

# Reconstruction algorithms for quantized redundant representations

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We study the problem of digital representation for overcomplete signal expansions. We focus on mathematical analysis for two different main approaches to this problem: fine quantization and coarse quantization. We present new algorithms and prove new error bounds in these settings. Our main emphasis in the context of fine quantization will be on an iterative thresholding algorithm of Rangan/Goyal; we show that this algorithm achieves optimal order mean squared reconstruction error under the classical PCM white noise hypothesis. Our emphasis in the setting of coarse quantization will be on the class of higher order sigma-delta algorithms. We show that it is possible to construct noncanonical reconstruction frames which for  $r$ -th order sigma-delta quantization of finite frame expansions achieves error of order  $1/N^r$  where  $N$  is the frame size; this order of approximation is generally not achievable with canonical dual frames.