

FAIRagro use case

„Non-invasive phenotyping with autonomous robots“

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Cluster of Excellence PhenoRob: Robotics and Phenotyping for Sustainable Crop Production



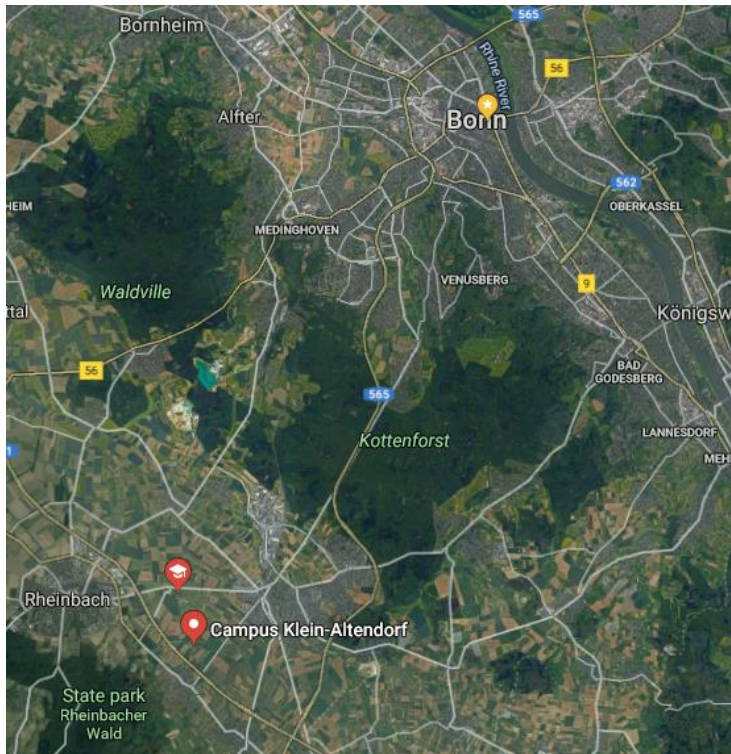
Use Case 5: „Non-invasive phenotyping with autonomous robots“

Overarching agricultural research question:

- How to **increase precision** of field interventions (weeding, fertilizing, ...) to achieve more **sustainability** in crop production?

Technological challenges:

- How to achieve **autonomous multi-sensor field robots** for **non-invasive plant phenotyping tasks**?
(E.g.: differentiation of weeds and crops, early detection of stress symptoms)
- Which combination of **sensors** and **algorithms** is optimal for detecting relevant **plant traits**?
 - sensor fusion
 - multi-modal machine learning



