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# COMPRESSED SENSING APPLIED TO ULTRASOUND IMAGE RF RAW DATA: EVALUATION OF IMAGE RECONSTRUCTION

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**Summary:** In the last few years, compressed sensing (CS) has attracted much attention from different research areas, like biomedical image processing, radar technology and seismology. Compressed sensing has found different applications in ultrasound imaging, like 3D imaging, ultrasound computed tomography and in the standard B-Mode imaging. In this work, we evaluate the application of CS to the ultrasound RF raw-data (pre-beamforming RF) of each individual channel. Thus, instead of applying CS techniques to the matrix of N channels together, we apply it to each nth vector of the matrix (each RF A-line). Prior reported works, to the best of our knowledge, only evaluate the error in each individual vector, not the quality degradation in the resulting reconstructed imaging. In this work, we used the Structural Similarity Index – SSIM to compare the original image to the image built with the data recovered with the lower sampled-rate data. We used Field II cyst phantom example as data input with sampling frequency of 35 MHz (a value close to the sampling frequency of real ultrasound imaging systems) and transducer center frequency of 3.5 MHz. Then we acquired a reduced number of points of each channel using a random matrix with normal distribution, recovered the data of each channel using optimization methods and built the B-Mode imaging following the example script provided by Field II. During this evaluation, we used DFT and DCT transforms as representation bases and l1-MAGIC MATLAB® toolbox to recover the data. We performed simulations with vectors with length equivalent to those we would obtain when using sampling frequencies of 28, 21, 14, 7 and 3.5 MHz and compared the reconstructed images with the example image that uses data sampled at 35 MHz. The best results (higher SSIM) were achieved using DCT transform. We obtain images visually similar to the original image when their reconstruction use signals acquired with sampling frequencies above or equal to 14 MHz, which do not represent a good data rate reduction (7 MHz instead of 35 MHz). These images have a SSIM greater than 0.85.