



# Augmenting a convolutional neural network with local histograms - A case study in crop classification from high-resolution UAV imagery

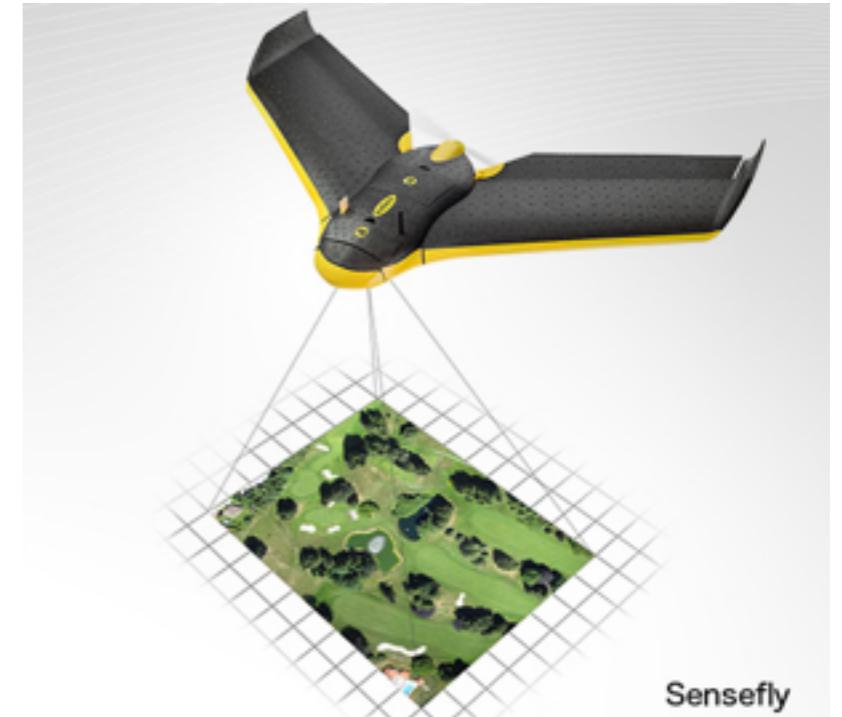
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# Agrovision project

- Use drones to obtain aerial imagery of farm fields
- Cheaper than planes
- Can make more frequent flights
  - Every 2 weeks / month
- Can see holes and other problems that are hard to see from the ground



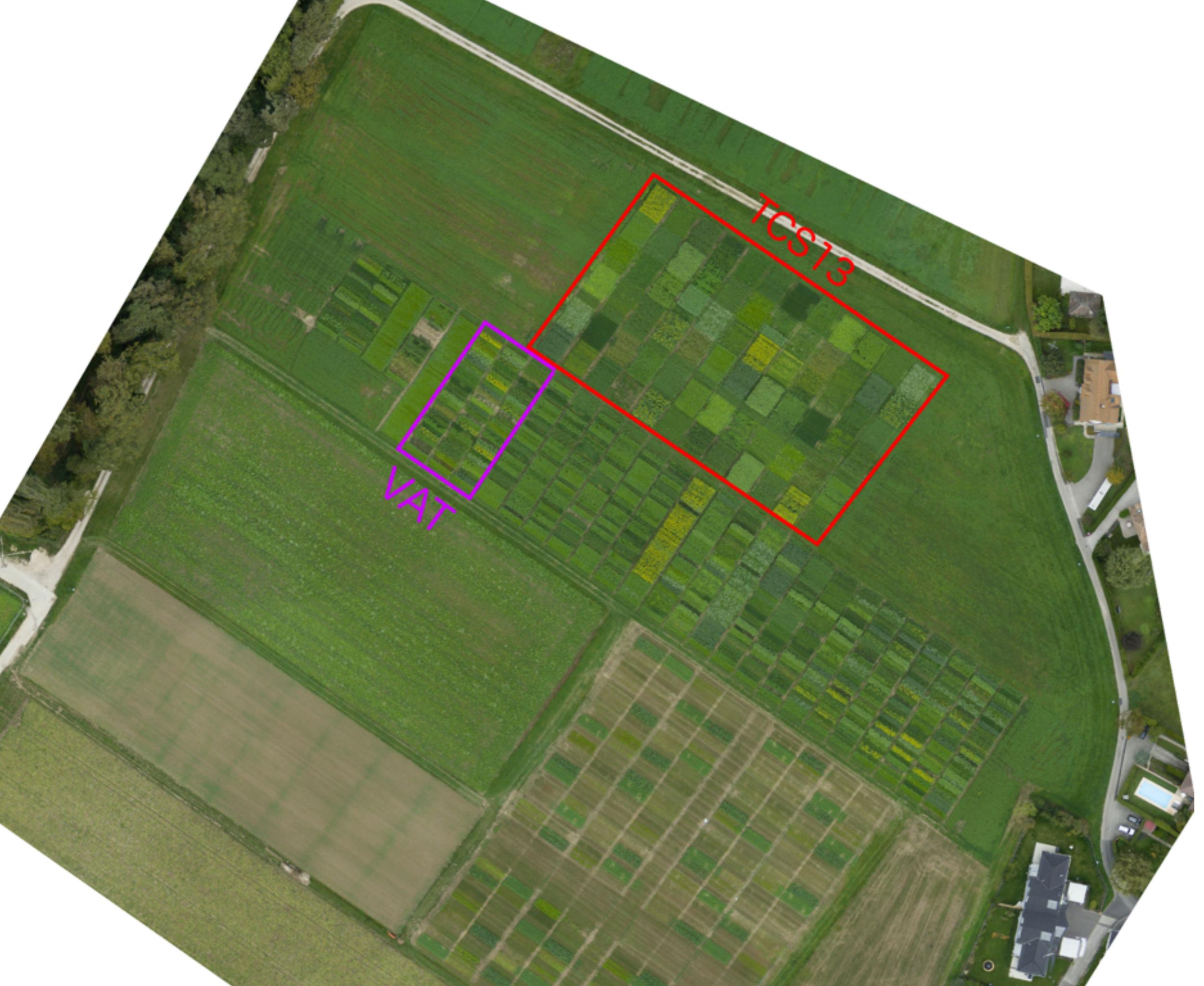
# Why automatic crop classification ?

