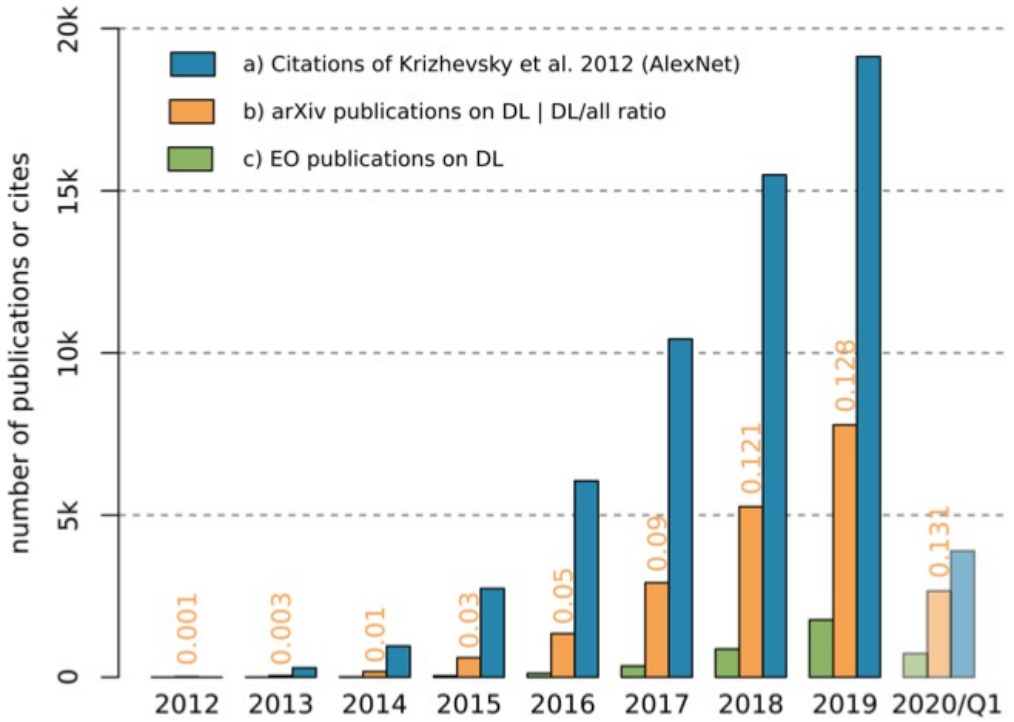
- Deep Learning for Earth Observation.
- Mainly, Computer Vision with CNNs.



