



Reinforcing the AI4EU Platform by Advancing
Earth Observation Intelligence, Innovation & Adoption

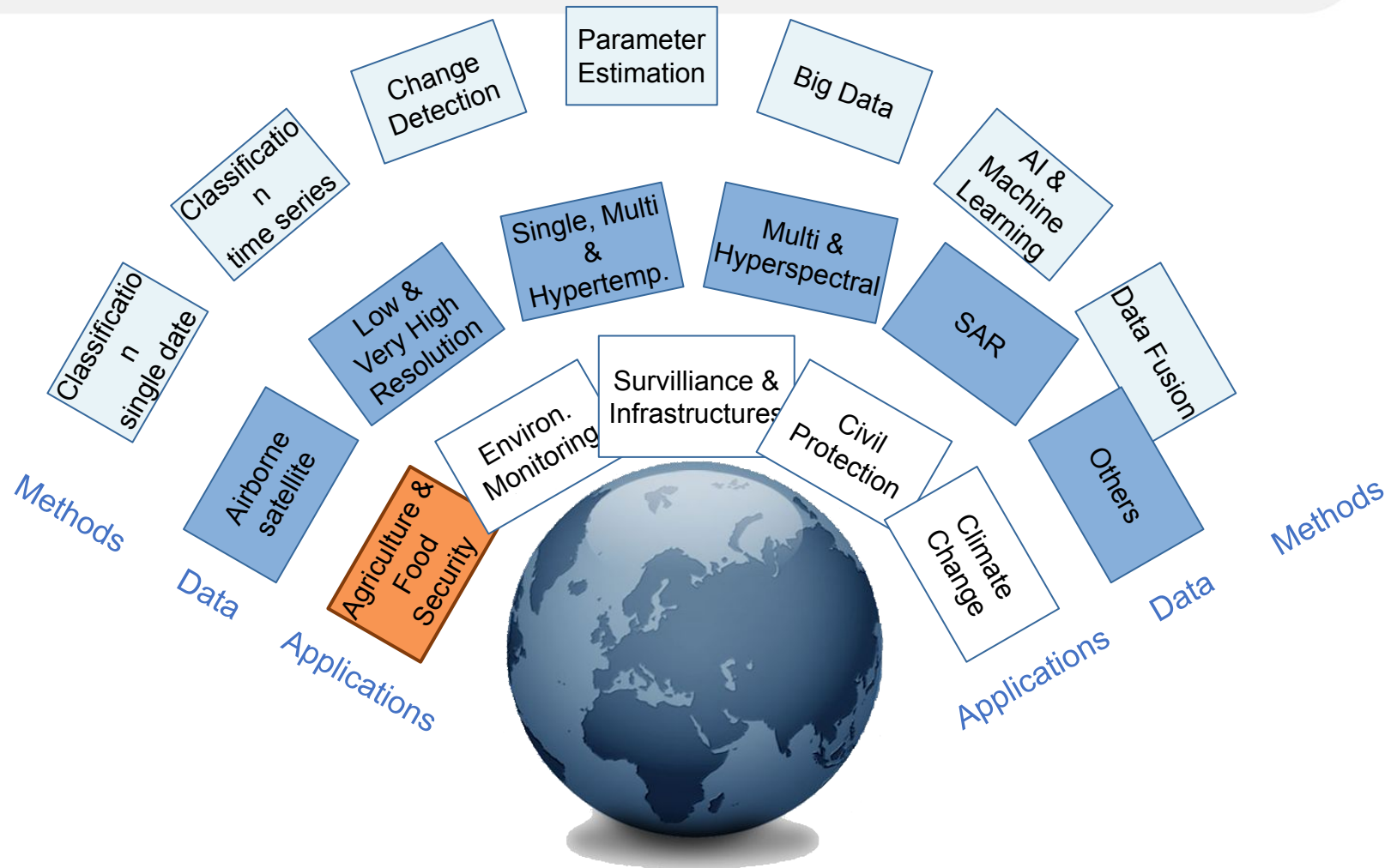
Crop Type Classification: Challenge Description and the Agriculture Bootstrapping Services

