Multisensory model for early detection of Cercospora leaf spot in sugar beet based on UAV multispectral imaging, epidemiological and micrometeorological data

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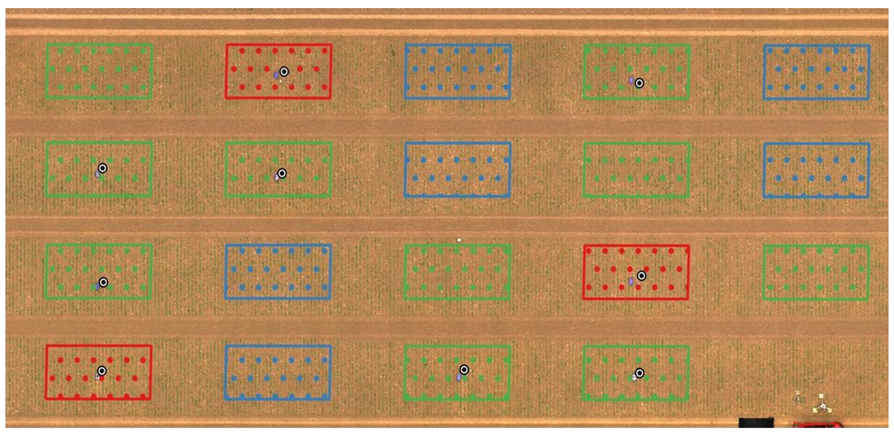
Field experiments

- 4 years of experiments (2019-2022)
- 3 locations
- 3 types of experiments
  - ❖ Variety trial
  - ❖ Measurement with stationary Iot-sensors and spore traps
  - ❖ Large scale trial



Control | Inoculated and treated with fungicide | Not inoculated and not treated with fungicide | Sensors and spore traps

* Micasense

UAV + RGB / multispectral camera

Expert scoring

IoT-Microweather Sensors

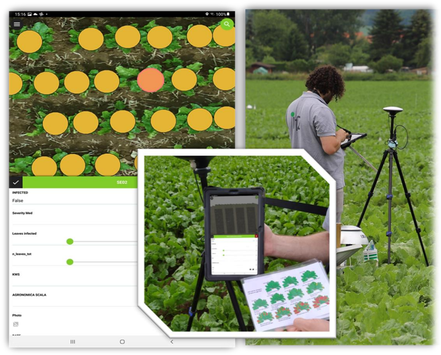
Spore Traps

Ground truthing

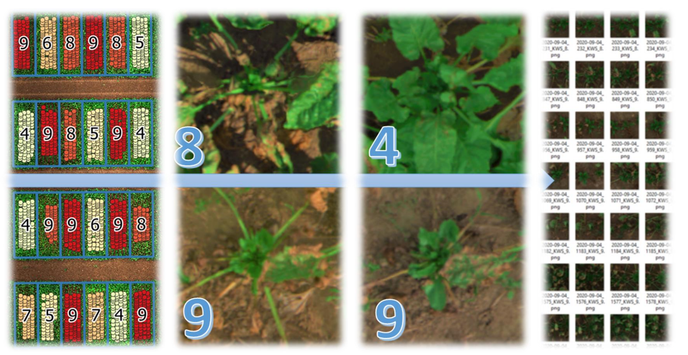
- Weekly field data collection
- Digital georeferenced scoring
- Digital cataloguing of plants
- Extrapolation of the real annotations to each plant

* Günder et al.: "Agricultural Plant Cataloging and Establishment of a Data Framework from Crop Images.

