Motion Correction in MR Renography: reference versus model-target image registration

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Introduction: Abdominal imaging using DCE-MRI is prone to breathing motion that needs to be corrected prior to renal perfusion measurement. Moreover, contrast administration leads to steep intensity changes making motion-correction a challenging problem using conventional image registration approaches. This study aims to compare reference intensity-based pairwise image registration against a novel method using DCE kinetic model fit as a target for the co-registration [1].

Method: MR renography was performed with a 2D-DCE sequence on three healthy volunteers at 3T MRI. An arterial input function was selected in the aorta on the transverse slice. In the reference approach, pairwise multi-resolution registration using free-form deformation (non-rigid B-splines), and mutual information similarity metric was applied with adaptive stochastic gradient descent optimisation [2]. For the proposed model-target approach, first a two-compartment filtration model [3],[4] was fit to the imaging data and then each time frame was co-registered to its corresponding model fitted slice in a pairwise manner, similar to the reference approach. The fitting-registration step was iterated multiple times, with the model fit being performed on the co-registered time series. The image registration step in the reference method as well as the model-target approach was implemented in Elastix [5].

Results and Conclusion: Figure 1 shows the results from these two registration approaches on the maximum enhancement maps (MEM) of the three volunteers (low, medium, high motion cases). The reference approach only partly corrects for motion-induced blurring in all cases. However, the proposed model-target method improves co-registration accuracy compared to the reference approach, mainly for the case with highest motion (see: right panel).

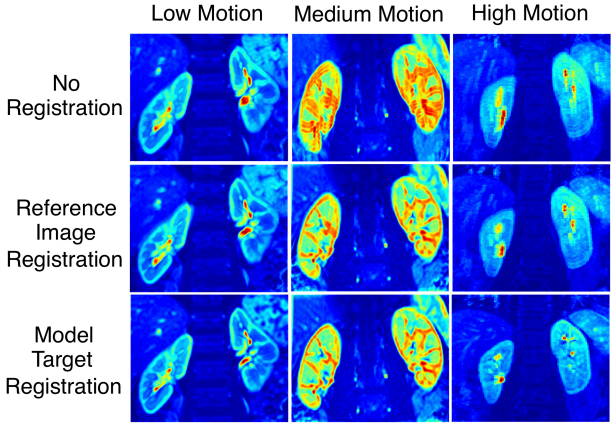

Figure 1. ***Top row:*** *Maximum enhancement maps (MIP) with low (left panels), medium (mid-panels), and high (right panels) breathing motion (before registration).* ***Middle row:*** *MIPs with image registration using reference approach.* ***Bottom row:*** *MIPs with image registration using model-target approach.*

References:
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[3]Sourbron et al., Invest Radiol,43(1):40-8, (2008)
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