Session 619 - Cognitive Control and Performance

Add To Itinerary

619.26 / VV2 - Characterizing human prefrontal cortex representations with fMRI

November 14, 2017, 1:00 - 5:00 PM | Halls A-C

Presenter at Poster
Tue, Nov. 14, 2017, 2:00 PM - 3:00 PM

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Authors

***A. BHANDARI**[1], M. RIGOTTI[3], C. GAGNE[4], S. FUSI[5], D. BADRE[2,6];
[1]Cognitive Linguistics and Psychological Sci., [2]Cognitive, Linguistic and Psychological Sci., Brown Univ., Providence, RI; [3]IBM T. J. Watson Res. Ctr., Yorktown Heights, NY; [4]Psychology, Univ. of California Berkeley, Berkeley, CA; [5]Ctr. for Theoretical Neuroscience, Col. of Physicians and Surgeons, Columbia Univ., New York, NY; [6]Brown Inst. for Brain Sci., Providence, RI

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Abstract

A central problem in cognitive neuroscience is understanding the nature and form of human prefrontal cortex (PFC) representations, which play a critical role in the expression of flexible, goal-directed behavior. An important property of such representations is their dimensionality. High-dimensional representation of task variables can support flexibility by enabling linear readouts of multiple, different conjunctions of task variables from the same representation. Indeed, in highly trained macaques, PFC representations of task variables approach maximum dimensionality, and this property predicts success on the task. Here we evaluate two proposed methods for estimating dimensionality from fMRI data. The first method involves enumeration of the number of arbitrary conjunctions of task variables that can be successfully decoded through multi-voxel pattern analysis (MVPA) of BOLD patterns. However, we demonstrate through a meta-analysis of published MVPA studies that the base rate for decoding information from PFC patterns is remarkably low, hampering the use of this method for estimating dimensionality. The second method involves estimating the similarity structure of the representation via cross-condition repetition suppression. This use of this method is complicated by the need to simultaneously estimate a large number of repetition suppression effects in the presence of low frequency fMRI noise. We evaluate the efficacy of a variety of fMRI designs, including isolated pair presentation and continuous carry over designs with deBruijn sequences for recovering representational dimensionality in simulations. Finally, we evaluate this method empirically in an fMRI experiment for estimating dimensionality of prefrontal cortex representations.