Sunlit Insights

Transferring Hyperspectral Imaging From Lab to Field

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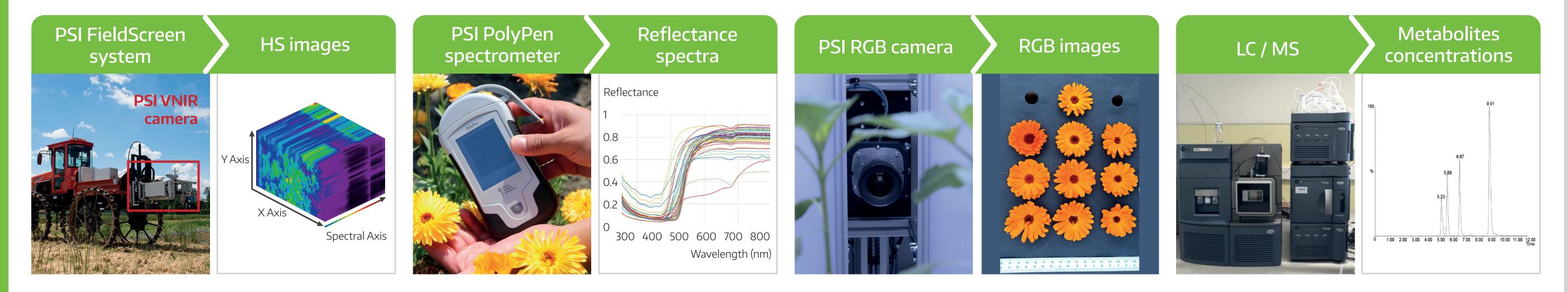
Hyperspectral imaging (HSI) is a a cornerstone of non-destructive plant phenotyping. With the growing interest in field phenotyping systems, Photon System Instruments (PSI) has developed the mobile PlantScreen[™] Field Phenotyping System, which integrates range of imaging sensors including the HySpec VNIR Camera and PSI RGB camera modules. In a pilot collaborative project with CATRIN/UPOL/CRI, we applied hyperspectral VNIR and RGB field-based imaging to non-destructively characterize the specific metabolite profile in Calendula sp. flowers of 8 different cultivars. Here, we present the pipeline for processing hyperspectral and RGB data, including validation based on reflectance spectra from a hand-held Polypen spectrometer (PSI) and integration with metabolomic data from Liquid Chromatography/Mass Spectrometry (LC/MS).





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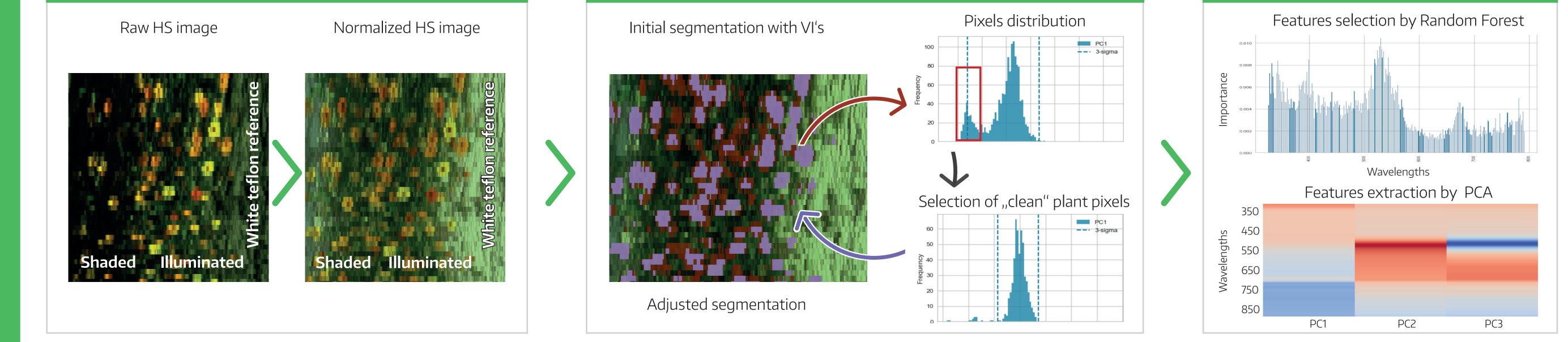
HSI data processing pipeline

Data processing includes **1. pre-processing** steps (white calibration and normalization) aimed to compensate for a challenging light conditions of field HSI imaging, **2. plant pixel segmentation** (with consequent unmixing) and **3. dimensionality reduction** to exctract most relevant spectral features.