- Up-to-date informations on crops at regional/national scale is relevant for :
  - Erosion risk assessment
  - Improve water management
  - Yield prediction
- Currently rely on farmers self-report
- Problems
  - This is a slow process
  - Cadastral parcels ≠ Crop parcels
- => **Automatic crop classification**



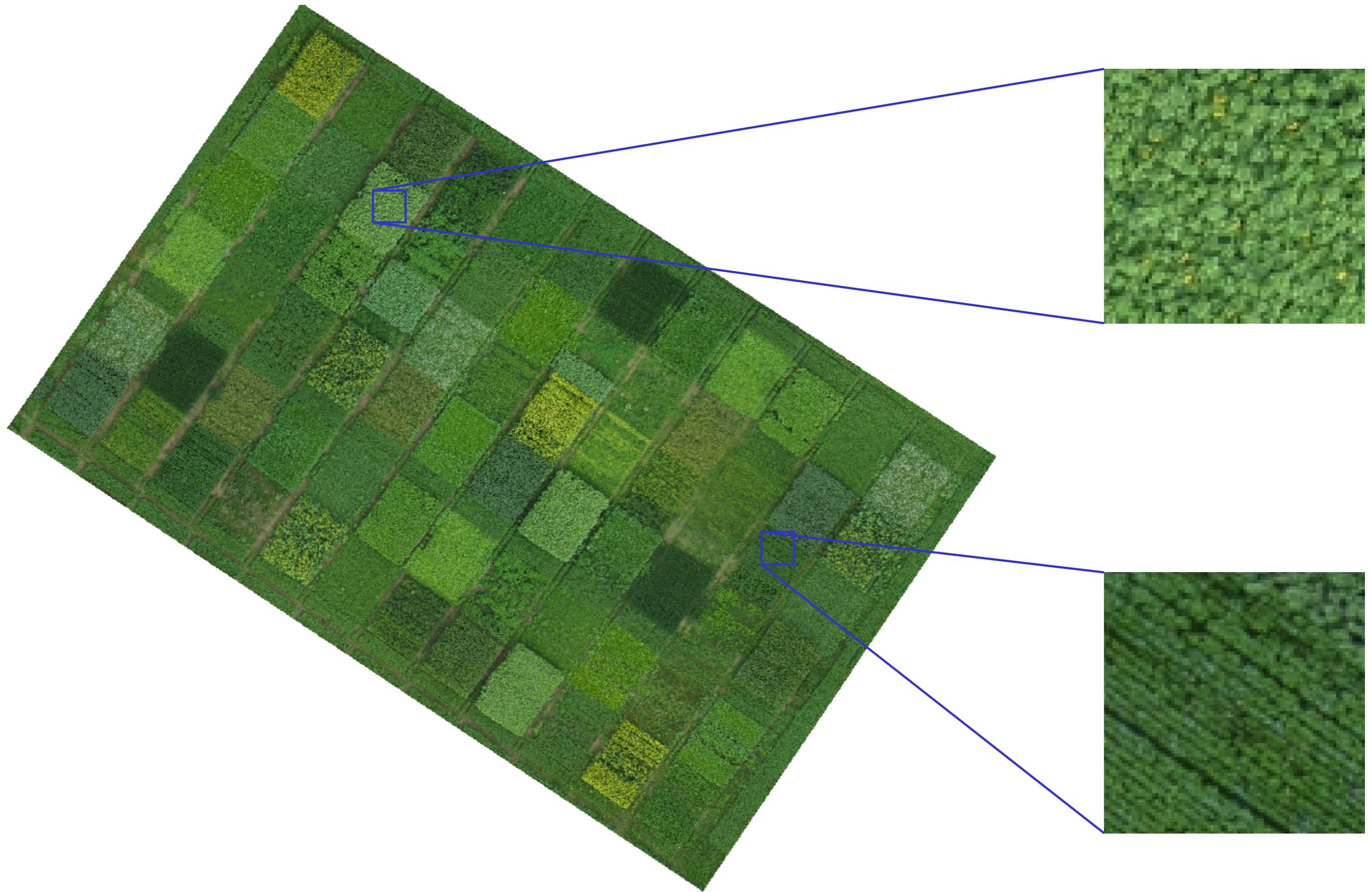
# Dataset

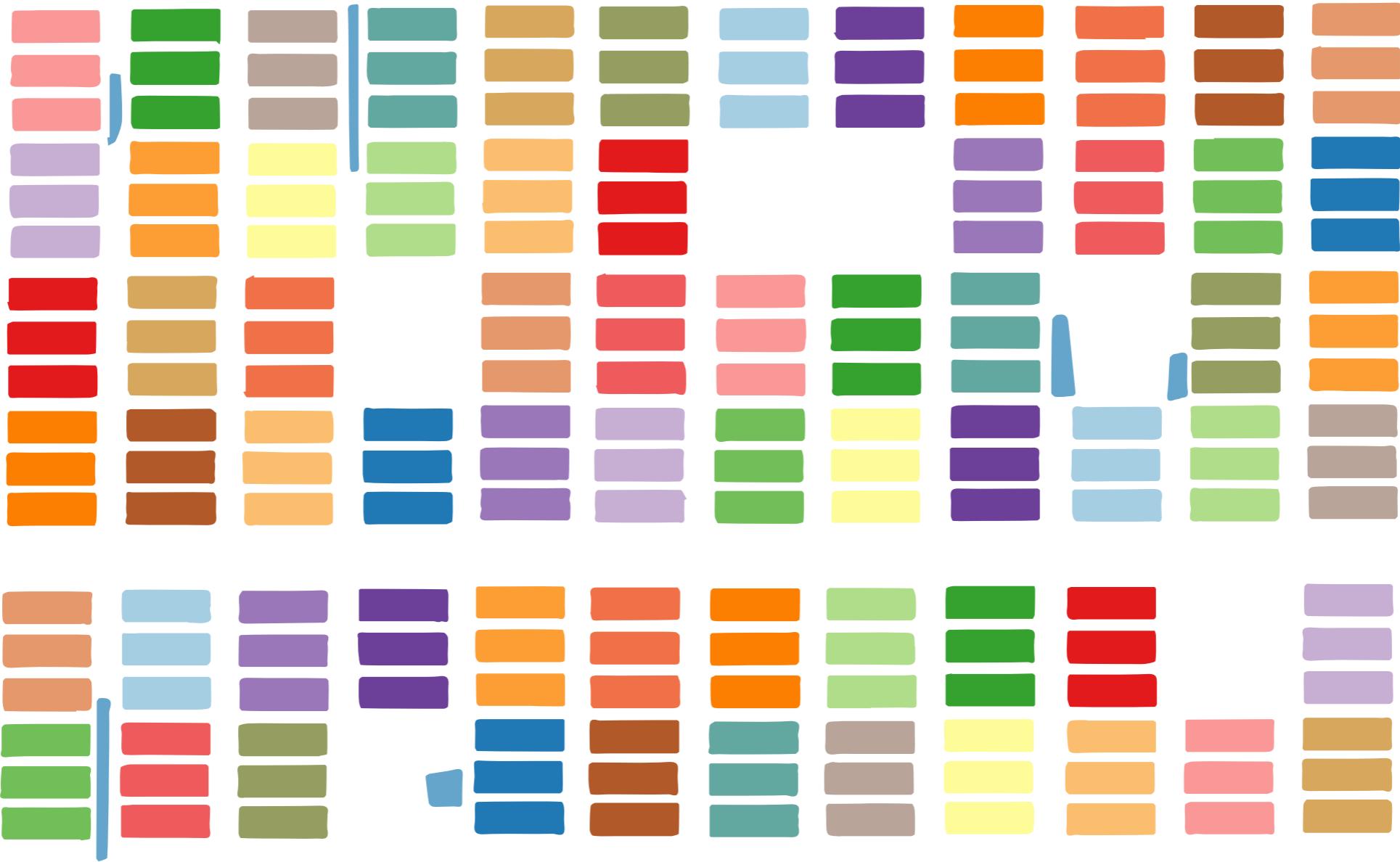
- Aerial imagery over a 100 x 60m “test” field
- Ground resolution of 5cm / pixel
- 22 different crop types (+ 2 ground classes)
- 3 repetitions of each crop



