ISC Symposium (Neuro): Recent Issues in Neuroimaging (II)

SY14-1

Assessing Regional Resting State Brain Activity Using fMRI

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Stemming from speculations of the baseline brain metabolism distribution and scrutiny to the noise-like spontaneous brain activity fluctuations, resting state brain activity mapping has been an active research topic for decades using a variety of imaging techniques especially fMRI because of its high spatial and temporal resolution compared to other techniques. Up to now, two kinds of fMRI have been used in resting state study: the blood-oxygen-level-dependent (BOLD) fMRI and arterial spin labeled (ASL) perfusion MRI with pros and cons. The former has higher signal-to-noise-ratio (SNR) and higher temporal resolution but the latter provides quantitative brain perfusion values and can be directly compared across subjects and different scan times. Limited by the low SNR, ASL imaging is still mainly used for measuring the mean perfusion map as a brain state index. BOLD fMRI is the major tool for studying the dynamic resting state activity. But due to the non-quantitative nature of BOLD signal, regional brain activity is generally characterized with empirical data properties. In this talk, I will provide an overview of the local metrics proposed in the literature for characterizing regional resting brain activity, including the amplitude of the low-frequency fluctuations, regional data coherence, variance, entropy, connectivity density, etc. I will also share several examples of their clinical applications and some of our speculations of the future development.

Keywords : Resting state, Bold fmri

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Structural and Resting-State Brain Connectivity of Motor Networks after Stroke

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Diffusion tensor imaging (DTI), which is a 3-dimensional representation of the distance covered in space by water molecules over time, allows the quantification of diffusion along each of the principle axes of the tensor. This diffusivity information can be converted into fractional anisotropy (FA), which is a sensitive measure of microstructural integrity but not specific for the type of pathology. The diffusion tensor model can also be used to reconstruct fiber tracts in 3-dimensions, thus enabling the in vivo visualization of structural connectivity. The resting-state functional MRI (rsfMRI) is a task-independent functional neuroimaging approach based on intrinsic low-frequency fluctuations in the blood oxygenation level–dependent (BOLD) signal and the rsfMRI provides functional connectivity made by computing the temporal correlations between spatially remote areas., as well as intrinsic neuronal activity. In acute stroke patients, ischemic brain lesions result in acute neurological deficits and affect remote brain areas caused to more widespread perturbation of entire functional networks even in the non-ischemic hemisphere. The use of DTI and rsfMRI can provide the assessment of brain structural connectivity, plasticity and reorganization underlying structural & functional recovery and adaptations of distributed brain networks mediated by connectivity in stroke patients. DTI & rsfMRI may offer the prospect of providing therapeutically useful information on both the focal vascular lesion and the connectivity-based reorganization and subsequent functional recovery. We reviewed the applications of DTI & rsfMRI to stroke diagnostics and prognostics and discuss future perspectives and considerations.

Keywords : MRI, DTI, Rs-fMRI, Stroke

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SY14-4

Machine learning-based analysis of MR images in glioblastoma

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In this talk, I would like present some of my recent work on machine learning-based methods for analyzing MR images in glioblastoma.

Keywords : Machine learning, Gliblastoma, MR