Why Microfilm Scanners with a Monochrome Image Sensor produce better quality images than a Colour Image Sensor

Introduction

There is always the possibility of overlooking monochrome cameras while seeking an imaging solution due to the availability of various new cameras with improved low light performance, vivid colour, and sharp contrast.

However, **monochrome cameras have a higher light sensitivity, generate sharper images with superior resolution, and output smaller file sizes**, making them suitable for a number of applications e.g. the scanning of Microfilm & Microfiche.

Advantages of Monochrome Image Sensor over Colour Image Sensors

Unlike a Colour Image Sensor, a Monochrome Image Sensor does not use a **Colour Filter Array (CFA),** which is an optical band pass filter.

The lack of CFA allows for more numbers of photons to reach the sensor's photosensitive surface, thus rendering it more sensitivity to light or higher quantum efficiency.

Moreover, IR cut filters are usually present in colour cameras with Colour Image Sensors to avoid infrared light from producing colour aberrations.

The absence of these filters would allow the red, green, and blue pixels to react with different near infrared (NIR) wavelengths, thus producing inaccurate and strange colours.

Conversely, **the lack of the CFA and IR cut filter enables every pixel of a Monochrome Image Sensor to detect a broader light spectrum, thereby significantly improving the overall performance of the camera in low lighting conditions.**

Hence, additional enhancements can be observed at higher wavelengths, especially above 650nm, where the NIR region begins.

Cameras featuring CFAs have to interpolate the colour data that is filtered out by the optical filters using complex demosaicing algorithms.

These calculations introduce a margin of error, as the data is interpolated and not quantified.

The added error can be eliminated upon removal of the CFA.

This, in turn, helps generate sharper images with a higher effective resolution due to the presence of a measured value in every pixel of a monochrome sensor that is not affected by its neighbour's (Figures 1A and 1B).

The reduced size of the monochrome image files can also attributed to the absence of the CFA.

There is a threefold reduction in the image size owing to the absence of specific colour channel information in the monochrome image data.

The bit depth would also be increased because of this size reduction without compromising storage savings, camera permitting.

Figure 1. A.

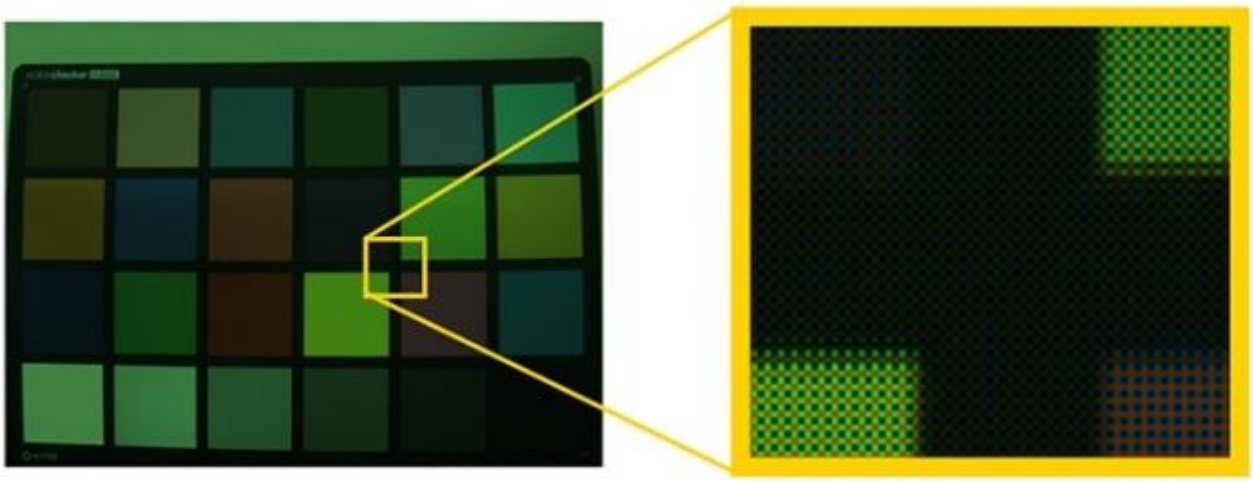

Figure 2.B

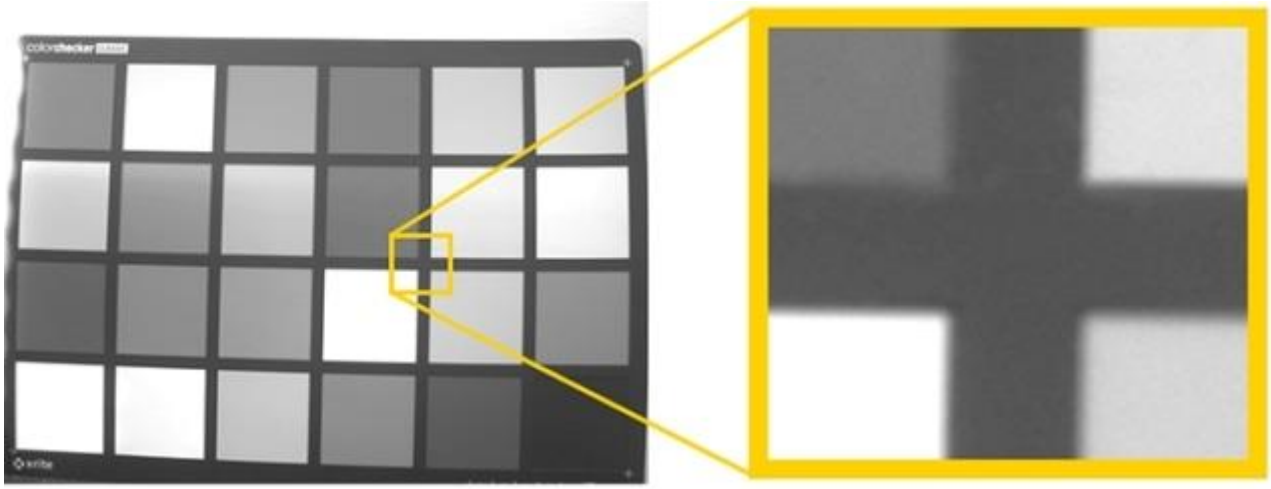

Figure 1. A. *Enlargement of **a raw RGB image capturing a colour chart**.*
The colour channels are displayed as seen by the image sensor, with Bayer pattern – without demosaicing.

Figure 2. B. *Enlargement of **a raw monochrome image capturing the same colour chart.***
Gray-levels are consistent for each area and no Bayer pattern is present – demosaicing not required.