DataCAP: A Satellite Datacube and Crowdsourced Street-level Images for the Monitoring of the Common Agricultural Policy

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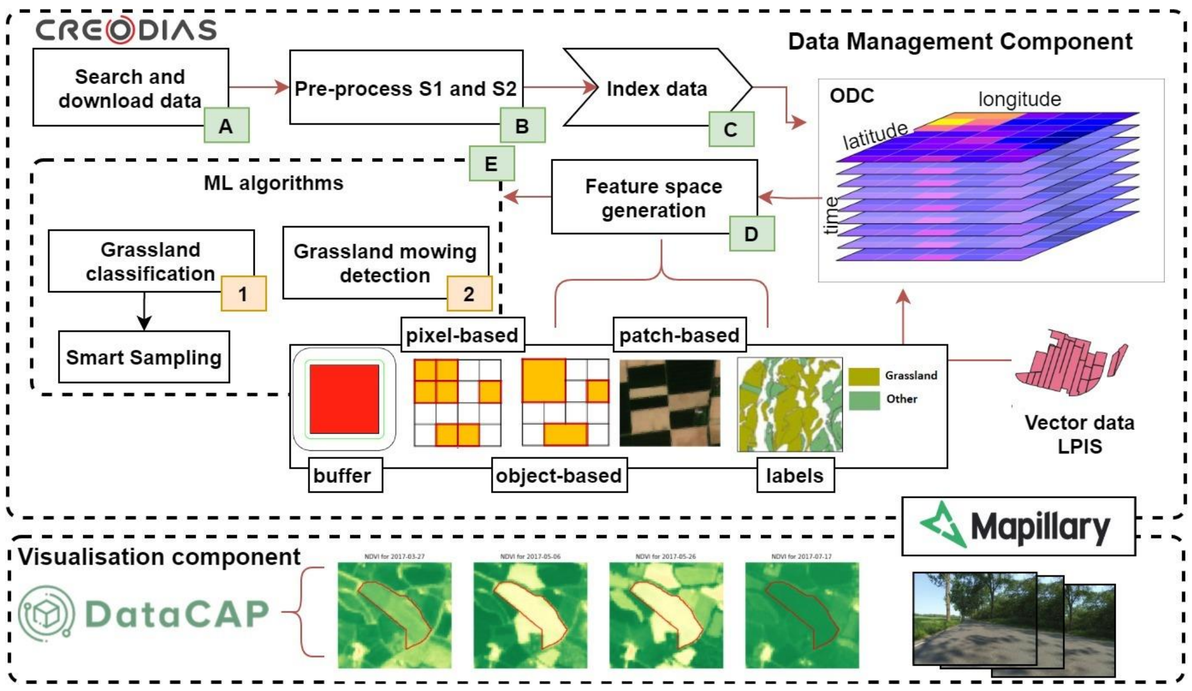
Motivation

- **Automated and efficient management, knowledge extraction and visualization of big Earth data** can enable the timely and effective decision making.
- **DataCAP** combines the **Open Data Cube (ODC)** technology on **Satellite Image Time-series (SITS)**, with **Machine Learning (ML)** pipelines and **crowdsourced street-level images** to assist in the monitoring of the Common Agricultural Policy (CAP).
- Objective: **Timely and remote identification of mistakes** in farmers' subsidy applications to allocate CAP money **fairly, transparently and efficiently**.



Satellite Data Cube

A - Search and download

- Sentinel-1 and Sentinel-2 data products automatically harvested and downloaded from CreoDIAS API.
- Request data for *time window, area of interest*, *cloud coverage* etc.

B - Pre-processing

- Processed to ARD. i) **Sentinel-1 backscatter coefficient and coherence** products, ii) **Sentinel-2** atmospherically corrected multi-spectral images; with **cloud and shadow masks**.

C - Index to ODC

- Index ARD to data cube, triggering a batch process whenever a new image is downloaded and pre-processed.

