NIVA

NEW IACS VISION IN ACTION

UC2 –Prefilled Application

8 May 2020

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Webinar agenda

1. Team & partners
2. Main concepts & terminology
3. Tools & components, Use Cases
4. Timeline and test process
5. Live Demo
6. Questions & Answers

Team & partners

- UC lead: National Paying Agency (NPA)
- Development partners: Sinergise, Itree
- Testing PA: FEGA

Main idea of prefilled application

Each year 3 main things are requested from the farmer during the declaration:

1. Parcel boundary
2. Crop type
3. Additional information

Goals and results of UC2 by developing

1. Crop type integration model and methodology

with harvested data from other use cases/ land cover classification, crop classification and activity monitoring provided by Sen4CAP;

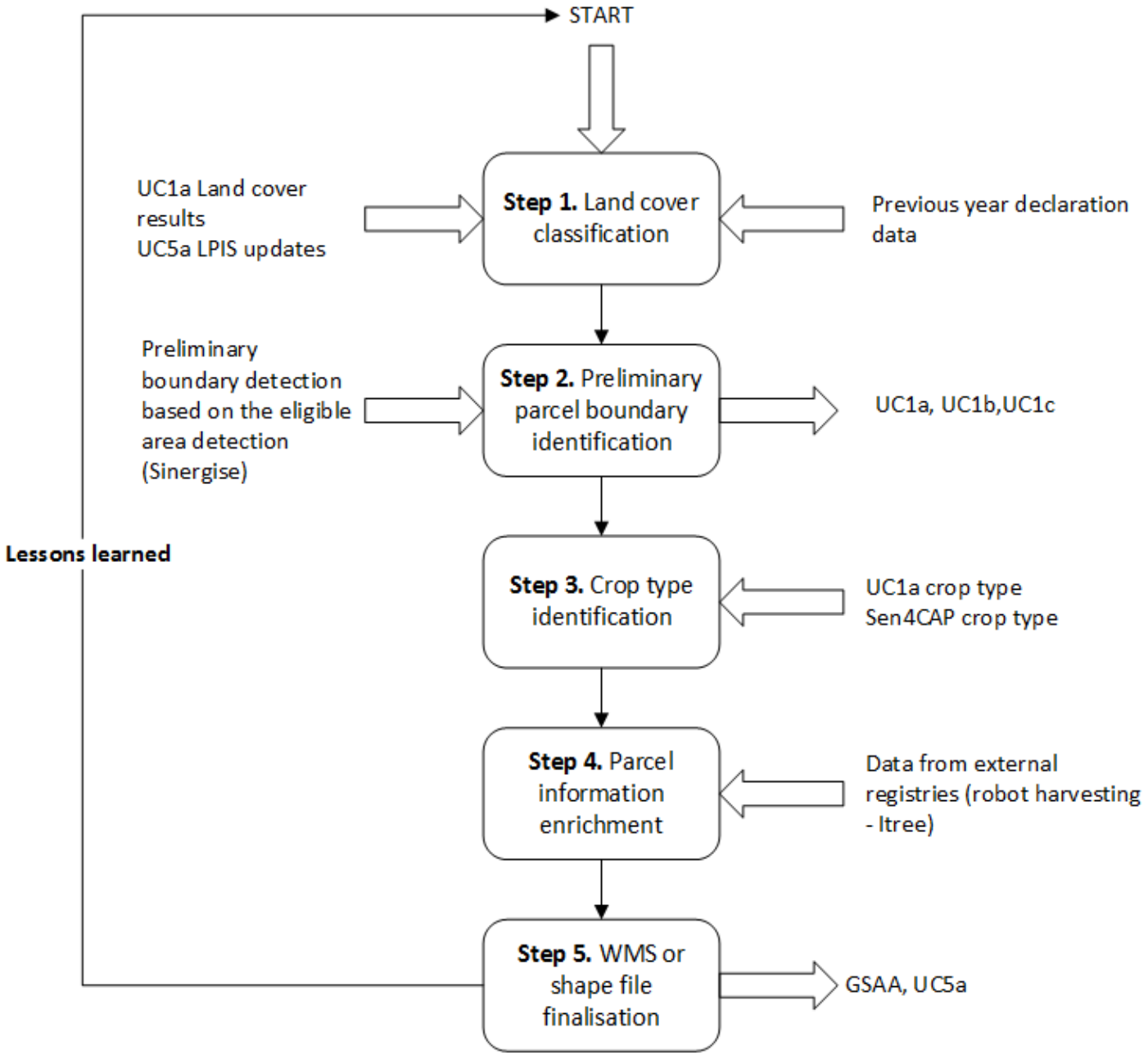
2. Preliminary parcel boundary automatic delineation component

