Agricultural Monitoring with Fields of The World (FTW)

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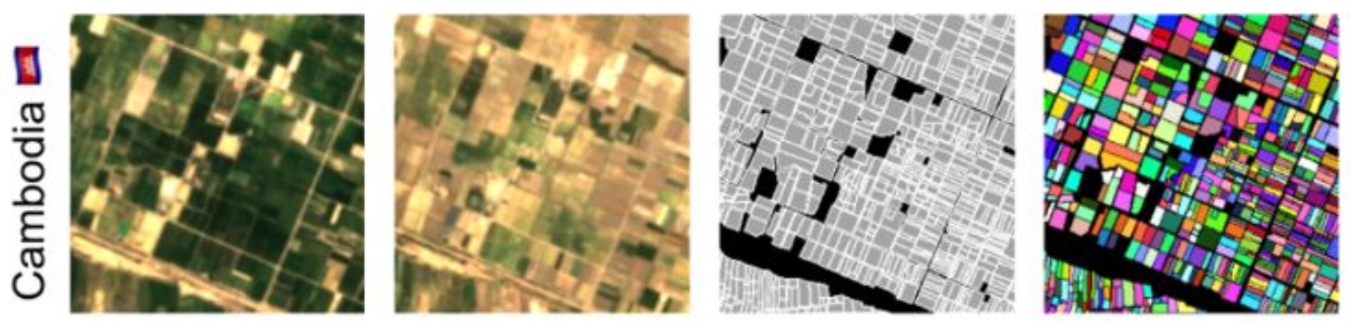
🌎 Overview

Fields of The World (FTW)[1]

- AI ecosystem for automated field boundary segmentation and postprocessing
