Sen4MaCro: In-season crop type classification for Germany using analysis-ready Sentinel-2 data on CODE-DE

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Introduction

Numerous agricultural remote sensing applications are based on the information: "Which crop type grows where?".

However, previous large-scale classification studies are retrospective, although many applications (e.g. crop yield estimation, see poster BRANDT et al. at this event) could be done in near real-time -with in-season classifications.

Therefore we develop a hierarchical multi-layer approach**, Sen4MaCro** (**Sen**tinel **for Map**ping **Cro**ps), to classify main crop types for Germany during the running growing season using Copernicus' Sentinel-2 data.

In order to scale the approach to national level, we have utilized our cloud-integrated spatial data infra-structure at JKI which leverages the EO platform CODE-DE (BEYER et al. 2023). An analysis-ready (ARD) Sentinel-2 datacube (S2_GermanyGrid) for Germany was established which is continuously supplemented with the latest data.

Approach

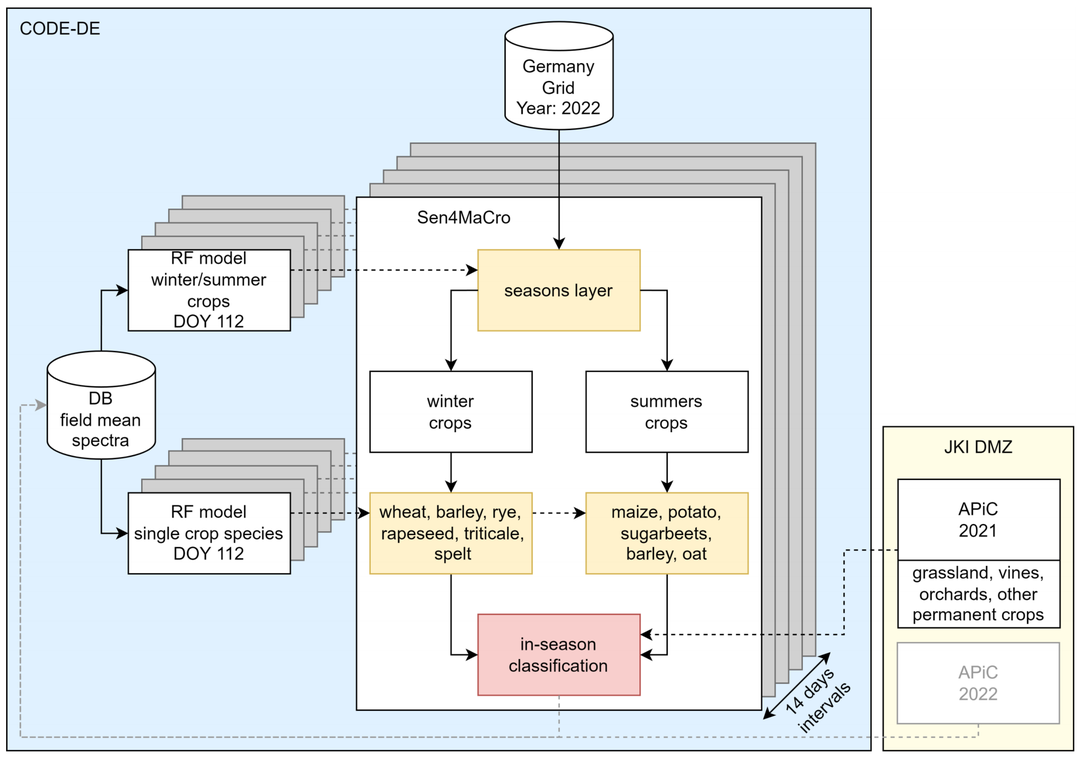
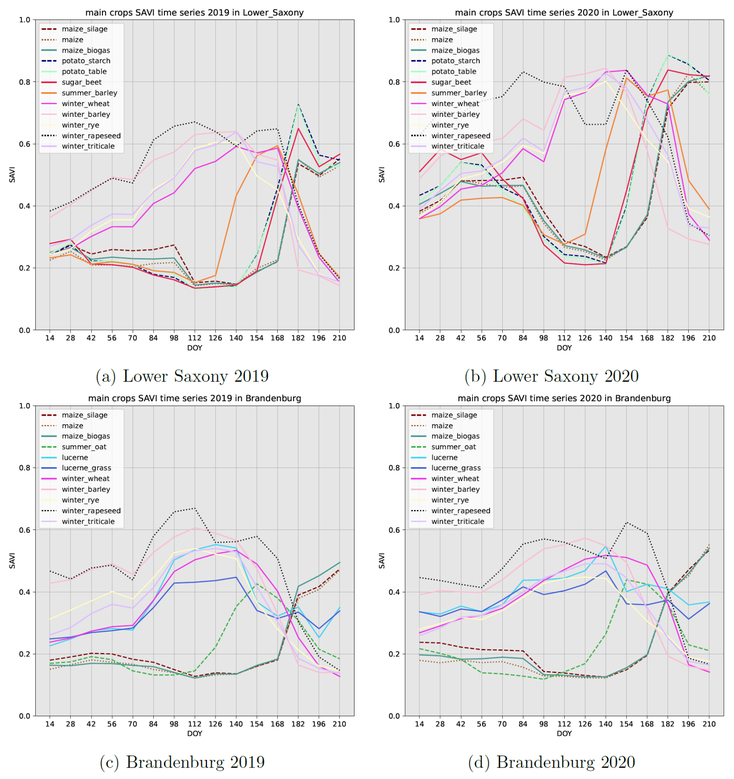


