



OpenGeoHUB

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<https://opengeohub.org>

Multisource spatiotemporal land cover classification using the LUISA Basemap and Convolutional Neural Networks

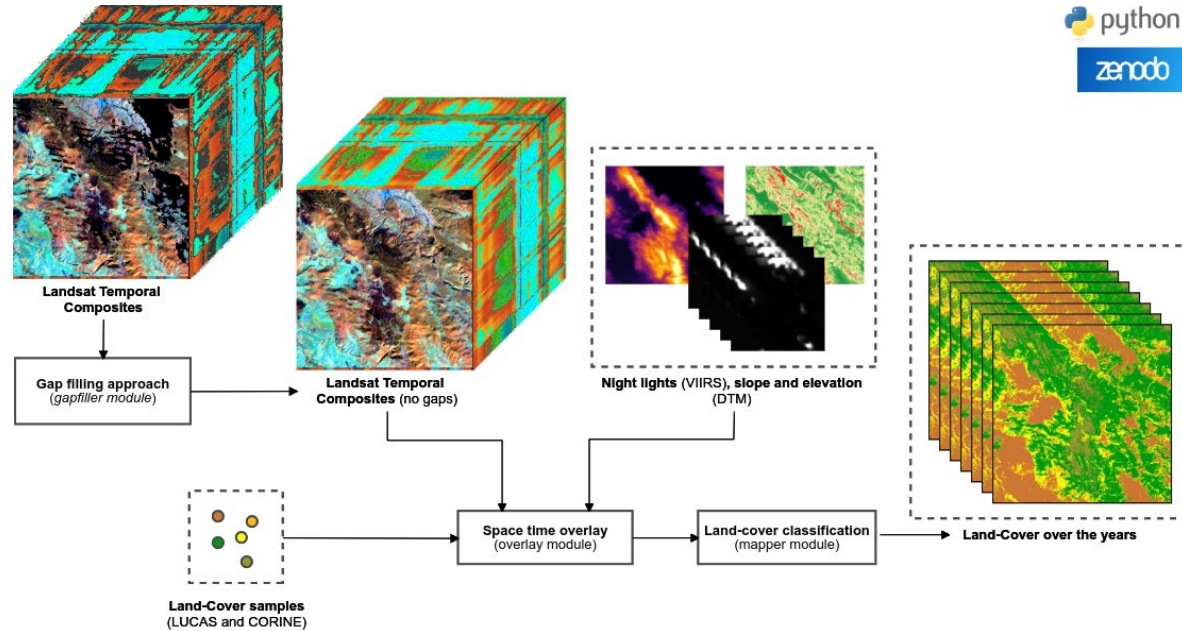
Martijn Witjes

martijn.witjes@opengeohub.org

<https://bit.ly/38J1qfV>

1 Who am I and what do I do?

- PhD student at Wageningen University
- Work at OpenGeoHub
- ML for land use / land cover mapping
- Data wrangling



What is OpenGeoHub?



OpenGeoHUB

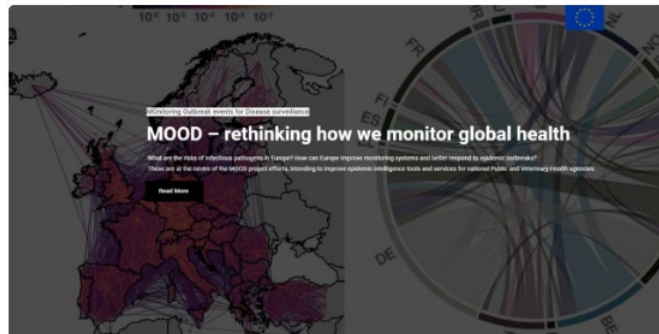
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Non-profit research foundation

Open Data

Open Source

Education



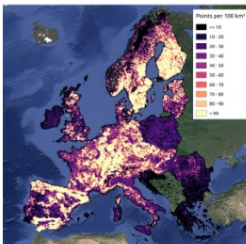
MOOD: MONitoring Outbreak events for Disease surveillance in a data science context

EU-FUNDED, Training



Datasets - 1 min read

Seamless 30 meter Sentinel-2 L2A Pan-European seasonal cloudless mosaics (2018 - 2020)



Datasets - 1 min read

Presence-Absence Points for Tree Species Distribution Modelling for Europe



Datasets - 1 min read

Potential and realized distribution at 30m for 16 forest tree species in Europe for 2000 - 2020



