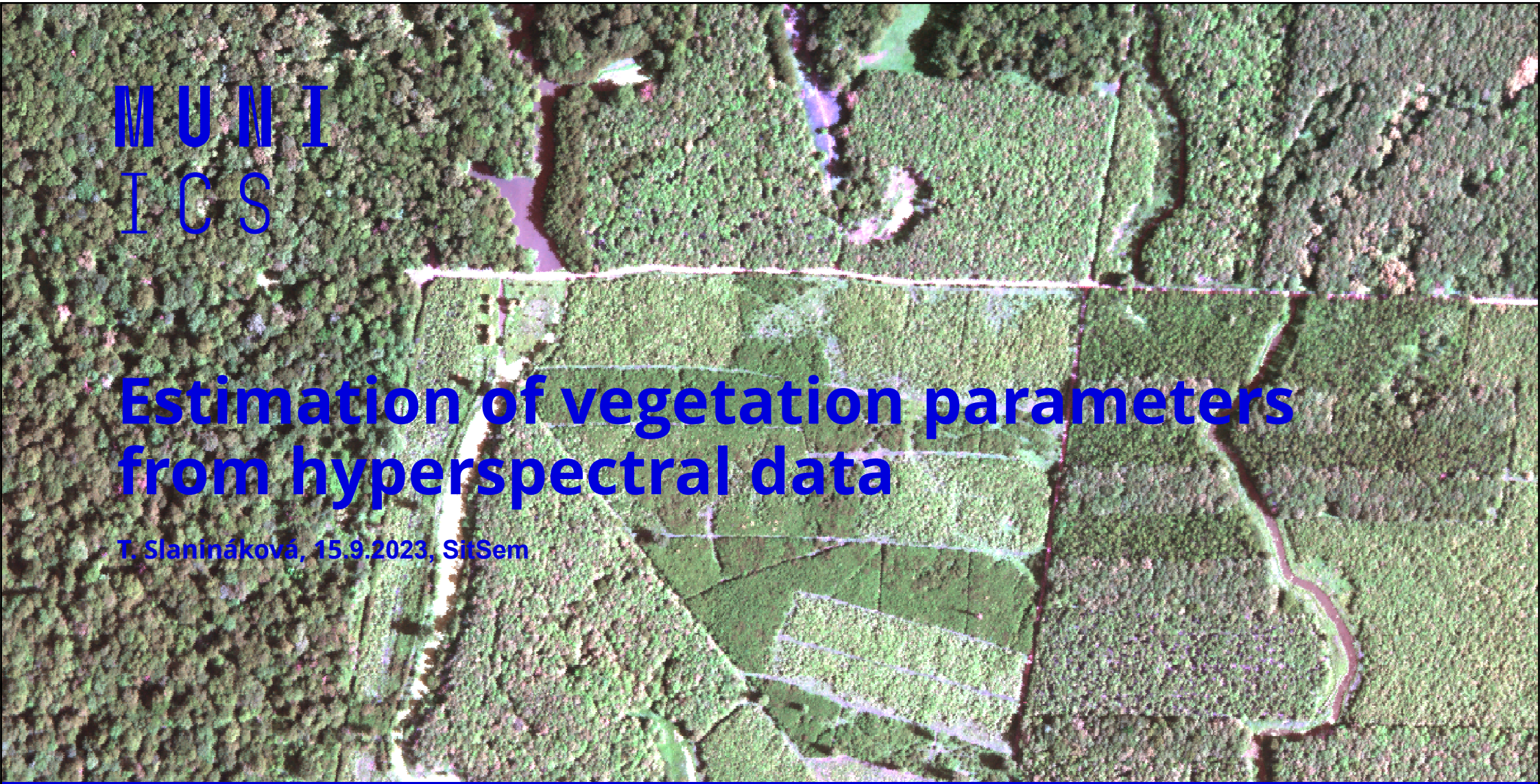


MUNI
ICS

Estimation of vegetation parameters from hyperspectral data

T. Slaninákova, 15.9.2023, SitSem

Context

EnviLab: Platform for providing data, visualizations and analyses of ecosystems in CZ