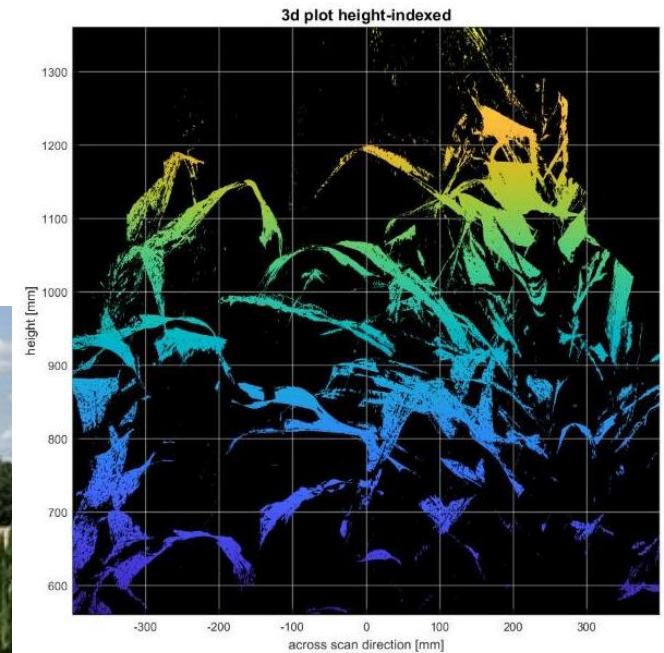
PhenoRob Central Experiment



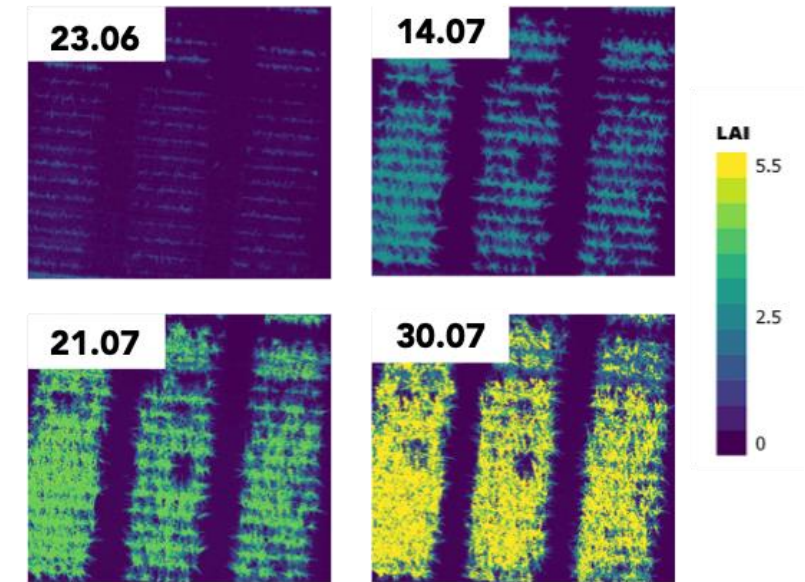
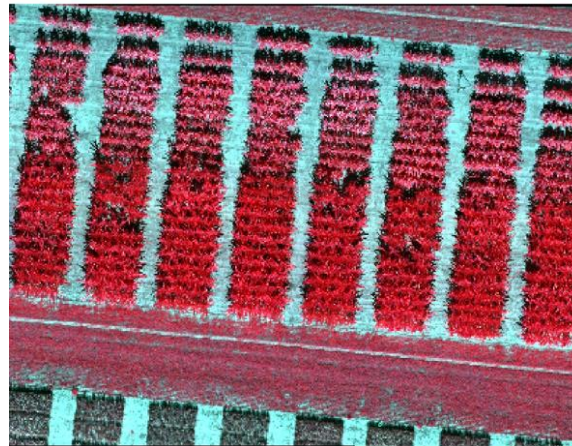
- Enabling an unmanned ground vehicle (UGV) to measure plant structure in the field.



- 3-d plants with multi-color Plant-Eye on the FieldSnake (MSc project of Lars Zinken, supervised by Onno Muller)



- Imaging spectroscopy from UAVs to retrieve biochemical and functional plant traits (PhD project of Erekle Chakhvashvili; PI: Uwe Rascher)



Maps of Leaf Area Index of maize canopy; PhenoRob Central experiment

- Spectral electrical impedance tomography (sEIT) in corn and sugarbeet (Valentin Michels & Andreas Kemna)

Build suitable cable construction for mobile sEIT setup



Shielded, customized cables

- plant phenotyping
- agricultural robotics

- plant, field, farm, region

- **harmonized data layers** that can be combined in a flexible way for different types of analyses
- appropriate **query interfaces and web services**
- **aggregated and simplified data views** (e.g., heat maps) for **on-site data visualization**
- explicit linkage of such views with **detailed representations** (e.g., 3d plant models)
- **reuse of data** acquired by agricultural field robots, e.g., by crop breeders

Was existiert bereits?

data management infrastructure for research data within the PhenoRob project

- based on open-source software GeoNetwork (web-interface, file system for research data, metadata, user and group management)
- metadata schema developed based on MIAPPE, Dublin Core
- for now only project intern and for project partners
- in future: access for externals; datasets published with DOIs; upload only for PhenoRob members

Was wird im Use Case realisiert (outcomes)?

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services that are reusable for other projects