- Includes benchmark dataset, pretrained models, command line interface (CLI), and other tools



About FTW

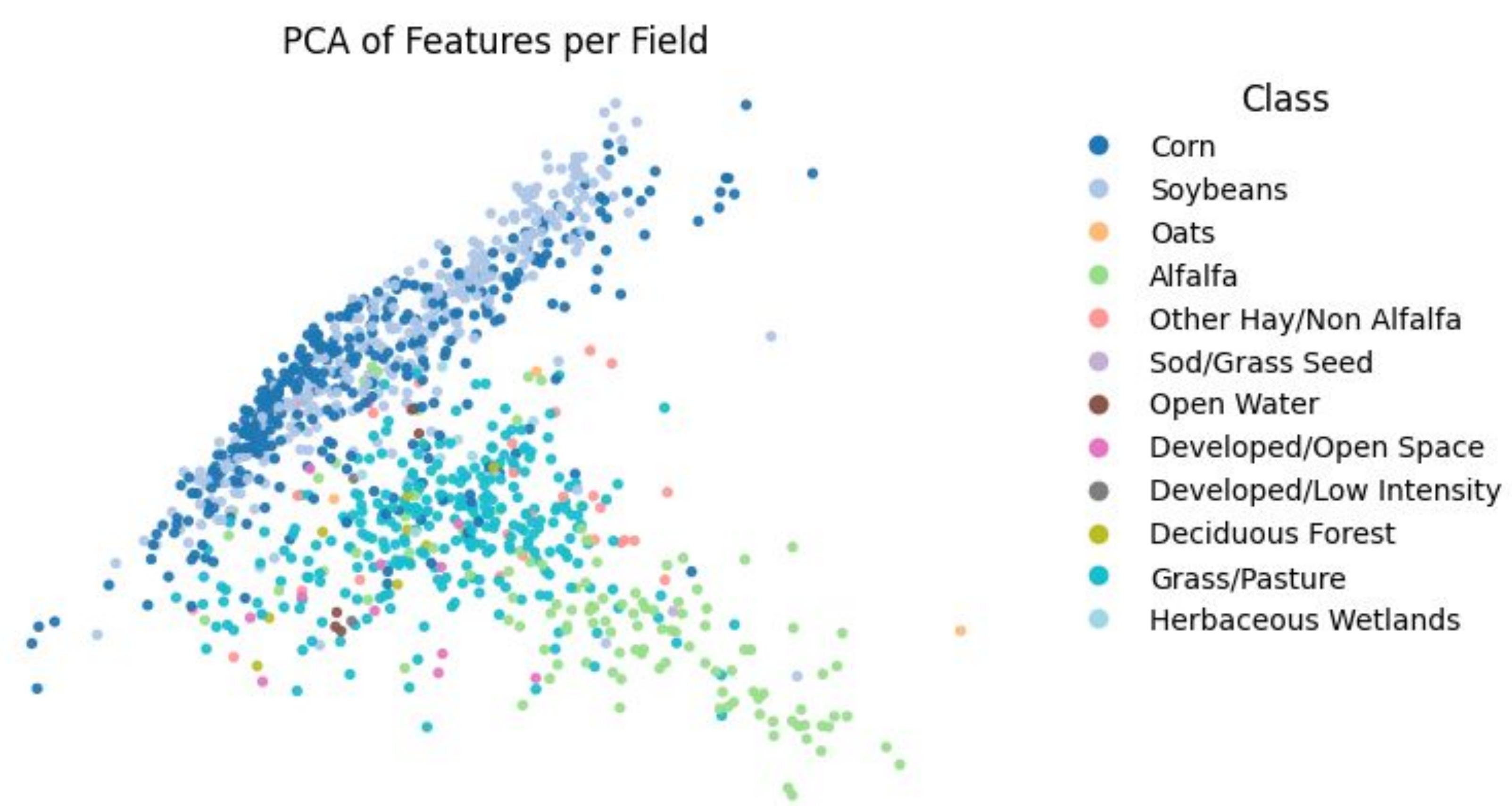
FTW dataset example. Left to right: Sentinel-2 images from planting and harvest season, 3-class semantic segmentation mask (background, interior, and boundary), and instance mask