Fig 1. Principle workflow of Sen4MaCro to classify main crop types in-season (RF = Random Forest, APiC = post-season crop type classification from PREIDL et al. 2020).

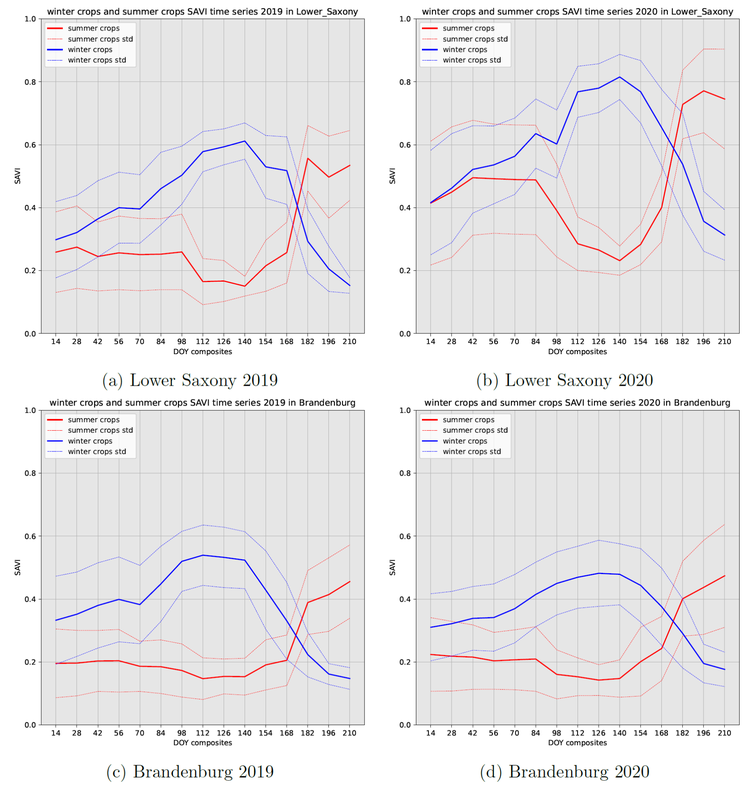
Results



(a) Lower Saxony 2019 (b) Lower Saxony 2020

(c) Brandenburg 2019 (d) Brandenburg 2020

Fig 2. 14-days composites of averaged SAVI time series of Lower Saxony and Brandenburg from two years 2019 and 2020 of main crop types (more than 1% area share of total agricultural area) based on IACS data (EC 2023).



