Abstract: Validation and uncertainty quantification of virtual simulations of ultrafast magnetic resonance imaging, Y1

Magnetic resonance imaging (MR) has been widely used for clinical assessment of cancer. In the standard-of-care setting, great emphasis is placed on collecting images at very high spatial resolution, thereby necessitating low temporal resolution (e.g., 60-120 sec). This precludes accurate quantification of pharmacokinetic parameters that are important indicators of malignancy, and does not allow tracking of the contrast media bolus as it propagates through the vasculature. In our previous work, we developed a novel pipeline of image acquisition, reconstruction, processing and computational modeling to characterize both morphology and hemodynamics of tumor-associated vessels, which indicated the advantages of ultrafast quantitative MRI on the diagnosis of suspicious breast lesions. In the present effort, we would like to systematically evaluate the uncertainty in our methodology via semi-synthetic digital phantoms and virtual MRI simulation. With this study, we seek to optimize the acquisition and reconstruction protocol of quantitative MR data for improving its diagnostic specificity.