https://doi.org/10.3390/rs12101667



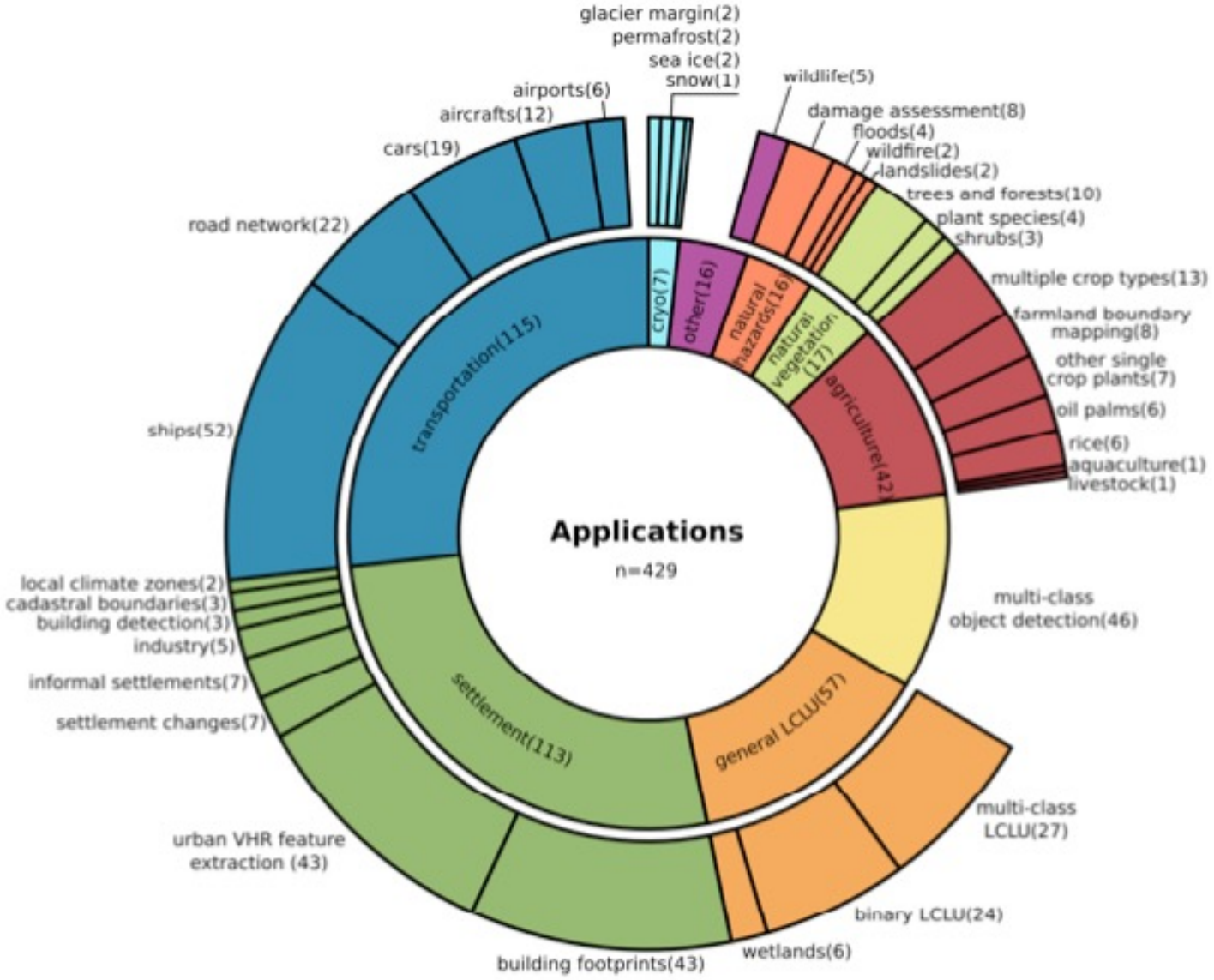
https://doi.org/10.1002/widm.1264



https://doi.org/10.1002/widm.1264

Success stories

- Transportation (ship, car, aircraft detection on optical and radar HR imagery).
- Settlement (building footprint, road extraction, infrastructure management, mapping, …)
- LULC (built-up areas, water bodies, river networks, …)
- Agriculture (crop monitoring, field mapping, …)
- Hazards (floods, fires, landslides, …)
- Others



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Why DL4EO ?

