SEMINAR NOTICE

Department of Electrical and Systems Engineering

Signal Recovery from Randomized Measurements Using Structured Sparsity Models

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Abstract: We are in the midst of a digital revolution spawned by the proliferation of sensing devices with ever increasing fidelity and resolution. The resulting data deluge has motivated compression schemes that rely on transform coding, where a suitable transformation of the data provides a sparse representation that compacts the signal energy into a few transform coefficients. This standard approach, however, still requires signal acquisition at the full Nyquist rate, which cannot be achieved in many emerging applications using current sensing technology. The new acquisition paradigm of compressive sensing (CS) leverages signal sparsity for recovery from a small set of randomized measurements. The standard CS theory dictates that robust recovery of a K-sparse, N-length signal is possible from M=O(K log(N/K)) measurements. New sensing devices that implement this measurement process have been developed for applications including optical and seismic imaging, communications, and biosensing.

In this talk, we show that it is possible to substantially decrease the number of measurements M without sacrificing robustness by leveraging more concise signal models that go beyond simple sparsity and compressibility. We review two frameworks to represent the additional structure. First, we present a model-based CS theory that exploits the dependencies between values and locations of the significant signal coefficients; we also provide concrete guidelines on how to create model-based recovery algorithms with provable performance guarantees that require only M=O(K) measurements. Second, we review manifold-based CS for applications where the signal acquired is governed by a small set of K parameters. Interestingly, we show that the information in an N-dimensional signal from the manifold can be recovered from M=O(K log N) measurements. We derive compressive estimation and classification algorithms that leverage the large amount of structure present in manifold models.

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Host: R. Martin Arthur

Bio: Marco F. Duarte is currently a PhD candidate in the Department of Electrical and Computer Engineering at Rice University. He obtained the BS degree (with distinction) in Computer Engineering and the MS degree in Electrical Engineering from the University of Wisconsin at Madison in 2002 and 2004, respectively. In the summer of 2006, he worked on computational imaging at Ricoh Innovations, Menlo Park, CA. His research interests include compressive sensing, dimensionality reduction, and distributed signal processing.

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