using the eligible area detection algorithm and using the data from other use cases dealing with LPIS boundaries;

3. Tool selection and methodology for robotized tools

for automatic data harvesting from external registers.

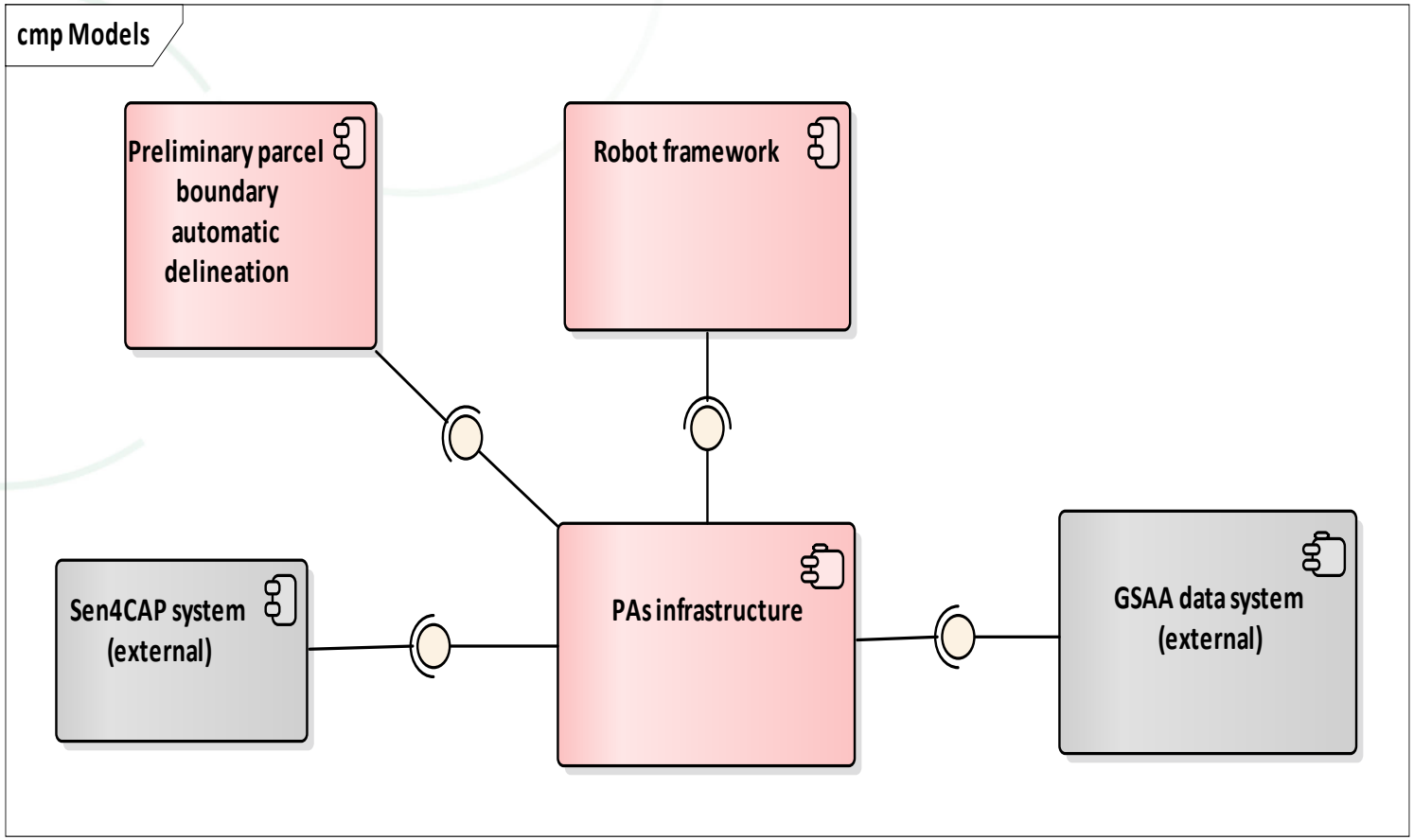
Use case steps



Results example

Crop type	Activity	Harvested data	Detected boundary	New ineligible object
Grassland	Mowed	Organic farming certified	Yes	No

Tools & components – architecture



Preliminary parcel boundary automatic delineation

About

Use Sentinel data to detect parcels borders.