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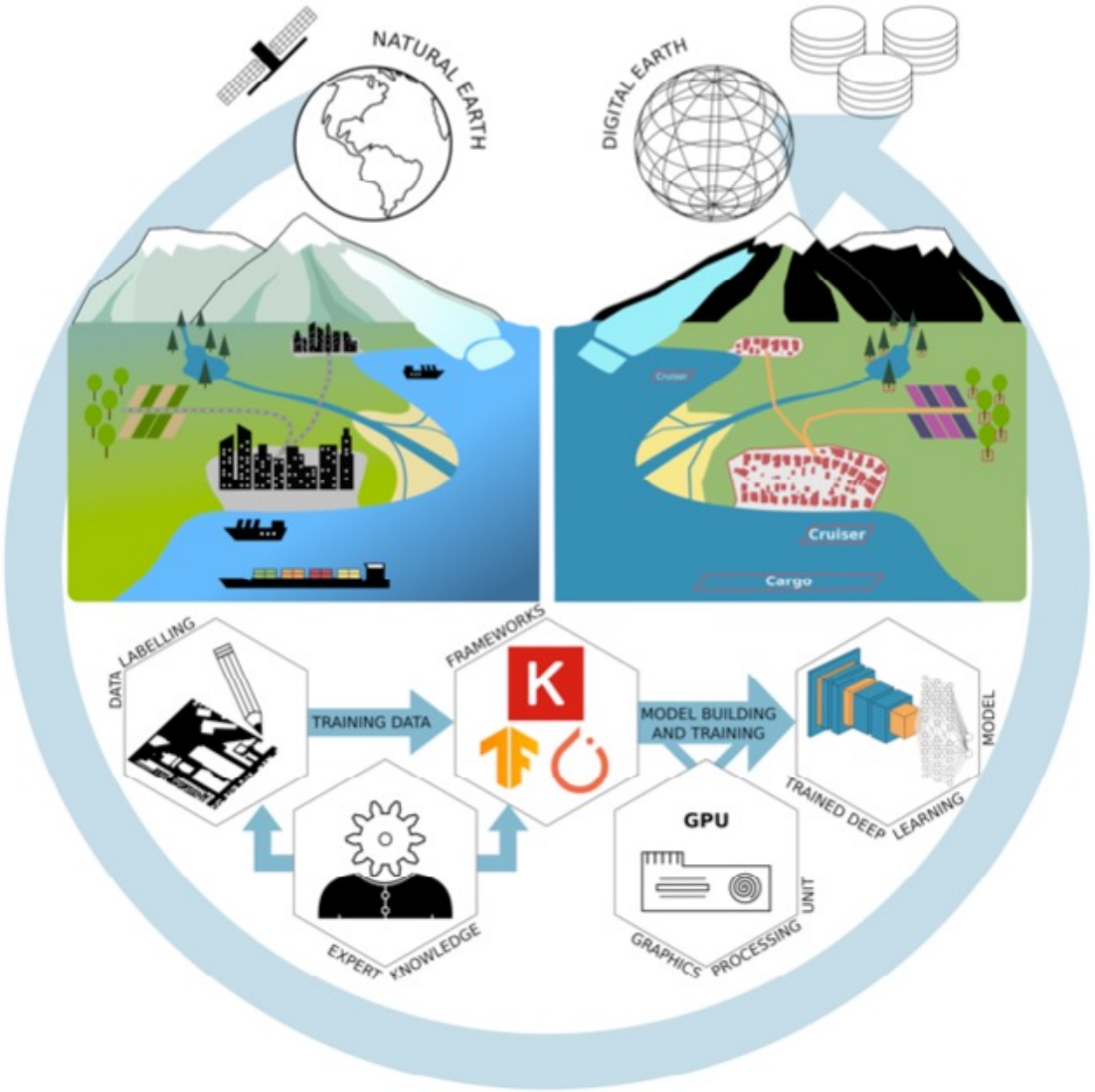

- The Digital Twin Earth (DTE)
- Cloud-based information retrieval and forecasting entity.
- Without EO data associated complexity.
- Connect any device (smartphones, cars, games, other AIs, …)