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AI4Copernicus Project Partners



Introduction



Introduction

Better resource
allocation and planning

Improved health
outcomes

Better water resource
management

Support urban
planning

Help monitor and
reduce deforestation



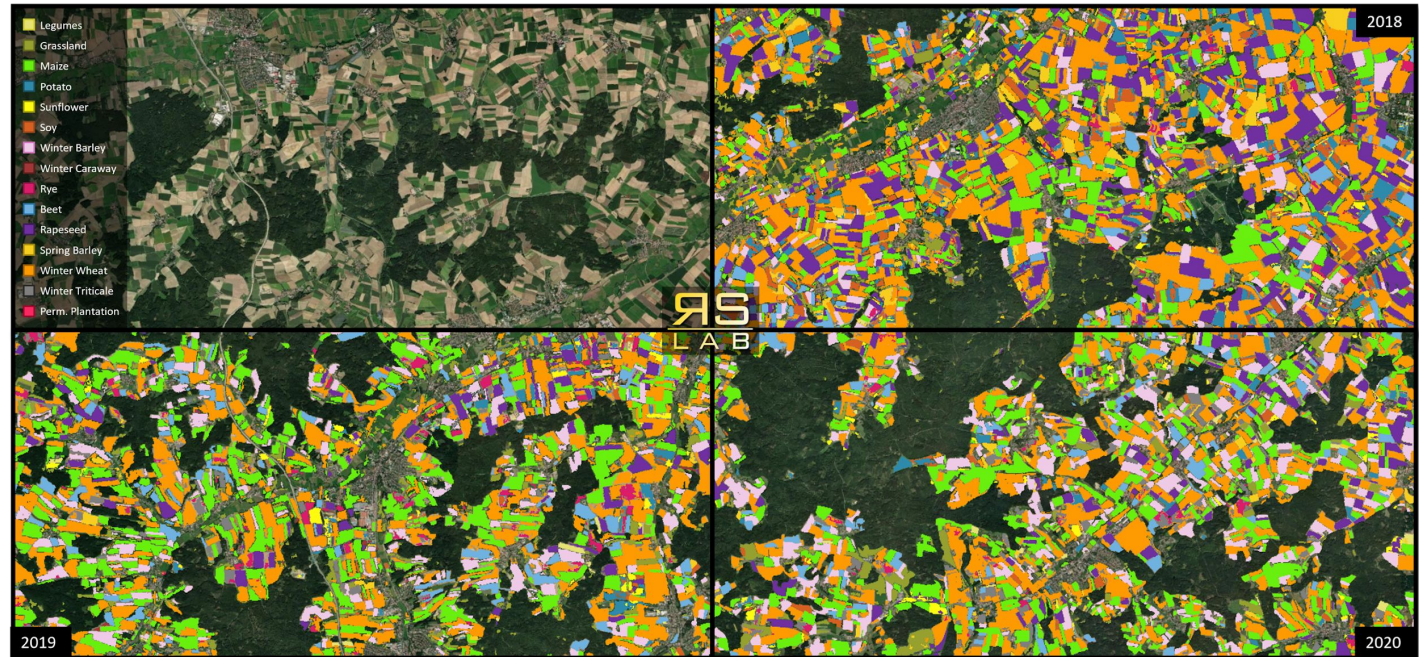
Promote sustainable
agricultural practices