(a) Lower Saxony 2019 (b) Lower Saxony 2020

(c) Brandenburg 2019 (d) Brandenburg 2020

Fig 3. 14-days composites of averaged SAVI time series aggregated to spring and winter crops with standard deviation (std).

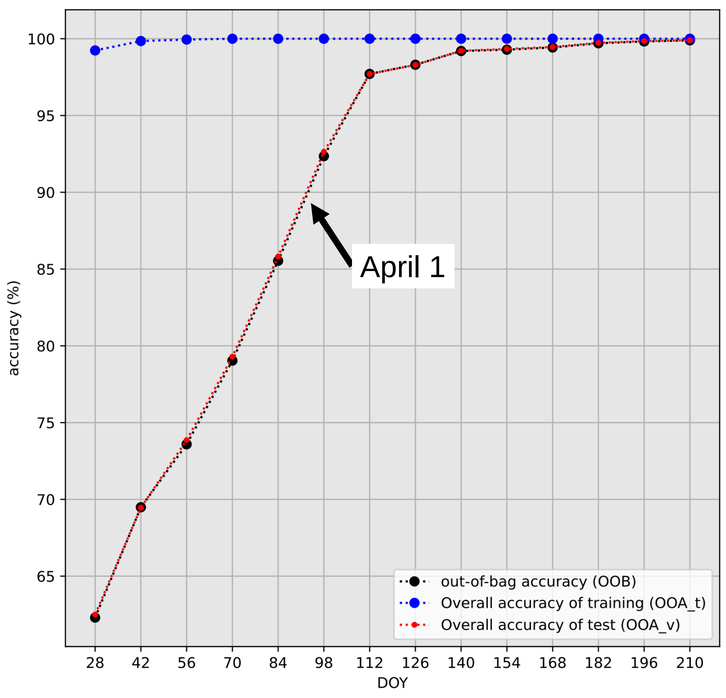


Fig 4. Overall classification accuracy (RF, 500 trees) of the Seasons Layer for distinguishing spring and winter crops based on the 14-day SAVI composites.