My research

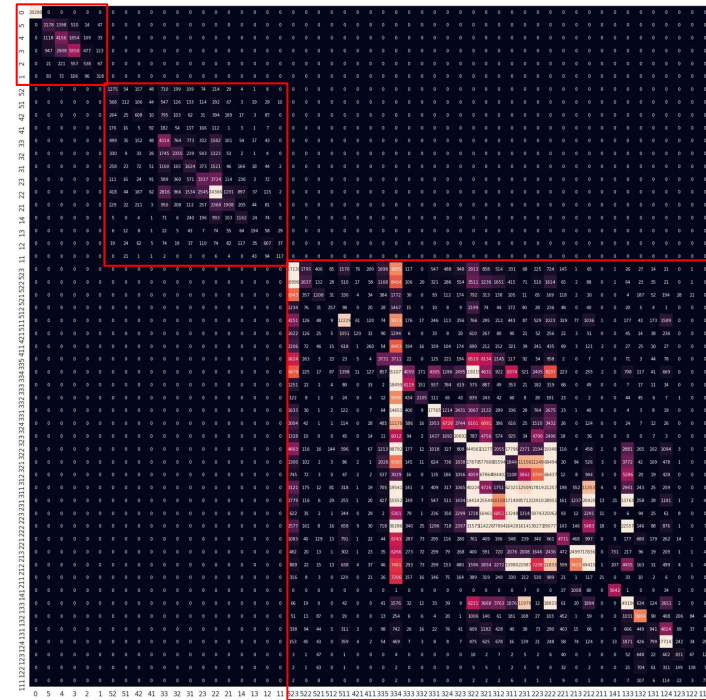
Open data LULC maps that are fit for as many use cases as possible

This leads to:

1. Continuity & time series
2. Large hierarchical legends
3. Optimizable for specific classes

HIERARCHICAL STRUCTURE VISUAL

LVL 1 LVL 2 LVL 3



My Publication

Replicate CORINE LULC annually

2000-2019

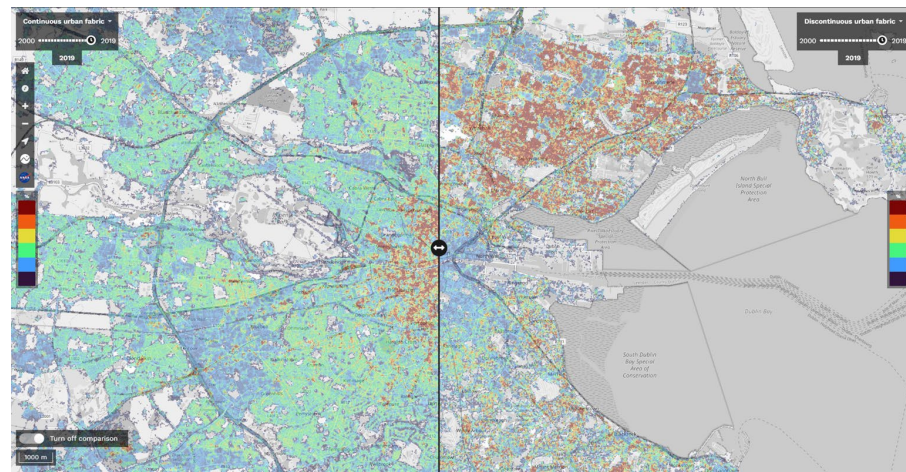
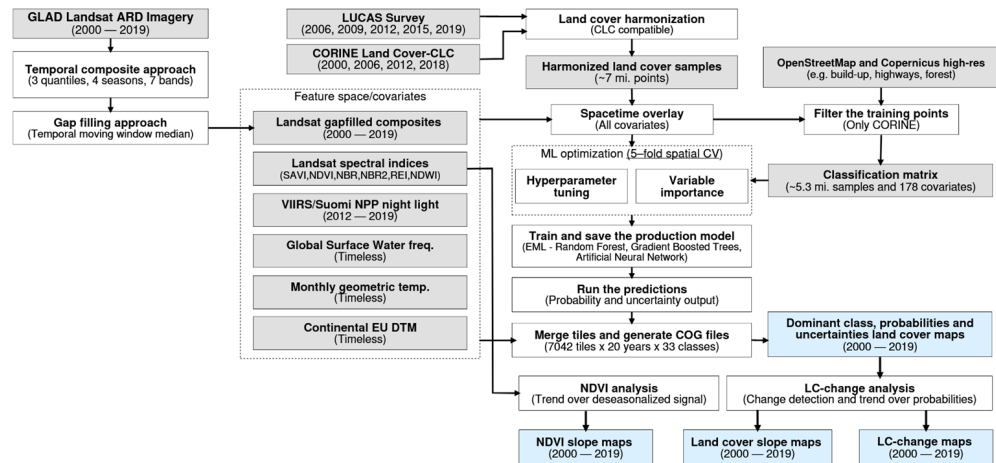
200+ covariates