Reduce land degradation, protect
biodiversity, promote sustainable land use

Promotes collaboration
among stakeholders

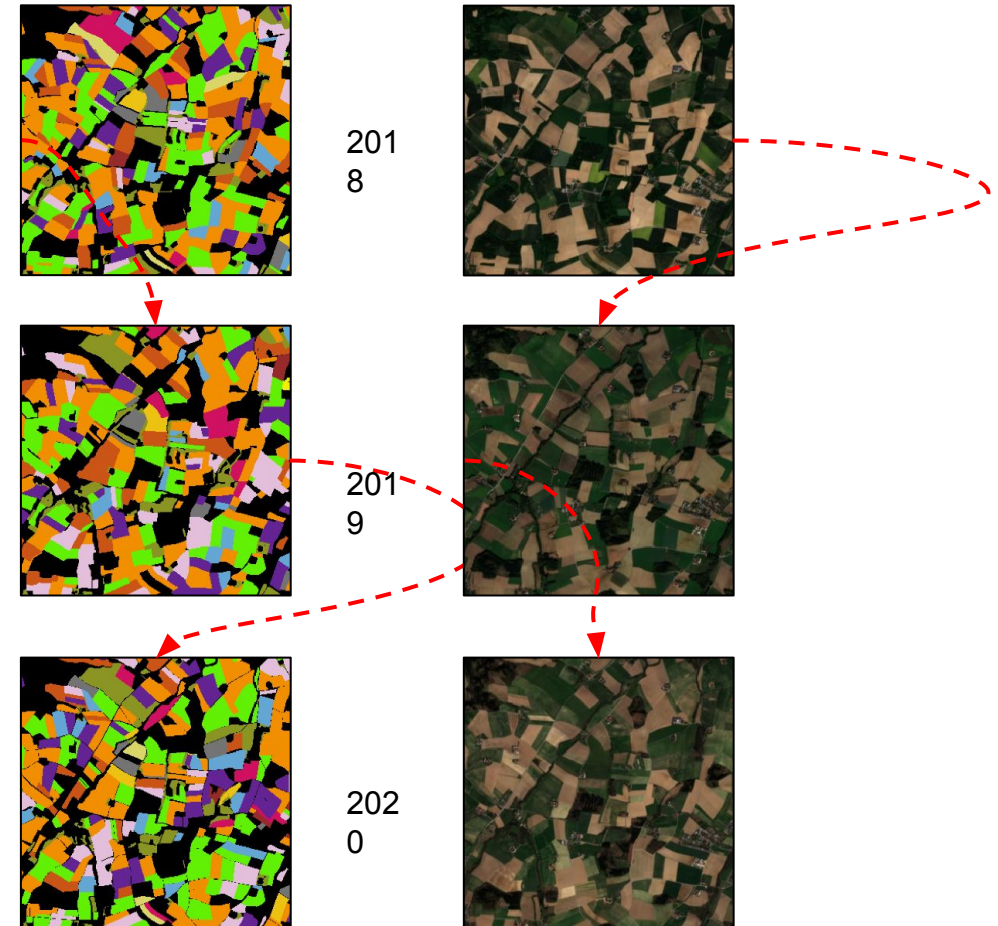
Crop type mapping

- What is **crop type mapping**?
 - Data collection
 - **Pre-processing**
 - Feature extraction
 - Supervised/Unsupervised **Classification**
 - Validation
 - **Visualization**