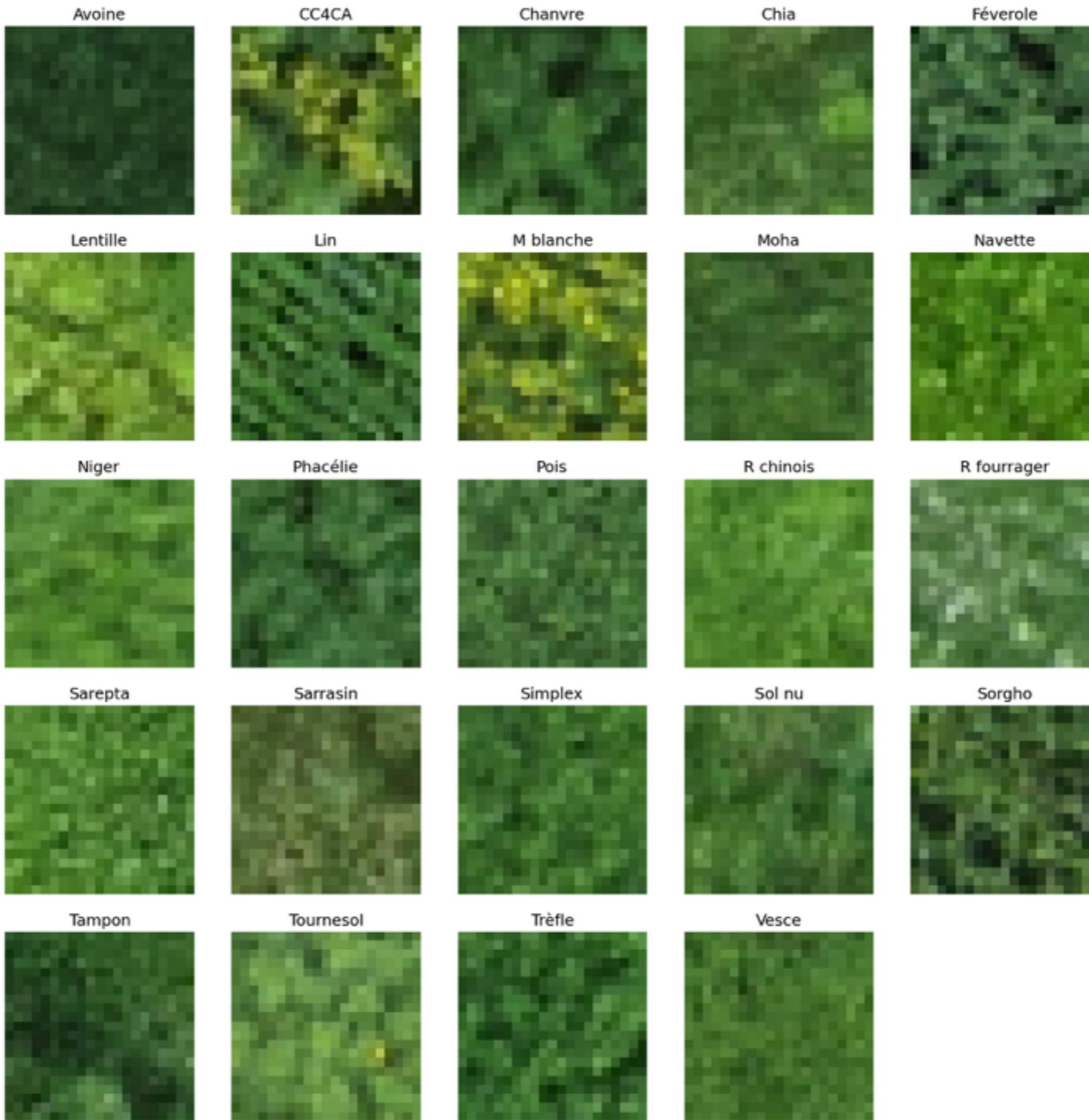
TCS13

VAT



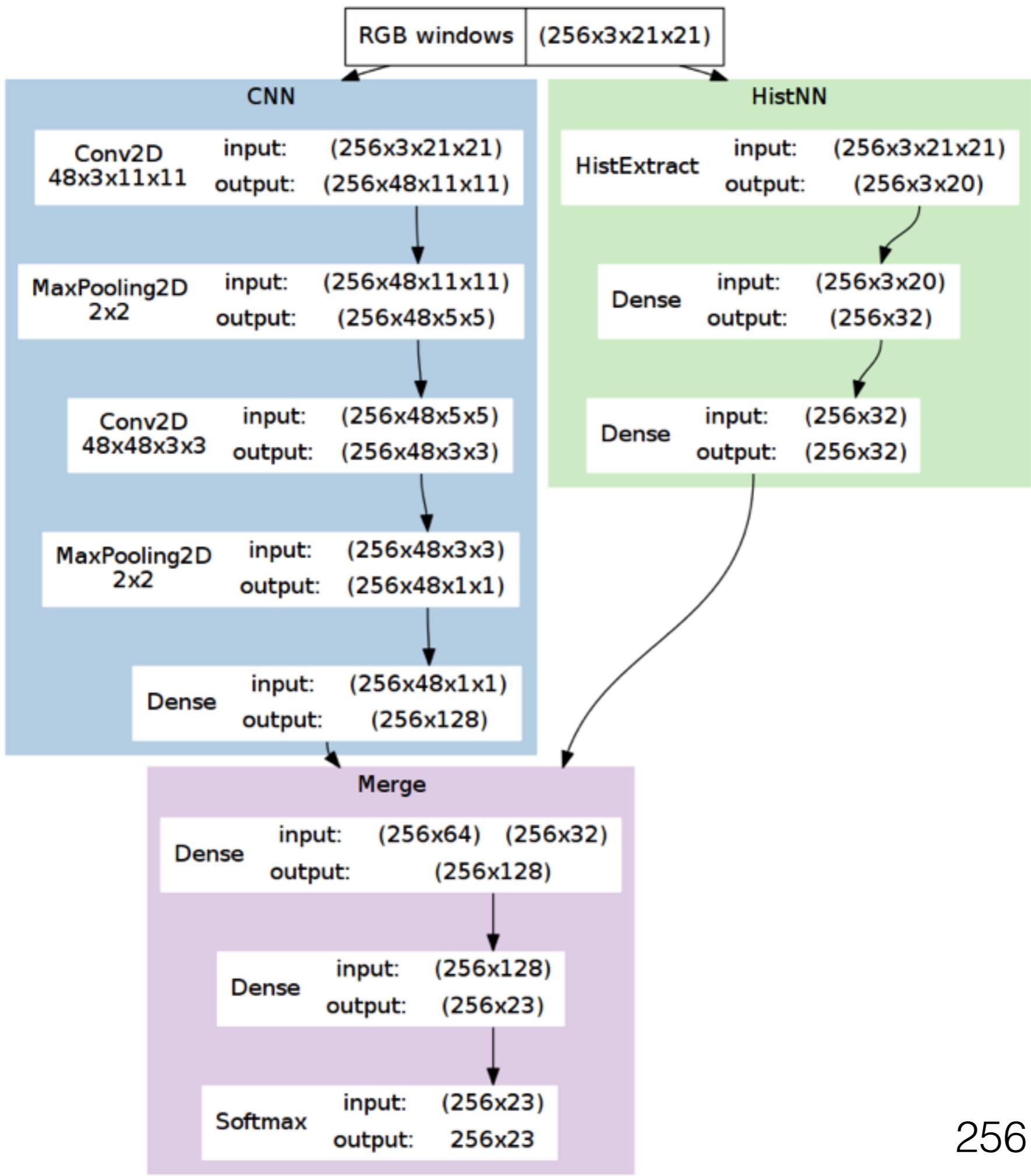


Avoine	M blanche	Sarepta
Bare soil	Moha	Sarrasin
CC4CA	Navette	Simplex
Chanvre	Niger	Sorgho
Chia	Phacelie	Tournesol
Feverole	Pois	Trefle
Lentille	R chinois	Vesce
Lin	R fourrager	

