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Low-Cost, High-Resolution Computational Ultrasound Imaging

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Abstract

Computational ultrasound imaging is a novel low-cost and high-resolution ultrasound imaging system that utilizes one ADC per array. Unfocused transmit and receive echo pulses are spatio-temporally apodized with random, binary sequences. The acquired single-channel signal is decoded using convex optimization in order to reduce signal interference. The system is capable of imaging spatially-sparse point scatterers, resulting in typical PSNRs of 37 dB. Computational ultrasound has a sub-wavelength resolution of 0.2 mm laterally and 0.3 mm longitudinally. Simulations of point scatterers and cysts are per- formed using Field II and CVX in Matlab. A Kalman filter motion-tracking framework is also proposed and implemented.