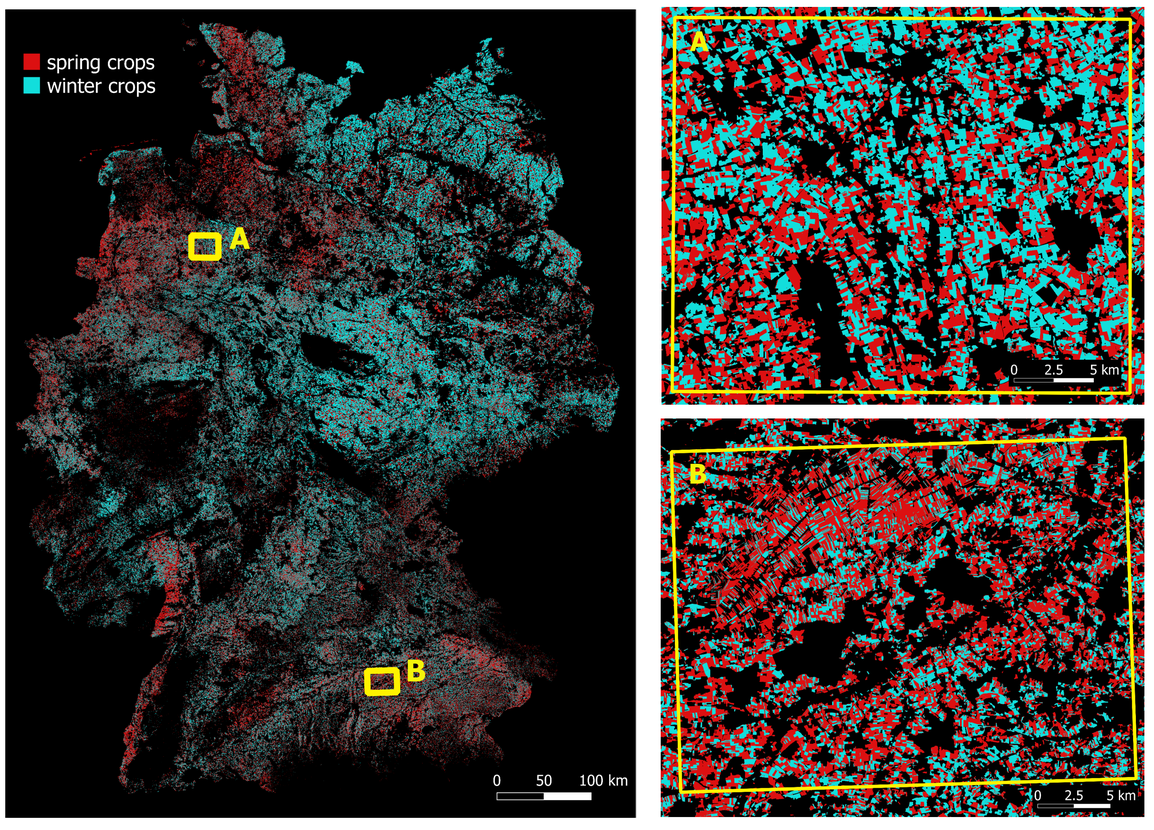


Fig 5. Seasons Layer: classification results of 2021 based on models trained with data from 2019 and 2020.

Conclusions

- 14 days compositing of ARD S2_GermanyGrid (published soon) data show reliable classification results to differentiate between spring and winter crops (> 90% as of April 1)
- Next layer level differentiates between individual crops and cereals for both spring and winter crops. First results show OOA > 85% from the beginning of June.

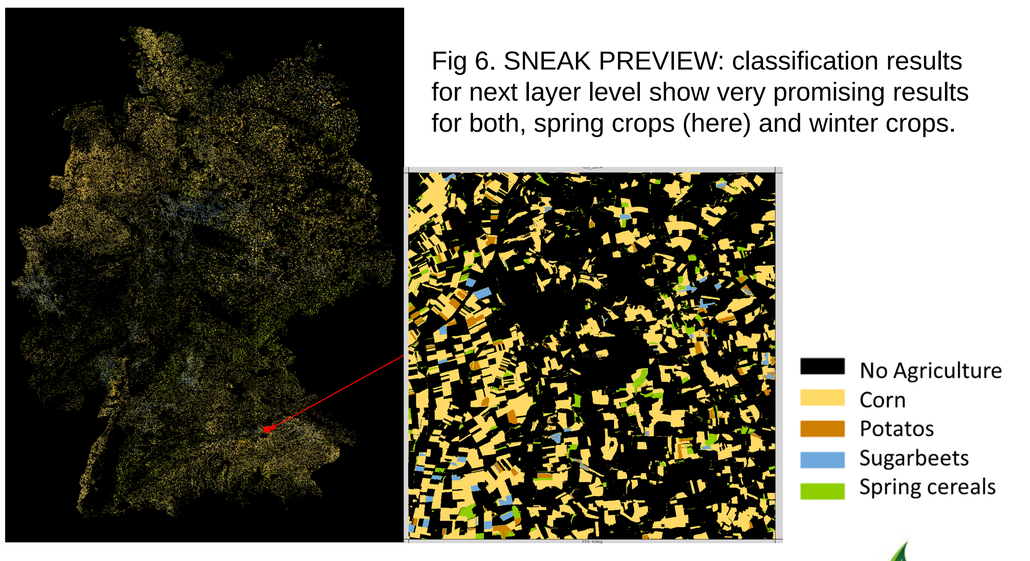


Fig 6. SNEAK PREVIEW: classification results for next layer level show very promising results for both, spring crops (here) and winter crops.

BEYER, F., BRANDT, P., SCHMIDT, M., STAHL, U., GOLLA, B., GERIGHAUSEN, H., & MÖLLER, M. (2023). A paradigm shift towards decentralized cloud-integrated spatial datainfrastructures: Lessons learned and solutions provided for public authorities (preprint). Eartharxiv.Org, 1–33. https://doi.org/10.31223/X53H3N

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