FAIRiCUBE

Use Case 2

Biodiversity and agriculture nexus

A FAIRiCUBE use case by Wageningen Research

Objective

The main aim of Use Case 2 is to investigate the impact of agricultural activities on the environment (e.g., soil, groundwater, emissions etc.) and further on biodiversity. Within the use case customized machine learning tools are utilized within data cube-based infrastructure. The expected results are established workflows and data pipelines including a prototype of a model that predicts causal relations between changes in farmland bird biodiversity and specific agricultural practices in the Netherlands.

Applications

The established model can be used by decision makers in agriculture and environmental protection by supporting better-informed decisions such as selecting more nature-inclusive practices promoting biodiversity through specific applications:

- **Spatial categorization:** The results of the observation and estimation steps for biodiversity can be used to categorize agricultural landscapes and e.g. administrative regions, based on predicted suitability.
- **Casual modeling:** Causal modelling allows reasoning about potential situations to answer 'What-if?" type of questions and creating scenarios for farmland landscape development considering biodiversity favorable conditions.
- **Smart tools:** The presented approach aims at improved understanding of causalities between farm activities and changes in biodiversity. When results are sufficiently robust, the model could be incorporated into advisory tools for farmers or policy makers, to help assess the consequences of actions.

Approach

Three main data categories (biodiversity, environment and agriculture) are handled primarily within their individual processing flows and data cubes, which are then ultimately merged using causal machine learning. Modelling methods such as causal inference and discovery provide insights into the underlying mechanisms describing the impact of agricultural practices on biodiversity. They do not only statistically predict the correlations but also provide meaningful explanations for those predictions, enhancing the overall interpretability of the model results.

All the tools are expected to be provided within FAIRiCUBE hub as shared data infrastructure and documented.
FAIRiCUBE hub | FAIRiCUBE docs

The five use cases are

Urban adaptation to climate change (urban focus)

Biodiversity and agriculture nexus (regional focus)

Environmental Adaptation Genomics in Drosophila (regional focus)

Spatial and temporal assessment of neighborhood building stock (urban focus)

Validation of Phyto-sociological Methods (urban/regional focus)

Deliver the power of data cubes and machine learning (ML) to decision/policy makers and data scientists.

Why FAIRiCUBE?

There is an ever-increasing amount of earth observation data available, largely in the form of data cubes. The relevant data formats are quite mature, data is (at least partially) freely available, various data processing libraries as well as visualization and data storage tools have been developed. Additionally, compute platforms can be used, they scale well and are becoming affordable.

Despite these relevant evolvements, non-EO experts who would greatly profit by integrating these resources into their work are still struggling to make full use of the available data as well as relevant analysis and processing tools. Diverse aspects continue to confound potential users, such as:

- How to connect different data sources with storage & compute resources? What if you bring your own data?
- What computational aspects must be considered when dealing with gridded spatiotemporal data?
- How can we share tooling such as (trained) machine learning models?
- How do we visualize and share the results with the relevant stakeholders?
- How can we properly document what processing has been applied to the data? How can we include this essential provenance information?

Our vision

Within FAIRiCUBE, we demonstrate a harmonized data space, the FAIRiCUBE Hub, where we connect all the pieces required for a data science pipeline into a user-friendly framework, where everything is FAIR (Findable, Accessible, Interoperable, Reusable) and TRUSTable (Transparency, Responsibility, User focus, Sustainability, and Technology). In this manner, we illustrate how the Green Deal Data Space (GDDS) could be formed pertaining to gridded data and the analysis thereof.

Objective

The objective of the FAIRiCUBE project is to enable players from beyond classic Earth Observation (EO) domains to provide, access, process, and share gridded data and algorithms in a FAIR and TRUSTable manner.

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