BME 599 – section 003 - Special Topics in functional MRI
Instructor: Luis Hernandez-Garcia and guests
hernan@umich.edu
Time: Tuesdays 14:30-16:30
Location: 1121 Lurie BME (Beal ave, across from the Ford Library, North Campus)

This course is intended to be a follow-up to the "Introduction to Functional MRI" course. Each week a current topic from the field of neuroimaging will be presented in depth by a student who is registered for credit. A paper or two are **suggested** below with each topic, but the students are **not limited to those papers** for illustration of the topic. In depth research is encouraged.

The discussion will take place as an interactive seminar and will be moderated by the instructor. Some papers will be moderated by invited faculty, depending on the topic.

Grades will be based on attendance, depth of the presentation, and class participation. Auditors are welcome and encouraged to participate in the discussion.

Prerequisite: BIOS 642/BME 499/PSYCH 808, (Intro to fMRI)

Syllabus

1/3 (Thursday, time TBA)– Informational meeting: Topics assigned.

1/8 - What is in the BOLD Time Series? I: metabolism
Presented by Xin Wang

> Ugurbil K. Toth L. Kim DS. How accurate is magnetic resonance imaging of brain function?. [Review] [67 refs] [Journal Article. Review. Review, Tutorial] Trends in Neurosciences. 26(2):108-14, 2003 Feb.
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> Hyder F, Kida I, Behar KL, Kennan RP, Maciejewski PK, Rothman DL: " Quantitative functional imaging of the brain: towards mapping neuronal activity by BOLD fMRI." NMR Biomed. 2001 Nov-Dec;14(7-8):413-31.

1/15. What is in the BOLD Time Series? II: vasculature
Presented by Scott L

> Vazquez, A. L., Cohen, E. R., Gulani, V., Hernandez-Garcia, L., Zheng, Y., Lee, G. R., et al. (2006). Vascular dynamics and BOLD fMRI: CBF level effects and analysis considerations. Neuroimage, 32(4), 1642-1655.
>
> Behzadi, Y. & Liu, T. T. (2006). Caffeine reduces the initial dip in the visual BOLD response at 3 T. Neuroimage, 32(1), 9-15.

1/22. The brain at rest
Presented by Rick

Raichle, M. E., MacLeod, A. M., Snyder, A. Z., Powers, W. J., Gusnard, D. A., & Shulman, G. L. (2001). A default mode of brain function. Proc Natl Acad Sci U S A, 98(2), 676-82.

Gusnard DA, Akbudak E, Shulman GL, Raichle ME.: Medial prefrontal cortex and self-referential mental activity: relation to a default mode of brain function.Proc Natl Acad Sci U S A. 2001 Mar 27;98(7):4259-64.

(note to presenter: the default network literature is quite extensive. Feel free to direct this topic toward any neuroscientific question you like)

1/29. Exotic Imaging techniques I: Arterial Spins Labeling and Statistics
Presented by Shaun

Detre JA, Wang J.: Technical aspects and utility of fMRI using BOLD and ASL. Clin Neurophysiol. 2002 May;113(5):621-34. Review.

Mumford, J. A., Hernandez-Garcia, L., Lee, G. R., & Nichols, T. E. (2006). Estimation efficiency and statistical power in arterial spin labeling fMRI. Neuroimage, 33(1), 103-114.

2/5 Exotic Imaging techniques II: SENSE
Presented by Hari

Pruessmann, K. P., Weiger, M., Scheidegger, M. B., & Boesiger, P. (1999). SENSE: sensitivity encoding for fast MRI. Magn Reson Med, 42(5), 952-62.

Weiger, M., Pruessmann, K. P., & Boesiger, P. (2000). Cardiac real-time imaging using SENSE. SENSitivity Encoding scheme. Magn Reson Med, 43(2), 177-84.

2/12. Functional connectivity I: Diffusion Tensor imaging
Presented by Robert

Basser, P. J., Pajevic, S., Pierpaoli, C., Duda, J., & Aldroubi, A. (2000). In vivo fiber tractography using DT-MRI data. Magn Reson Med, 44(4), 625-32.

2/19. Functional connectivity II: Self organizing maps
Presented by Scott P

Obrig, H., Neufang, M., Wenzel, R., Kohl, M., Steinbrink, J., Einhaupl, K., et al. (2000). Spontaneous low frequency oscillations of cerebral hemodynamics and metabolism in human adults. Neuroimage, 12(6), 623-39.

Peltier, S. J., Polk, T. A., & Noll, D. C. (2003). Detecting low-frequency functional connectivity in fMRI using a self-organizing map (SOM) algorithm. Hum Brain Mapp, 20(4), 220-26.

2/26. Spring Break

3/4 - Functional Connectivity III: DCM
Presented by Hari

Penny, W. D., Stephan, K. E., Mechelli, A., & Friston, K. J. (2004). Modelling functional integration: a comparison of structural equation and dynamic causal models. Neuroimage, 23 Suppl 1, S264-74.

3/11 Functional Connectivity IV: Granger causality
Presented by Ann

Roebroeck, A., Formisano, E., & Goebel, R. (2005). Mapping directed influence over the brain using Granger causality and fMRI. Neuroimage, 25(1), 230-42.

3/18. Noise in FMRI data
Presented by Luis

Lund, T. E., Madsen, K. H., Sidaros, K., Luo, W. L., & Nichols, T. E. (2006). Non-white noise in fMRI: does modelling have an impact? Neuroimage, 29(1), 54-66.

Behzadi, Y., Restom, K., Liau, J., & Liu, T. T. (2007). A component based noise correction method (CompCor) for BOLD and perfusion based fMRI. Neuroimage, 37(1), 90-101.

3/25. Multi-Subject and multi-contrast analysis I: mixed effects
Presented by Mostafa

Beckmann, C. F., Jenkinson, M., & Smith, S. M. (2003). General multilevel linear modeling for group analysis in FMRI. Neuroimage, 20(2), 1052-63.

Woolrich, M. W., Behrens, T. E., Beckmann, C. F., Jenkinson, M., & Smith, S. M. (2004). Multilevel linear modelling for FMRI group analysis using Bayesian inference. Neuroimage, 21(4), 1732-47.

4/1. Multi-Subject and multi-contrast analysis II: Conjunctions
Presented by Jeanne

Nichols, T., Brett, M., Andersson, J., Wager, T., & Poline, J. B. (2005). Valid conjunction inference with the minimum statistic. Neuroimage, 25(3), 653-60.

4/8. Multi-Subject and multi-contrast analysis III: Statistical Power
Presented by Ann

Desmond, J. E., & Glover, G. H. (2002). Estimating sample size in functional MRI (fMRI) neuroimaging studies: statistical power analyses. J Neurosci Methods, 118(2), 115-28.

Power Calculation for Group fMRI Studies Accounting for
Arbitrary Design and Temporal Autocorrelation
Still in press but you can download it from::
http://www.fmripower.org/power_mumford_nichols.pdf
http://www.fmripower.org/mumford_hbm_2007.pdf

4/15. Data driven analysis I: independent components
Presented by Mostafa

McKeown, M. J., Makeig, S., Brown, G. G., Jung, T. P., Kindermann, S. S., Bell, A. J., et al. (1998). Analysis of fMRI data by blind separation into independent spatial components. Hum Brain Mapp, 6(3), 160-88.

Calhoun, V. D., Adali, T., Stevens, M. C., Kiehl, K. A., & Pekar, J. J. (2005). Semi-blind ICA of fMRI: A method for utilizing hypothesis-derived time courses in a spatial ICA analysis. Neuroimage, 25(2), 527-38.