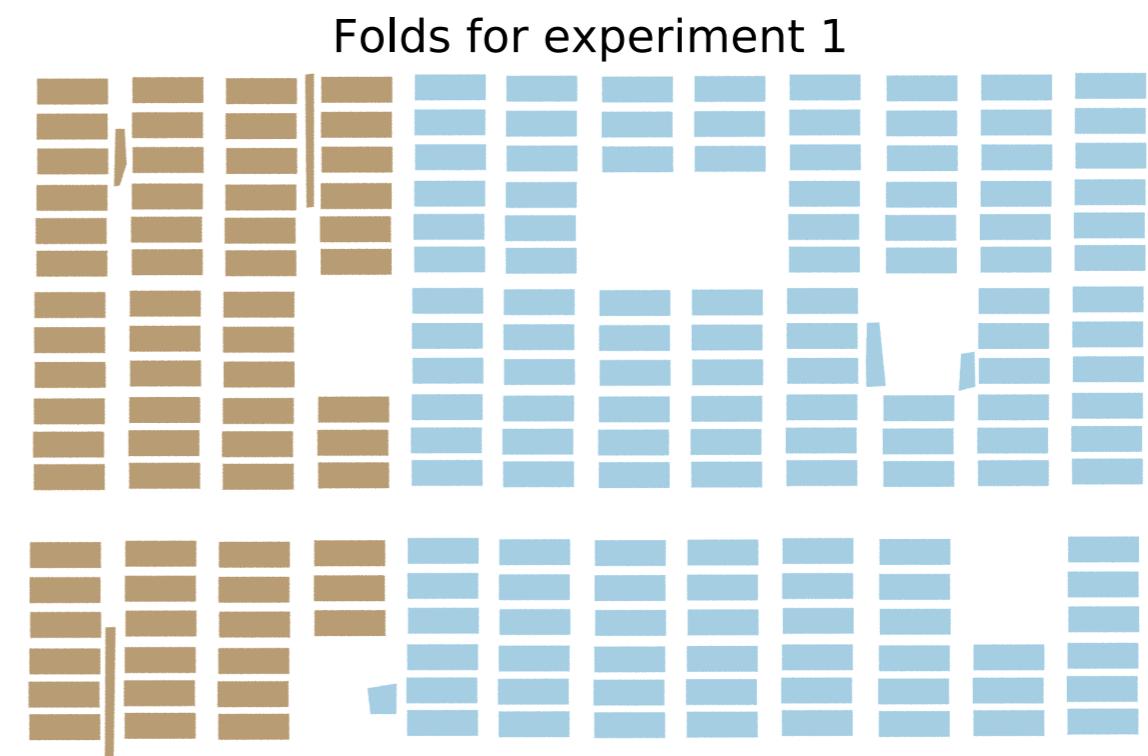
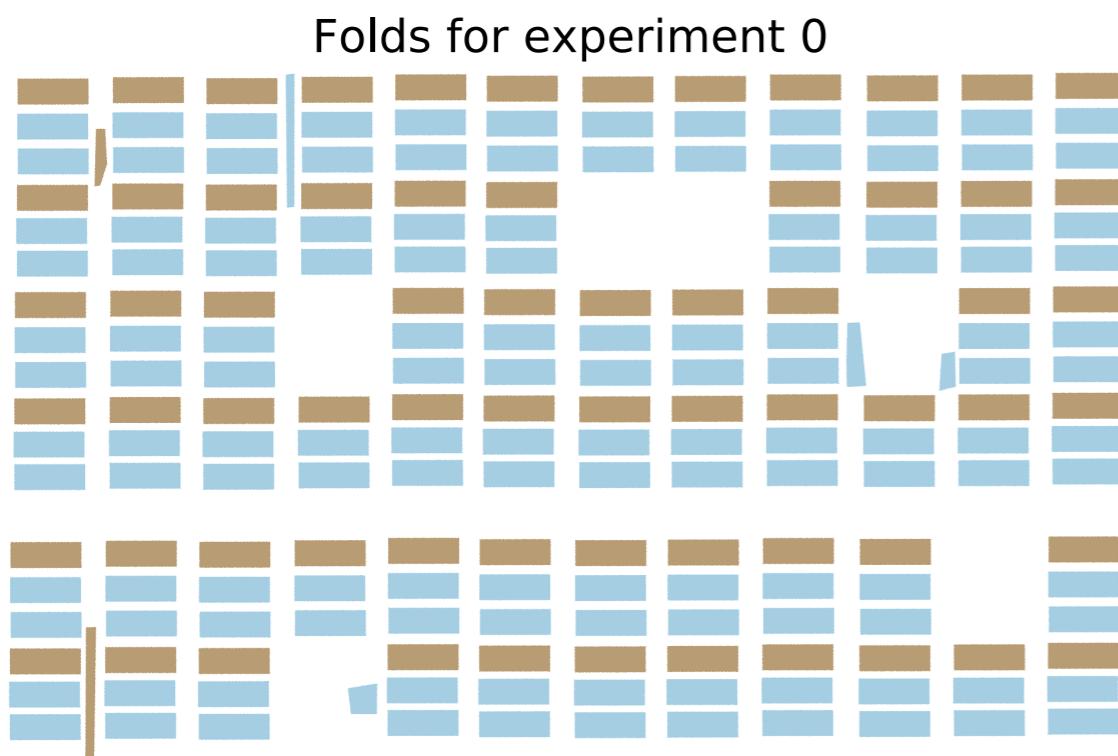


