Head motion estimation and correction using slab-selective FIDnavs


Figures

Figure 1. Flowchart of the algorithm shows that reference large slab body coil image is trained by applying 1mm/1° motion in 6 degrees of freedom. Points are selected randomly from the entire excited volume, a limitation of measuring non-selective FIDnavs, is that the FIDnav is sensitive to signals from the neck and jaw region, which do not move rigidly with the head. In this work, we propose using slab-selective FIDnav to estimate motion by including slab profile estimation. This calibration procedure provides a more practical solution, particularly for pediatric applications where patient specificity is a concern.

Figure 2. Comparison of retospective motion correction using FIDnav and EM tracking. The estimated rigid-body motion from both EM tracking and FIDnavs was used to retrospectively correct the acquired k-space data. Figure 2 shows a comparison of translational and rotational motion estimations from FIDnavs and EM tracking of a volunteer performing (A) abrupt head motion and (B) slow head-shaking motion every minute with accuracy and precision for translation and rotation 0.3±0.2mm 0.9±0.6° and (B) slow head-shaking motion once every minute with accuracy and precision for translation and rotation 0.2±0.2mm 0.6±0.4°.

Figure 3. Motion estimation results for abrupt head motion. (a) no motion reference image, (b) uncorrected abrupt head motion, (c) retrospectively corrected image using EM tracker, and (d) retrospectively corrected image using FIDnavs. FID-navigated motion correction results in a comparable improvement in image quality.

Figure 4. Retrospective motion correction results for slow head-shaking motion. (a) no motion reference image, (b) uncorrected slow head-shaking motion, (c) retrospectively corrected image using EM tracker, and (d) retrospectively corrected image using FIDnavs. FID-navigated motion correction results in a comparable improvement in image quality.

Figure 5. The plots display image metrics of NRMSE and SSIM for abrupt head motion and slow head-shaking motion. The metrics are calculated relative to the corresponding no motion image. The results are in good agreement with external measurements.

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