
Color Correction Matrix Application Note

Conceptually, the color correction is designed to eliminate the overlap in the color channels caused by the fact that Blue light is seen by the Red and Green pixels on the imager, Red light is seen by the Blue and Green pixels, and Green light is seen by the Red and Blue pixels. The color correction matrix provides a means of subtracting out this overlap. In the camera, each pixel has a Bayer mask which forces it to only see one color.

The custom matrix converts RGB pixels to new R'G'B' pixels in the following manner:

$$\text{NewPixel} = \text{CCMatrix} * \text{Pixel}$$

or:

$$\begin{bmatrix} R' & G' & B' \end{bmatrix} = \begin{bmatrix} \text{CC1} & \text{CC2} & \text{CC3} \\ \text{CC4} & \text{CC5} & \text{CC6} \\ \text{CC7} & \text{CC8} & \text{CC9} \end{bmatrix} * \begin{bmatrix} R & G & B \end{bmatrix}$$

So to calculate the new R' as an example:

$$R' = [\text{CC1} \text{ CC2} \text{ CC3}] * [R \ G \ B]$$

or:

$$R' = \text{CC1} * R + \text{CC2} * G + \text{CC3} * B$$

The actual values for CC1, CC2 and CC3 will typically have CC1 > 1 and CC2 < 1 and CC3 < 1. The sum of all three will always equal 1, to maintain color balance and brightness.

For example:

$$\text{CC1} = 1.6$$

$$\text{CC2} = -0.3$$

$$\text{CC3} = -0.3$$

So, with these values the equation for the new Red pixel becomes:

$$R' = 1.6 * R - 0.3 * G - 0.3 * B$$

The effect of this equation is a boost to the Red component and a subtraction of a portion of the Blue and Green components.

For Green, the values for CC4, CC5 and CC6 would be something like:

$$\text{CC4} = -0.3$$

$$\text{CC5} = 1.6$$

$$\text{CC6} = -0.3$$

So in this configuration, the Green is boosted and a portion of the Red and Blue components are subtracted.

(Blue left as an exercise for the reader.)

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