

Non-uniformities in Colour Balancing

Introduction & Motivation

Digital image sensors function by capturing the light intensity of a scene through an array three different colour filters. This information, however, cannot be directly output to produce an image. There are several image processing steps that have to be performed to take this raw data and produce an acceptable image. Steps in this image processing pipeline include defect correction, lens shading, demosaicing and colour balancing.

The colour balancing processing step is a critical step in the pipeline. Without the colour balancing stage, the colours in the image could look very distorted to the viewer. This is because a digital image sensor just records what it sees, whereas the human visual system is system which is constantly adapting the information to take into account the environment. Thus, what the eye sees, and what a digital image sensor sees can be drastically different.

The human visual system interprets the scene by taking into account the lighting, and so digital image sensors need to perform colour balancing to produce the correct perception of colours.

As an example, figure 1 shows a sample image without proper colour balancing, while figure 2 shows the same image with colour balancing applied.



Figure 1: Image without proper colour balancing. Lighting conditions make image look very yellow-ish



Figure 2: Color balanced version of previous image. In this image, the yellow-ish effect of the lighting has been corrected

Motivation

While colour balancing is an area that has been studied extensively in the past, new digital image sensors are beginning to show undesirable colour effects that produce a challenge for traditional colour balancing algorithms.

The colour effects that appear in the images are beginning to exhibit non-uniformities across the image. Different areas of the image sensor are beginning to show different colourations. To further complicate matters, it may be the case that certain colours are showing this variable distortion more than other colours.

As a motivating example, figure 3 shows an image and figure 4 shows the same image but with variable colour distortion (in this case, as a function of distance from the centre of the image).



Figure 3: Original image



Figure 4: Image showing non-uniform colour distortion. Image periphery shows more distortion than image centre