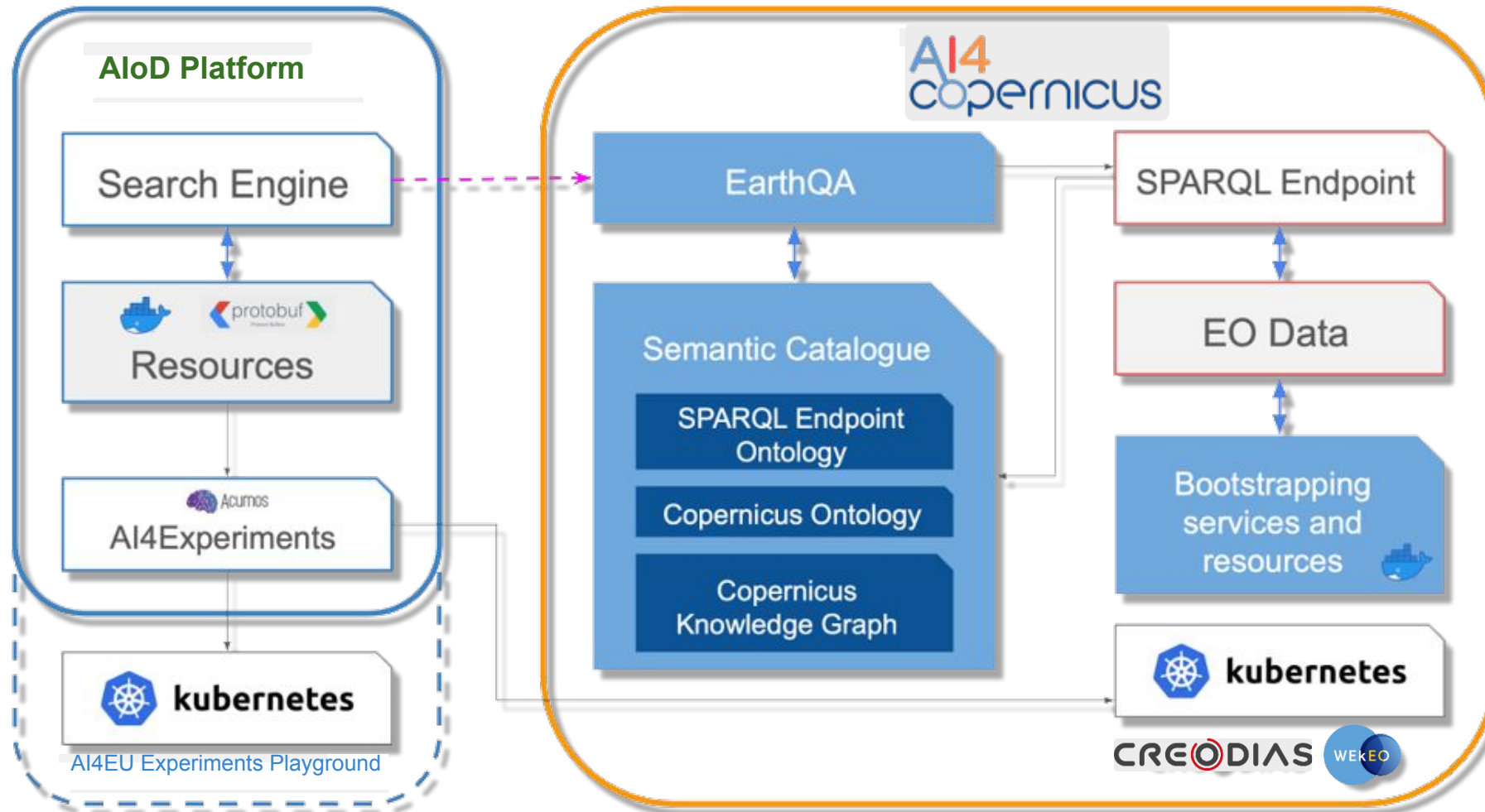


Challenges

- What are the **challenges**?
 - Spatial/**Temporal** resolution
 - **Cloud Cover** and Weather
 - Spectral Confusion
 - **Mixed Pixel**
 - **Spectral Variability** of crop types
 - Crop rotation
 - **Ground Truth** Data
 - Scale and Generalization



AI4Copernicus



The AI4Copernicus Effort



- AI4Copernicus aims at leveraging AI and the AI4EU platform for economic - and non-economic - value creation based on Copernicus data.
- Through CREODIAS and WEkEO, the users can access an environment where computational resources can be exploited for their applications.
- AI4Copernicus aims at addressing the challenges presented by:
 - Bringing together EO and AI experts
 - Pushing reusable AI methods and data products
 - Reaching integrators, innovators and developers
 - Proposing outreach and dissemination activities
 - Reinforcing the integration of AI4EU via the Open Calls
 - Reaching a wide variety of domains and different applications
 - Supporting the high-impact domains with bootstrapping services and resources
 - Contributing to the technology readiness of the AI4EU

Agriculture Bootstrapping Services

Resources

Sentinel-2 time series monthly composite techniques

Supervised classifier based on LSTM deep network [1]

LSTM for NDVI prediction

TimeSen2Crop: Large and detailed crop training set [2]

Deep network for pixel-level classification of S2 patches [3]

Scope

Harmonization of time-series through monthly composite approach.

