BSCS

Data of courses form

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Homepage:

Title of the course: Brain Imaging and Cognition (or "How I learned to think critically about fMRI")

Detailed syllabus of the course, with topics addressed in each 90 minutes lecture (less than 2 pages):

Background information on the web (optional):

Short CV (less than half page): http://community.frontiersin.org/people/VaibhavDiwadkar/5904

Important publications (5-10):

Muzik, O., Diwadkar, V.A., 2016. In vivo correlates of thermoregulatory defense in humans: Temporal course of sub-cortical and cortical responses assessed with fMRI. Human Brain Mapping. 10.1002/hbm.23233

Jagtap, P., Diwadkar, V.A., 2016. Effective connectivity of ascending and descending frontalthalamic pathways during sustained attention: Complex brain network interactions in adolescence. Human Brain Mapping 37, 2557-2570.

Woodcock, E.A., Wadehra, S., Diwadkar, V.A., 2016. Network profiles of the dorsal anterior cingulate and dorsal prefrontal cortex in schizophrenia during hippocampal-based associative memory. Front Systems Neurosci 10, 32.

Soloff, P.H., White, R., Omari, A., Ramaseshan, K., Diwadkar, V.A., 2015. Affective context interferes with brain responses during cognitive processing in borderline personality disorder: fMRI evidence. Psychiatry Research 233, 23-35.

Diwadkar, V.A., Murphy, E.R., Freedman, R.R., 2014. Temporal sequencing of brain activations during naturally occurring thermoregulatory events. Cerebral Cortex 24, 3006-3013.

Anything else (course requirements, readings list, etc): See syllabus

Brain Imaging and Cognition (or "How I learned to think critically about the value of fMRI").

Instructor:

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Prospectus. *In vivo* functional imaging of the brain has dramatically enhanced researchers' ability to examine the neural correlates of cognition and behavior. In particular functional Magnetic Resonance Imaging (or fMRI) is a particularly attractive technique. fMRI relies on the physical and magnetic properties of brain tissue (in particular blood) which change under conditions of neural activity. This Blood Oxygen Level Dependent (BOLD) contrast is endogenous to the brain and unlike Positron Emission Tomography does not demand the injection of radioactive contrast agents. fMRI (based on BOLD) is therefore a perfectly safe technique for studying brain function, can and is easily applied to the study of diverse populations (including children), and has reasonable spatial ("where in the brain") and temporal ("how quickly is something in the brain changing") resolution.

In this segment of the Budapest Seminar in Cognitive Science we will:

a) Examine the physical and physiological bases of fMRI. That is we will review the physics and technology that makes it possible to measure the fMRI signal and how this signal is correlated with electrophysiological activity in the brain;
b) Review experimental techniques and designs for fMRI. That is, we will learn how to design experiments for fMRI to answer questions of interest relating to perception and cognition
c) Understand how fMRI data is processed before we can reach a stage where we can draw inferences from it.

Next, we will consider domains of human cognition where fMRI has particularly enhanced our understanding of the brain, and has extended previous understanding gained from other techniques (including animal studies, experimental psychology, and neuropsychology).

Suggested Text Book:

Cognition, Brain, and Consciousness (CBC): Introduction to Cognitive Neuroscience (2nd Edition), 2010. Bernard J. Baars & Nicole M. Gage. Academic Press, San Diego CA.

Sept 26 (Lecture 1): A brief history of approaches to understanding brain function & Physiological Bases of fMRI. 1) CBC (Ch 1). 2) Logothetis, N.K., 2002. The neural basis of the blood-oxygen-level-dependent functional magnetic resonance imaging signal. Philos Trans R Soc Lond B Biol Sci 357, 1003-1037.

Sept 27 (Lecture 2): Physiological Bases of fMRI contd. & Experimental Design for fMRI and Modeling Brain Interactions. 1) CBC (Ch 4: pp 113-124); Appendix: pp 555-557, 570-582). 2) Amaro, E., Jr., Barker, G.J., 2006. Study design in fMRI: Basic principles. Brain Cogn 60, 220-232. 3) Savoy, R.L., 2005. Experimental design in brain activation MRI: cautionary tales. Brain Res Bull 67, 361-367.

Sept 28 (Lecture 3): Experimental Design for fMRI and Modeling Brain Interactions contd. & Problems of inference in brain networks. 1) Stephan, K.E., 2004. On the role of general system theory for functional neuroimaging. J. Anat. 205, 443-470. 2) Friston, K.J., 2011. Functional and effective connectivity: a review. Brain connectivity 1, 13-36. 3) Diwadkar, V.A., 2015. Critical perspectives on causality and inference in brain networks: Allusions, illusions, solutions? Phys Life Rev 15, 141-144.

Sept 29 (Lecture 4): Applications (Learning, Memory & Physiology). 1) CBC (Ch 9, pp 305-330). 2) Banyai, M., Diwadkar, V. A., Erdi, P., 2011. Model-based dynamical analysis of functional disconnection in schizophrenia. NeuroImage 58, 870-877. 3) Jagtap P & Diwadkar, V.A., 2016. Effective connectivity of ascending and descending frontalthalamic pathways during sustained attention: Complex brain network interactions in adolescence. Hum Brain Mapp, 37, 2557-70. 4) Muzik O. & Diwadkar, V. A. In vivo correlates of thermoregulatory defense in humans: Temporal course of sub-cortical and cortical responses assessed with fMRI. Hum Brain Mapp. doi: 10.1002/hbm.23233.