Application for QIBA Project Funding

Title of Proposal: DWI-DRO Development for ADC Analysis		
QIBA Committee/Subgroup: MR – PDF / DWI BC		
NIBIB Task Number(s) which this project addresses: `		
PI (Project Coordinator or Lead Investigator Information)		
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Institution/Company: University of Michigan		
Total Amount Requested:		

Project Description

Quantitative metrics provided by DWI, such as ADC, are being incorporated into clinical trials as potential radiological markers for diagnosis or therapy response. The sources of variability for such metrics include both DWI acquisition and post-processing. The quality control of DWI acquisition is being addressed by development of DWI phantoms and MRI equipment evaluation protocols. To assess and eliminate variability from post-processing, diverse DWI analysis SW and tissue models utilized by the clinical sites needs to be tested using uniform (vendor-agnostic) DICOM DWI standard Digital Reference Object (DRO). To provide the means to benchmark DWI SW performance across sites against ground truth over the tissue-relevant range of ADC values, this project proposes to build trace-DWI DRO using forward tissue diffusion models/values with Rician noise and standard diffusion DICOM attributes. The feedback from such DRO will facilitate optimization of DWI analysis and acquisition for specific tissue diffusion model and establishment of corresponding DWI DICOM requirements for vendors.

Primary goals and objectives

Similar, to DCE DRO, the DWI DRO will be designed as set of trace-DWI DICOM images that cover the tissue-relevant range of input ADC values and SNR levels for single-component (mono-exponential) diffusion as a function of b-values (“dynamic” scans). The DRO DICOM header will utilize acquisition parameters used for QIBA DWI phantom assuming standard MRI acquisition bit depth of 12. Once built, the mono-exponential DRO framework will provide standard DW-MRI DICOM data attributes for the array of b-values used in clinical studies and could be expanded to multi-component diffusion models (e.g., bi-exponential or IVIM).