Informatics

Tuesday, Jun 19: 10:30 AM - 11:45 AM
Oral Sessions
Tuesday - Oral Session

Presentations

2000: ReproIn: automatic generation of shareable, version-controlled BIDS datasets from MR scanners

10:30 AM - 10:42 AM
Lack of reproducibility is a problem in neuroimaging. Adherence to open standards, easy data sharing, and automation of data conversion and analysis steps are some of the key solutions to address it. The formalization of the Brain Imaging Data Structure (BIDS) [1] made it easier for researchers to collaborate on shared data and to benefit from standardized processing using various BIDS-aware application. At Dartmouth, following the philosophy that science should be open by design [2], we automated the collection of neuroimaging data as a hierarchy of BIDS datasets right from the MR scanner. Thus, individual research groups do not have to convert their data to BIDS manually, eliminating one of the biggest barriers to data sharing. Adherence to the BIDS standard allows investigators to immediately use BIDS-aware applications for data QA (e.g., bids-validator, MRIQC [3]) to catch obvious problems with data acquisition, and to automate preprocessing and analysis. Because the entire process occurs in a Singularity container [4], and all data is version-controlled with DataLad and git, our approach eliminates virtually any ambiguity in data provenance. Here we present details of our setup, named ReproIn (Reproducible Input). All system configurations, software, and material are released under open-source licenses and are provided in a container, so that any institution can easily implement this solution at their imaging centers.

Presenter

Matteo Visconti di Oleggio Castello, Dartmouth College

2019: Same Data - Different Software - Different Results? Analytic Variability of Group fMRI Results.

10:42 AM - 10:54 AM
A plethora of tools and techniques are now available to process and model fMRI data. However, this 'methodological plurality' has come with a drawback. Application of different analysis pipelines (Carp, 2012), alterations in software version (Glatard, 2015), and even changes in operating system (Gronenschild, 2012) have all been shown to cause variation in the results of a neuroimaging study. This high analytic flexibility has been pinpointed as a key factor that can lead to increased false-positives (Ioannidis, 2005), and compounded with a lack of data sharing, irreproducible research findings (Poldrack, 2017). In this work, we seek to understand how choice of software package impacts analysis results. We reproduce the results of three published neuroimaging studies (Schonberg, 2012; Moran, 2012; Padmanabhan, 2011) with publicly available data within the three main neuroimaging software packages: AFNI, FSL and SPM, using parametric and nonparametric inference. All information for how to process, analyze, and model each dataset we obtain from the publication. We make a variety of comparisons to assess the similarity of our results across both software packages and choice of inference method.

Presenter

Alexander Bowring, University of Oxford

2537: FMRell - a toolbox for the analysis of fMRI reliability

10:54 AM - 11:06 AM

As one of the key requirements for prediction and classification, reliability of measurements is regularly reported in psychological research. However, the reliability of fMRI has received limited attention so far, considering the wide range of analysis level, paradigms and employed measures (e.g. Plichta et al., 2012; Vetter et al., 2017) and has often focused primarily on group effects. Nevertheless, the reliability of fMRI data at an individual level is crucial for development of biomarkers (Nord, Gray, Charpentier, Robinson, & Roiser, 2017). Therefore, we implemented a toolbox for the analysis of fMRI reliability including various reliability measures and the possibility to estimate split-half reliability (Fröhner, Teckentrup, Smolka, & Kroemer, 2017).

Presenter

Juliane Fröhner, Technische Universität Dresden

2539: Encoding models for the Cognitive Neuroscience Literature

11:06 AM - 11:18 AM

Mapping mental processes to brain structures is central to cognitive neuroscience. Neuroimaging studies can map brain activity associated with a cognitive task. However, the cognitive coverage of a given study is limited as it explores only a handful of mental processes. Meta-analyses aim to map a broader range of mental processes to the brain. They pool together many neuroimaging studies (via the reported peak activation coordinates), and identify patterns that occur consistently. A difficulty is that there is no formal and consensual definition of the meaningful psychological concepts or how they relate to each other. Cognitive neuroimaging needs such constructs, as brain mapping, in a single study or across studies, relies on a decomposition of tasks into the mental processes they involve. Significant effort has gone into gathering data and building methods for meta-analysis. However, the lack of rigorous validation frameworks is an impediment to improving their use for cognitive mapping. In this work, we construct the largest corpus of neuroimaging studies to date, spanning 14,000 full-text articles. We extract text-based features and fit statistical models to predict brain activations. We propose a validation framework for open-ended encoding and decoding of mental processes. We show for the first time that encoding and decoding models trained on the literature can make predictions far above chance level. We compare how several representations of psychological notions perform at predicting brain activations. This shows that the largest ontology of cognition, Cognitiveatlas, would benefit from additional terms.

Presenter

jerome dockes, inria

1879: An atlas of intracranial EEG: “normal” neurophysiological activity in different cortical regions

11:18 AM - 11:30 AM

While the scalp EEG in healthy individuals is fully defined, the accumulated knowledge on physiological intracranial EEG activity is surprisingly sparse. This lack of normative intracranial EEG data of brain activity is mainly because intracranial electrodes are used in the presurgical investigation of drug-refractory epilepsy patients in whom the placement of electrodes in healthy brain tissue is relatively rare, and the identification of healthy brain regions is challenging. Additionally, there is a lack of standardization in intracranial electrode placement compared to scalp EEG, resulting in problems performing inter-subject comparisons of EEG activity. We address these issues in this multicenter study, providing an atlas of normal intracranial EEG.

Presenter

Birgit Frauscher, Montreal Neurological Institute and Hospital

1713: Spatiotemporal Neonatal Cortical Surface Atlases Construction from 39 to 44 Weeks Using 764 Subjects

11:30 AM - 11:42 AM

Human brain undergoes exceptionally dynamic development during first postnatal weeks. Therefore, high quality neonatal cortical surface atlases are highly needed for neonatal brain analysis but still remain scarce (Hill J. 2010;Bozek J. 2016). To address this issue, we unprecedentedly construct a set of neonatal cortical surface atlases from 764 term-born neonates, which is the largest neonatal dataset to our knowledge. To better characterize the dynamic cortical development during this stage, instead of constructing a single atlas, we construct spatiotemporal atlases at each week from 39 to 44 gestational weeks. Rather than averaging co-registered surfaces to construct atlas, which generally leads to over-smoothed cortical folding patterns, we adopt a spherical patch-based group-wise sparse representation to overcome noises and potential registration errors. Our atlases preserve sharp cortical folding patterns, thus lead to better alignment of new subjects onto the atlases.

Presenter

Zhengwang Wu, UNC Chapel Hill