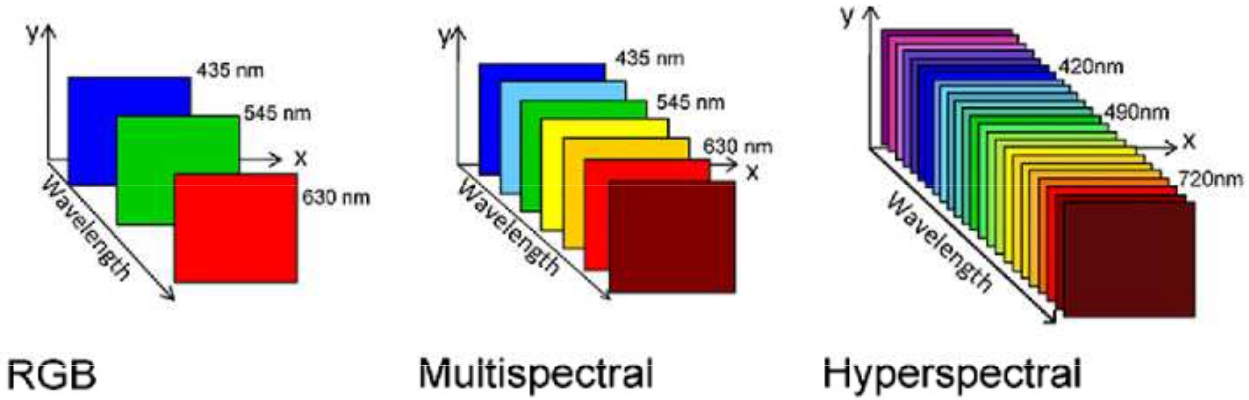
- Why?

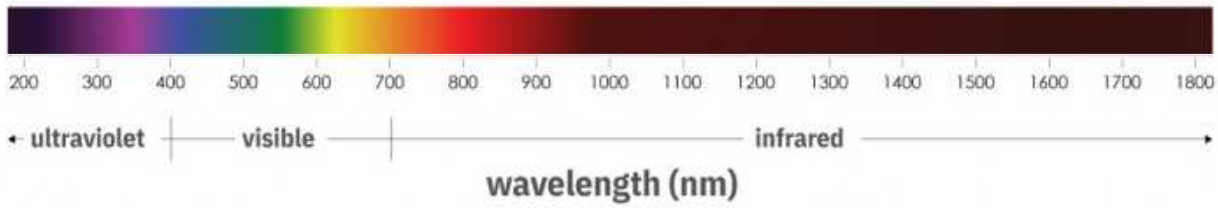
Features:

- Aggregating and providing geo data from remote sensing via Web, API
- Hosting visualizations, analyses, and results of various research groups
- Providing data analyses
  - Analysis/visualization of bark beetle's reproduction/spread over Czech forests
  - **Vegetation parameters**

Context

- Lots of *multi/hyperspectral* data from remote sensing

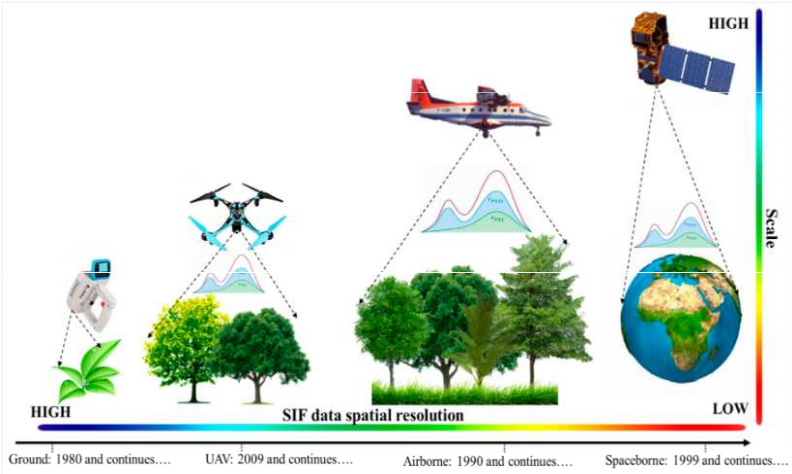




Source: Single-Cell Analysis Using Hyperspectral Imaging Modalities.