Digital score



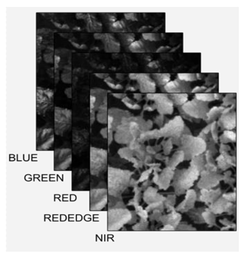
Digital field annotations

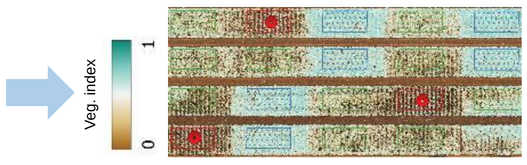


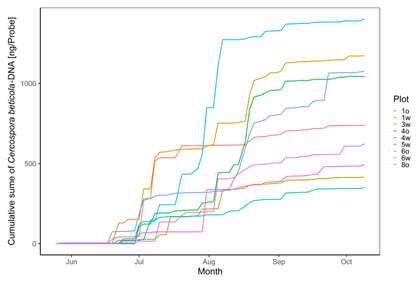
Annotations and cataloguing plants

Data preprocessing

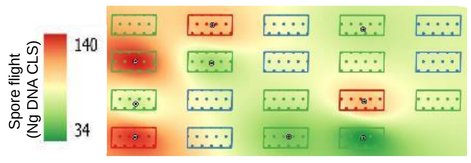
- Transformation of each dataset into a layer for the model
- Additional indices are derived from each dataset
- More than 30 layers/features have been generated





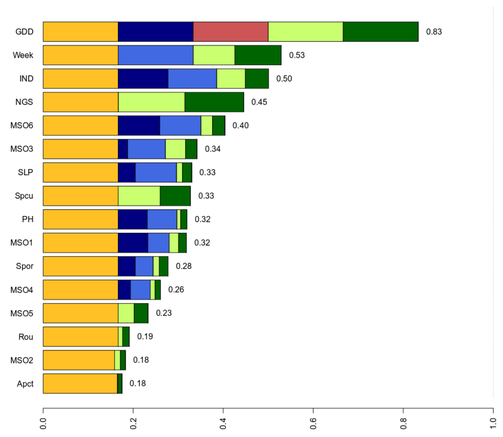


Cumulative sume of spore-DNA

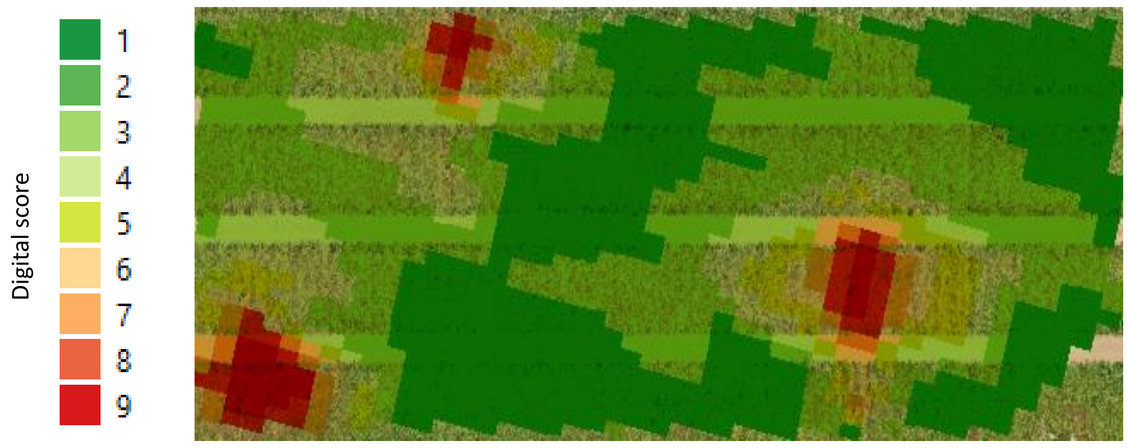


Results

- Selection of the most important features
- Discard the features that generate bias
- Testing of different machine learning models
- Training of models for catalogued plants and at pixel level



Ensemble Feature Selection



Result of the model generated with the use of the 10 most important features

Conclusions

- **Biotic and environmental factors are important to better understand plant response to disease infection.**
- **It is possible to drastically reduce model computation time by discarding variables that are highly correlated with each other or that contribute little to the models.**
- **It is possible to determine in maps generated with UAV the most affected areas.**
- **This work is the first step towards the generation of a model that allows the integration of optical and environmental data for detection.**

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