Try and compare the results of two different approaches:

- Unsupervised (LSMS) and
- Supervised machine learning (eo-learn&eo-flow)

Input data:

- EO data (Sentinel-2 data through DIAS APIs)
- GSAA parcels in shapefile format

Output data:

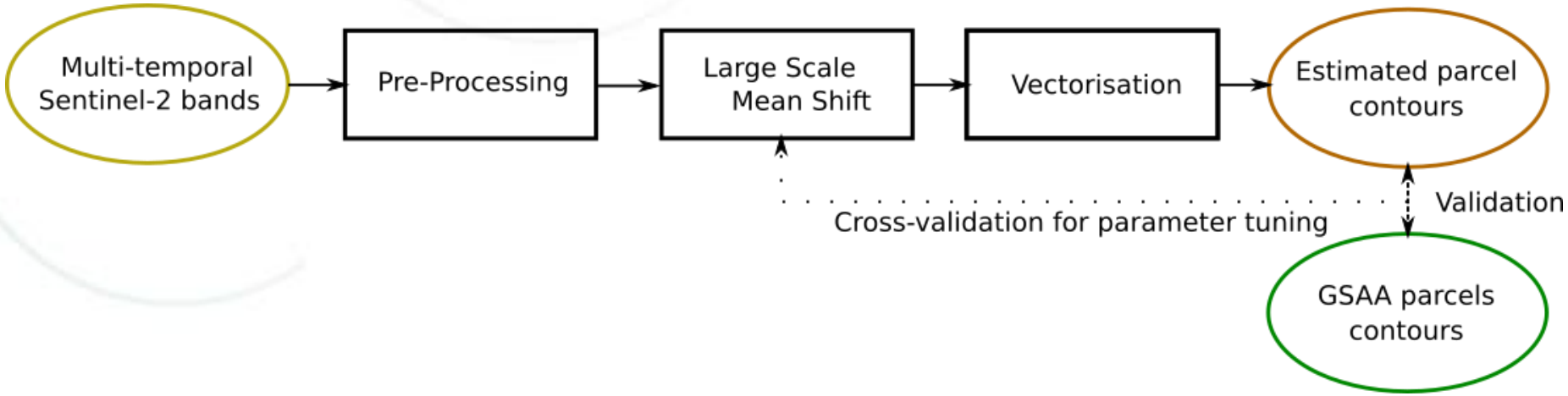
- shapefile with parcel boundaries

Unsupervised approach

LSMS – Large Scale Mean Shift:

- 4 chained steps of the MeanShit framework
- Generates vector data with extracted regions
- Allows adapting the sensitivity of the algorithm
- Removes/merges small regions
- Computes mean and standard deviation.