Context

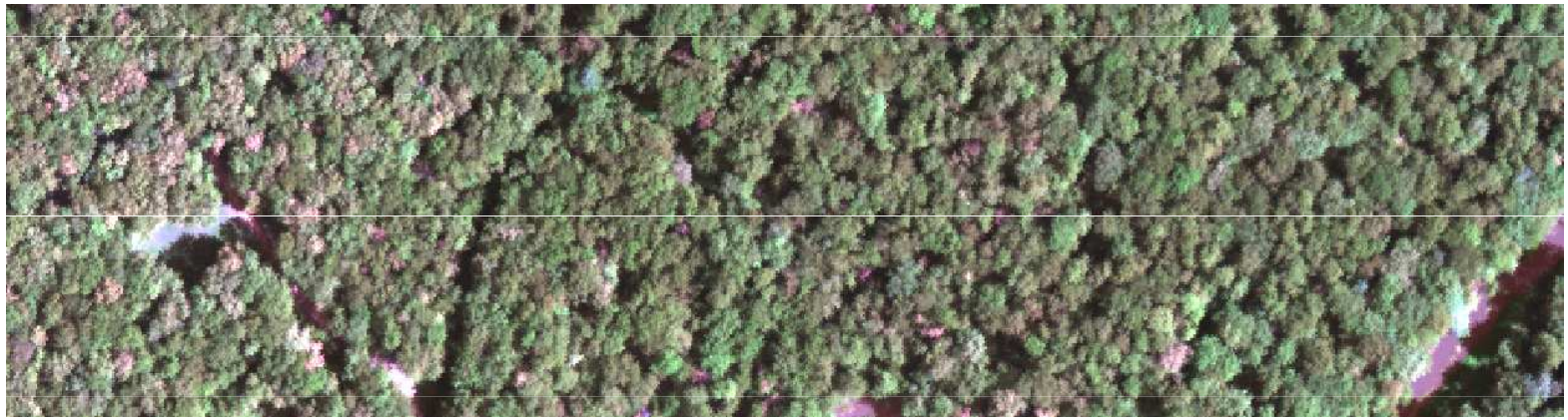
- Lots of multi/hyperspectral data from remote sensing
  - ESA – Sentinel 1,2,3,5P missions (program COPERNICUS)
    - Many more data sources in the future (FLEX ‘25, CHIME ‘28)
  - CzechGlobe (CAS) – Airborne missions
  - Use of such data:
    - Mining/geology
    - Urban land-use mapping
    - Agriculture: health of the crops
    - Vegetation analysis



Review of Top-of-Canopy Sun-Induced Fluorescence (SIF) Studies from Ground, UAV, Airborne to Spaceborne Observations

Context

- Monitoring the health of forests through assessing **vegetation parameters**
  - Why:
    - Interesting for CzechGlobe, foresters
    - Attractive for us as a nice use case for EnviLab
    - Interesting research problem with active scientific community



