

Title:

Magnetic Resonance Imaging Guided Interventions: A multidisciplinary challenge

Abstract:

As one of the frontiers of modern medicine, the field of Image Guided Interventions (IGI) is rapidly evolving with an ever-widening range of clinical applications. This evolution is stemmed by a necessity to incorporate new technologies for improved patient care and cost effectiveness. Among such technological advancements are multimodality imaging, from the molecular to the organ level, assistive manipulators, image and vital signs signal processing, haptic sensing, information fusion and comprehensive visualization. One of modalities under development for use with IGI is magnetic resonance imaging (MRI), due to its wide range of soft tissue contrast mechanisms, lack of ionizing radiation, true 3D nature, and on-the-fly adjustment of imaging parameters. Areas of major engineering challenges and potential growth in interventional MRI include those of dynamic imaging and visualization, assistive (robotic) manipulators, the implementation of multi-modality guidance, and image processing and visualization.

We will present dynamic MR imaging approaches that include strategies for the selective acquisition of raw MR data (inverse or k-space), fast MRI preparations for the manipulation of tissue contrast, and multiplanar volumetric imaging. In addition, two MR-compatible robotic manipulators will be presented that offer direct access to the patient inside MRI scanners for real-time guidance. We will also present approaches in the integration of the robotic manipulators with the MR scanner, and current work on image segmentation. Finally, we will overview current needs in multi-modality IGI, real-time image processing, human-machine interfacing and augmented reality visualization of procedures in real-time.

Bio:

Nikolaos V. Tsekos received his BS degree in Physics from the National and Kapodistrian University of Athens, his M.Sc. degree in Physiology and Biophysics from the University of Illinois in Urbana Champaign and his PhD from the University of Minnesota in Minneapolis. His research is focused on the development of cardiovascular and interventional MRI methodology, and includes the areas of dynamic MRI and MR-compatible robotics for performing interventions with real-time MRI-guidance. His work has been funded by the NIH, the Whitaker Foundation, the American Heart Association and the RSNA. He is an Assistant Professor of Radiology and Biomedical Engineering at the Washington University in St. Louis.