Unsupervised model schema

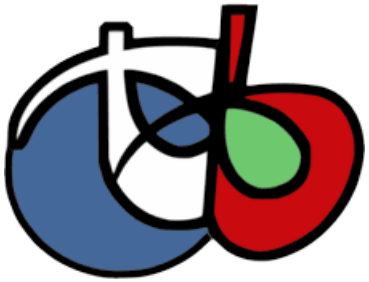


Unsupervised approach – the tools

Orfeo toolbox:

- open-source project (CeCILL-v2)
- Wide variety of algorithms (LSMS implementation)

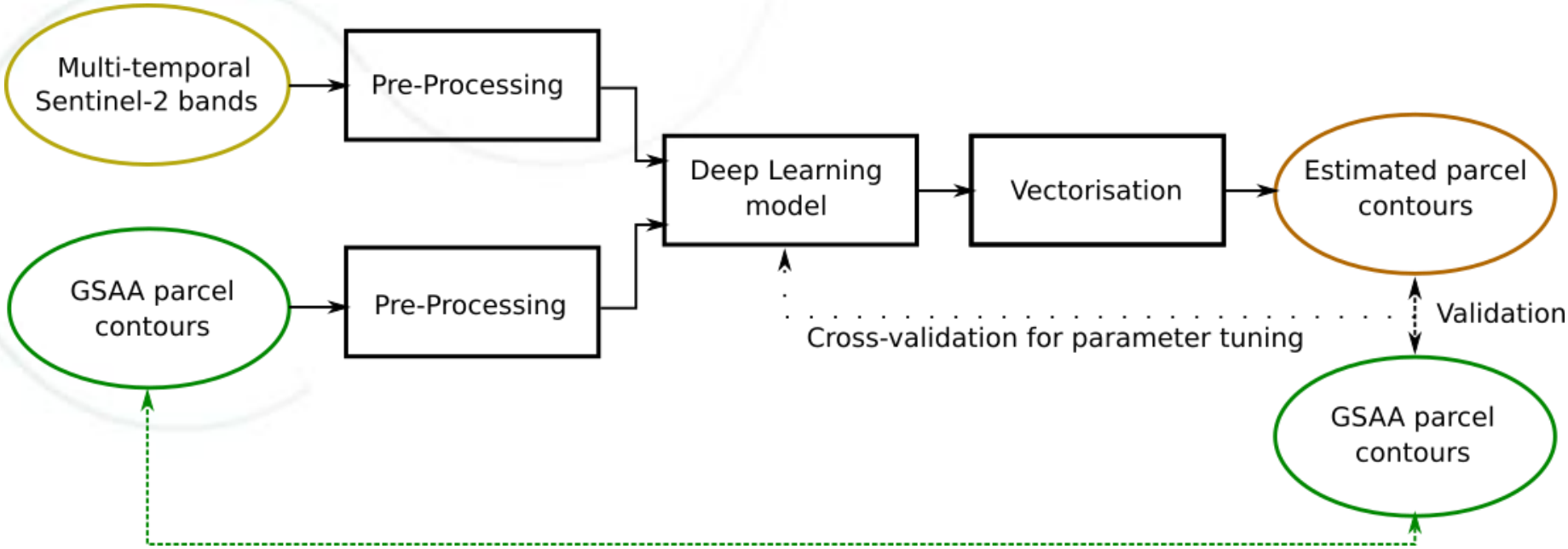
Usage of Python and Jupyter notebooks



Supervised machine learning

1. Preparation phase
   - analyse of vector reference data and Sentinel-2 images
   - process input data into a suitable format for the training of the machine learning model
2. Data processing
   - splitting area of interest into smaller imaging patches
   - extraction of indices relevant to the task
   - rasterization of the vector reference data
3. Training of the convolutional deep learning model
   - to extract relevant features from images
   - to maximize the similarity between the output and the reference GSAA delineations.
4. Prediction on the entire area of interest

Supervised model schema



Supervised machine learning – the tools

EO-LEARN - development of the processing pipelines:

- An open-source Python package for the processing of Spatio-temporal satellite imagery
- easy to use, modular design, encourages collaboration
- for easy extraction of valuable information from satellite imagery
- bridge between EO and Python ecosystem for data science and machine learning
- uses NumPy arrays to store and handle data