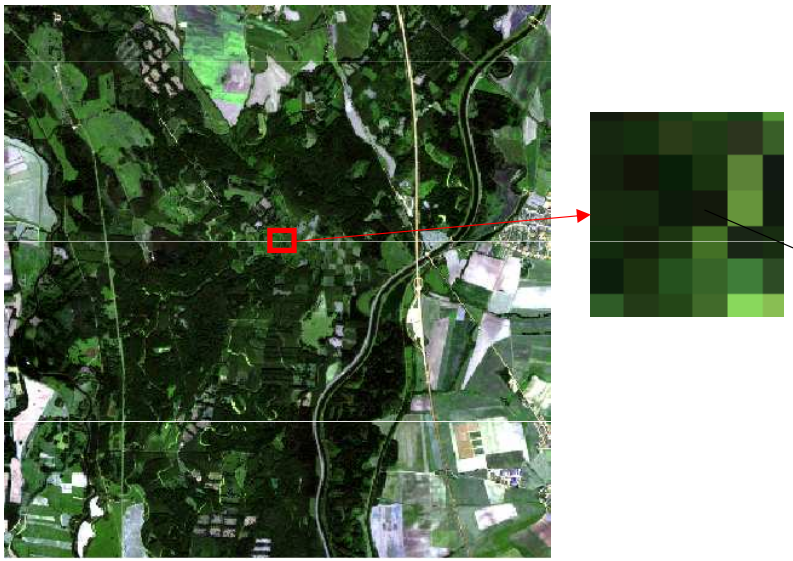
Outline

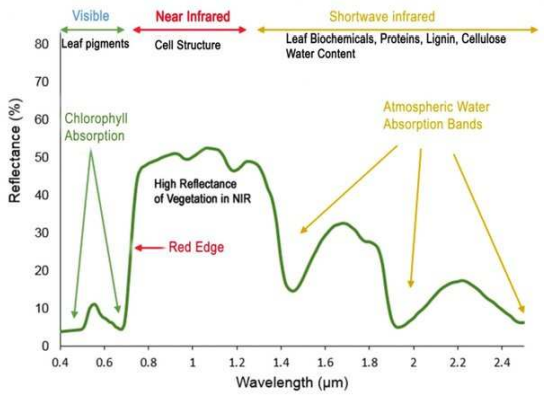
1. Context
2. Problem definition
3. Approach
4. Results
5. Next steps

Problem definition

- Given data from remote sensing (satellite, airborne) train a model to predict vegetation parameters

Data





Problem definition

- Given data from remote sensing (satellite, airborne) and simulated spectra, train a model to predict vegetation parameters

Data

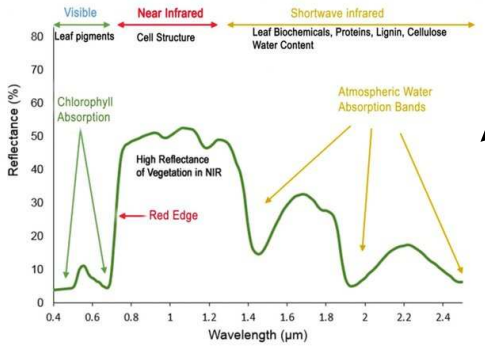
Simulated spectra

Vegetation parameters

LAI	Cab	Car	Cm	Cw
10	5.925077	4.305555	0.015740	0.009335

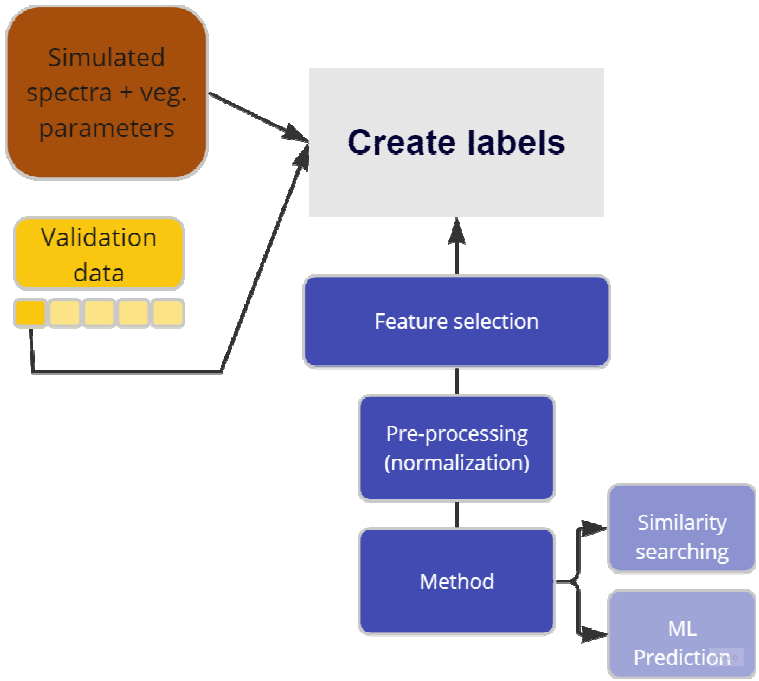
Spectra

	0	1	2	3	4	5	6	7	8	9	10	11	12	...
0	0.443930	0.496540	0.560010	0.664450	0.703890	0.74022	0.78247	0.83511	0.86480	0.94503	1.373500	1.613700	2.202400	...



