Doctoral
FIS 2010
3

Neurociencia de Sistemas

Rodrigo Quian Quiroga – Universidad de Leicester, UK
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Duracion del curso: 28 horas (6 horas por semana, cuatro semanas, mas 4 horas de practica)

Evaluacion: Examen Final

Martes y Jueves 16:00 – 19:00.
Comienza el martes 23 de Marzo 2010.

Aula Federman – Departamento de Física
Pab. I – Ciudad Universitaria

Programa tentativo:

Clase 1. Introducción

Clase 2. Registros extracelulares – Spike sorting (tutorial: Wave_Clus).

Clase 3. Procesado de información visual.

Clase 4. Percepción y memoria.

Clase 5. Descodificación – Teoría de la información.

Clase 6. Electroencefalografía – Análisis de tiempo-frecuencia y Wavelets.

Clase 7. Potenciales evocados – Análisis de ensayo único (tutorial: EP_den).

Clase 8. Dinámica no-lineal – Sincronización (tutorial: Synchro).

Clase 9. Proyectos.

Bibliografía:

1-3913, 16, 30, 40-60

1. Bryant, H. L. & Segundo, J. P. Spike initiation by transmembrane current: a white-noise analysis. J.Physiol. 260, 279-314 (1976).
2. Jones, J. P., Stepnoski, A. & Palmer, L. A. The Two-Dimensional Spectral Structure of Simple Receptive Fields in Cat Striate Cortex. J.Neurophysiol. 58, 1212-1232 (1987).
3. Optican, L. M. & Richmond, B. J. Temporal Encoding of Two-Dimensional Patterns by Single Units in Primate Inferior Temporal Cortex. III. Information Theoretic Analysis. J.Neurophysiol. 57(1), 162-178 (1987).
4. Richmond, B. J., Optican, L. M., Podell, M. & Spitzer, H. Temporal Encoding of Two-Dimensional Patterns by Single Units in Primate Inferior Temporal Cortex. I Response Characteristics. J.Neurophysiol. 57(1), 132-146 (1987).
5. Richmond, B. J. & Optican, L. M. Temporal Encoding of Two-Dimensional Patterns by Single Units in Primate Inferior Temporal Cortex. II. Quantification of Response Waveform. J.Neurophysiol. 57(1), 147-161 (1987).
6. Vogels, R. & Orban, G. A. How well do response changes of striate neurons signal differences in orientation: a study in the discriminating monkey. J.Neurosci. 10, 3543-3558 (1990).
7. McClurkin, J. W., Gawne, T. J., Optican, L. M. & Richmond, B. J. Lateral Geniculate Neurons in Behaving Primates. II. Encoding of Visual Information in the Temporal Shape of the Response. J.Neurophysiol. 66(3), 794-808 (1991).
8. Ahissar, E. et al. Dependence of cortical plasticity on correlated activity of single neurons and on behavioral context. Science 257, 1412-1415 (1992).
9. Recanzone, G. H., Merzenich, M. M. & Schreiner, C. E. Changes in the Distributed Temporal Response Propertiesof SI Cortical Neurons Reflect Improvements in Performance on a Temporally Based Tactile Discrimination Task. J.Neurophysiol. 67(5), 1071-1091 (1992).
10. Miller, E. K., Li, L. & Desimone, R. Activity of neurons in anterior inferior temporal cortex during a short-term memory task. J Neurosci 13, 1460-78 (1993).
11. Tovee, M. J., Rolls, E. T., Treves, A. & Bellis, R. P. Information encoding and the responses of single neurons in the primate temporal visual cortex. J Neurophysiol 70, 640-54 (1993).

