Sigma-Delta Quantization for Compressed Sensing Measurements

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Compressed sensing deals with the problem of representing sparse signals in high dimensions using a small number of linear measurements. Algorithms such as basis pursuit have been extensively studied and are known to provide stable and robust methods for recovering signals from their compressed sensing measurements. An important practical consequence of robust recovery results is that compressed sensing performs well in the presence of quantization (i.e., analog-to-digital conversion). We study the class of sigma-delta algorithms as a quantization method for compressed sensing and prove error bounds to quantify the improvement over standard scalar quantization. This requires a two stage reconstruction that first uses a coarse support-identifying step, and then crucially makes use of Sobolev dual frames associated to Gaussian random matrices. This is joint work with Sinan Gunturk, Mark Lammers, Rayan Saab, and Ozgur Yilmaz.