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Compressed Sensing and its Applications in Imaging DHARMPAL TAKHAR, TING SUN, JASON LASKA, MARCO DUARTE, RICHARD BARANIUK, KEVIN KELLY, Department of Electrical and Computer Engineering, Rice University, Houston, Texas — Compressed sensing is a new sampling theory which allows reconstructing signals using sub-Nyquist measurements/sampling. This can significantly reduce the computation required for image/video acquisition/encoding, at least at the sensor end. Compressed sensing works on the concept of sparsity of the signal in some known domain, which is incoherent with the measurement domain. We exploit this technique to build a single pixel camera based on an optical modulator and a single photosensor. Random projections of the signal (image) are taken by optical modulator, which has random matrix displayed on it, corresponding to the measurement domain (random noise). This randomly projected signal is collected on the photosensor and later used for reconstructing the signal. In this scheme we are making a tradeoff between the spatial extent of sampling array and a sequential sampling over time with a single detector. In addition to this method, we will also demonstrate a new design which overcomes this shortcoming by parallel collection of many random projections simultaneously. Applications of this technique in hyperspectral and infrared imaging will be discussed.

Kevin Kelly
Department of Electrical and Computer Engineering, Rice University, Houston, Texas

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