**Calibration of UAV Multispectral Images for Uniform Reflectance Using Vignette and BRDF**

Chansol K.1, Seungchan L.2, Cheonggil Jin3 and Chuluong C.4\*

1First Author’s Affiliation: Master’s Degree(Coursework), Division of Earth and Environmental System Sciences(Major of Spatial Information Engineering), Pukyong National University, Republic of Korea

2Second Author’s Affiliation: Master’s Degree(Coursework), Division of Earth and Environmental System Sciences, Pukyong National University, Republic of Korea

3Third Author’s Affiliation: PhD, Division of Earth and Environmental System Sciences(Major of Spatial Information Engineering), Pukyong National University, Republic of Korea

4Fourth Author’s Affiliation: Prof., Division of Earth and Environmental System Sciences(Major of Spatial Information Engineering), Pukyong National University, Republic of Korea

[cuchoi@pknu..ac.kr](mailto:cuchoi@pknu..ac.kr)

***ABSTRACT***

Image mosaicking is a technology that is essential in fields that require UAV images in a wide area, such as agriculture, forestry and marine monitoring. However, UAV multispectral images have seam lines in the resulting images, even when they are stitched together during the same time period. This problem occurs because the reflectance of each image varies due to the position of the sun relative to the camera and changes in solar irradiance. In this study, the Vignette filter and BRDF (Bidirectional Reflectance Distribution Function) were applied to each image to compensate for the uneven reflectance of the aligned images. To obtain UAV images for the study, three types of flights (Vignette, BRDF Dome, and Validation) were conducted with the CRT (Calibrated Reference Tarp) in the centre. To compensate the images considering the weather conditions in the field, the irradiance and CRT radiance were measured with our own ROX (Reflectance bOX) and the irradiance was measured with the HOBO Solar&Par Sensor to validate the accuracy of the ROX. The non-unit DN (Digital Number) of the image has been converted to unit radiance to obtain objective and consistent values. The vignette and BRDF filters were then applied to each image for calibration and accuracy was verified with a validation image. For only Vignette filter, the image in the row direction showed a greater difference in reflectance than the image in the column direction due to the lower sidelap. When both the vignette filter and the BRDF filter were applied, a uniform reflectance was obtained in both the column and row directions, and it was difficult to find the seam line with the naked eye. The multispectral image normalisation technique developed in this study is expected to be widely used in various remote sensing applications, as it enables images of uniform reflectance to be obtained without significantly increasing sidelap and overlap.

**Keywords:** BRDF, Irradiance, Multispectral Image, UAV, Vignette