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INVESTIGATION OF THE SMARTPHONE CAMERA WITH SOLID-STATE ILLUMINATION FOR HYPERSPECTRAL IMAGING

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Every camera including those in smartphones can be called quasi-hyperspectral imaging devices due to the typical three- or four-color channel imaging. In particular Red (R), Green (G), Blue (B) and sometimes IR colors are captured separately resulting in a stack of monochromatic pictures. Such an approach is sufficient for taking the best memories of your life but usually is not sufficient for the analytical and scientific analysis of the objects under investigation. Therefore, a choice of sophisticated and expensive imaging instruments in the market is available and expanding each year. In particular, multicolor imaging devices and even imaging spectrophotometers (hyper spectral cameras) are available and applied for scientific purposes. Unfortunately, such devices are sophisticated, bulky, expensive and very difficult to operate.

In this work we present a slightly different approach of hyperspectral imaging where standard smartphone camera in combination with multicolor illumination system is applied. Such a system could be applied in variety of fields ranging from artwork investigation to medical examination or sophisticated laparoscopy surgery. The aim of the work is to develop the principles of the smart solid-state lamp with direct control from the smartphone to take pictures at different illumination regimes (different colors). To accomplish this task the camera properties of the brand-new smartphone (Google Pixel 7 pro) were investigated and tested at different regimes. In particular, dynamic linearity, flat field pixel mapping, sensitivity spectra, etc. were measured. Furthermore, the proof of concept was demonstrated by taking pictures at different illumination regimes, and color discrimination ability calculated.

To conclude we have demonstrated that even consumer-market-grade smartphone camera might be operated as multispectral imaging device for a specific task. On the other hand the applicability limitation of such an approach has to be taken into account.