Training and Classification based on Long-Short Term Memory (LSTM) deep network optimized for the analysis of time series of Sentinel-2 images.

Training and Inference based on Long-Short Term Memory (LSTM) deep network for the prediction of NDVI values in time series of Sentinel-2 images.

Large data set with crop-type labeled multitemporal samples for the training of deep learning architectures.

Training of a custom pixel-level classifier of Sentinel-2 patches based on a U-Net model.

Pre-requisite

Sentinel-2 (Level2A) time series

Sentinel-2 (Level2A) time series

Sentinel-2 (Level2A) time series

N/A (produced in the H2020 ExtremeEarth project)

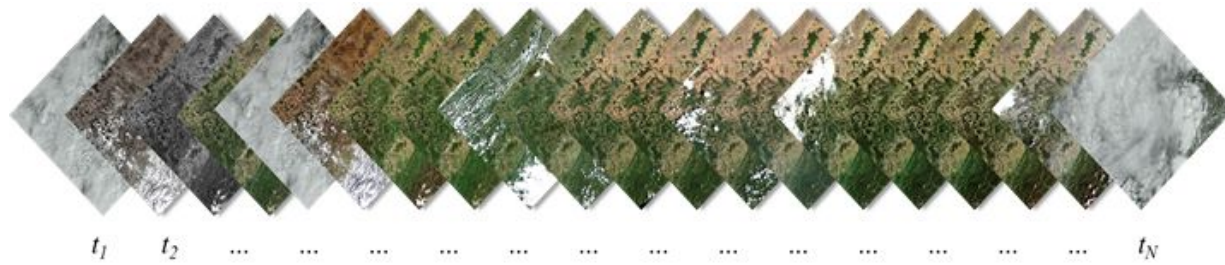
Sentinel-2 (Level2A)

[1] Claudia Paris, Giulio Weikmann, & Lorenzo Bruzzone (2020). Monitoring of agricultural areas by using Sentinel 2 image time series and deep learning techniques. In *Image and Signal Processing for Remote Sensing XXVI* (pp. 115330K). SPIE.

[2] G. Weikmann, C. Paris and L. Bruzzone, "TimeSen2Crop: A Million Labeled Samples Dataset of Sentinel 2 Image Time Series for Crop-Type Classification," in *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 14, pp. 4699-4708, 2021, doi: 10.1109/JSTARS.2021.3073965.

[3] Ciocarlan, A.; Stoian, A. Ship Detection in Sentinel 2 Multi-Spectral Images with Self-Supervised Learning. *Remote Sens.* **2021**, *13*, 4255. <https://doi.org/10.3390/rs13214255>

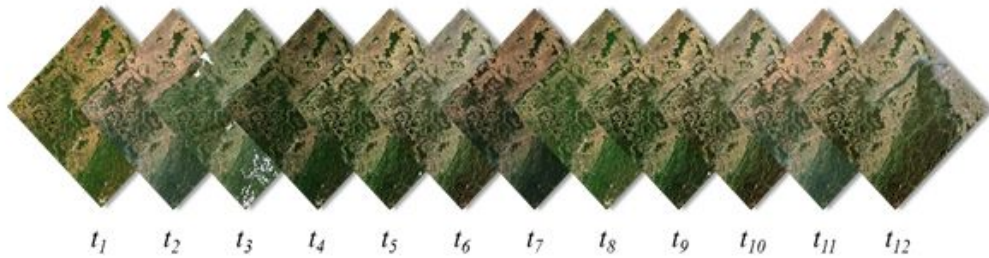
Pre-processing (Monthly Composites)



