



Practical Spectral Photography

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Abstract

We introduce a low-cost and compact spectral imaging camera design based on *unmodified* consumer cameras and a custom camera objective. The device can be used in a high-resolution configuration that measures the spectrum of a column of an imaged scene with up to 0.8 nm spectral resolution, rivalling commercial non-imaging spectrometers, and a mid-resolution hyper spectral mode that allows the spectral measurement of a whole image, with up to 5 nm spectral resolution and 120×120 spatial resolution. We develop the necessary calibration methods based on halogen/fluorescent lamps and laser pointers to acquire all necessary information about the optical system. We also derive the mathematical methods to interpret and reconstruct spectra directly from the Bayer array images of a standard RGGB camera. This objective design introduces accurate spectral remote sensing to computational photography, with numerous applications in color theory, colorimetry, vision and rendering, making the acquisition of a spectral image as

simple as taking a high-dynamic-range image.

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