FlakeAutoFind

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1 General Algorithm

The image is flattened using an infered background level. After increasing contrast, edge detection is used to

2 Flattening

The symmetry of the background is assumed to that of an ellipse. Similar to a circle, where the radius is defined

$$s^2 = (x - x_c)^2 + (y - y_c)^2$$

we define a distance coordinate

$$s^2 = (x - x_c)^2 + r^2(y - y_c)^2$$

where r is the aspect ratio of the ellipse, given

$$r = \frac{\text{width}}{\text{height}}$$

In this way, we consider the background to be a function of the elliptical distance. To maintain smoothness, the background is modeled as the sum of even terms:

$$B_N(s) = \sum_{n=0}^{N} a_n s^{2n}$$

Clearly, the first n coefficients can be solved for using a system of linear equations generated by n samples of the background. This yields the equation

$$B = SA$$

where B is a vector of background values, A is a vector of the coefficients, and S is the Vandermonde matrix of the values s_i^2.

Once the coefficients are determined, the equation can be determined recursively as:

$$f_0 = a_N$$

$$f_n = s^2 f_{n-1} + a_{N-n}$$

with

$$B_N(s) = f_N$$

For simplicity, we consider only the lowest two orders,

$$B_2(s) = a_0 + a_1 s^2$$

Taking two samples,

$$B_2(s_1) = a_0 + a_1 s_1^2$$

$$B_2(s_2) = a_0 + a_1 s_2^2$$

$$B_2(s_2) - B_2(s_1) = a_1(s_2^2 - s_1^2)$$

$$a_1 = \frac{B_2(s_2) - B_2(s_1)}{s_2^2 - s_1^2}$$

$$a_0 = B_2(s_1) - a_1 s_1^2 = B_2(s_2) - a_1 s_2^2$$