ICO HyperPi Program

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Hyperspectral and multispectral cameras have proven to be indispensable analysis tools in pre- and post-harvest agricultural inspection, in art restoration and preservation, in quality control of pharmaceuticals, in plastics recycling, in astronomical chemical analysis, in biological tissue discrimination to name a few. Multispectral and hyper spectral images contain many spectral data points per pixel. Such spectral content allows the user to see subtle differences or unique properties that are not detectable on standard cameras.

Unfortunately, such cameras can be very expensive (up to tens of thousands of dollars) making them out of reach for most users. Recently, the International Commission for Optics (ICO) has developed the HyperPi program, a low-cost ($100-$200) method to build a multi-spectral camera using the Raspberry Pi motherboard and camera module that can be used in a wide variety of contexts. The program serves many purposes. First, the low cost allows resource-constrained researchers around the world to use the powerful features of the cameras to perform state-of-the-art research. Second, student chapters who engage in the project learn about 3D printing, electronics, image analysis, programming, artificial intelligence, and feedback. It can become an important tool in their experimental physics/engineering/optics training. Third, the cameras can be used to benefit lives, such as improving crop yields, maintaining water purity, enabling plastics sorting and recycling and eliminating tainted or bogus pharmaceuticals—significant issues that affect the developing world.

The first successful demonstration of the camera is the HyperActivePi (Figs. 1, 2, 3). Groups in Ecuador, the United States and South Africa are working on developing their models as well as experiments that can utilize the HyperPi including: post-harvest food monitoring, tissue discrimination, forest monitoring and wheat stress. At the upcoming ICO General Assembly, we will hear from these researchers and learn about their findings.

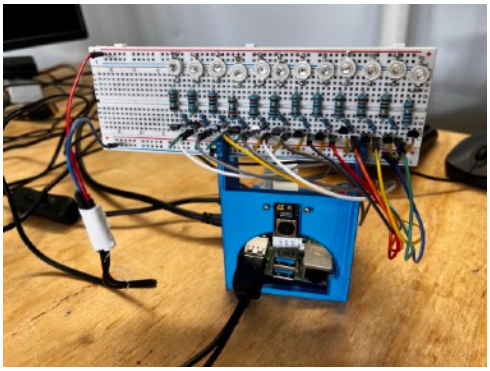

Fig. 1: HyperActivePi

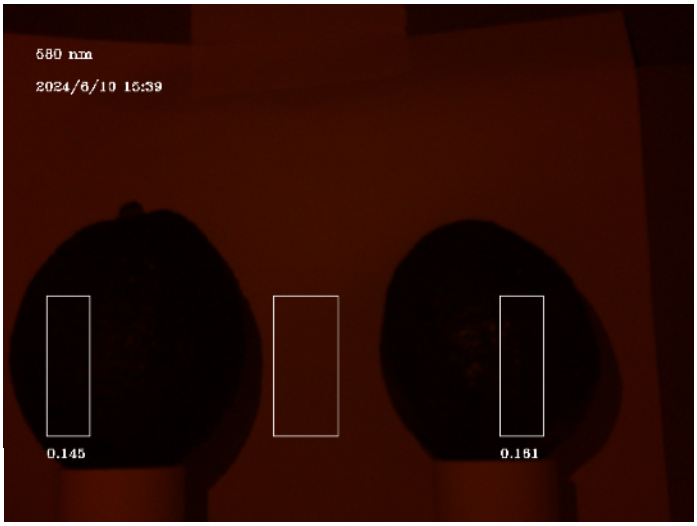

Fig. 2: 580 nm image of ripening avocados

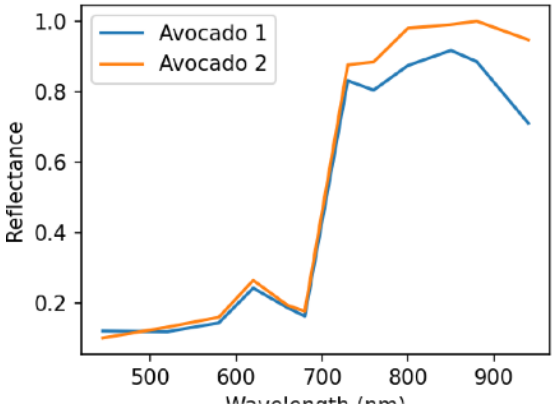

Fig. 3: Average spectral reflectance in the regions over the avocados.