https://doi.org/10.3390/rs12101667

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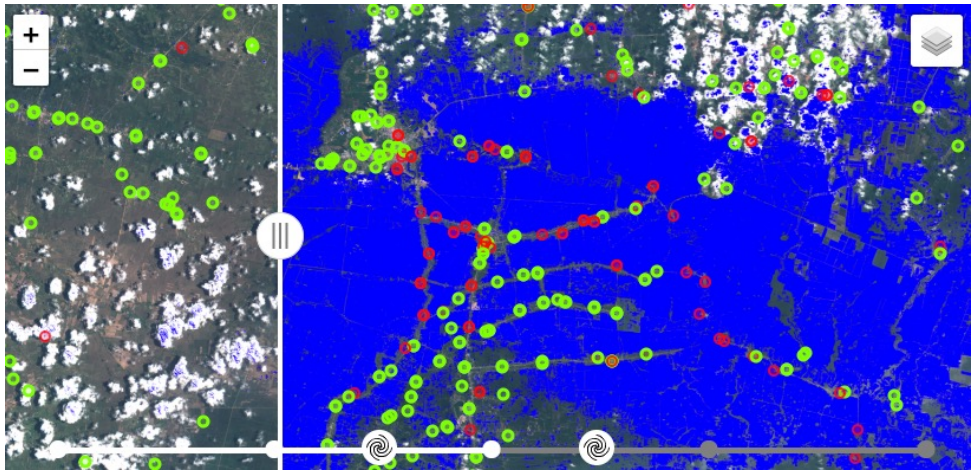
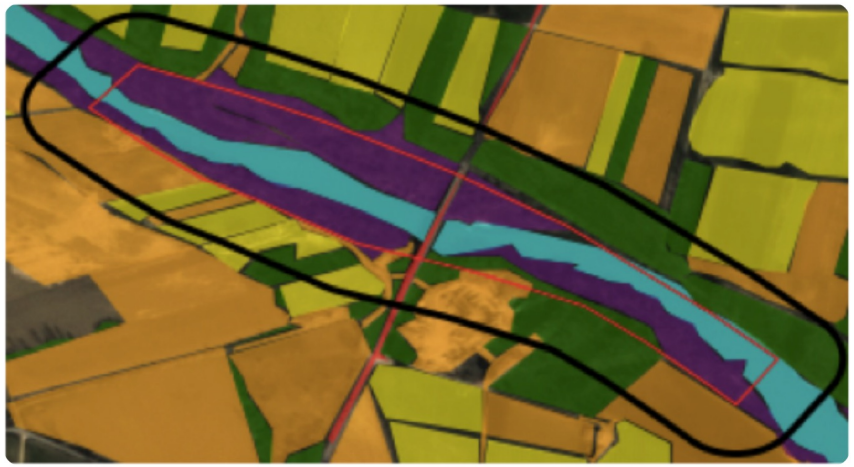
- SPAI: Satellite Processing Application Interface.
  - API for data access and information retrieval.
- Pulses: Our solution for non-experts.
- SCAN: Satellite Collaborative ANnotation tool.
  - AI-assisted labelling tool.
- Pytorch EO: OS library for easy DL4EO.
  - Data fusion, SSL, Multi-task, custom models, …
- Models Universe: DL models repository for EO applications.
- AI4EO: challenges https://platform.ai4eo.eu/
- Know more → https://earthpulse.ai/



Impact Pulse example



Vulnerability Pulse example

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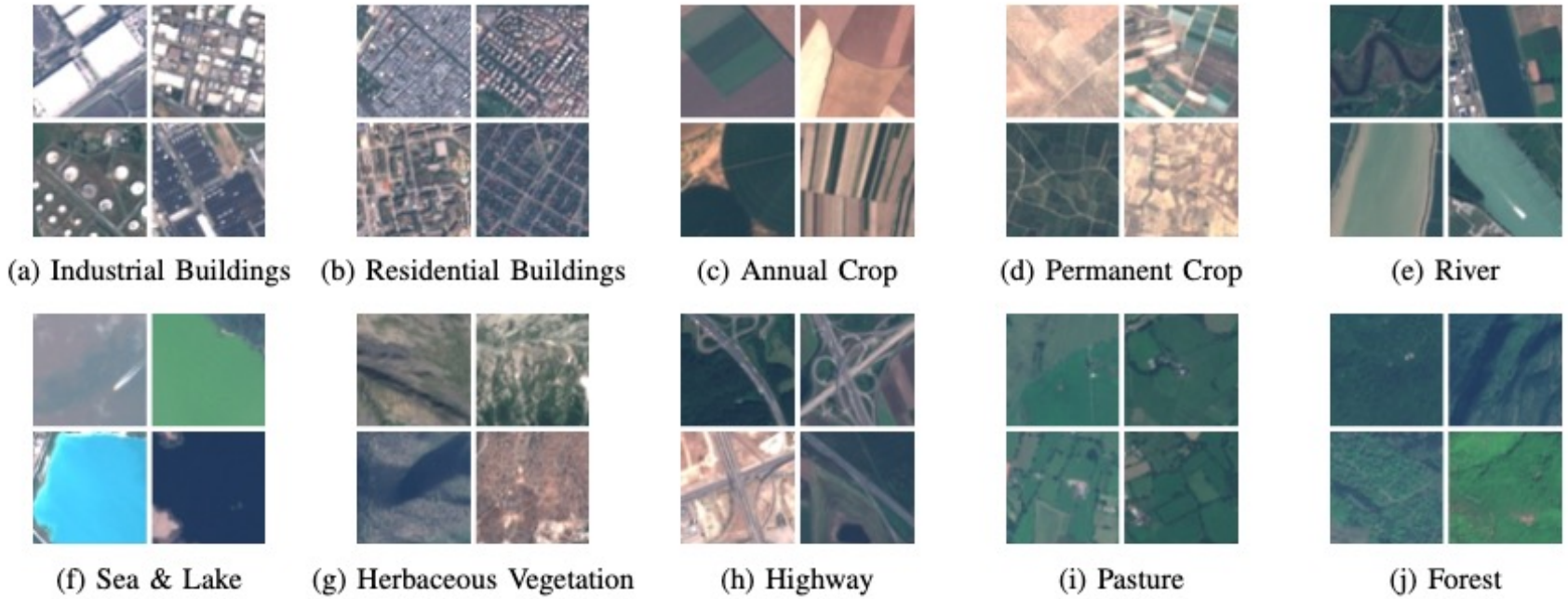
- The Challenge: Train a Neural Network to classify Satellite Images with the EuroSAT dataset (https://github.com/phelber/EuroSAT).
  - Data: Sentinel 2 imagery + labels.
  - Task: Image classification in 10 classes.
  - O1: maximize accuracy on test set.
  - O2: Can you build something interesting with it?



