A process for reflectance calibration of UAV image data sequences

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Low cost and low weight UAV imaging systems offer great potential for local area remote sensing applications, such as agricultural, forestry, mining industry and hydrological applications, as well as scientific research. To obtain good reconstruction of object, images are collected in a block structure with large forward and side overlaps. Accurate interpretation of the data requires rigorous geometric and radiometric processing. Objective of this investigation was to develop method for accurate reflectance calibration of UAV image block data.

Phases of the reflectance calibration process are the laboratory calibration of the sensor and the radiometric correction of the campaign image data. Laboratory calibration includes determination of the spectral response of the sensor and determination of the model for lens falloff using a flat field. Rest of the processing is carried out using image data collected in the remote sensing campaign. First of all, the image block is georeferenced using self-calibrating bundle block adjustment method and accurate DSM is generated by automated image matching. The varying radiometric level of images due to changes in illumination and instability of exposure of the sensor are eliminated using a relative radiometric block adjustment technique. Finally, the relatively calibrated image block is transformed to absolute reflectance units by using characterized reflectance reference targets that are available in the campaign area. Output of this process is directional reflectance data, which can be further corrected for BRDF effects.

In this paper we present our reflectance calibration approach and evaluate its performance by using empirical image blocks collected in three different test areas: in an agricultural test area, in photogrammetric test field in Sjökulla and in a built area. All the campaigns were carried out under controlled conditions with reflectance reference targets.