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How Does Prism Technology Help to Achieve Superior Color Imaging

Achieving superior image quality requires real and full color depth for every channel, improved color contrast and color differentiation, low inter-channel crosstalk and noise levels. These vital image quality factors can be achieved using the unique advantages of prism technology. Cameras based on Bayer pattern sensors block part of the light falling on it due to the very nature of the light filtering process. Due to this reason, several camera technologies on the market rely heavily on FPGA based image processing to repair image quality.

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WHITE PAPER
 How does prism technology help to achieve superior color image quality?

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1. Background and Motivation

Since the advent of machine vision, camera technology has been at the center of its growth. Image sensors used in these cameras have developed exponentially. A few of the CMOS sensors available today (like the 2nd generation Sony IMX ProPlus Series) provide better SNR, stability and linearity than CCD sensors. Today, even though a large portion of imaging is monochrome, the share of color cameras is growing much faster than expected. A large part of color imaging is based on "Bayer pattern sensors". As there is no significant pricing difference between monochrome and Bayer sensors, the latter has been successful in replacing monochrome cameras in many low cost applications where color requirements are fairly simple. Camera manufacturers are able to take full advantage of these developments and today it has become relatively easy to assemble these sensors in simple camera housing, then add signal processing and a data interface to it. As the market demand for superior color image quality is growing, there has been a significant effort to add intelligent image processing algorithms on the camera head to repair the artifacts arising from the Bayer pattern. However, this improvement is at the cost of critical factors such as sharpness, color accuracy, image noise and speed.

On the other hand, multi-sensor prism-based cameras are sophisticated. The assembly of sensors along with the prism block requires very high precision and demands in-depth know-how and skill. The advantage of this technology is superior image quality which does not require image repair. This white paper focuses on multi-sensor prism-based camera technology, highlights its technological advantages and showcases the future of color imaging in machine vision.

2. Multi-sensor prism-based vs. single sensor cameras

2.1 Propagation of light

Inside a prism-based camera, the photons entering the optical system propagate through the prism before interacting with the sensors.



Fig. 1: Separation of light inside the prism block

White Paper Series - Prism Technology
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