Abstract Submitted
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A multi-modality approach for enhancing 4D flow MRI in cerebral aneurysms via sparse representation[1] JIACHENG ZHANG, MELISSA BRINDISE, SEAN ROTHENBERGER, Purdue University, MICHAEL MARKL, Northwestern University, VITALIY RAYZ, PAVLOS VLACHOS, Purdue University — A multi-modality approach is introduced to enhance the resolution and accuracy of time-resolved, three-directional magnetic resonance imaging (4D flow MRI) of velocity fields in cerebral aneurysms. Using a library of high-resolution velocity-fields constructed from patient-specific computational fluid dynamic (CFD) simulations and in vitro particle tracking velocimetry (PTV) measurements, the sparse representation of the flow-library was obtained to reconstruct the flow field of 4D flow MRI data. The method was evaluated with synthetic 4D flow MRI data in two patient-specific cerebral aneurysm models. Compared to the synthetic MRI data, the reconstruction increased the resolution by 3-4 times along each spatial dimension, reduced the velocity error by up to 75%, and reduced the bias error by more than 50% in flow-derived hemodynamic quantities affecting aneurysm progression, including pressure and wall shear stress (WSS). The method was finally applied to in vivo 4D flow MRI data in a basilar tip and an internal carotid artery aneurysms. The results suggested using the sparse-representation flow-reconstruction provides more reliable hemodynamic analysis in cerebral aneurysms with in vivo 4D flow MRI.

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