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Crop monitoring with Sentinels and crowd-sourced street level imagery

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In our studies, we are exploring the use of state-of-the-art deep learning computer vision methods applied to crowd-sourced geo-tagged street-level imagery of agricultural parcels. Over 47% of the European Union (EU) territory is covered by agricultural land and about 70 million parcels are subject to support measures under the Common Agriculture Policy (CAP).

The increasingly detailed and available information at parcel level from the Copernicus Sentinel satellites and governmental data at parcel level opens up novel possibilities for efficient near-real time and wall-to-wall agricultural monitoring. Sentinel-1 SAR and Sentinel-2 multi-spectral sensors with short revisiting periods (6 and 5 days, respectively) are acquiring free, open, global, and high resolution imagery. Cloud-based computing capacities to process these Big Data sets are currently becoming more widely available (e.g. Google Earth Engine, Copernicus DIAS).

However, high quality and timely *in situ* data are still a pre-requisite to build robust operational crop monitoring systems. Crowd-sourced, geo-tagged and time-stamped street level imagery can deliver unprecedented opportunities for *in situ* data collection. Besides providing classical ground-truth data, this type of data can also be used for (satellite-guided) targeted field-level monitoring.

We present results of a data collection campaign focusing on permanent grasslands in the Netherlands. Additionally, we discuss applications and results from on-going campaigns in Flevoland (NL), and in Bayern and Mecklenburg-Vorpommern (DE) to collect biophysical parameters and crop phenological stages with systematic repetition, leading to massive geo-tagged imagery collection and coverage. The data collected are uploaded to an open-access platform. Additionally, we take advantage of pictures shared by other contributors to this platform, and assess their availability and the benefit these can bring in the context of agricultural monitoring. Taking advantage of these data opens new perspectives for timely *in situ* data collection and can become of major importance to upscale crop type and crop yield mapping obtained with wall-to-wall Sentinel coverage.