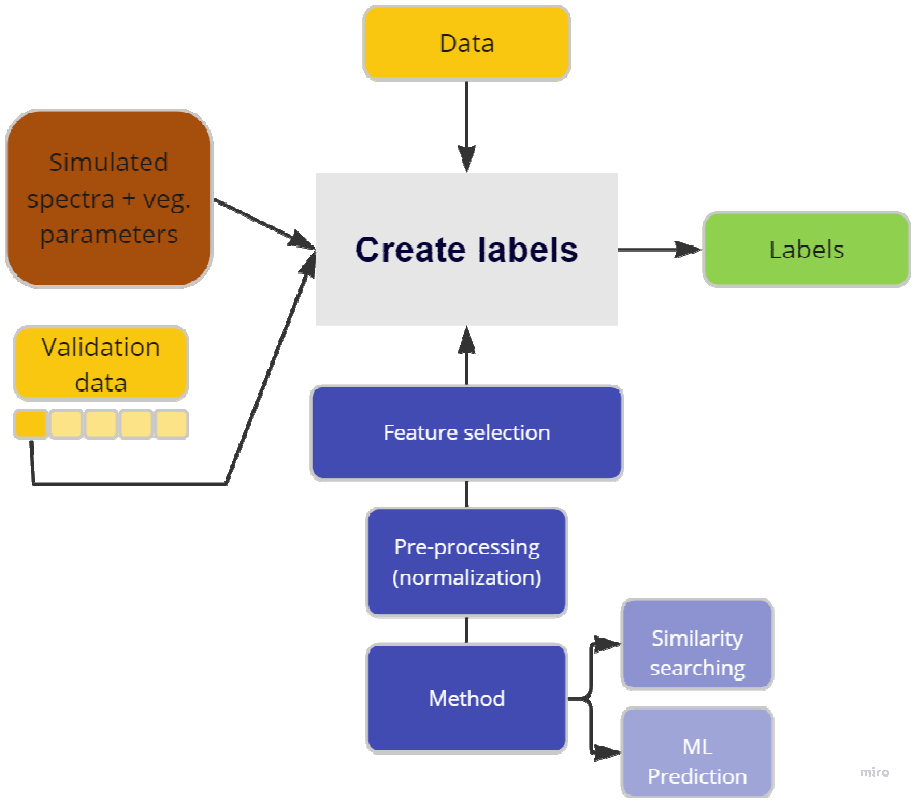
Approach

Our approach



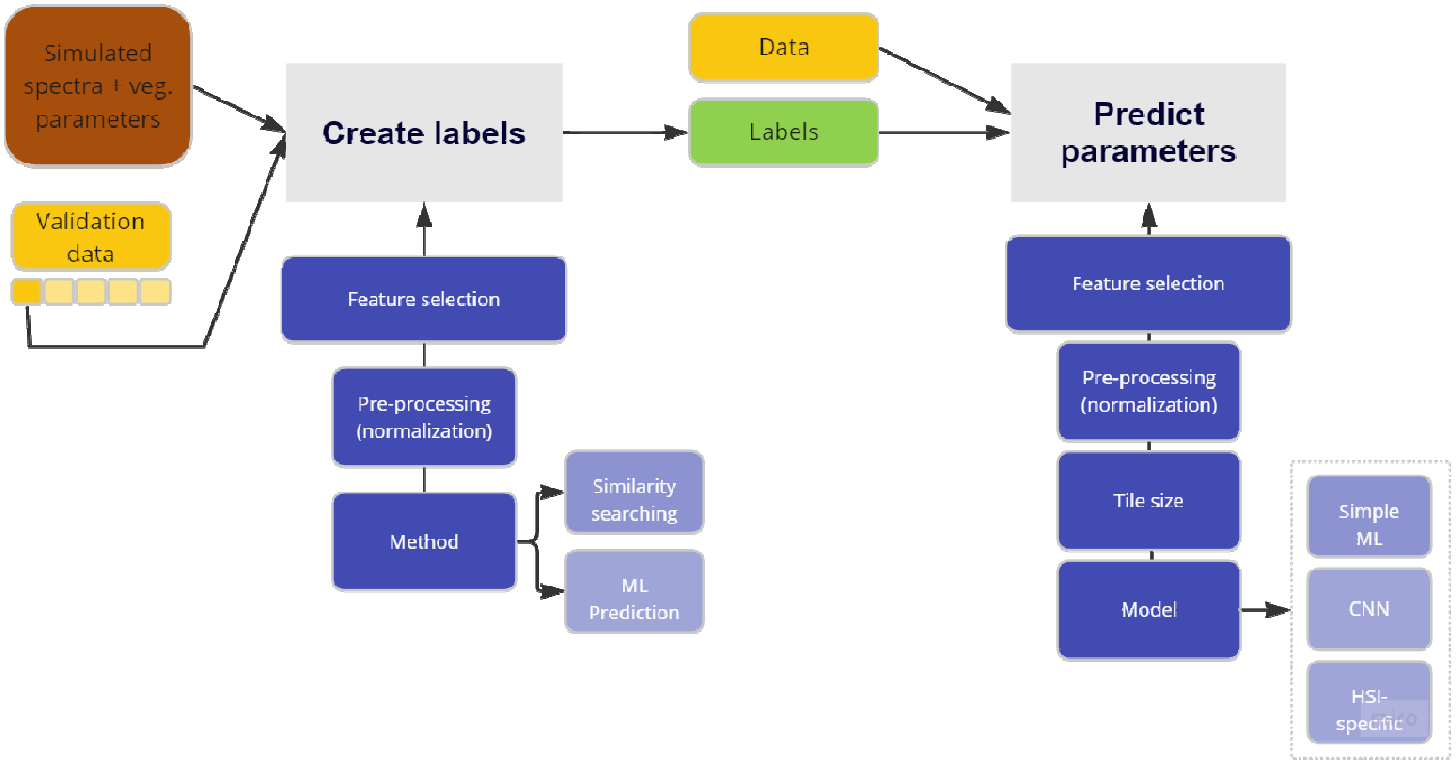
Approach

Our approach



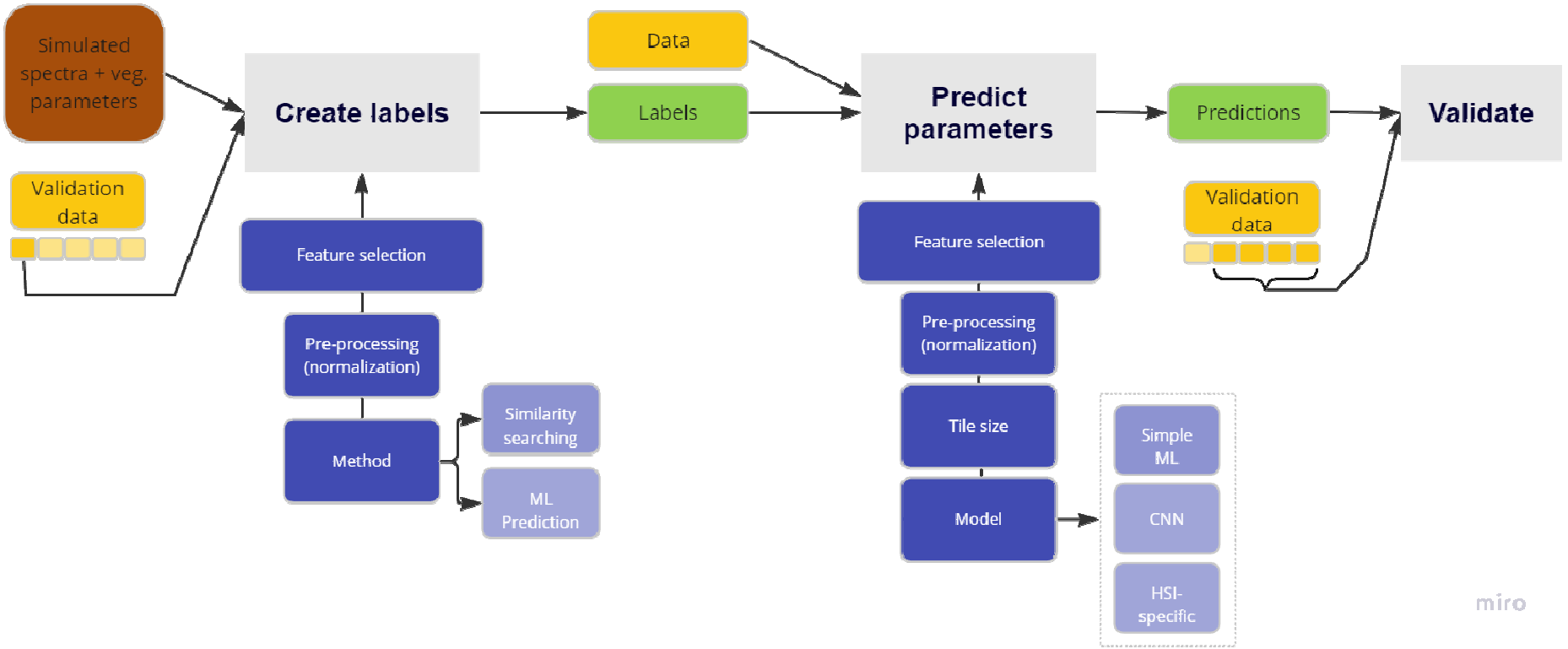
Approach

Our approach



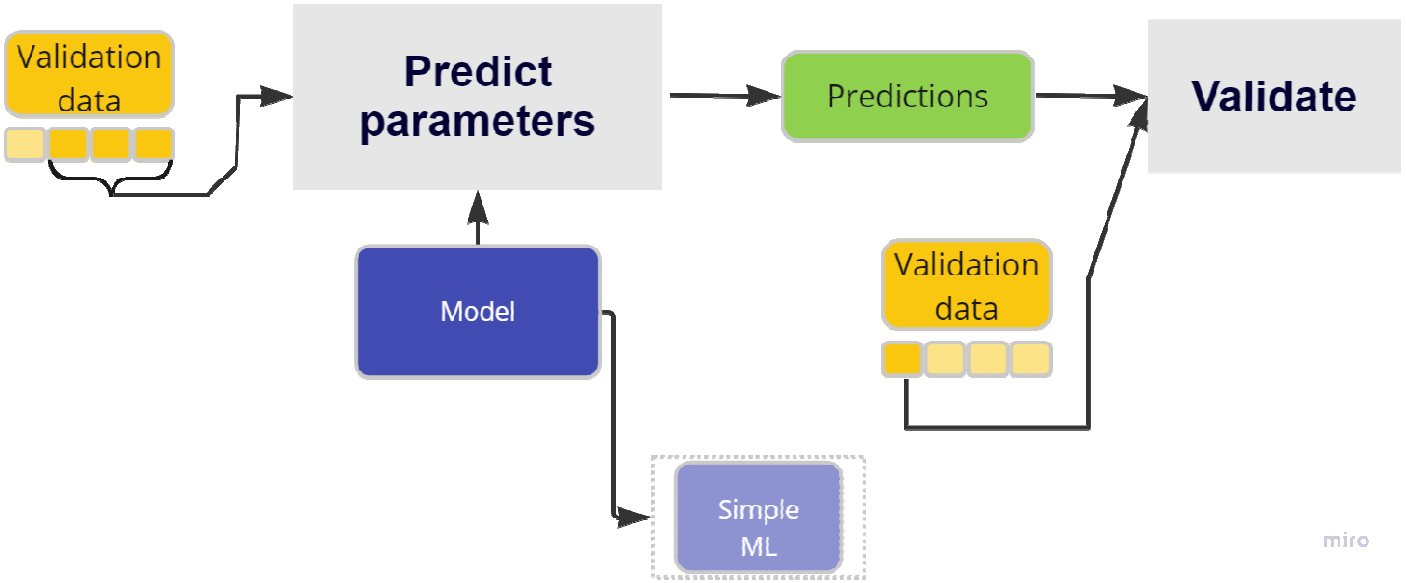
