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## ESTIMATION OF THE SPECTRAL SENSITIVITY FUNCTIONS OF UN-MODIFIED AND MODIFIED COMMERCIAL OFF-THE-SHELF DIGITAL CAMERAS TO ENABLE THEIR USE AS A MULTISPECTRAL IMAGING SYSTEM FOR UAVS

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**Abstract.** Commercial off-the-shelf (COTS) digital cameras on-board unmanned aerial vehicles (UAVs) have the potential to be used as multispectral imaging systems; however, their spectral sensitivity is usually unknown and needs to be either measured or estimated. This paper details a step by step methodology for identifying the spectral sensitivity of modified (to be response to near infra-red wavelengths) and un-modified COTS digital cameras, showing the results of its application for three different models of camera. Six digital still cameras, which are being used as imaging systems on-board different UAVs, were selected to have their spectral sensitivities measured by a monochromator. Each camera was exposed to monochromatic light ranging from 370 nm to 1100 nm in 10 nm steps, with images of each step recorded in RAW format. The RAW images were converted linearly into TIFF images using DCRaw, an open-source program, before being batch processed through ImageJ (also open-source), which calculated the mean and standard deviation values from each of the red-green-blue (RGB) channels over a fixed central region within each image. These mean values were then related to the relative spectral radiance from the monochromator and its integrating sphere, in order to obtain the relative spectral response (RSR) for each of the cameras colour channels. It was found that different un-modified camera models present very different RSR in some channels, and one of the modified cameras showed a response that was unexpected. This highlights the need to determine the RSR of a camera before using it for any quantitative studies.

[Conference paper](#) (PDF, 1100 KB)

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