# Models

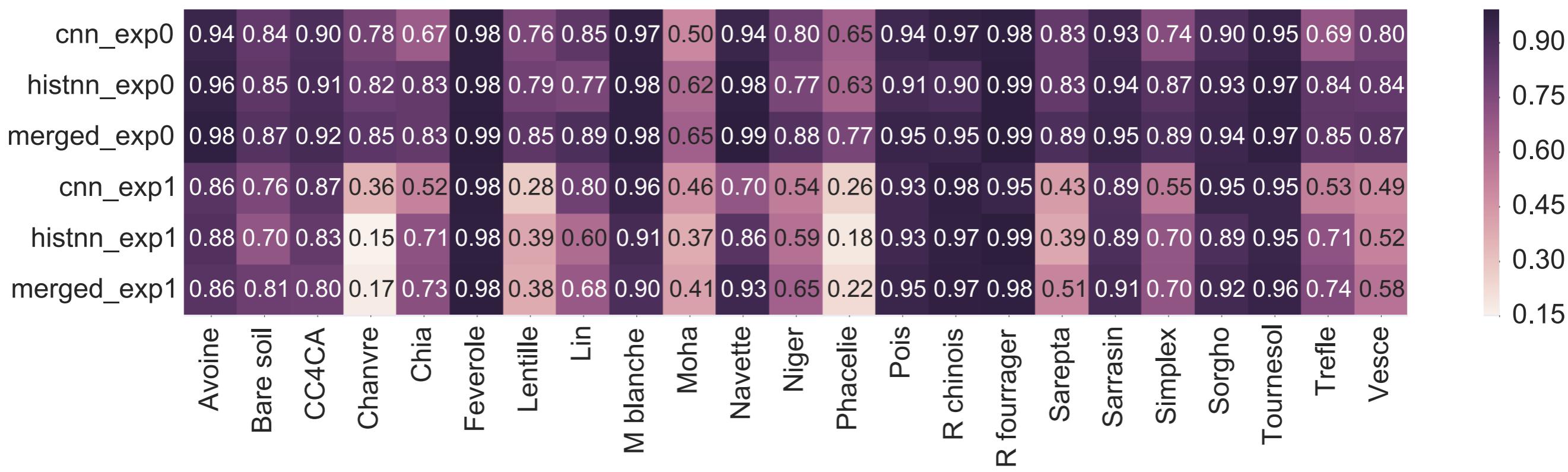
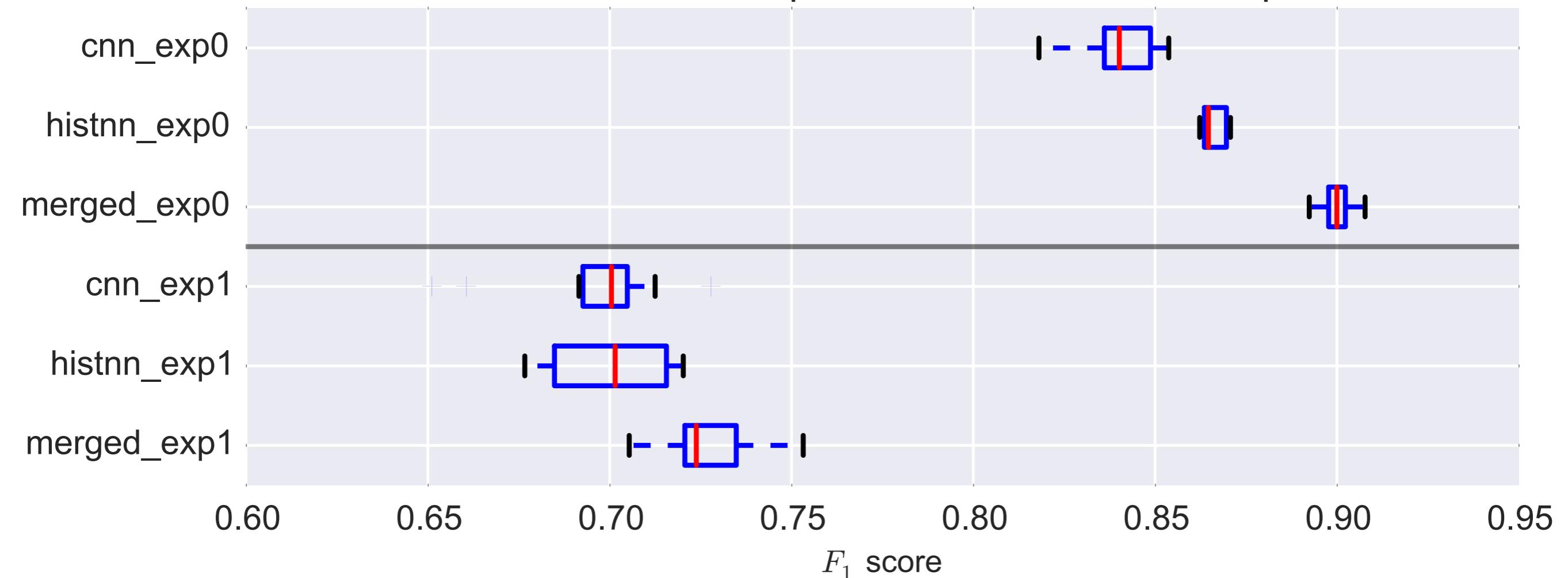
- Input : 21x21x3 RGB windows around each pixel (=1m x 1m)
- HistNN
  - 20 bins histograms of the RGB channels
  - Color distribution helps discriminate crops
- Convolutional Neural Network (CNN)
  - Learn filters to extract patterns (line stripes, round flowers)
- Merged CNN + HistNN

