Imaging Methods - Aquisition II

Thursday, Jun 21: 10:30 AM - 11:45 AM
Oral Sessions
Thursday - Oral Session

Presentations

1917: Introducing automated ROI-based analysis for 3D-multivoxel magnetic resonance spectroscopy

10:30 AM - 10:42 AM

Up to now, most Magnetic Resonance Spectroscopy (MRS) studies were carried out using single-voxel approaches. However, a strong a priori hypothesis is crucial for single-voxel MRS to detect possible metabolic changes in a pre-defined volume of interest (VOI), whereas there is a high chance that changes in other areas remain undiscovered. Recent advancements in MRS techniques lead to the development of 3D-multivoxel MRS (MRSI) sequences. In consequence, data analysis needs to be adapted. Here, we introduce ROI-based analysis for 3D-multivoxel MRS.

Presenter

Benjamin Spurny, Medical University of Vienna

1789: Quiet, Distortion-Free Whole Brain T2-BOLD fMRI at 7T

10:42 AM - 10:54 AM

In this work, we have developed fast, quiet, and distortion-free whole brain fMRI at 7T using a T2-prepared 3D Rotating Ultrafast Imaging Sequence (RUFIS)[1]. Because RUFIS is a zero TE (ZTE) imaging technique, it does not suffer from signal dropout near air-tissue boundaries nor from spatial distortions caused by B0 inhomogeneity[1,2]. Its minimal gradient switching between acquisitions leads to reduced eddy current distortions and minimal acoustic noise which are common in EPI-based methods. This technique has previously been demonstrated at 3T to be 30-40dB quieter than GE and SE- EPI with comparable BOLD sensitivity to SE-EPI[2]. Preliminary 7T whole-brain T2-BOLD 3mm isotropic results for a block design hand-squeezing motor task are shown for a single volunteer and compared against GE-EPI fMRI.

Presenter

Brian Burns, PhD, GE Healthcare

1892: A millisecond-scale real-time decoded neurofeedback system for alpha amplitude modulation

10:54 AM - 11:06 AM

EEG-based neurofeedback is an important neural modulation technique for enhancement of perceptual and cognitive functions and for rehabilitation of mental impairments [1]. The effect of existing neurofeedback techniques heavily depends on the user's autonomous control and the degree of their training, so that their real-time capability, precision, and applicability are limited. On the other hand, neuroscientific evidence has shown that the visual stimulus would cause phase-resetting of the alpha oscillations [2, 3]. Furthermore, the stimuli at the different phases evoke different alpha dynamic behaviors [4, 5]. It inspires us to develop a new neurofeedback paradigm which can deliver visual stimuli continuously at a specific alpha phase based on real-time estimation of the dynamic evolution of the alpha wave (Fig. 1), so that the amplitude of alpha wave can be more precisely modulated by visual stimuli deliver at specific alpha phases. To this end, we designed a millisecond-precision real-time decoded neurofeedback system which can achieve continuous, precise, untrained and adaptive alpha wave modulation.

Presenter

Jia Liu, School of Biomedical Engineering, Health Science Center, Shenzhen University, Shenzhen 518060, China

1849: 400µm dMRI and tractography of early human visual system projections ex vivo using kT-dSTEAM at 9.4T

11:06 AM - 11:18 AM

Ex vivo diffusion MRI (dMRI) is an important research tool in the human brain for neuroanatomical investigations and the validation of in vivo diffusion MRI techniques. For instance ex vivo dMRI studies of the human brain have focussed on validation of white matter orientation estimates [1, 2], the atlasing and mapping of large subcortical structures [9] and the delineation of layered grey matter structures [7]. All of these applications benefit from mesoscale (< 1mm isotropic) dMRI resolution over large fields of view, which is difficult to achieve primarily because of the strongly reduced T[sub]2[/sub] and diffusivity of fixed tissue. We employ a homogeneized kT-dSTEAM sequence [3] at 9.4T with the aim of acquiring high resolution (400µm isotropic) diffusion-weighted images of the entire human occipital lobe and performing tractography of early human visual system projections.

Presenter

Francisco Fritz, Maastricht University

1726: Acceleration of Golden Angle-Sampled FMRI Data with Data-Driven Priors and Low-Rank Constraints

11:18 AM - 11:30 AM

We present k-t PERRI (Prior Enhanced Rank Reliant Inference), a low-rank k-t method that incorporates flexible constraints drawn from the data to guide under-sampled functional MRI image reconstruction in both space and time. As the desire for higher spatial and temporal resolutions in FMRI increases the burden on the image acquisition, undersampling image reconstruction methods are becoming increasingly important. Low-rank methods, for example, use a k-t approach to reconstruct an orthogonal decomposition of the highest variance components of the data [1,2].

Presenter

Harry Mason, University of Oxford

1818: Mechanisms of negative BOLD responses

11:30 AM - 11:42 AM

Alongside with Positive BOLD Responses (PBR), Negative BOLD Responses (NBR) appear in both event related and block design fMRI experiments. These responses also follow interictal epileptogenic discharges (IEDs) in epileptic patients. Contrary to PBR, there is less consensus about the mechanisms underlying NBR. We identify five different mechanisms underlying NBR and propose parsimonious biophysical models. In general, NBR can be caused by pure vascular/hemodynamic mechanisms of blood reallocation: 1) arterial blood stealing (ABS)[1] and 2) vein blood backpressure (VBB)[2]; or by 3) lateral/callosal inhibition (LCI)[3]. In epilepsy, IED-related NBRs can be 4) neuronal disruption of activity (NDA), with a slow recovery, of resting state networks[4] or due to 5) altered neuro-metabolic couplings (ANC)[5]. We show that, under realistic physiological/observation noise and model parameter variability, the HRFs estimated from BOLD data of these different mechanisms are distinguishable. This separation furnishes a better characterization of brain networks and function by distinguishing neuronal from vascular signal fluctuations. In surgical planning of intractable epilepsy, this would benefit the identification of seizure onset zones (SOZ) by identifying what we believe are the clinically relevant NBRs: those underlying NDA and ANC.

Presenter

Pedro Valdes, Florida International University