27th Annual Meeting of the International Society for Magnetic Resonance in Medicine
Montreal, Canada (May 11th-16th, 2019)

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BIAC Faculty, Staff, and Student Presentations

(Listed in Order of Presentation)

Monday, May 13th

Jonathan Cuthbertson, **Dean Darnell**, Robert Stormont, Fraser Robb, **Allen Song**, **Trong-Kha Truong**
"A 4-Channel iPRES-W AIR Coil Array for Simultaneous MR image Acquisition and Wirelessly-Controlled Localized B0 Shimming of the Spinal Cord"

B0 inhomogeneities near air-tissue interfaces can cause distortions, signal loss, and incomplete fat suppression in many applications such as diffusion-weighted imaging of the spinal cord. Here, we develop a 4-channel iPRES-W AIR coil array to perform simultaneous imaging and wirelessly-controlled localized B0 shimming of the cervical spinal cord. In vivo experiments showed a 58.5% reduction in B0 root-mean-square-error (RMSE) after shimming the spinal cord using the iPRES-W AIR coil array, resulting in substantially reduced geometric distortions in diffusion-weighted images, ADC maps, and FA maps
Digital Poster: MR Engineering (RF Coils & Arrays) (Monday 9:15-10:15; Exhibition Hall; Computer #56)

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Julia Bresticker, Zachary Thompson, Devin Willey, Allen Song, Dean Darnell, Trong-Kha Truong
"Simulations of Integrated Radio-Frequency/Wireless Coil Designs for Simultaneous MR Image Acquisition and Wireless Communication"

A novel RF coil design, termed an RF/wireless coil, enables simultaneous image acquisition and wireless communication by allowing currents to flow simultaneously at the Larmor and WIFI frequencies. Measurements of the far-field radiation parameters are not practical in an MRI scanner. Thus, simulations are performed to optimize the far-field performance within the scanner bore to maintain the wirelessly transmitted data integrity. In this work, finite element simulations, verified with anechoic chamber gain-pattern measurements and SNR maps from a constructed RF/Wireless coil, are performed to optimize the far-field gain, directivity, and link budget of the RF/Wireless coil within the scanner bore.
Digital Poster: MR Engineering (MRI Unplugged: Wireless, Portable & Flexible) (Monday 9:15-10:15; Exhibition Hall; Computer #108)

Tuesday, May 14th

Lijia Zhang, Chris Petty, Allen Song
"Improved quantitative accuracy using ultrahigh resolution DTI-guided QSM"

Quantitative susceptibility mapping (QSM) has been increasingly used to help access the brain development, especially white matter myelination. However, the quantitative accuracy is limited by its angle dependence to the magnetic field. In this study, ultrahigh resolution diffusion tensor imaging (DTI) was used to delineate the fiber bundles (i.e. corpus callosal fibers), followed by tract-based QSM to minimize the angle dependence and accurately assess magnetic susceptibility changes in different brain regions.
Digital Poster: Neuro (Novel Neuroimaging Methods) (Tuesday 14:30-15:30; Exhibition Hall; Computer #175)

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Wenlin Wu, Robert Anderson, Serge Koudoro, Eleftherios Garyfallidis, David Dunson, Carol Colton, **Alexandra Badea**
"Vulnerable Networks in the Aging Mouse Brain"

Despite recent advances in aging research, the underlying mechanisms of selective brain vulnerability to aging remain to be elucidated. Mouse models may provide useful tools to dissect the mechanisms behind age and sex associated vulnerability of brain circuits. We used high resolution accelerated protocols and tensor network analyses to reveal structural network differences in aging C57BL/6 mice.
Digital Poster: Neuro (Experimental Model of CNS Disease: Structural/Diffusion) (Tuesday 16:45-17:45; Exhibition Hall; Computer #69)

Wednesday, May 15th

Muge Karaman, **Allen Song** (Moderators)
Scientific Session: Diffusion MRI: Acquisition & Reconstruction (Wednesday 8:15am-10:15am; Room 710B)

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Iain Bruce, Christopher Petty, Allen Song
"Imaging Cortical Columns in Gray Matter with Sub-Millimeter isotropic DTI"

The microarchitecture in gray matter of the human brain is comprised of short (<3 mm) cortical columns that traverse six cortical layers. To most accurately delineate these columns in-vivo, it is essential to achieve isotropic spatial resolutions on the order of 0.8 mm or less. In this study, we present a means of acquiring diffusion tensor imaging data with ultrahigh spatial resolution to effectively characterize the complex architecture of gray matter.
Digital Poster: Diffusion (Diffusion MRI: Image Reconstruction) (Wednesday 8:15-9:15am; Exhibition Hall; Computer #23)

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Robert Anderson, Christopher Long, Evan Calabrese, Scott Robertson, Gary Cofer, G Johnson, **Alexandra Badea**
"Optimizing Imaging Protocols for Structural Connectomics in Mouse Models of Neurological Conditions"

Network approaches provide sensitive biomarkers for neurological conditions such as Alzheimer's disease. Mouse models provide tools to dissect vulnerable circuits at prodromal stages, and to assess the effects of interventions. We have simulated mouse brain structural connectomes, balancing angular, spatial resolution and scan time. Specifically, we evaluated protocols with 6, 12, 15, 20, 30, 45, 60 and 120 angles; and 3 voxel sizes at 43, 86 and 172 μm. Our results indicate schemes using 46 or 60 diffusion directions, acquired at 86 μm resolution achieve a good cost/performance balance relative to a high spatial, high angular resolution sampling scheme.
Digital Poster: Diffusion (Diffusion in Disease) (Wednesday 9:15-10:15; Exhibition Hall; Computer #92)

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Iain Bruce, Christopher Petty, Allen Song
"Sub-Millimeter Isotropic DTI and fiber tractography of the human Spinal Cord in-vivo"

The ability to characterize complex microstructures in the small cross-sectional area of the spinal cord through diffusion tensor imaging has traditionally been limited by the achievable spatial resolution in-vivo. Through ultra-high spatial resolution diffusion imaging, this study presents a technique for accurately delineating complex fiber pathways such as the corticospinal tracts. When imaged with sub-millimeter isotropic spatial resolutions, it is possible to characterize intricate details in the spinal cord such as the bifurcations and decussations of the corticospinal tracts. The improved delineation of neural pathways in the spinal cord could facilitate the placement of stimulation electrodes for movement disorder treatments.
Digital Poster: Diffusion (Diffusion MRI: Data Acquisition) (Wednesday 9:15-10:15am; Exhibition Hall; Computer #1)