43 class probabilities

Prediction uncertainty

Data viewer

Open data, open source code



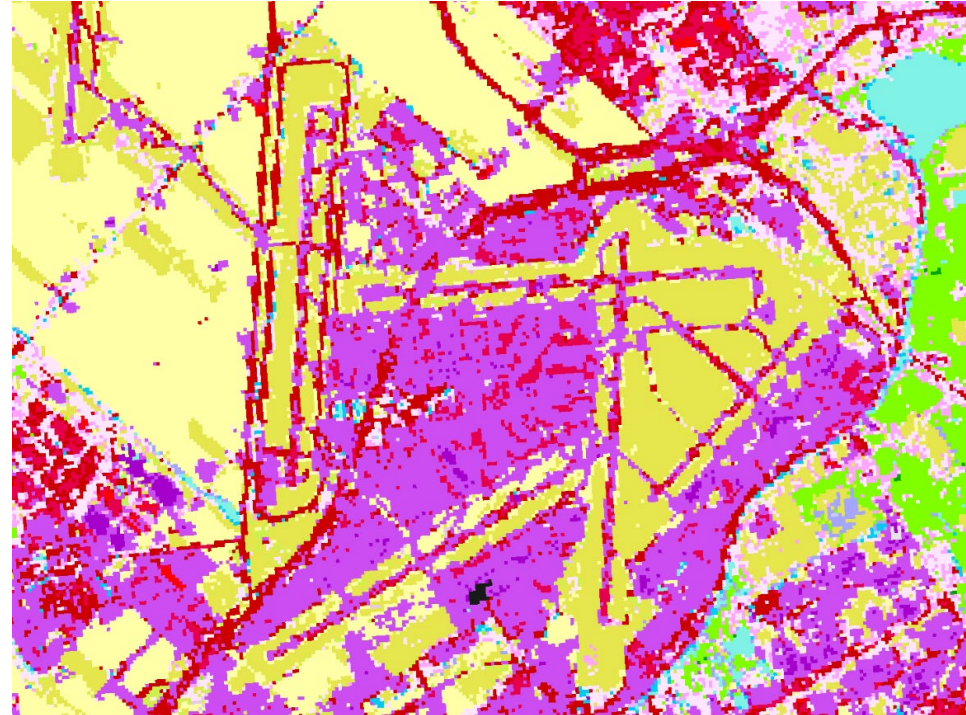
Example of limits: Schiphol Airport, NL



GLAD Landsat ARD - RGB

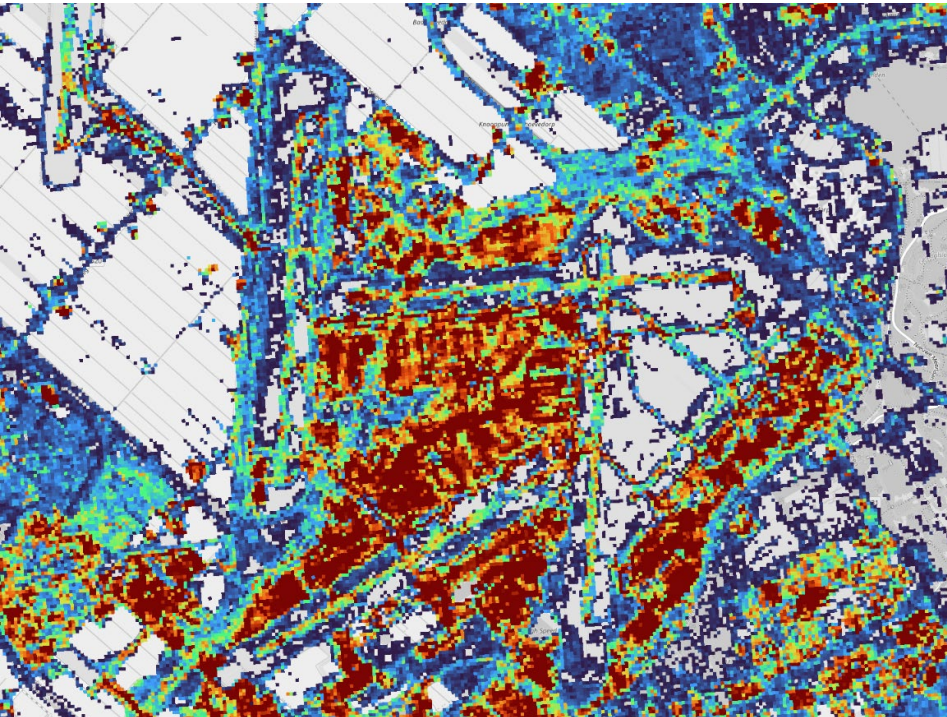


Predicted most likely class

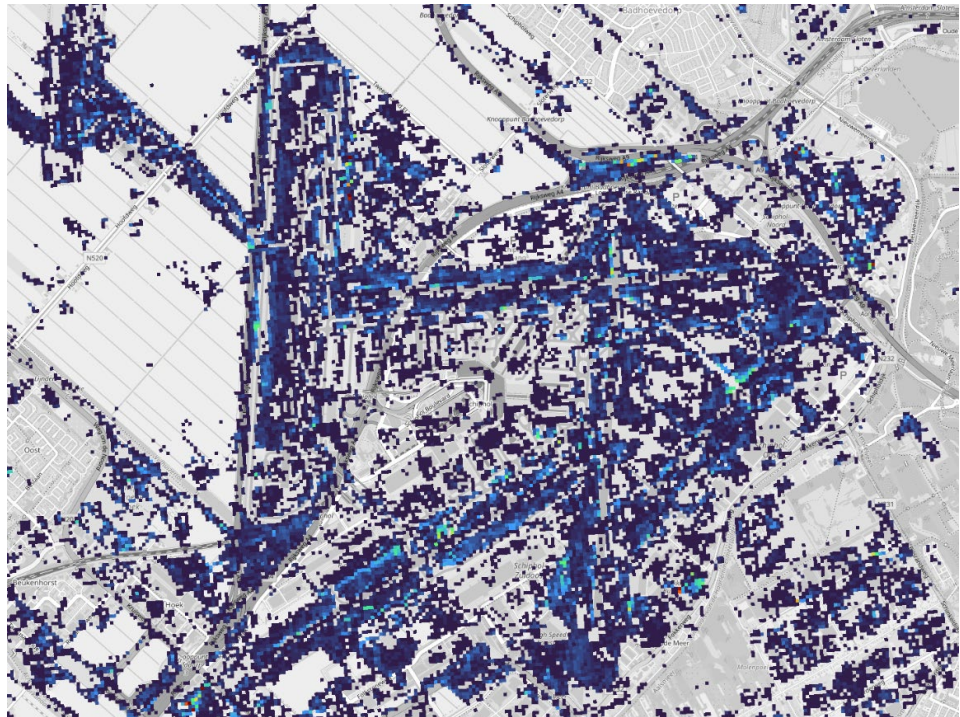


Schiphol predicted probabilities

Industrial & Commercial buildings



...Airports