Approach

Our approach



Approach

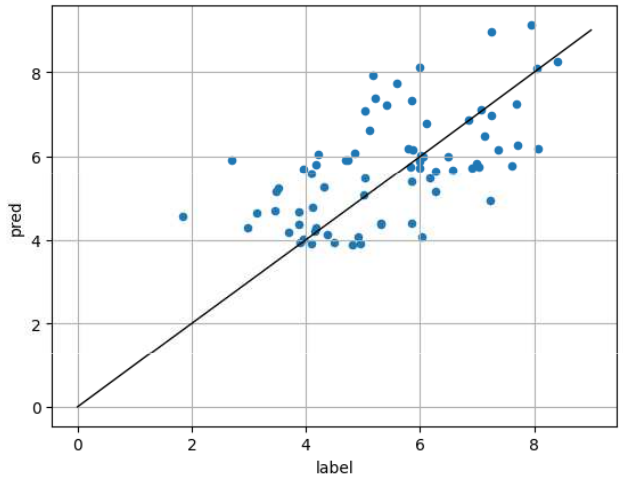
CzechGlobe's approach



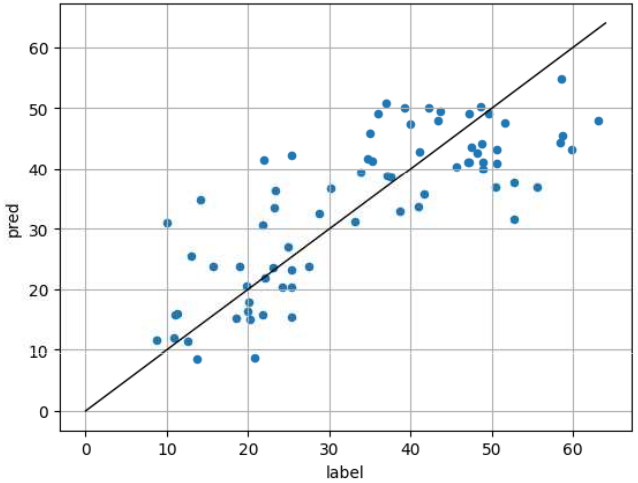
Results

On hand-collected validation data (different locations, different times)
