

Geometric quality assessment of multi-rotor UAV-borne Remote Sensing product for Precision Agriculture (PA)

Miniaturization of the electronic devices opens doors for remote sensing using Unmanned Aerial Vehicle (UAV) with small imaging sensors. Cloud free, very high spatial resolution, real time remote sensing products can be obtained from the UAV remote sensing. Vegetation monitoring is the most applied remote sensing application using UAV. Precision Agriculture (PA) is a new level of farming strategy which used remote sensing as a main tool. UAV remote sensing provides the opportunity to collect accurate, timely data over agriculture fields to conduct PA applications. This study focus on geometric accuracy of the UAV remote sensing products from two different cameras that attached to the UAV for the PA. Moreover, remote sensing product generation from UAV images and difficulties of the process were identified from the study. A multi-rotor UAV with a consumer grade optical camera and a five band multispectral camera were used in this study. UAV was flew over test agriculture fields and image were acquired from both cameras. Acquired images were tested for light condition and blurriness effects. Based on the quality level UAV images were processed to obtain Digital Surface Models (DSM) and Ortho-rectified Image Mosaics from each image set. Geometric accuracy assessment using Ground Control Points (GCPs) were performed with different number of GCP and different pattern GCP distribution. Vertical accuracy of the products were not evaluated but average relative height difference of the two DSMs were evaluated. The DSM with 4.2 cm resolution and the ortho-mosaic with 2.1 cm resolution were derived from optical camera images. Similarly, the DSM with 22.6 cm and 5-band ortho-mosaic with 5.6 cm resolutions were obtained from multispectral images. Relative average elevation difference of agriculture crop area and non-crop area were 0.27 m and 0.14 m in derived DSM. The horizontal geometric accuracies of the optical camera product and multispectral camera product were 2 pixels and less than one pixel respectively. According to the area of 0.07 square kilometres, 06 GCPs were enough to obtain required geometric accuracy for PA. Blurriness of the UAV-borne images was identified as a limitation of the UAV remote sensing exercise and UAV motion blur, cloud shadow, and wind were noted as possible causes for the blurriness in this study.

Keywords: UAV, Precision Agriculture (PA), Geometric Accuracy, Blurriness, Ortho-Mosaic, Digital Surface Model (DSM)

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Master degree thesis, 30 credits in Master of Geomatics

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Student thesis series INES nr XX