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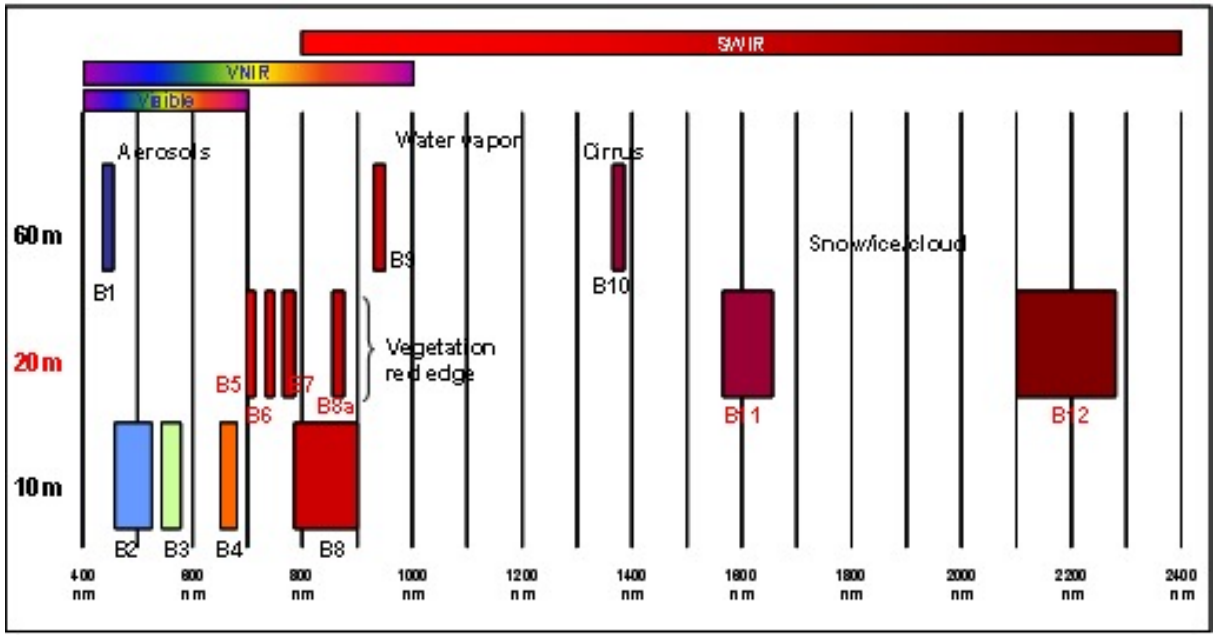
- The Data: Sentinel 2 is multispectral satellite with 13 bands.
  - Q1: What is the best combination of bands ?