Best model based on (n)rmse

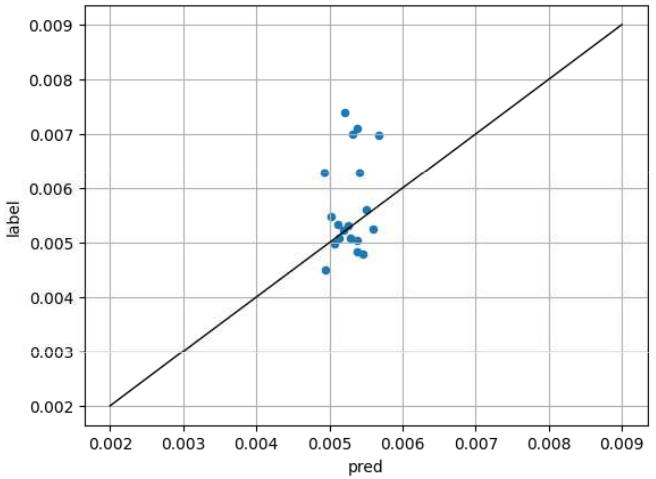
Carotenoids



Chlorophyll



Water content



Rmse	1.27	8.63	0.00087
nrmse	0.2	0.184	0.301

Next steps

- Improve the quality of labels
  - More detailed simulated spectra
  - Involve more validation data into the process
- Include more data
  - Extend with data from different time segments (unclouded)
  - Extend with airborne data
- Try more robust models
  - **Prithvi-100M-multi-temporal-crop-classification**