Tutorial objectives

📐 Use FTW to extract field boundaries for an ROI
🍚 Use field boundaries for perform field-scale crop type classification (in Iowa, USA)
🌳 Use field boundaries to identify forest loss in agricultural landscapes (in Mato Grosso, Brazil)

🌾 Use Case: Crop Type Classification

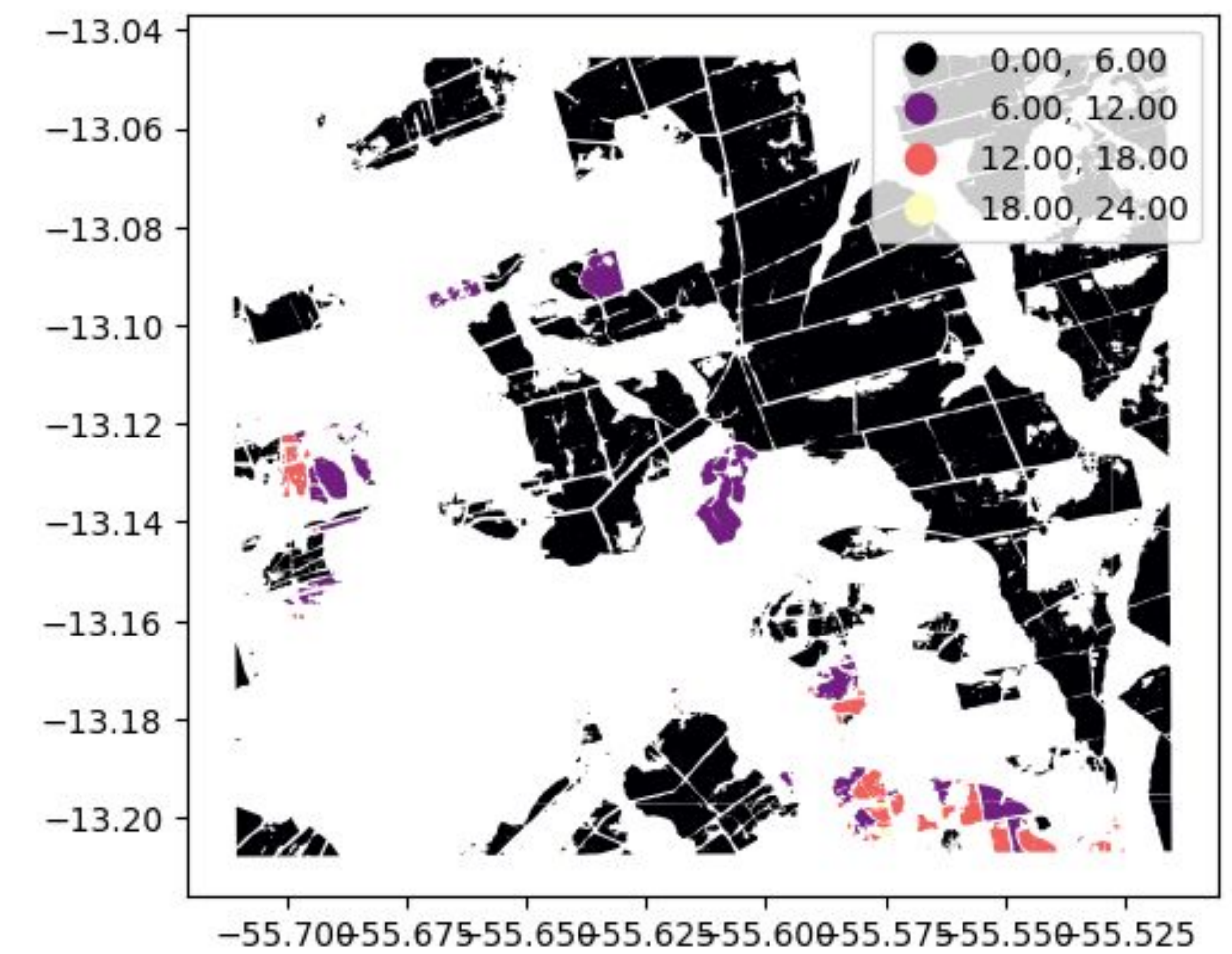
1. Predict boundaries for crops in Iowa, 2023 🧑‍🌾
2. Generate embeddings 🧠 for each field with MOSAIKS[2]
3. Extract crop type labels 🏷️ to fields using majority class from USDA Cropland Data Layer[3]
4. Train logistic regression model to predict crop type using 1-50% of the training data 📈



MOSAIKS embeddings visualized using PCA. Corn and soybeans have similar spectral signatures, making them hard to differentiate. Alfalfa and Grass/Pasture are also similar to each other, but different from corn/soy.

🌳 Use Case: Forest Loss Monitoring

1. Predict boundaries for crops in Mato Grosso, 2022 🧑‍🌾
2. Extract "loss year" (year of deforestation) 🪾 using mean value from Hansen Forest Change dataset[4]
3. Visualize the deforestation year for each field 📉



Black: fields cleared before 2006.

Purple: Forest loss between 2006-2012.

Red: Forest loss between 2012-2018.

Yellow: recent loss 2018-2024.