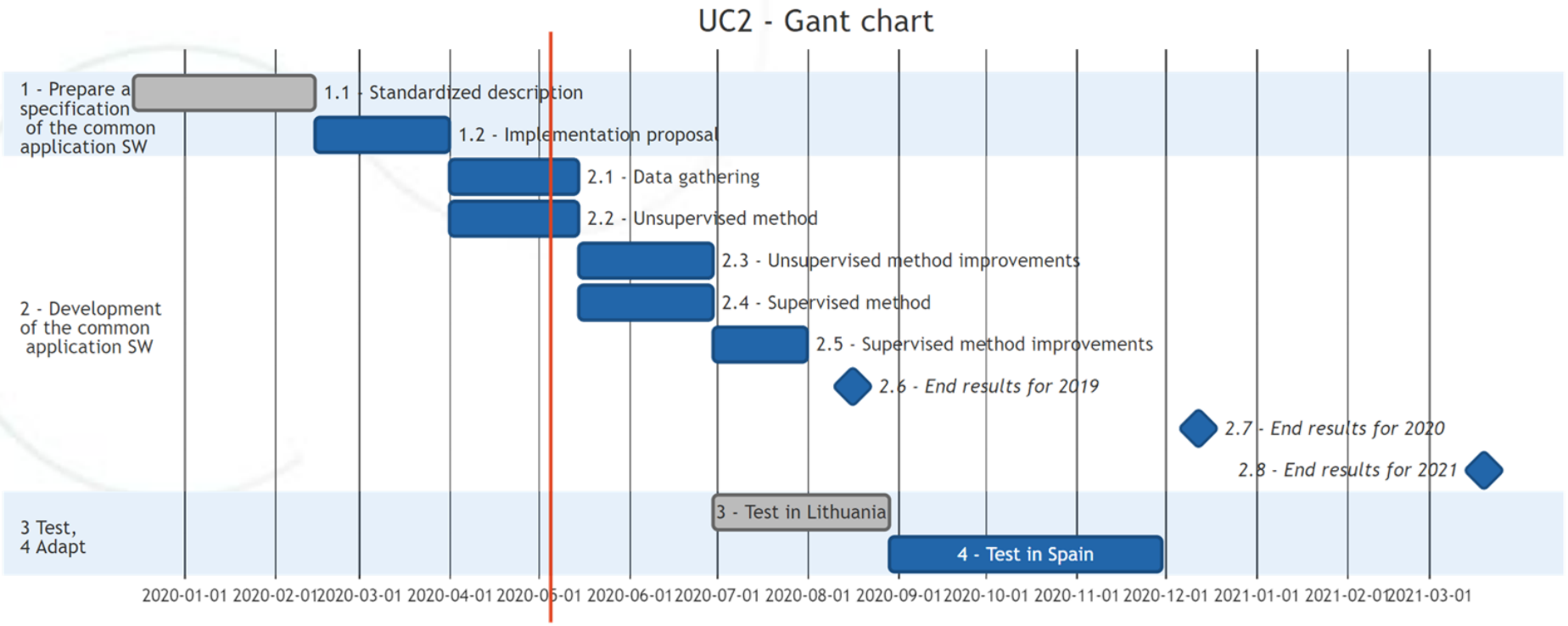
eo-learn

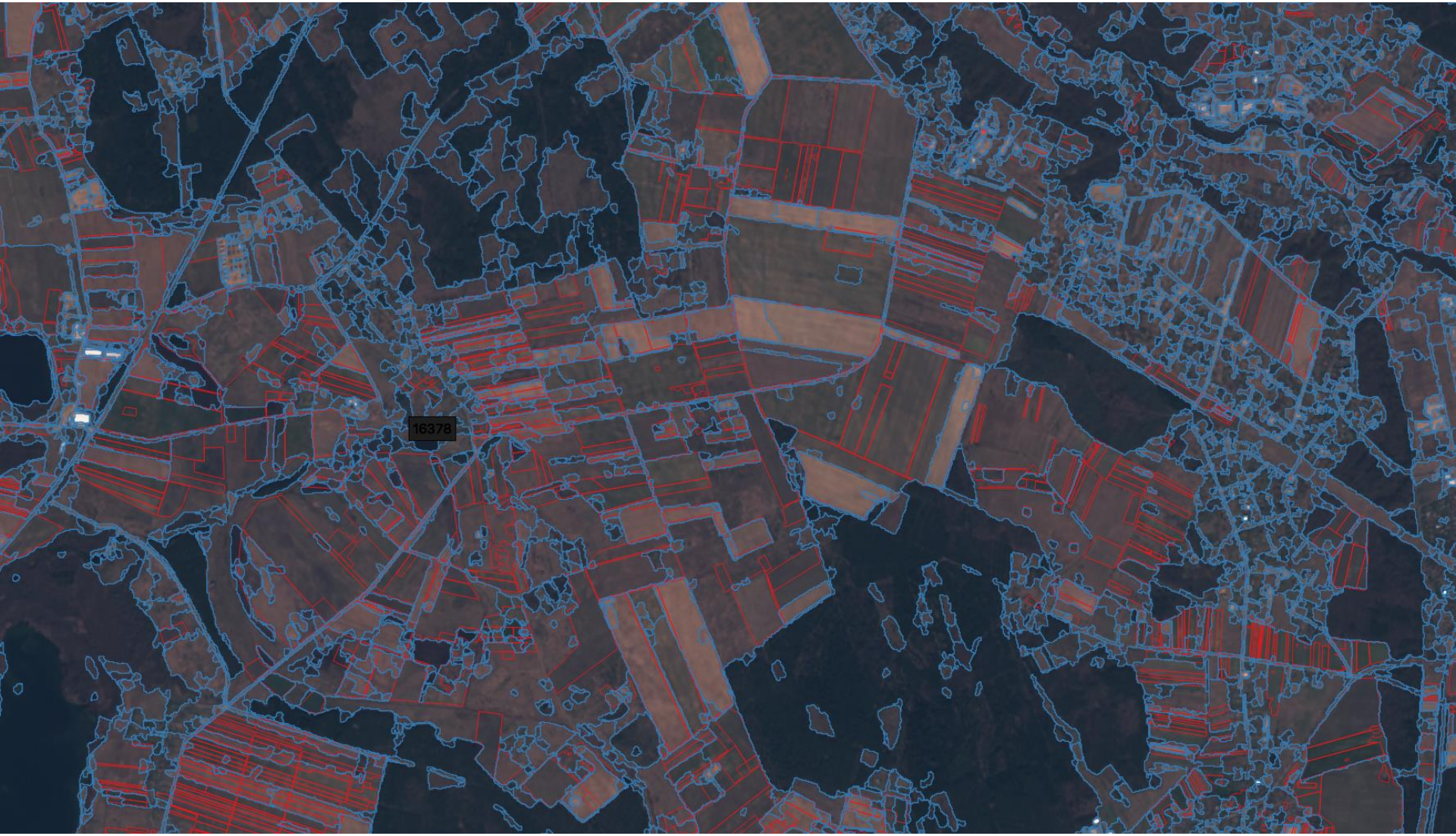
Supervised machine learning – the tools

EO-FLOW - training of deep learning model:

- a collection of deep learning architectures and utilities that uses TensorFlow 2.0 with Keras
- TensorFlow is an end-to-end open source platform for machine learning, with extensive support for model deployment in large production environments

Timeline


UC2 - Gant chart
1 - Prepare a specification of the common application SW
1.1 - Standardized description
1.2 - Implementation proposal
2 - Development of the common application SW
2.1 - Data gathering
2.2 - Unsupervised method
2.3 - Unsupervised method improvements
2.4 - Supervised method
2.5 - Supervised method improvements
2.6 - End results for 2019
2.7 - End results for 2020
2.8 - End results for 2021
3 Test, 4 Adapt
3 - Test in Lithuania
4 - Test in Spain
2020-01-01 2020-02-01 2020-03-01 2020-04-01 2020-05-01 2020-06-01 2020-07-01 2020-08-01 2020-09-01 2020-10-01 2020-11-01 2020-12-01 2021-01-01 2021-02-01 2021-03-01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Test process