D - Data analytics and feature engineering

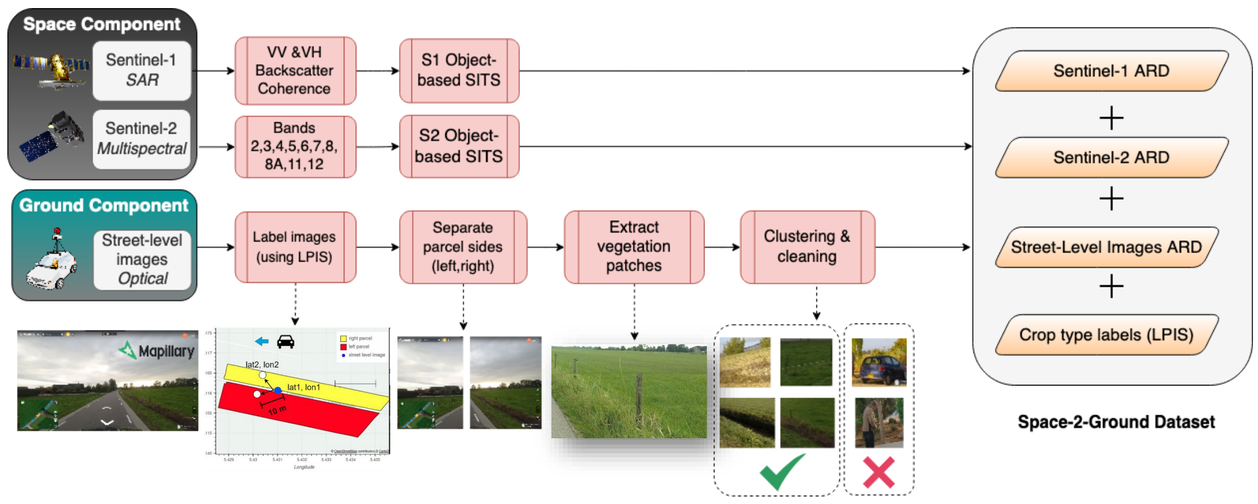
- DataCAP enables **the fast, easy and versatile generation of satellite-image time-series feature spaces** to feed ML pipelines.
- Users can execute i) **a number of complex spatio-temporal queries** using vector data (parcel geometries) and scene classification products (i.e., cloud mask); ii) create pixel-based, object-based or patch-based **feature spaces**; iii) apply **inward buffers** to avoid mixed pixels and more.

E Crop classification and smart sampling

- Perform crop classification using the model in [1].
- Flag potential wrong declarations using the model in [2].
- Verify through visual inspection satellite and street-level images.

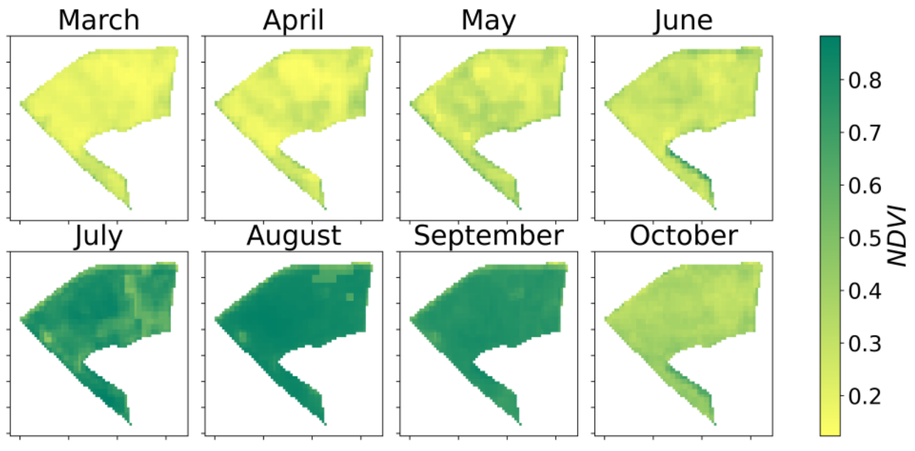
Crowdsourced street-level images

- Perform collection campaigns using the cars of CAP inspectors.
- Upload and then access street-level images from Mapillary.
- Annotate images with LPIS vector layer (farmer declarations).
- Use annotated street-level image patches to train CV models.

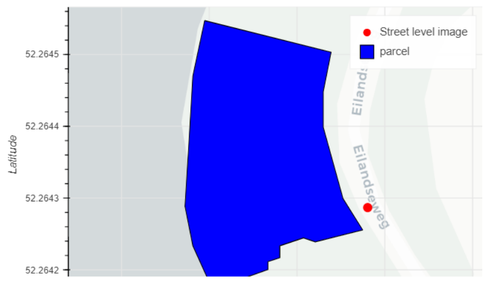


Visualization Component

Verify the cultivated crop type using time-series of satellite images



Or any available crowdsourced street-level images



Conclusions

- DataCAP is a **data handling and visualization module** for the monitoring of the CAP.
- It consists of:
  1. a **back-end component** that helps collect and prepare satellite ARD to feed pertinent ML pipelines, and
  2. a **front-end component** that utilizes the satellite ARD and street-level images to help verify the ML outputs.
- DataCAP is **scalable, extendable and reproducible**.
- **The code and produced annotated datasets** are open

References

[1] Sitokonstantinou et al., Scalable parcel-based crop identification scheme using sentinel-2 data time-series for the monitoring of the common agricultural policy. Remote Sensing 10(6), 911 (2018)

[2] Rousi et al., Semantically enriched crop type classification and linked earth observation data to support the common agricultural policy monitoring. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 14, 529–552 (2020)

Acknowledgements and Further Information

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