Sentinel-2 bands	Central wavelength (µm)	Resolution (m)
Band 1 – Coastal aerosol	0.443	60
Band 2 – Blue	0.490	10
Band 3 – Green	0.560	10
Band 4 – Red	0.665	10
Band 5 – Vegetation red edge	0.705	20
Band 6 – Vegetation red edge	0.740	20
Band 7 – Vegetation red edge	0.783	20
Band 8 – NIR	0.842	10
Band 8A – Vegetation red edge	0.865	20
Band 9 – Water vapour	0.945	60
Band 10 – SWIR – Cirrius	1.375	60
Band 11 – SWIR	1.610	20
Band 12 – SWIR	2.190	20



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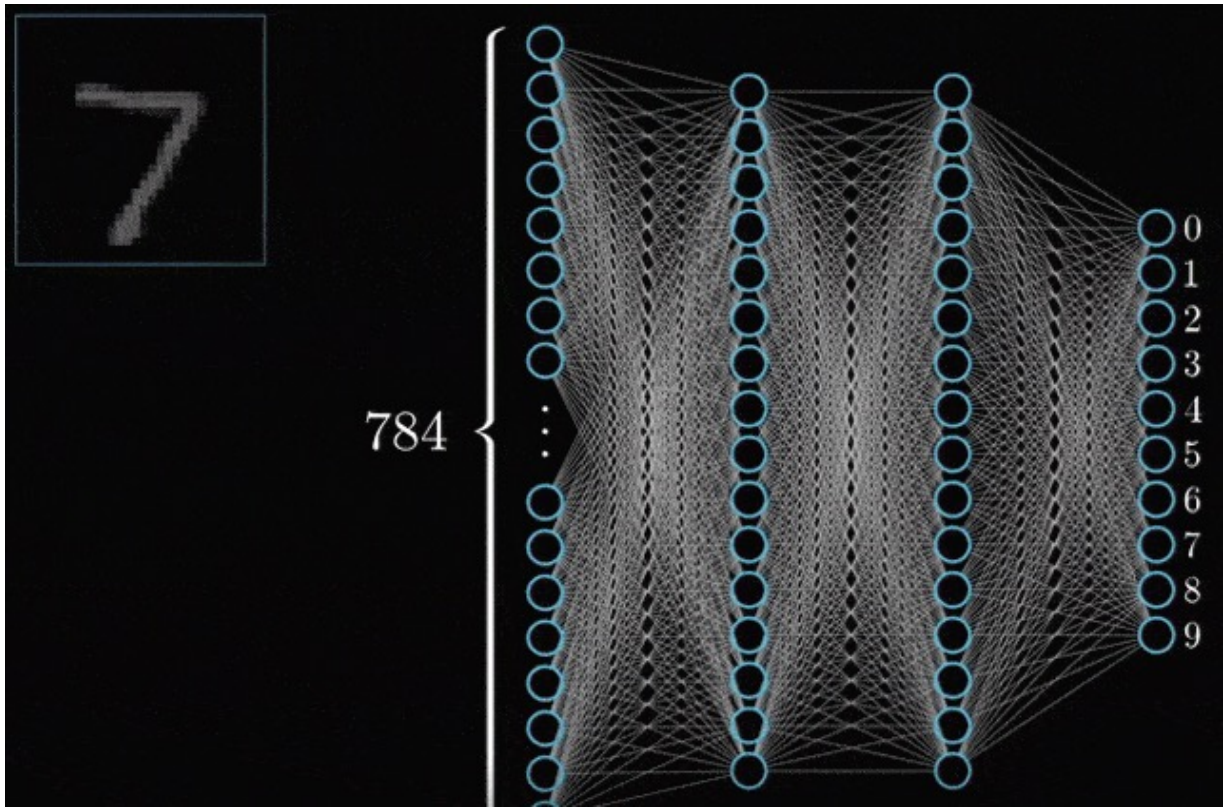
- The Task: Image classification in 10 classes.
  - Q2: What architecture to use (hint, a CNN is a good start) ?
  - Q3: What hyperparameters work best with our data ?



