Optimizing hyperspectral indicators for stress detection in orchards

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- OSTC-project Hypercrunch
- Partners: RUCA (Antwerp), VITO (Mol)
- Aim reduction dimensionality hyperspectral data → provide generic tool for optimal band selection
Experimental testsites

- **Apple orchards** (Golden, Jonagold)

- **Different stresses:**
  - Fungi (scab)
  - Virus (CLS)
  - Nutrient stress (N-stress)
  - Aphids (red apple aphid)
  - Bacteria (Fire blight, pear)

- **Three different sample data:** June, August, September
Measurements

- **Leaf measurements:**
  - Li-Cor 1800-12S
  - 350 – 1650 nm

- **Canopy measurements**
  - Cherrypicker → ASD and GER

- **CASI-SWIR airborne campaign**
  - Pixel resolution: 0,98 m x 2,37 m
  - CASI 96 bands 400-950 nm
  - SWIR 160 bands 850-2500 nm
Data analysis and methodology

- Only on leaf reflectance up to now
- Features are wavelengths
- Explorative analysis: subtraction of mean reflectance values of stressed and unstressed leaves
- Statistical analysis: non-parametric test → logistic regression analysis
  - Single wavelengths
  - Combination of wavelengths e.g. SDVI
Results

Reflectance difference

Wavelength

JNR-JN
GMR-GM

Wavelength

400 600 800 1000 1200 1400 1600

0 0.01 0.02 0.03 0.04 0.05
Results
Results

![Graph 1](image1)

![Graph 2](image2)
Results

Significance for stress detection with SDVls (JN3030)

Significance for stress detection with SDVls (JN3029)
Results

Significance for stress detection with SDVIs (GM2830)

Significance for stress detection with SDVIs (GM2930)
Conclusions and future objectives

- Reflectance between stressed and unstressed leaves clearly different

- Spectral regions were specific to a stress or disease → corresponded to biophysical assumptions

- Able to distinguish between different stress types

- Able to predict performance of traditional vegetation indices e.g. SDVI

- Upscaling to tree-level and airborne data