

## Application note: How to correct vignetting in images

The application note describes how to correct the vignetting in images acquired by a Sequoia camera.

For a given pixel  $p$ , its vignetting  $v$  affects incoming irradiance  $i$  depending on its coordinates in pixels  $(x_p, y_p)$  as follows:

$$p(x_p, y_p) = v(x_p, y_p)i(x_p, y_p)$$

Vignetting is continuous over  $(x_p, y_p)$  and can be represented as a polynomial  $v(x, y)$ .

In order to correct vignetting, an image is acquired over a flat field. This image then gets modeled by a 2D polynomial.

The following tags Xmp.Camera.VignettingPolynomial2DName and Xmp.Camera.VignettingPolynomial2D represent a 2D polynomial over  $[0, 1] \times [0, 1]$ .

Xmp.Camera.VignettingPolynomial2DName represents the powers of the variables  $x$  and  $y$  pairwise  $(n,m)$ . Each pair of powers corresponds to an element in Xmp.Camera.VignettingPolynomial2D  $(c_{n,m})$ .

The polynomial is then

$$v(x, y) = \sum_{n,m} c_{n,m} x^n y^m$$

In order to convert the pixel coordinates  $(x_p, y_p)$  to polynomial coordinates  $(x, y)$  one divides by the dimensions of the image  $w, h$ :

$$x, y = \frac{x_p}{w}, \frac{y_p}{h}$$

For example, Xmp.Camera.VignettingPolynomial2DName={"0,0,1,0, ..., 2,2,3,1"} and Xmp.Camera.VignettingPolynomial2D={0.633287676149, 1.47936368033, ..., 1.58329242609, 0.130259802058} means  $c_{\{0,0\}}=0.633287676149$ ,  $c_{\{1,0\}}=1.47936368033$ , etc...

Xmp.Camera.VignettingPolynomial2D	XmpSeq of String		Coefficients of the polynomial
Xmp.Camera.VignettingPolynomial2DName	XmpSeq of String		Powers of the variables $x$ and $y$ pairwise $(n,m)$

Due to continuous updates of our products, some tags may be missing in your images. If so please check that you updated your camera to the latest firmware available. If the problem persists, contact us at [sequoia@parrot.com](mailto:sequoia@parrot.com) to discuss recalibration options.