Bodkin Design and Engineering Demonstrates Spectral Video Microscopy

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Simultaneous measurement of over ninety spectral bands allows the identification of biologically important chemicals in real time in living tissues. At frame rates of up to 60 FPS, the chemical changes associated with processes such as blood flow, mitosis, apoptosis and endocytosis can be observed as they happen.

For the preliminary demonstration, imagery was taken from a MONOprep® slide of prepared cervical epithelial tissue. Using a 100X oil immersion lens, cell nuclei and other sub-cellular structures were clearly visible in the hyperspectral image.
Figure 2 Comparison of images taken through the microscope with a conventional color camera (a) and with the VNIR90 hyperspectral imager (b). The VNIR90 produces hyperspectral images with 90 wavebands, from which three were chosen to form the RGB image above. Each pixel in the hyperspectral image has a complete spectrum over the range of 500 to 900 nm. Note that the nuclei in the cell at left are clearly visible, and in addition, there is at least one hyperspectral pixel, and thus unique spectrum, on each of the sub-cellular structures to the right of the nuclei.

As illustrated in Figure 2, the resolution of the hyperspectral image is comparable to that of the conventional color image, where each salient structure is visible, with multiple pixels to give accurate spectral information.

As with all products in BDE’s line of Hyper-Pixel Array (HPA™) hyperspectral imagers, the VNIR90 is designed with a fore-optic separate from the optical processor. This means that the system can be used with any fore-optic having a C-mount. This flexibility allows the instrument to be used with any microscope, which enables analysis of fixed tissue, live-well, and even in-vivo imaging of biological tissues. The nature of BDE’s HPA® imagers allows them to acquire full spectral images at the frame rate of the detector array, thus allowing hyperspectral imaging at video rates.

The entire VNIR90 system consists of the small imager, readily mounted to any microscope, and a conventional laptop computer. Communication with the imager is through USB, and the computer performs all hyperspectral image processing and analysis. The hyperspectral images produced by the VNIR90 are in ENVI format, allowing analysis using standard hyperspectral tools. As illustrated in Figure 3, the hyperspectral image can be examined pixel by pixel to extract spectral information.
Figure 3: Screenshot from VNIR90 laptop computer. The background displays the same sample photographed with a conventional color image and with the VNIR90. The insets show the ENVI® analysis window and the full spectrum of a single selected pixel.

This breakthrough in medical imaging is part of an ongoing effort by BDE to expand the utility and application of hyperspectral imaging. In addition to integrating our systems with microscopes, our patented HPA™ imagers have been used for near and far-field imaging, and for hyperspectral imaging through telescopes.

Contact BDE to find out how our revolutionary hyperspectral technology can add a new dimension to your medical imaging.

ABOUT THE COMPANY

Bodkin Design and Engineering, LLC has been providing concept development and design and build services since 1992. Headquartered in Newton, Massachusetts, the company serves the international OEM, commercial, military, and research communities and is a leading maker of custom-engineered electro-optic instruments for the biotechnology and healthcare industry. The company’s products are manufactured and marketed through a combination of in-house efforts and strategic relationships. BD&E has a diverse patent portfolio and has overseen the successful introduction of products ranging from dental imagers to spectroscopic instruments for drug discovery.