Learning Sub-Nyquist Sampling for FRI Signals

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Finite-rate-of-innovation (FRI) signals are ubiquitous in applications such as ultrasound, radar, and time of flight imaging [1, 2]. FRI signals can be sampled at sub-Nyquist rates and reconstructed using sparse-recovery algorithms [2, 3]. The reconstruction is performed from the Fourier samples of the FRI signals. The reconstruction quality depends on the choice of Fourier samples and recovery method. In this work, we jointly optimize the choice of Fourier samples and reconstruction parameters. Our framework is a fusion of a greedy subsampling algorithm and a learning-based sparse recovery method. Unlike existing techniques [4-6], the proposed algorithm is flexible to changes in the sampling rate and exact knowledge of the FRI pulse is not required. The proposed joint design leads to lower reconstruction error for FRI signals compared to non-learning-based approaches such as random sampling and greedy CRLB-based sampling.

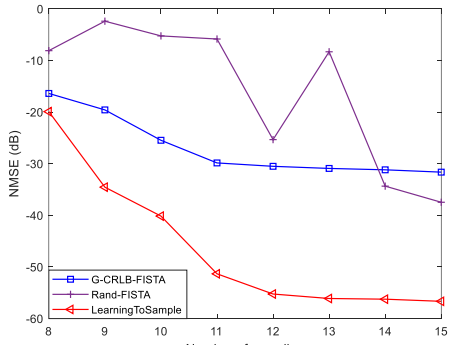

Fig. 1 A comparison of performances different methods as a function of number of samples.

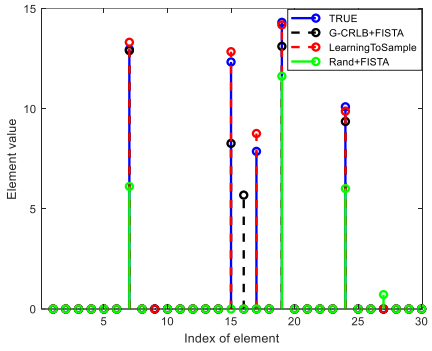

Fig. 2: An example of recovery performances for different algorithms.

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