Pre-processing

Plant pixels segmentation

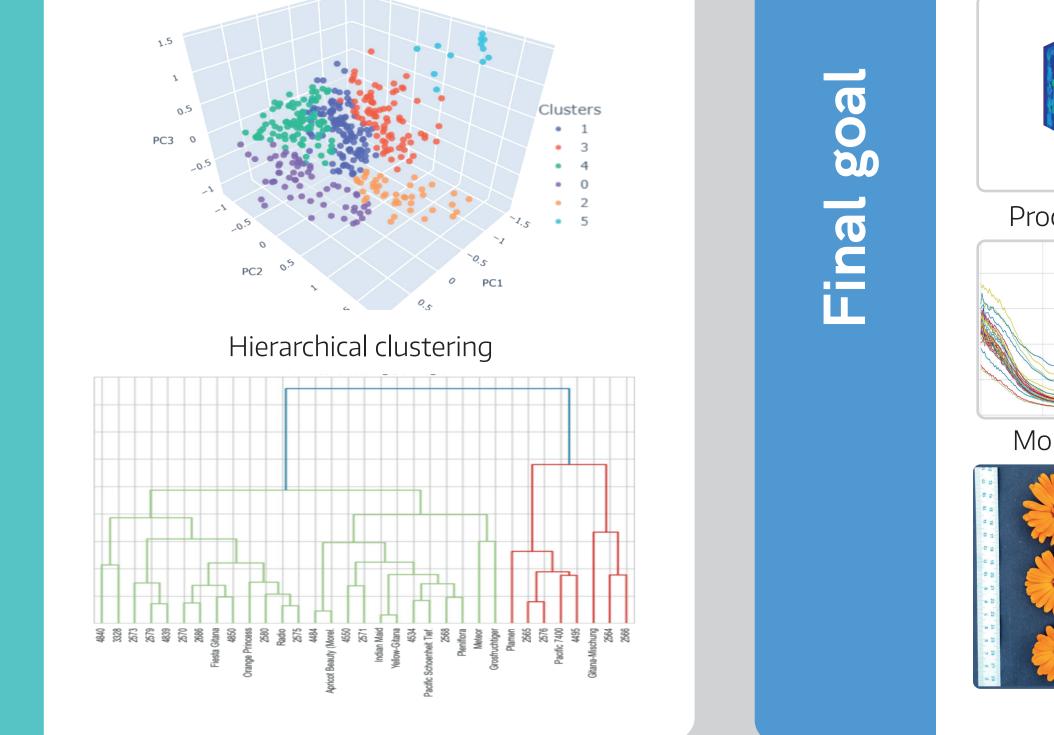
Dimensionality reduction



Visualisation

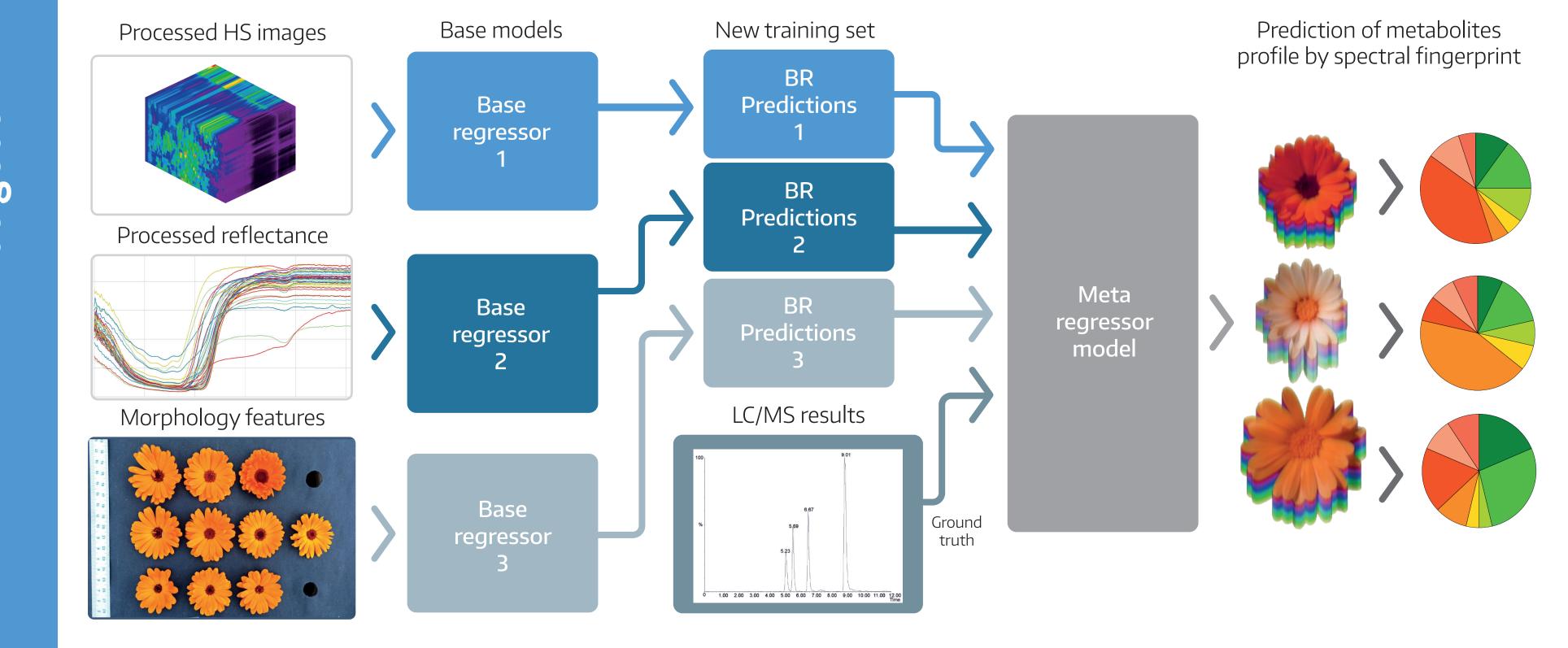
Transformed HS spectra are clustered to visualize the similarities between Calendula cultivars.

PCA-transformed spectra



Final goal - pipeline for non-destructive metabolites profiling

Processed data from multiple sensors are loaded into base models for spectral, morphological, and metabolic data. Their predictions form a new training set for a meta regressor model, which predicts the metabolite profile of Calendula cultivars using LC/MS data as the ground truth.



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