Large-scale crop classification from satellite images

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Annual inspections of farmland in Switzerland is a time-consuming process and requires lots of human labor. Each year many farmlands are visited to validate the cultivated crop types reported by farmers and to inspect over-fertilization. These tasks are not only labor-intensive and time-consuming but also do not scale to the entire country in practice. Therefore, the Swiss Federal Office for Agriculture (BLW) has initiated a four-year project in 2018 to develop an automatic system for farmland inspection from satellite images. Within the scope of this project, we are currently working on crop type classification method from publicly available Sentinel-2 images.

Most previous work uses physics-inspired models. They compute one or multiple vegetation-related indexes, form time series, and feed them to a classifier, e.g, a random forest. Such models capture only a limited part of the complex reflectance distribution of the vegetation and its evolution. We posit that this is one of the factors that limit their performance, and undermines their robustness against noise in the data, even when advanced pre-processing techniques are used. Our approach is based on deep learning, which has recently shown great success in prediction tasks, from both image data and time series (e.g. in speech processing). We use a recurrent multi-layer neural network to learn the complex spectral, spatial and temporal patterns that differentiate different crop types from raw data. Our model is fed with a temporal sequence of images and encodes both spectral and temporal information, from which it then predicts the likelihoods of different crop types. We do not do any pre-processing, rather we let the model learn to disregard uninformative and noisy data, such as clouds and cloud shadows.

Here, we present the project aims, the processing methods, preliminary results, and initial validations.