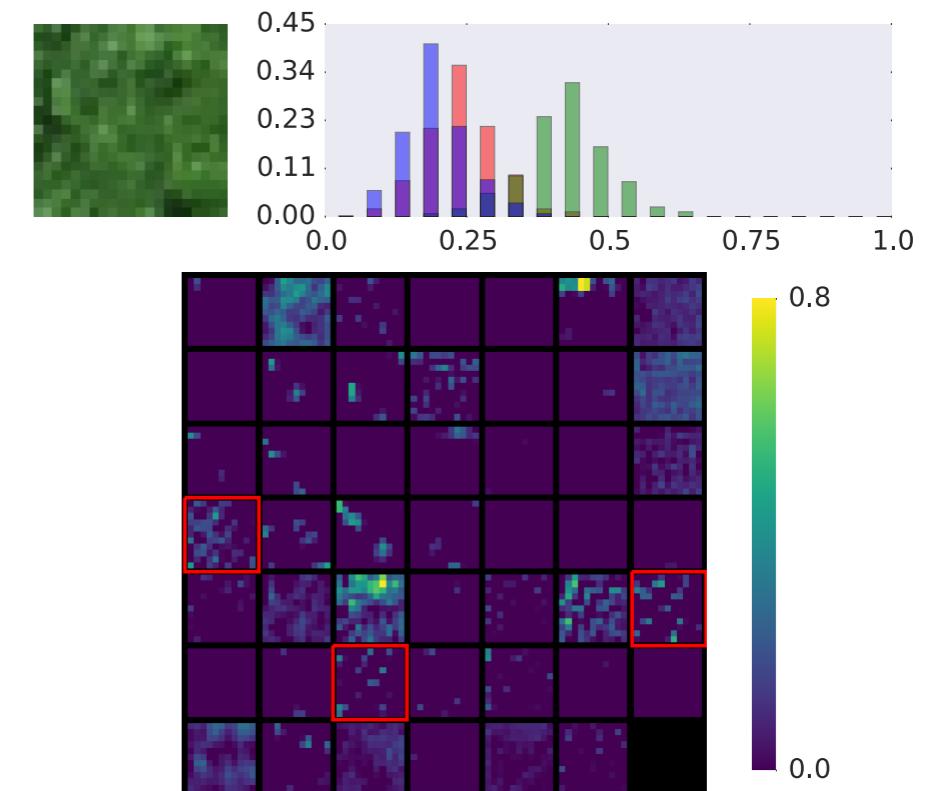
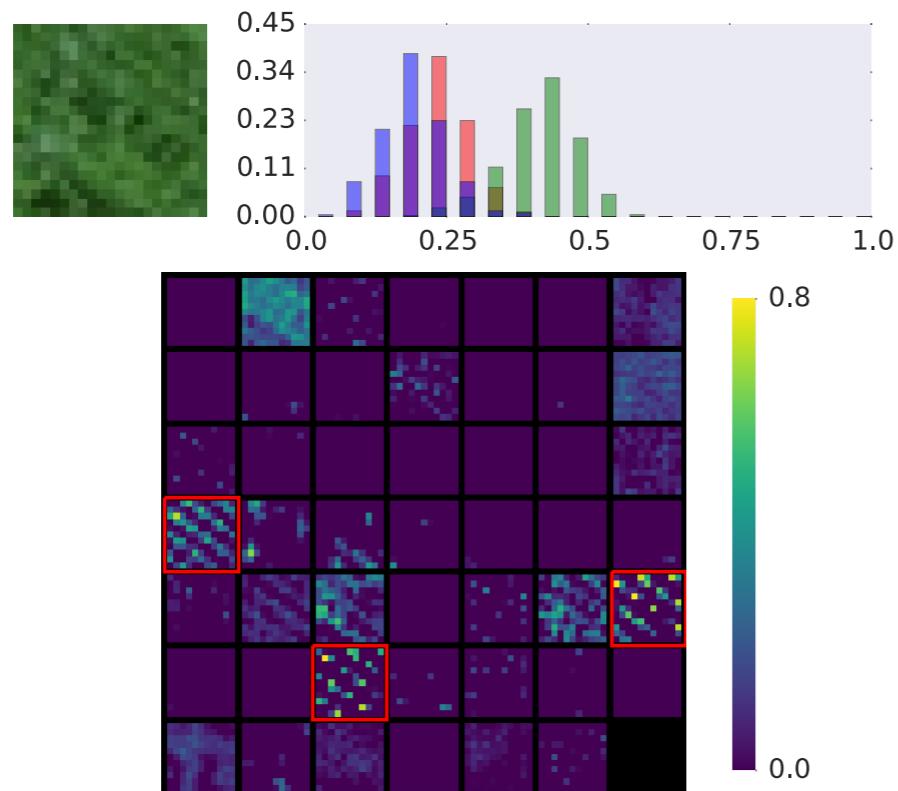