Incorporating spatial context with CNNs



Convolutional neural networks

Very successful in computer vision & remote sensing

1 <small>x1</small>	1 <small>x0</small>	1 <small>x1</small>	0	0
0 <small>x0</small>	1 <small>x1</small>	1 <small>x0</small>	1	0
0 <small>x1</small>	0 <small>x0</small>	1 <small>x1</small>	1	1
0	0	1	1	0
0	1	1	0	0

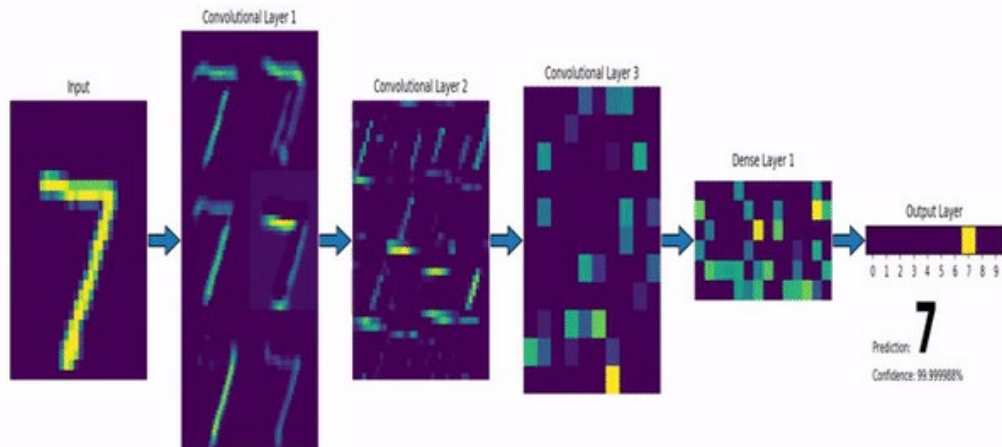
Image

4		

Convolved Feature

Training data limitations:

