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Selecting The Right Hyperspectral Imager Is Key To Bringing Critical Data Into View

Selecting The Right Hyperspectral Imager Is Key To Bringing Critical Data Into View

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Hyperspectral imaging is a valuable technique for revealing data the eye alone cannot capture. Now, a new class of hyperspectral imaging systems is taking things one step further by addressing image quality issues and enabling further ease-of-use. These features, coupled with their unwavering ability to pick out different characteristics from an image, make hyperspectral imagers highly prized for a range of applications, from studying crime scenes to gathering forensic evidence and checking foods for signs of contamination, to precision agriculture using unmanned aerial vehicles (UAVs).

Despite its myriad of benefits, the hyperspectral imager does come with challenges, not the least of which is choosing the right one to use for any given application. That decision depends in part on the user's requirements, the wavelength range in which the imager will be used, and the intended application. Selecting the right hyperspectral imaging system is critical to acquiring optimal data.

Hyperspectral Imaging 101

Before delving into the criteria for selecting a hyperspectral imaging system, it's critical to first have a basic understanding of how these systems work and their limitations. Hyperspectral imaging is a technique in which the spectrum of each pixel in an image is determined and then used to find objects, identify materials, or detect processes. It works by gathering spatial data in the X and Y dimensions and then adding in hundreds of layers of spectral data on top. The result is a three-dimensional cube that can be processed and analyzed.

There are two main types of hyperspectral imaging systems, push broom and snapshot. In push-broom mode, the imager gathers one spatial dimension and the spectral dimension. The other spatial dimension is acquired by moving the imager over the scene being imaged, or moving the objects being viewed past the imager (e.g., on a conveyor belt). In snapshot mode, no movement is necessary. Instead, the imager sensor is subdivided into many different regions, each taking the same X-Y image, but with each sub-region covering a different wavelength.

Unlike a standard RGB camera, which sees only a specific range of wavelengths (between 470 to 670 nm) and essentially three broad bands of color, hyperspectral imagers can cover a much wider range (ultraviolet, visible, visible to near-infrared, short-wavelength infrared, and long-wavelength infrared) and distinguish among hundreds of bands of color. As a result, information that would otherwise be invisible becomes visible – such as a hidden piece of work under a painting.

The technique does have its limitations, however. Legacy hyperspectral imaging systems are bulky, heavy and costly. They are also difficult to operate. Because of that, they have typically been installed in satellites or mounted on aircraft for surveying forest canopies or performing other types of environmental studies. Their use in airborne applications, such as in a drone, was simply impractical. While newer hyperspectral imaging systems are smaller and light enough to make

Hyperspectral imaging is a valuable technique for revealing data the eye alone cannot capture. Revealing different characteristics from an image, hyperspectral imaging is highly prized for many applications, from gathering forensic evidence and checking food contamination, to precision agriculture using unmanned aerial vehicles (UAVs). Despite its myriad of benefits, the hyperspectral imager does come with challenges, not the least of which is choosing the right imager for acquiring optimal data. This paper reveals critical criteria for selecting the right hyperspectral imager for a given application.

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