# Results



# Per-model classification performance for 10 train repetitions



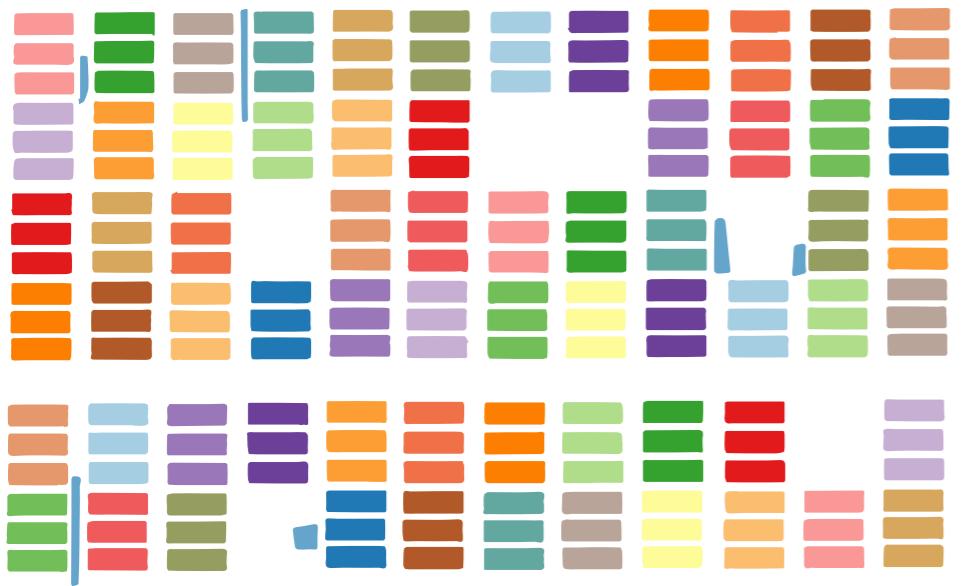


	Ground truth	CNN	HistNN	MergedNN
Prediction	Lin	Lin	Simplex	Lin

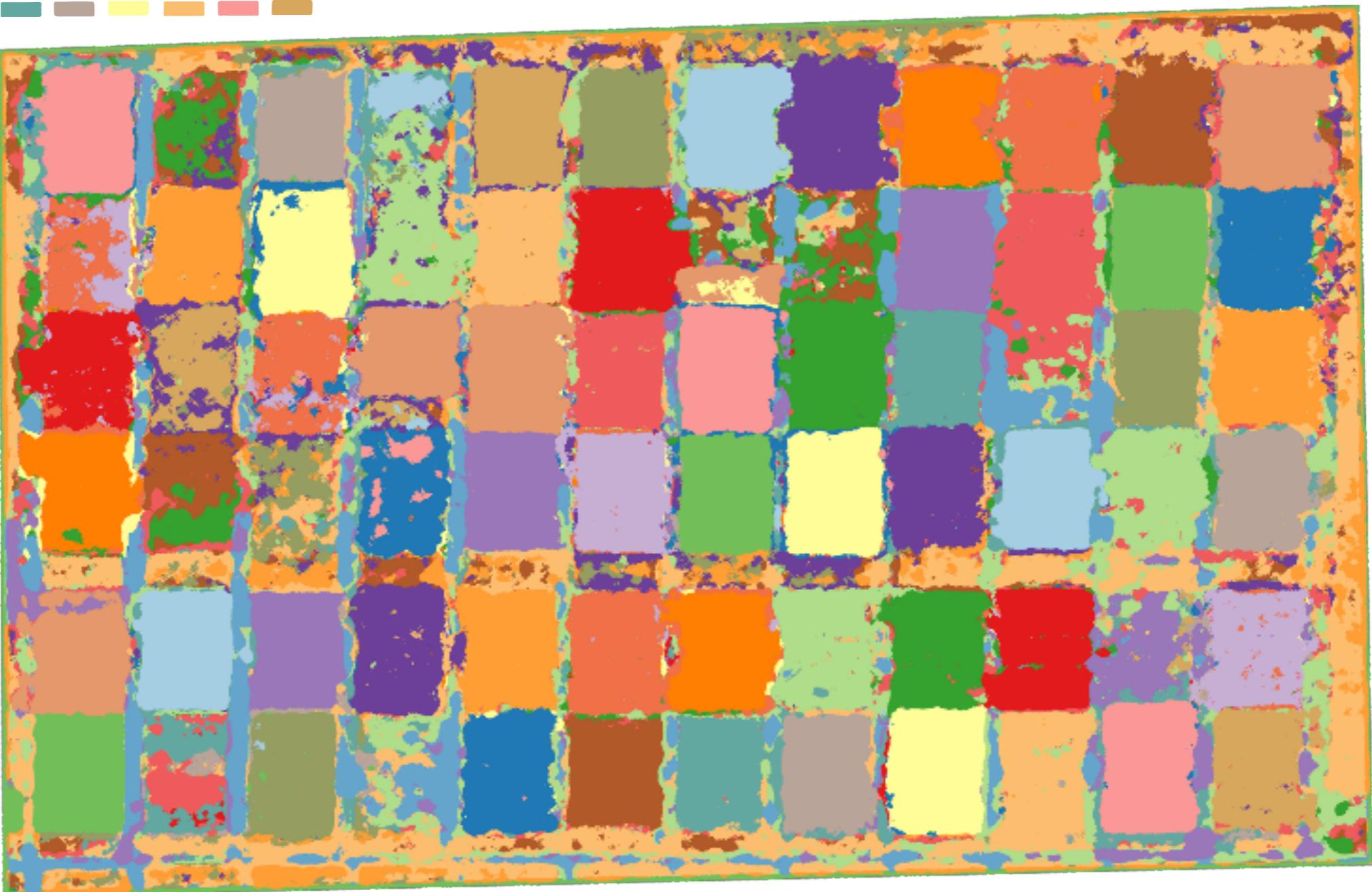
	Ground truth	CNN	HistNN	MergedNN
Prediction	Simplex	Simplex	Simplex	Simplex

Lin

Simplex



Merged Hist/CNN

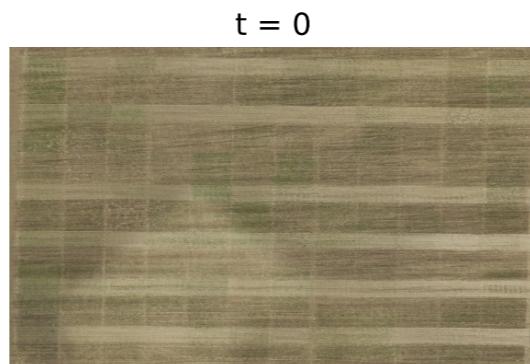


# Conclusion

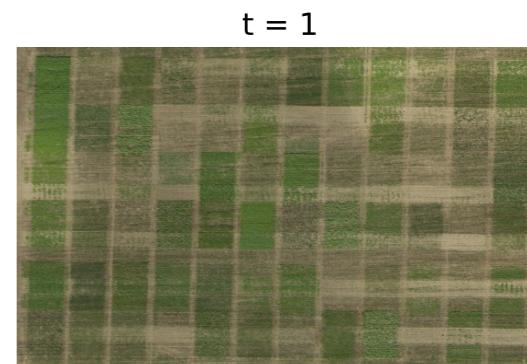
- We can classify 22 different crops from RGB images
- Future work:

- Classify a whole region

- Use historical imagery



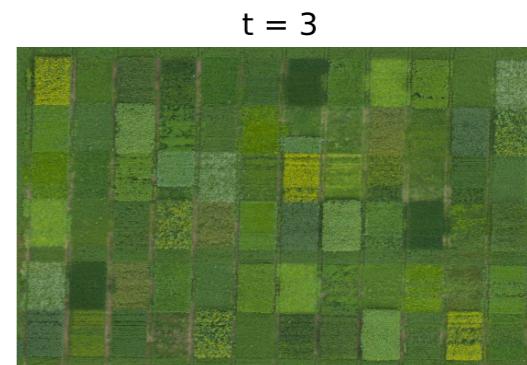
$t = 0$



$t = 1$



$t = 2$



$t = 3$

- Growth stage prediction

The background of the image is a photograph of agricultural land from an aerial perspective. The fields are organized into large, rectangular plots. Some plots contain dark green crops, while others are yellow or light green, suggesting different types of agriculture or stages of growth. Several irrigation systems are visible as dark, branching lines extending from pipes across the fields. A small white rectangular box is positioned in the upper left area of the image, containing text.

Code and data :

[https://github.com/julienr/agro\\_esann16](https://github.com/julienr/agro_esann16)