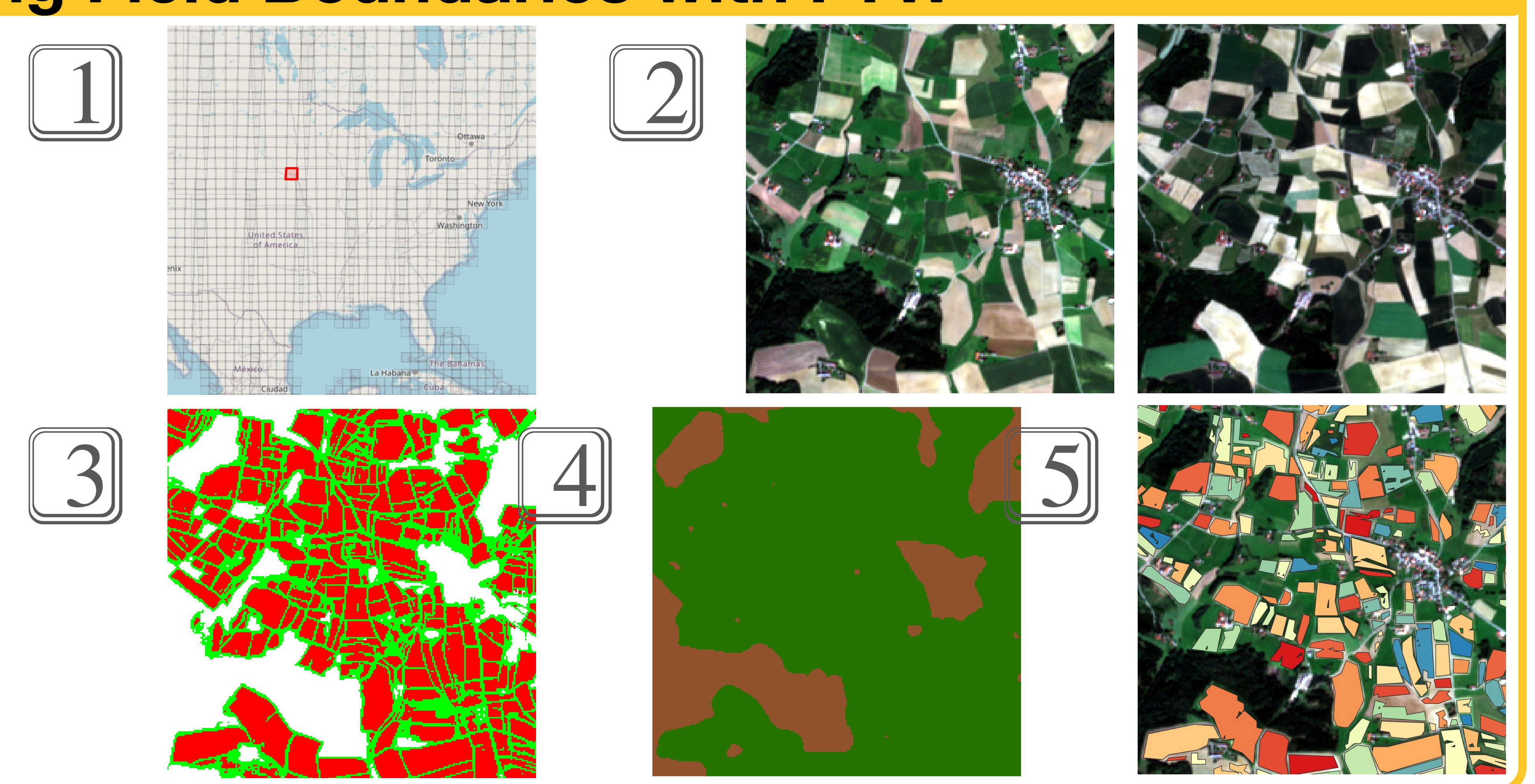
Visualization of average forest loss year in each field. Most fields in this area of Mato Grosso, Brazil were cleared before 2006. However, there are clusters of expansion from 2006-2023 (purple) and 2012-2018 (red).

🌡️ Climate Change Relevance

- Agricultural expansion and management contribute to deforestation, biodiversity loss, and greenhouse gas emissions
- Climate change threatens crop yields, food security, and rural livelihoods
- Accurate, up-to-date data about field location and management is essential for building sustainable and resilient food systems
- This information is unavailable, outdated, or fragmented in most parts of the world

👩‍💻 Steps for Generating Field Boundaries with FTW

1. Specify your region of interest (ROI) 📍 and time of interest (TOI) 📅
2. Download Sentinel-2 🛰️ images from two time windows: planting 🌱 and harvest 🌽 season
3. Use pretrained FTW model to predict field boundaries (segmentation mask) 🦾
4. [Optional] Filter predictions by land cover/land use mask (removes false positives) 🏡
5. Polygonize boundaries: convert the segmentation mask to vector-format polygons



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References: [1]Kerner et al. (2024) *AAAI*. [2]Rolf et al. (2021) *Nature Comms*. [3]USDA NASS, Cropland Data Layer (CropScape). [4]Hansen et al. (2013) *Science*.