PRE-PROCESSING OF XEVA-XS IMAGERY FOR DETERMINING SPECTRAL REFLECTANCE COEFFICIENTS IN LABORATORY CONDITIONS

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ABSTRACT:

The work described in this paper had been conducted as part of the “IRAMSWater - Innovative remote sensing system for the monitoring of pollutants in rivers, offshore waters and flooded areas” project (PBS1/B9/8/2012), financed by polish National Centre for Research and Development. This project will enable the execution of the Water Framework Directive (2000/60/WE).
In recent years there had been a visible increase in the availability of light weight “amateur” UAV’s, which can be adapted for remote sensing applications, e.g. for research concerning water pollution. One of the many methods used to detect pollutants in water is a method based on spectral reflectance coefficients.
Spectral reflectance coefficients can be obtained from imagery acquired in different bands of the electromagnetic spectrum due to their close correlation to the pixel value (DN) on acquired imagery. There are two different methodologies which can be used to acquire imagery from which it would be possible to obtain spectral reflectance characteristics - the first based on images of a scene in which a reference panel had been included, and the second based on precisely selected exposure parameters. This paper is concerned with the first of these two methods based on experiments conducted using a 14bit XEVA XS-1.7.320 infrared sensor.
The paper firstly describes the effect of different exposure settings on the accuracy with which we can later determine the spectral reflectance coefficients. A series of three images of a test field, consisting of wooden and textile samples and a 95% white reference panel were obtained. Each scene was illuminated in exactly the same way. Between each acquisition the f-stop was changed in order to obtain a sensor response of $90\%*2^{14}$DN, $60\%*2^{14}$DN and $30\%*2^{14}$DN on the white reference panel. Knowing that that sensors noise level is about 250DN it was possible to calculate the relative errors in determining spectral reflectance coefficients. Next, the same procedure was repeated, only this time the f-stop was being set so that a grey reference panel reaches a given sensor response value.
The next step when working with such imagery in laboratory conditions is to eliminate the effect of the uneven distribution of illumination. This step can usually be omitted when acquiring imagery in field conditions, however in laboratory conditions it is almost impossible to obtain perfectly scattered light. In the paper we present two proposed methods for eliminating the uneven distribution of illumination - an additive method and a quotient method.
After that it is essential to stretch the DN values. Once again we investigated two possible methods of doing this - firstly, by stretching the data using only the white reference panel, adjusting the maxDN value of the image of the surface of the reference panel to 95%. The second method additionally adds a second reference point - a black reference panel which reflects 5% of incident radiation.
The spectral reflectance coefficients of chosen samples acquired using all of the above mentioned methods are compared with reference data obtained using a spectroradiometer. Establishing the most optimal methodologies will greatly increase the accuracy of obtained spectral response coefficients, which at the same time will increase the accuracy with which, in this case, water pollutants will be identified.

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