Title: Ultrasound Imaging for Motion Compensation of MRI
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Abstract:
A well-known technique to reduce motion artifacts in MRI uses MR navigator readouts to track the position of the object being imaged, and compensates for the motion using this position information. We demonstrate an analogous technique, tracking motion using echoes from a single ultrasound transducer. The ultrasound data can be analyzed in real time for prospective motion correction, or processed offline for retrospective correction. Ultrasound navigation allows the use of unmodified MRI pulse sequences, avoiding many of the difficulties experienced with MR navigators.

We report demonstrations of ultrasound navigation of MRI for motions both parallel and perpendicular to the axis of ultrasound propagation. When motion is parallel to the beam axis, extraction of position information proceeds via simple cross-correlation analysis. Using this approach, we have measured positions at over 100 Hz on basic computing hardware, and prospectively updated scanning parameters with a latency of less than 20 ms. When motion is perpendicular to the beam axis, we have employed a pattern similarity algorithm to extract the positional phase of arbitrary reciprocal motion, calibrated using training data from MRI. Development is motivated by MRI-guided ultrasound thermal ablation in organs, such as the liver, that undergo substantial motion during the breathing cycle.