- Need large amounts*
- Need seamless labels*
- Need labels at pixel level*



LUIA Basemap



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46 Classes:

11 Agriculture

17 Built-up

5 Water

13 Forest/Nature

2 years:

2012

2018

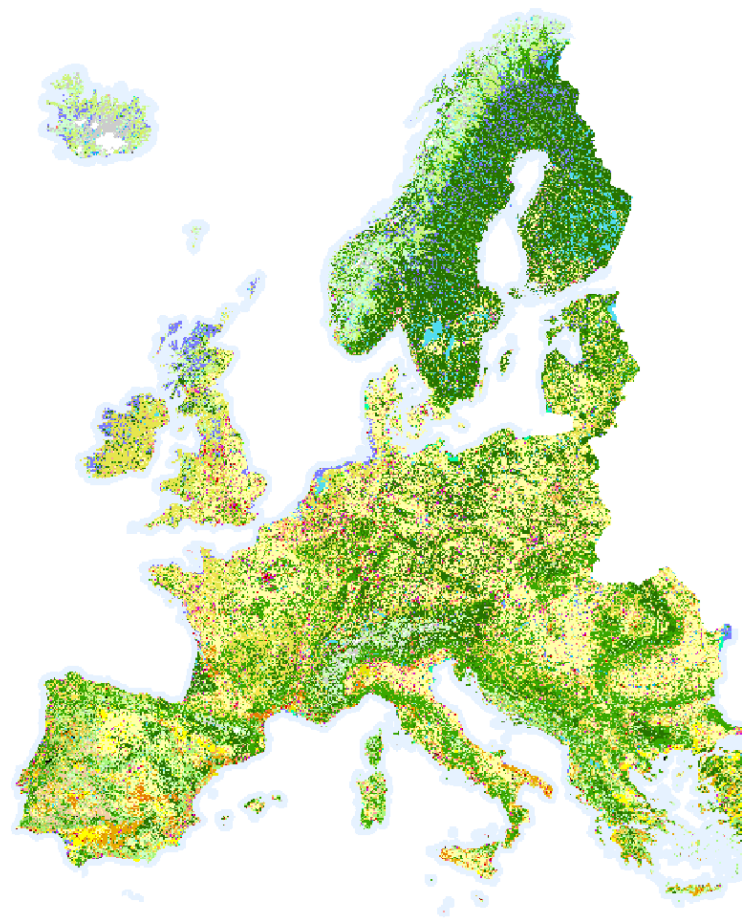
+CLC compatible:

Expanded:

- Urban 4 densities + vegetation
- Airport areas + terminals
- Road/rail + stations
- Sport/Leisure built + green

Simplified:

- wetlands



4 Current work: An escalated pet project

- Train a CNN (UNet) to predict 46 Luisa Basemap classes
- At multiple resolutions, using:
 - Our 30m Landsat 8 ARD data cube
 - A 10m Sentinel-2 ARD data cube
 - A small number of Planet Fusion tiles
- Make EU-wide maps of any year sufficient LUCAS land cover samples
- Validate with LUCAS land cover samples:
 - LUISA Basemaps 2012 & 2018
 - Predictions at 30m, 10m, and 3m

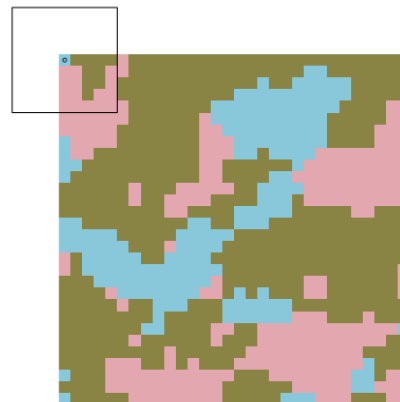
First experiments



Pilot sites: 12 regions in Europe

Data augmentation:

