Possibilities and Challenges of Crop-Type Classification in Western Kenya

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Background

Status of the Kenyan economy and food security

- Smallholder agriculture is an important contributor to food production and employs 54% of the population.

- Climate- and environmental changes increasingly threaten harvests (floods and droughts).

  → Risk for food security and the economy

Improvement Strategy

- Increase food security and support smallholder livelihood.

  → Timely and accurate harvest forecasting models

Crop maps
Objective

Developing methods for accurate, intraseasonal crop classification based on EnMap and Sentinel data.

Project Partners:

- Cloud-based processing with native time series.
- Processing with modular, transparent workflows.
- AI training with existing frameworks and integration into workflows.
- Open source platform with WebGIS UI and Python API
- Field mapping campaigns in Kenya.
- One campaign per growing season (2/year).
Challenges

- Spatial resolution
- Small field sizes
  \( \bar{x} \) 0.4 acres, 1600 m\(^2\)  
or 1.8 EnMap pixels)
- Irregular geometries
Challenges

• Spatial resolution

• Small field sizes
  \( \bar{x} 0.4 \text{ acres, } 1600 \text{ m}^2 \text{ or } 1.8 \text{ EnMap pixels} \)

• Irregular geometries

• Intercropping

• Class overlap
  (Maize-Cassava, Cassava-Maize)

Mixed Pixels
Establishing a baseline model:

**Goal:** Classifying main crops on a single EnMap acquisition.

- Building feature spaces via spectrum transformations
- Applying feature selection

**Model Info:**
- EnMap scene from 06.12.2023
- Season peak greenness
- Pixel coverage fraction $\geq 0.75$
- $\sim 1800$ pixels in training
- Four crop-type classes
Establishing a baseline model:

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Spectrum transformations improve model robustness (+6% F1-Score).
Current Work and Next Steps

**However:** Single acquisition classification cannot surpass a F1-Score of 0.71.

**Suspected reasons:**
- Mixed pixels and class-overlaps.
- Fields are insufficiently represented by large pixels.
- Strong confusion of phylogenetically **closely related crops**.

**Envisioned solutions:**
- Including secondary crops in the model
- EnMap Sentinel-2 superresolution
- Detailed feature analysis
- Incorporating the temporal domain
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