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- Objective 1: maximize accuracy on test set.
  - R1: Use the provided test set.
  - R2: Your solution should be reproducible.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

- Objective 2: Can you build something interesting with it?
  - Example: https://youtu.be/6RPe0Vl4zm4

- How to start ?
  - Baseline: https://colab.research.google.com/github/earthpulse/pytorch_eo/blob/master/challenges/euroavia_hackathon_21/baseline.ipynb
  - Resources:
    - PytorchEO: https://github.com/earthpulse/pytorch_eo (docs are coming soon... Contact me for any question!)
    - Pytorch: https://pytorch.org/tutorials/
    - Pytorch Lightning: https://pytorch-lightning.readthedocs.io/en/latest/
    - Learn AI (in Spanish): https://www.youtube.com/c/sensio-ia

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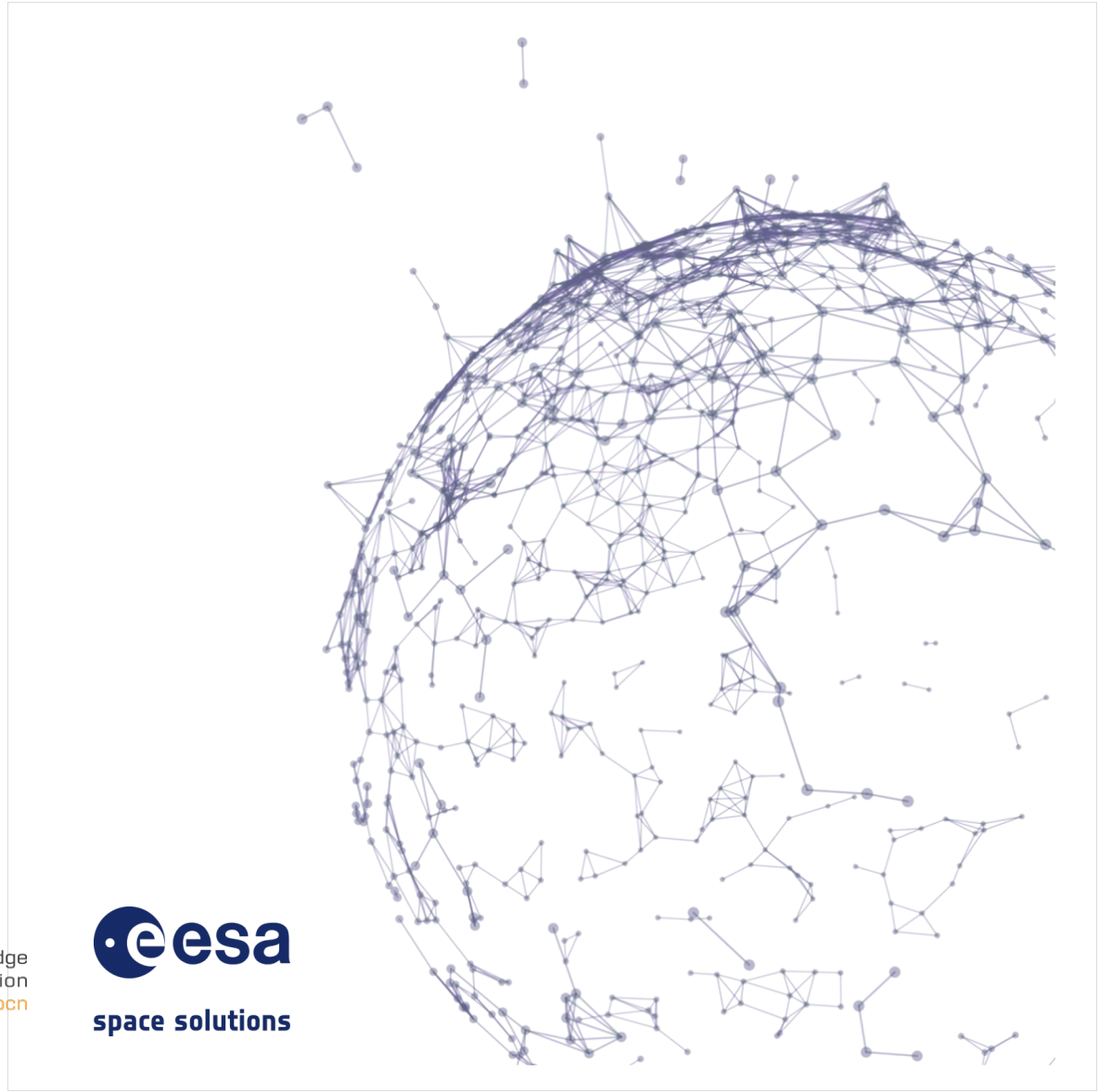

Thank you ! Questions ?

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