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UAV-based NDVI calculation over grassland: An alternative approach

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The Normalised Difference Vegetation Index (NDVI) is one of the most widely used indicators for monitoring and assessing vegetation in remote sensing. The index relies on the reflectance difference between the near infrared (NIR) and red light and is thus able to track variations of structural, phenological, and biophysical parameters for seasonal and long-term monitoring.
Conventionally, NDVI is inferred from space-borne spectroradiometers, such as MODIS, with moderate resolution up to 250 m ground resolution. In recent years, a new generation of miniaturized radiometers and integrated hyperspectral sensors with high resolution became available. Such small and light instruments are particularly adequate to be mounted on airborne unmanned aerial vehicles (UAV) used for monitoring services reaching ground sampling resolution in the order of centimetres. Nevertheless, such miniaturized radiometers and hyperspectral sensors are still very expensive and require high upfront capital costs.
Therefore, we propose an alternative, mainly cheaper method to calculate NDVI using a camera constellation consisting of two conventional consumer-grade cameras: (i) a Ricoh GR modified camera that acquires the NIR spectrum by removing the internal infrared filter. A mounted optical filter additionally obstructs all wavelengths below 700 nm. (ii) A Ricoh GR in RGB configuration using two optical filters for blocking wavelengths below 600 nm as well as NIR and ultraviolet (UV) light. To assess the merit of the proposed method, we carry out two comparisons: First, reflectance maps generated by the consumer-grade camera constellation are compared to reflectance maps produced with a hyperspectral camera (Rikola). All imaging data and reflectance maps are processed using the PIX4D software. In the second test, the NDVI at specific points of interest (POI) generated by the consumer-grade camera constellation is compared to NDVI values obtained by ground spectral measurements using a portable spectroradiometer (Spectravista SVC HR-1024i).
All data were collected on a dry alpine mountain grassland site in the Matsch valley, Italy, during the vegetation period of 2015. Data acquisition for the first comparison followed a pre-programmed flight plan in which the hyperspectral and alternative dual-camera constellation were mounted separately on an octocopter–UAV during two consecutive flight campaigns. Ground spectral measurements collection took place on the same site and on the same dates (three in total) of the flight campaigns. The proposed technique achieves promising results and therewith constitutes a cheap and simple way of collecting spatially explicit information on vegetated areas even in challenging terrain.