Brain Mapping Center

SEMINAR SERIES

Sponsored by the UCLA Brain Mapping Center Faculty

The focus of these talks is on advancing the use of brain mapping methods in neuroscience with an emphasis on contemporary issues of neuroplasticity, neurodevelopment, and biomarker development in neuropsychiatric disease.

Hosted By: Roger P. Woods, M.D., Neurology, UCLA

Quantifying and correcting the effects of motion in structural MRI using volumetric navigators (vNavs)

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The use of MRI for structural imaging in neuroscience, and increasingly in clinical neuroimaging, centers on 3D-encoded sequences to maximize SNR and allow for high-resolution scans with isotropic voxels. However, these methods are acutely sensitive to subject motion on a millimeter scale during the roughly five minutes they take to acquire. For patient populations that are unable to stay still, (e.g., pediatric subjects, or those with dementia) this requirement may be challenging to meet in practice. We have developed a prospective motion-correction system, called volumetric navigators (vNavs) that runs on the scanner with no modifications to hardware or additional calibration. The vNavs system is based on acquiring high-speed, low-resolution, whole-head volumes interspersed during the “dead time” of longer scans, then performing volume registration on them to estimate subject motion, and finally modifying the sequence on-the-fly to ensure imaging stays in consistent head-relative coordinates. The vNavs system has proved capable of significantly improving image quality in both research and clinical contexts, particularly in pediatric subjects.

Although the vNavs can correct for a substantial amount of subject motion and produce visually acceptable images for clinicians, their effect on morphometric measures is important for neuroscience studies. In functional and connectivity studies, it is increasingly being noted that group differences in subject motion may confound some measurements previously reported as biological differences. To study what impact motion has on grey matter volume and cortical thickness estimates from major software packages, we scanned healthy volunteers repeatedly, asking them to perform different motions in each scan. In all scans, we used vNavs to track subject motion, and in some scans also used it to prospectively correct subject motion. Our results show that subject motion causes a significant, motion-dependent bias in grey matter volume and cortical thickness estimates, and that vNavs significantly reduce both the bias and variance in these estimates. For studies where disease state is correlated with subject motion, quantifying and correcting motion will be essential to disentangling the biological effects of disease from the effects of motion on measurement.

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Ahmanson-Lovelace Brain Mapping Center Conference Room (221)
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