FEGA a testing PA will need to provide:

- Test region
- Input data:
  - GSAA, LPIS

Sen4CAP system (external)

Sen4CAP system (external)

Objectives

Providing to UC2:

- land cover classification
- crop classification
- activity monitoring

The data provided by Sen4CAP will be owned by the Paying Agency

Main Innovations

- Farmers will be provided additional data for the application submission which will reduce time spent filling applications and limiting number of farmer errors
- Paying agency will get less errors in the farmers' applications

Sen4CAP data for 2020 CY

Version	Date at which declaration are provided to Sen4CAP	Approximate amount of declared parcel	Date when data collected from the field by NPA worker will be uploaded to Sen4CAP FTP (up to 200 fields)	Date when result data should be uploaded to FTP by Sen4CAP team (no need of NRT, but of dated product)	Algorithms results			Comments
					L4A	L4B	L4C	
~~1~~	~~Previous year data set~~	~~100%~~	-	~~01/04~~	~~+~~	-	-	~~Land cover classification by customized configuration file (crop grouping by land cover)~~
2	Previous year data set	100%		**01/05**	+			Land cover classification by customized configuration file (crop grouping by land cover)
3	~~04/05~~ **12/05**	40%		13/05	+			Land cover classification by customized configuration file (crop grouping by land cover+ winter crop type)
4	01/06	80%	27/05	10/06	+	+		In situ data for spring/ winter crops
5	15/06	90%	10/06	24/06		+		In situ data for Grasslands indicating mowing/grazing
6	01/07	95%		08/07	+	+	+	
7	08/07	98%		15/07		+	+	
8	22/07	100%	15/07	29/07		+	+	In situ data for Catch crop (PS), fallow land, spring (nitrogen fixing crops), grasslands(mowing/grazing)
9		100%		12/08	+	+	+	
10		100%	12/08	02/09		+	+	In situ data for Catch crop (IS), spring/ winter crops
11		100%	22/09	21/10		+	+	In situ data for Catch crop (IS), (PS)

Sen4CAP data as crop type input

- ✓ Check if any results form Sen4cap crop/land cover type, activity monitoring:
- can be gathered before declaration beginning
- can be available during declaration period as preliminary crop type, activity data, at what concrete time and of how much quantity (crop types/ parcels/area/farmers).

- ✓ Check results accuracy based on collected crop type in situ data.

- ✓ DIONE project results us crop/land cover type, activity monitoring input from 2021

Test process M18

Spain as a testing country needs to provide:

- Sen4CAP crop type detection results data flow in Spain
- review and compare GSAA UML model

Robotic Process Automation Tool

Robotic Process Automation (RPA) Tool Selection

- Criteria
  - Open Source
  - Support and Community
  - Usability (Learning curve)
  - Versatility (add-ons, multiple platforms, APIs, etc.)
  - Price (for additional features)
  - Orchestration
- Shortlist
  - **Robot Framework**
  - Automagica
  - Taskt

Robot Framework Advantages

robotframework.org

- Open source and free
- Active community and development
- Rich ecosystem (additional tools and libraries)
- OS and application independent
- Relatively easy to use

Timeline / Following actions

- **Actions done:**
  - Tool selection
  - Replicating an existing NPA process on selected tool
- **Actions to do:**
  - Prepare Whitepaper on RPA usage for NPA purposes (M12-13)
- **Alternatives for next actions:**
  - Automate selected FEGA (testing agency) process to check if selected RPA tool is suitable in different environment.
  - Design and prepare process which uses tool developed by Sinergise (UC2) to check if selected RPA tool is suitable in NIVA environment.

Discussion

Questions & Answers

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THANK YOU!

This project has received funding from the european union's horizon 2020 research and innovation programme under grant agreement no. 842009