Detecting snow in vegetation (PhenoCam) image time series using machine learning

Koen Hufkens, Margaret Kosmala, Donald M. Aubrecht, and Andrew D. Richardson

Harvard University, Richardson Lab, Cambridge, United States (koen.hufkens@gmail.com)

The PhenoCam network is a network of ∼400 cameras spread across the US which capture images on regular interval to monitor vegetation growth throughout the seasons. Currently, the >10 million images (∼8TB of data) are synoptically represented as a colour index (Gcc, or % green) tracking the state of the vegetation and supporting various (phenology) modelling efforts (https://phenocam.sr.unh.edu/).

However, the use of colour based indices limits the use of visual / contextual data stored within the images. Using a simple case study on the detection of snow within PhenoCam images using a Deep Neural Network (DNN) we show that additional ecological relevant information (e.g. canopy albedo and snow phenology) can be extracted from PhenoCam imagery.

More so, the DNN machine learning approach allows automatic processing of the complete archive in a consistent and reproducible way, scaling beyond what is possible by manual classification. As such, this initial exploration of snow detection using a DNN leads a new line of research by re-analyzing digital repeat photography time series within the PhenoCam archive using machine learning.