

SMAIL – Super-Resolution-Based Monitoring through AI for Small Land Parcels

The goal of *SMAIL* is to overcome the limitations of **monitoring small-structured agricultural land** in remote sensing applications, especially for the monitoring of ecological cultivation processes, caused by the limited spatial resolution of freely available Copernicus Sentinel-2 time series.

This will be achieved using **AI-assisted super-resolution reconstruction**, which processes imagery from the Sentinel-2 satellites in their native resolution (up to 10 m) into high-resolution output imagery while preserving the multispectral information.

A research prototype will be **integrated into existing agricultural monitoring workflows** to evaluate the effectiveness of the approach for agricultural management tasks.

Such a newly developed AI-assisted monitoring pipeline for agricultural parcels enabling the monitoring of ecological cultivation processes is needed to **shift to a more sustainable system of agricultural production** that minimizes farming's environmental footprint and to protect and sustain nature within the European Green Deal.

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Project partners: Paris-Lodron-Universität Salzburg, Fachbereich Geoinformatik – Z_GIS
EOX IT Services GmbH
Agrarmarkt Austria

Project duration: 01.05.2022 – 30.04.2024



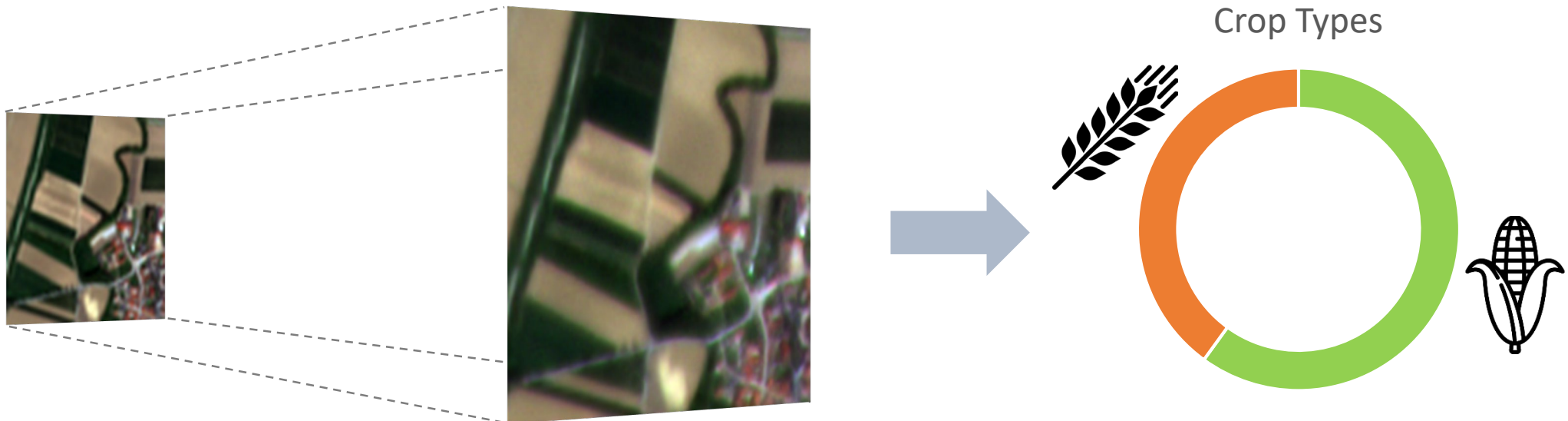
Goals

- Support mandatory satellite monitoring of agricultural areas in EU
- Overcome problem of small parcels (**one third** of all parcels in Austria)
- Use freely available Sentinel-2 satellite imagery with 10 m resolution



Tasks

- Develop neural network solutions for **multispectral super-resolution reconstruction**
- Train with PlanetScope satellite imagery (2.5 m, 4 spectral bands), 2–5 diverse regions in Austria, entire year 2021
- Evaluate spectral quality and increase the classification rate
- Integrate the developed solutions into operational systems and workflows



Parcel polygon



640 m

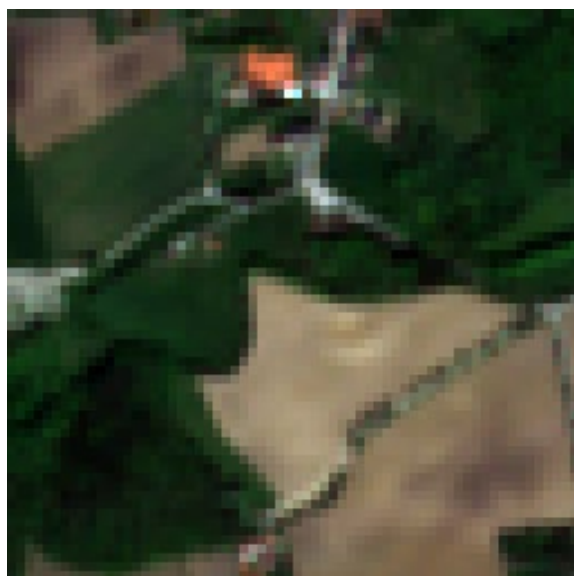
Sentinel-2 (10 m)



PlanetScope (2.5 m)



SRR result



Challenges

- Choosing the right training setup and objective
 - Fully Convolutional (FC) training with reconstruction loss
 - **GAN training with reconstruction and adversarial losses**
- Super-resolving spectral bands without high-resolution ground-truth
- Guidance of the super-resolution training by the classifier of the monitoring system

