Deep learning to extract information from daily agricultural images

K. Velumani, E. David, S. Madec, J. Labrosse, R. Lopez Lozano, B. de Solan, and F. Baret
UMT CAPTE, Avignon, France

Study

► Context: field daily monitoring, precision farming application

► Objective: To present on-going research work to identify phenological stages and increase the resolution of images using CNNs.

IoT Field Sensors

► 55° Field of View

► 1m above the plant canopy; 1024 x 768 pixels

► 45° inclination angle: non-uniform scale

Counting by regression to identify wheat heading date

Pretrained ResNet50 finetuned to perform binary classification to detect presence of wheat spikes

Weights Initialization

Training Data

X: RGB
Y: ear density

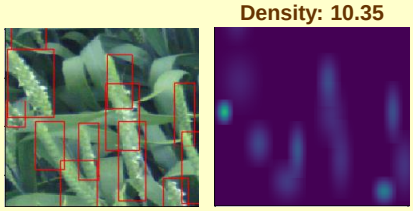
Model

Resnet50

2 FCN

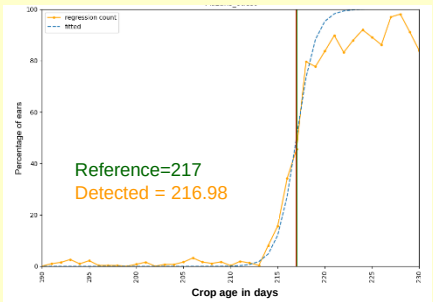
Regression based counting

Density: 10.35



Fitting 2D Gaussian within bounding boxes to estimate the ear density per patch

Identifying the heading date from the dynamics of the daily ear appearance



Dataset size

	Binary Classification	Regression
Spike	9696	320
No Spike	13504	492

Super Resolution GANs

Input Low Resolution resized by Bilinear Interpolation

Generated High Resolution Image

► CNN with transposed convolution (encoder decoder architecture) now allows the generation of images.

► Through an adversarial branch, the model was trained to generate high to low and low to high resolution images.

► This weakly supervised strategy associated with the huge amount of images collected opens up the possibility to leverage the low spatial resolution images (for light data transmission from the fields) acquired by the IoTs.