Novel Approaches for Real-time Compressive Sensing
Reconstruction of Sparse Signal Sequences

APPLICATION AREAS
Compressed Sensing

ABSTRACT
Compressed sensing (CS), also known as compressive sensing or sparse reconstruction, is an emerging field of research related to signal processing. Compressive sensing allows data from a signal source to be simultaneously sampled and compressed, and allows a single or few sensors to acquire a fraction of the data that in the past has been obtained by many similar sensors and uses a mathematical solution to reconstruct the signal. Most solutions for CS of a time sequence of signals/images employ an approach that treats the entire time sequence as a single spatiotemporal signal and performs batch-CS to reconstruct it. In addition to not being in real-time, this is a non-causal solution and also has high computational cost. On-line compressive sensing requires many more measurements per unit time for accurate reconstruction, which effectively translates into longer scan time. If the number of observations is small, current simple compressive sensing approaches can also incur a large error. To overcome these drawbacks, an ISU researcher has developed new approaches: Kalman Filtered Compressed Sensing (KF-CS) and its non-Bayesian version called Least Squares Compressed Sensing (LS-CS). These are recursive algorithms for sparse signal sequence reconstruction, and have been evaluated for causal reconstruction of medical sequence images from magnetic resonance (MR) data with greatly improved reconstruction results from cardiac dynamic and brain MRI data compared to other CS approaches. In addition, KF-CS and LS-CS have utility for other applications, including real-time video imaging using a single-pixel camera, video compression/transmission/decompression for real-time applications such as video conferencing, real-time sensing applications, such as temperature/pressure field sensing.

BENEFITS
- Enables real-time compressed sensing
- Provides accurate signal reconstruction
- Requires fewer measurements than currently available MRI reconstruction algorithms
- Shown to be several hundred times faster than batch CS methods
- Has utility for numerous applications

REFERENCES:


INVENTOR(S)
Dr. Namrata Vaswani (Electrical and Computer Engineering)
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LICENSED CONTACT
Jay Bjerke
E-mail: licensing@iastate.edu
Phone: 515-294-3621 (Direct Line)