Time Series of Sentinel 2 images



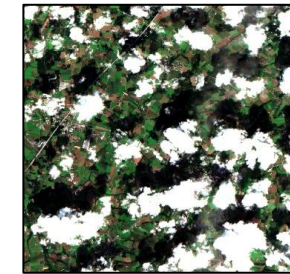
Optical Pre-Processing
Time Series Harmonization



Time Series of 12 Monthly Composites



08th September
2017



18th September
2017



23rd September
2017

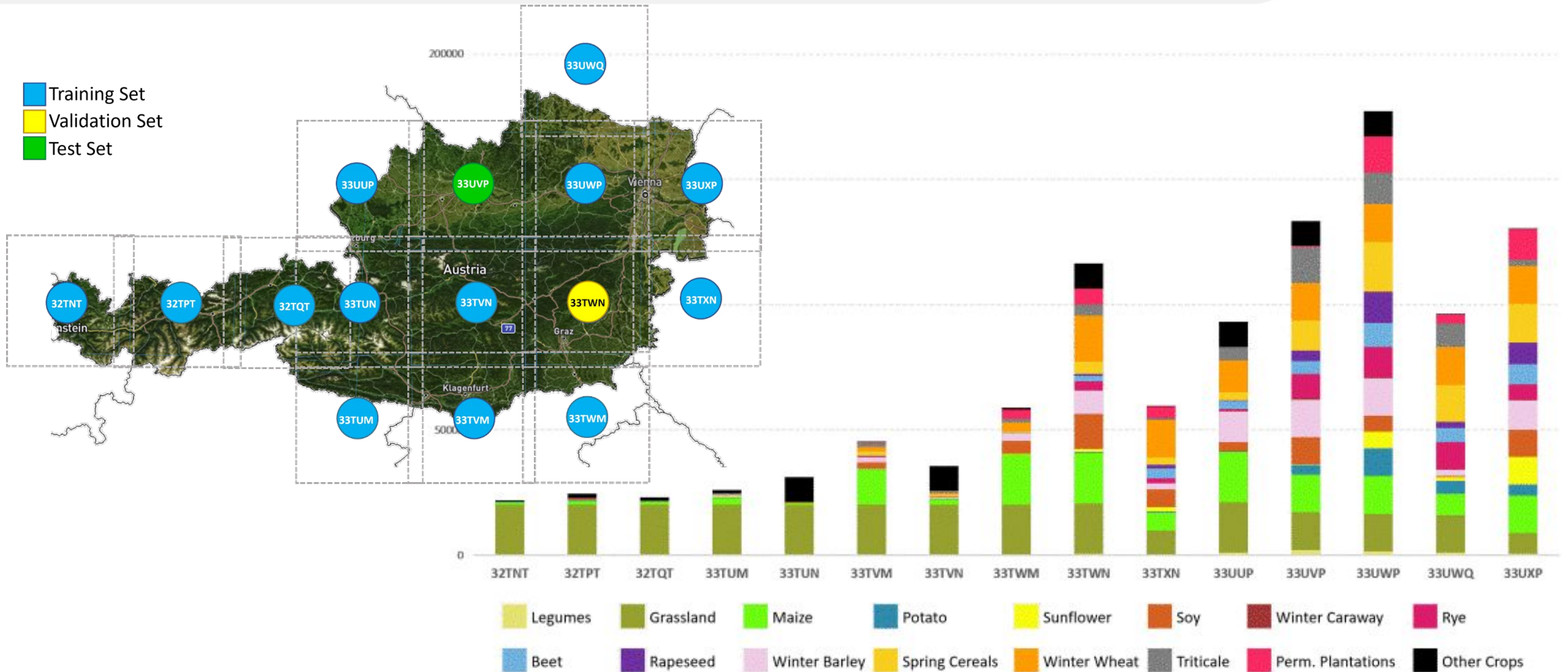


28th September
2017



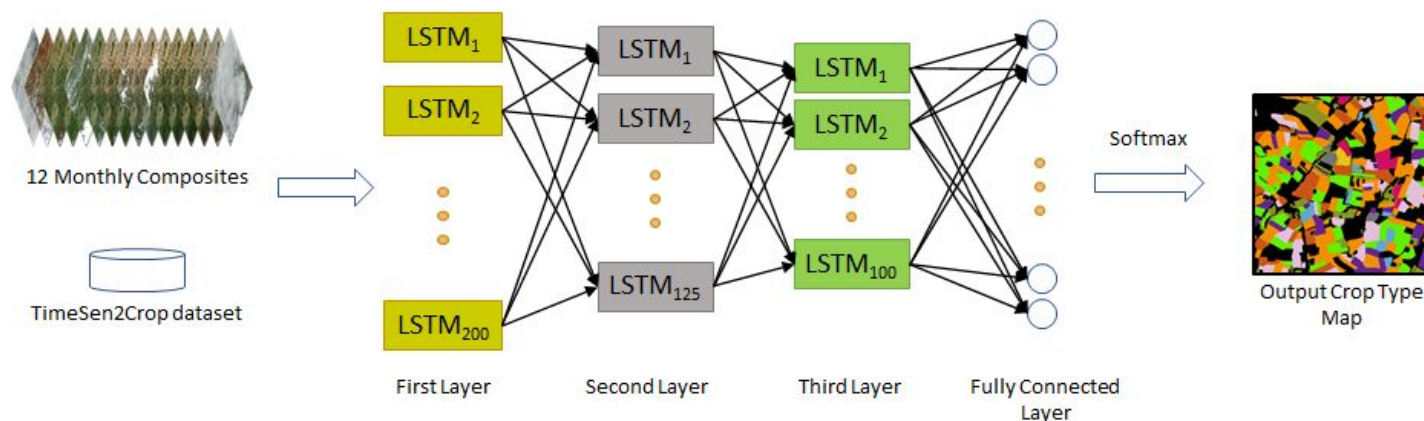
Monthly Composite
September

TimeSen2Crop



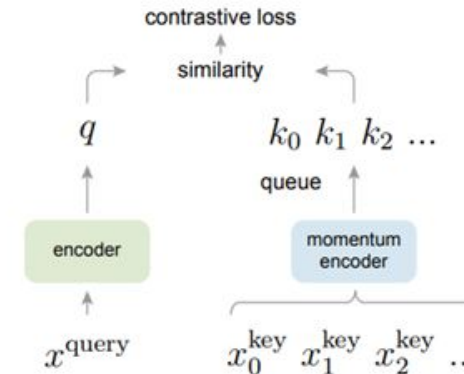
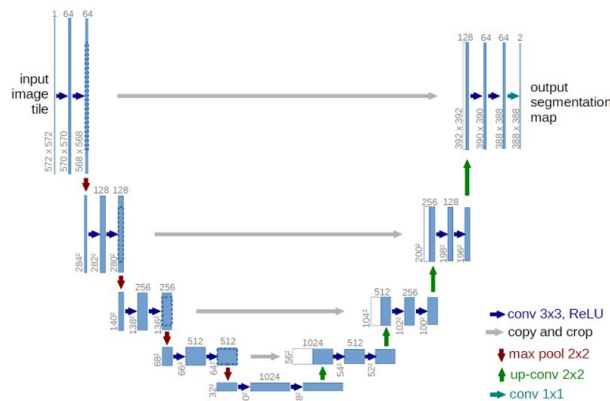
Long Short-Term Memory NN

- Pre-trained and trainable LSTM available.
- Pre-trained network trained on TimeSen2Crop dataset.
- An LSTM for the NDVI prediction is also available.
- The network has been trained on a time series of 12 monthly composites.



Deep Network for pixel-level classification of S2 patches

- Based on a modified U-Net for multispectral images.
- Fully customizable.
- Multi-label segmentation.
- Pre-trained backbone available (self-supervised), trained on a huge number of unlabeled images based on a siamese approach.



Thank You!

Any Questions?

