DISTRIBUTED NOISE-SHAPING QUANTIZATION OF BANDLIMITED FUNCTIONS IN SEVERAL VARIABLES USING RANDOM SAMPLES

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Abstract. Noise-shaping quantization techniques are widely used for converting bandlimited signals from the analog to the digital domain. They work by "shaping" the quantization noise so that it falls close to the reconstruction operator's null space. In our previous work [1], we established a first error analysis for reconstruction from quantized random samples of bandlimited signals both in the case of $\Sigma\Delta$ and distributed noise-shaping. Our theoretical findings suggested an advantage of the latter approach, which we also observed in our numerical experiments. As a result, distributed noise-shaping quantization is the sole focus of our present work.

In our earlier work [1], we examined the three-bin situation, where the sample points $\{x_i\}_{i=1}^m$ are partitioned into three sets or bins. In our present study, we investigate the impact of increasing the number of bins on our obtained error estimates. Furthermore, our previous results concentrated on bandlimited functions defined on $\mathbb{R}$ and their quantization, but in our current work, we explore higher dimensional cases. In our prior study, the sampling interval increased as the number of samples grew. In this study, we develop and investigate an algorithm in which the error decreases with increasing sample size but does not require a corresponding increase in the sampling interval. This is a joint work with Felix Krahmer and Radha Ramakrishnan.

References

1. Rohan Joy, Felix Krahmer, Alessandro Lupoli, and Radha Ramakrishnan, *On the reconstruction of bandlimited signals from random samples quantized via noise-shaping*, 2023, https://arxiv.org/abs/2306.15758v2.

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