- Flip
- Mirror
- Moving window



Preliminary results



Not enough Planet Fusion data

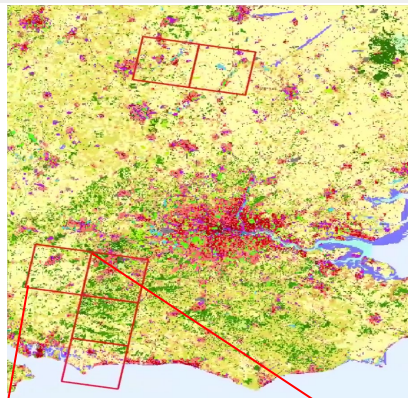
data too sparse & diverse

Preliminary:

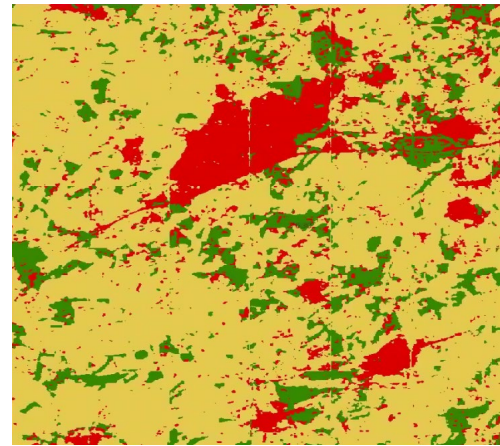
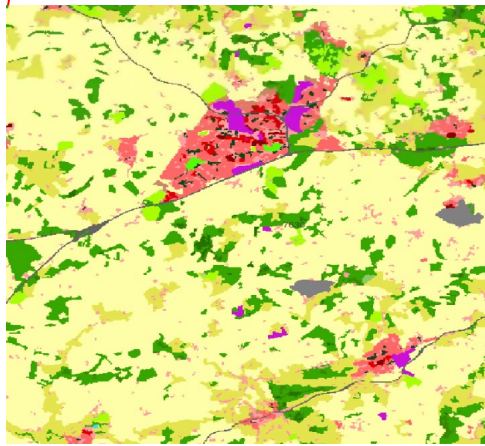
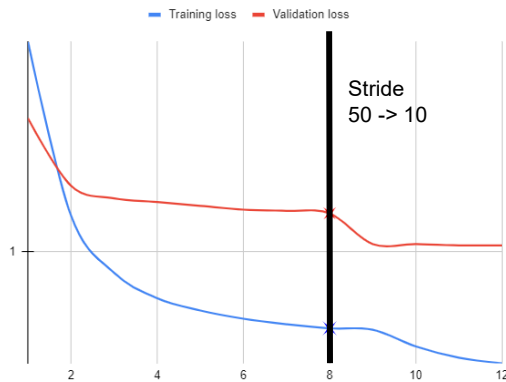
- Aggregated to lvl1 (5 classes)
- 30m Landsat ARD
- UK regions

Log loss 1.005 F1 score 0.824

Smaller stride -> less overfitting



Train & Validation loss



Next steps

Design better architecture (multi-input)

Combine multiple resolution data sources

Investigate & Optimize moving window training schedule



Long-term goal

Organize LULC benchmarking dataset
similar to Imagenet (for computer vision)

Y: All 4 levels of LUISA LULC

X: Multiple sources

- 30m Landsat
- 10m Sentinel-2
- 3m Planet

It will be part of project starting now:

OpenEarth Monitor



Open-Earth-Monitor Cyberinfrastructure



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PROJECT CONSORTIUM

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Innovative governance, environmental observations and digital solutions in support of the European Green Deal

VIRTUAL EVENT

Open-Earth-Monitor project launch • Keynote speakers
Discussion panels • Networking • Demo • Talks

WAGENINGEN, NETHERLANDS
19 JULY 2022

OPEN EARTH MONITOR
Project start: 1 June 2022

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WAGENINGEN
UNIVERSITY & RESEARCH

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No.101059546

Software + EO Data + Community

<http://earthmonitor.org>

Martijn Witjes

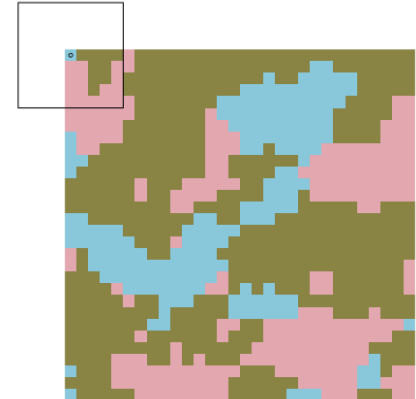
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Questions
