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Realization of Confocal and Hyperspectral Microscopy via Compressive Sensing TING SUN, Rice University, DHARMPAL TAKHAR, JASON LASKA, MARCO DUARTE, VIVEK BANSAL, RICHARD BARANIUK, KEVIN KELLY — Given its important role, factors such as sensitivity, resolution, dwell time, and bandwidth limit are critical parameters for detectors in modern microscopy. A new method known as compressive sensing has emerged, which greatly improves the imaging resolution of these detectors. In our configuration, a digital micromirror device randomly but controllably modulates the light before it is collected at the detector. This process simultaneously compresses the signal because the measurement projects the signal onto a white-noise basis. Subsequently, the data from this incoherent basis is reconstructed into a complete real-space image. Given its compressive nature, far fewer measurements are required than the total number of pixels which greatly decreases the acquisition time of the signal. In addition, the intensity of the compressed signal at the detector is much greater than its raster scan counterpart and therefore results in greater signal sensitivity and improved image quality. These advantages make compressive sensing particularly attractive for use in hyperspectral and confocal microscopy.

Ting Sun
Rice University

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