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Poster presentation

Visualization of dynamic active devices via adaptive undersampled projection imaging

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Introduction

Accurate knowledge of the location of an interventional device is crucial to the success of MR-guided interventions. This paper extends previous work [1,2] in visualizing an active device at a single time-instant, to the case of moving devices, by updating the dynamic device trajectory from vastly reduced projection data.

Purpose

To seamlessly visualize dynamic active devices in a multi-slice real-time display by reducing data requirements.

Methods

Knowledge of the device trajectory at a particular time-instant is used to adapt the orientation of the two projection images from which the device trajectory at the next time-instant will be estimated. They are chosen to have independent and unobstructed views of the device, a small FOV in the phase-encoding direction, and allow for some device motion between the current time-instant and the next.

As shown in Figure 1 the two projection images are related to the main plane of the device trajectory ("i") by a rotation of +r ("ii") and -r ("iii") degrees about the readout axis (dashed line). Choosing r = 67 gives an acceptable compromise between a small FOV and an unobstructed view. We also allow for the wrapping of the projection image in certain cases and partial-Fourier reconstructions of the projection for further data reductions.

To compute the trajectory at a time-instant we evaluate local 2D slices, which are perpendicular to the device trajectory at the previous time-instant, in the volume image formed from the product of the two projection images. We update the previous device trajectory by the location of the centroids of these local 2D slices [2] and further

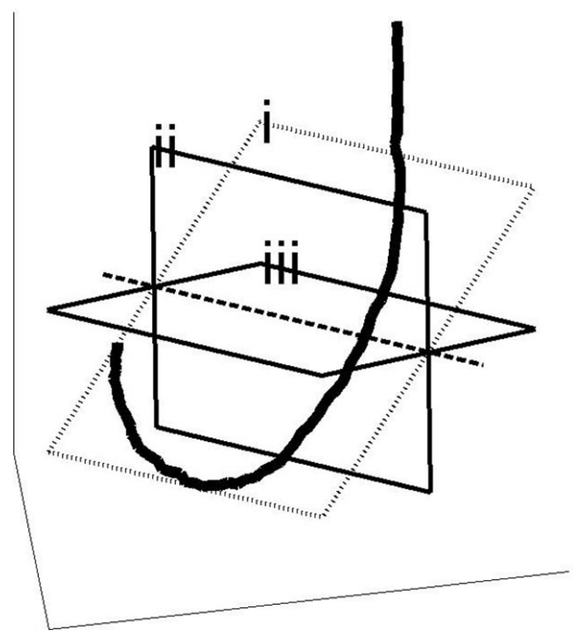

Figure 1

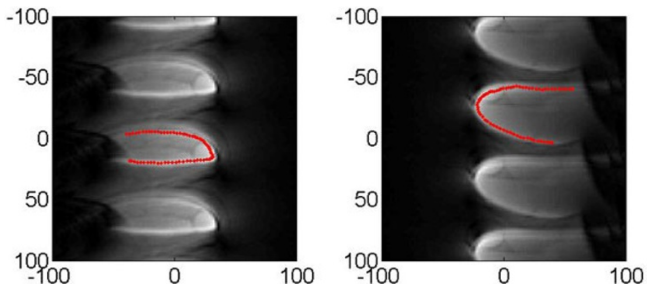

Figure 2

refine the estimate by extending or cropping the ends of the device based on the re-projection of the 3D point onto each 2D projection image [2].

Results

The method was successfully tested on an active device in an Aortic phantom. Rotational motion of the device was simulated from full 3D k-space data (as in [3]). The data is reduced by a factor of 9 (44 total k-space lines ~150 ms). The two projection images with the estimated trajectory overlaid are displayed in Figure 2. The repetition along the phase-encoding direction reflects the undersampling.

Conclusion

Adapting the orientation and size of the projection images to the current estimate of the device trajectory allows for greater reductions in data requirements than previously achieved [3].

References

1. George , *et al.*: *to appear MRM* .
2. George , *et al.*: *ISMRM* 2009.
3. Schirra , *et al.*: *ISMRM* 2009.