12. Tovee, M. J., Rolls, E. T. & Azzopardi, P. Translation invariance in the responses to faces of single neurons in the temporal visual cortical areas of the alert macaque. J Neurophysiol 72, 1049-60 (1994).
13. Arieli, A., Shoham, D., Hildesheim, R. & Grinvald, A. Coherent spatiotemporal patterns of ongoing activity revealed by real-time optical imaging coupled with single-unit recording in the cat visual cortex. J.Neurophysiol. 73, 2072-2093 (1995).
14. Mainen, Z. F. & Sejnowski, T. J. Reliability of Spike Timing in Neocortical Neurons. Science 268, 1503-1506 (1995).
15. Kovacs, G., Vogels, R. & Orban, G. A. Cortical correlate of pattern backward masking. Proc Natl Acad Sci U S A 92, 5587-91 (1995).
16. Cruishank, S. J. & Weinberger, N. M. Receptive Field Plasticity in the Adult Auditory Cortex Induced by Hebbian Covariance. J.Neurosci. 16(2), 861-875 (1996).
17. Gawne, T. J., Kjaer, T. W., Hertz, J. A. & Richmond, B. J. Adjacent Visual Cortical Complex Cells Share About 20% of Their Stimulus-Related Information. Cerebral Cortex 6(3) May/Jun, 482-489 (1996).
18. O'Keefe, J. & Burgess, N. Geometric determinants of the place fields of hippocampal neurons. Nature 381, 425-8 (1996).
19. Thompson, K. G., Hanes, D. P., Bichot, N. P. & Schall, J. D. Perceptual and motor processing stages identified in the activity of macaque frontal eye field neurons during visual search. J Neurophysiol 76, 4040-55 (1996).
20. Berry, M. J., Warland, D. K. & Meister, M. The structure and precision of retinal spike trains. Proc.Natl.Acad.Sci.USA 94, 5411-5416 (1997).
21. de Ruyter van Steveninck, R. R., Lewen, G. D., Strong, S. P., Koberle, R. & Bialek, W. Reproducibility and variability in neural spike train. Science 275, 1805-1808 (1997).
22. Levitt, J. B. & Lund, J. S. Contrast dependence of contextual effects in primate visual cortex. Nature 387, 73-76 (1997).
23. Reich, D. S., Victor, J. D., Knight, B. W., Ozaki, T. & Kaplan, E. Response variability and timing precision of neuronal spike trains in vivo. J.Neurophysiol. 77, 2836-2841 (1997).
24. Riehle, A., Grun, S., Diesmann, M. & Aertsen, A. Spike sychronization and rate modulation differentially involved in motor cortical function. Science 278, 1950-1953 (1997).
25. MacLeod, K., Backer, A. & Laurent, G. Who reads temporal information contained across synchronized and oscillatory spike trains? Nature 395, 693-698 (1998).
26. Warzecha, A. K. & Egelhaaf, M. Variability in spike trains during constant and dynamic stimulation. Science 283, 1927-1930 (1999).
27. Reich, D. S., Mechler, F., Purpura, K. P. & Victor, J. D. Interspike intervals, receptive fields, and information encoding in primary visual cortex. J.Neurosci. 20, 1964-1974 (2000).
28. Cecchi, G. A. et al. Noise in neurons is message dependent. Proc Natl Acad Sci U S A 97, 5557-61 (2000).
29. Lamme, V. A., Super, H., Landman, R., Roelfsema, P. R. & Spekreijse, H. The role of primary visual cortex (V1) in visual awareness. Vision Res 40, 1507-21 (2000).
30. Heeger, D. J., Huk, A. C., Geisler, W. S. & Albrecht, D. G. Spikes versus BOLD: what does neuroimaging tell us about neuronal activity? Nat Neurosci 3, 631-3 (2000).

31. Bichot, N. P., Thompson, K. G., Chenchal Rao, S. & Schall, J. D. Reliability of macaque frontal eye field neurons signaling saccade targets during visual search. J Neurosci 21, 713-25 (2001).
32. Roitman, J. D. & Shadlen, M. N. Response of neurons in the lateral intraparietal area during a combined visual discrimination reaction time task. J Neurosci 22, 9475-89 (2002).
33. Pesaran, B., Pezaris, J. S., Sahani, M., Mitra, P. P. & Andersen, R. A. Temporal structure in neuronal activity during working memory in macaque parietal cortex. Nat Neurosci 5, 805-11 (2002).
34. Fujii, N. & Graybiel, A. M. Representation of action sequence boundaries by macaque prefrontal cortical neurons. Science 301, 1246-9 (2003).
35. Holmes, P. et al. From neural spikes, through stochastic differential equations, to behavior. Proc Int Symp Nonlinear Theory and its Applications (2004).
36. Makeig, S. et al. Electroencephalographic brain dynamics following manually responded visual targets. PLoS Biol 2, e176 (2004).
37. Wong, K. F. & Wang, X. J. A recurrent network mechanism of time integration in perceptual decisions. J Neurosci 26, 1314-28 (2006).
38. Yuval-Greenberg, S., Tomer, O., Keren, A. S., Nelken, I. & Deouell, L. Y. Transient induced gamma-band response in EEG as a manifestation of miniature saccades. Neuron 58, 429-41 (2008).
39. Dimigen, O., Valsecchi, M., Sommer, W. & Kliegl, R. Human microsaccade-related visual brain responses. J Neurosci 29, 12321-31 (2009).
40. Rockstroh, B. et al. Cortical self-regulation in patients with epilepsies. Epilepsy Res 14, 63-72 (1993).
41. Wackermann, J., Lehmann, D., Michel, C. M. & Strik, W. K. Adaptive segmentation of spontaneous EEG map series into spatially defined microstates. Int J Psychophysiol 14, 269-83 (1993).
42. Heeger, D. J., Simoncelli, E. P. & Movshon, J. A. Computational models of cortical visual processing. Proc.Natl.Acad.Sci.USA 93, 623-627 (1996).
43. Boynton, G. M., Engel, S. A., Glover, G. H. & Heeger, D. J. Linear systems analysis of functional magnetic resonance imaging in human V1. J Neurosci 16, 4207-21 (1996).
44. Carandini, M., Heeger, D. J. & Movshon, J. A. Linearity and normalization in simple cells of the macaque primary visual cortex. J.Neurosci. 17, 8621-8644 (1997).
45. Demb, J. B., Boynton, G. M. & Heeger, D. J. Brain activity in visual cortex predicts individual differences in reading performance. Proc Natl Acad Sci U S A 94, 13363-6 (1997).
46. Menon, V., Ford, J. M., Lim, K. O., Glover, G. H. & Pfefferbaum, A. Combined event-related fMRI and EEG evidence for temporal-parietal cortex activation during target detection. Neuroreport 8, 3029-37 (1997).
47. Baillet, S. & Garnero, L. A Bayesian approach to introducing anatomo-functional priors in the EEG/MEG inverse problem. IEEE Trans Biomed Eng 44, 374-85 (1997).
48. Makeig, S., Jung, T. P., Bell, A. J., Ghahremani, D. & Sejnowski, T. J. Blind separation of auditory event-related brain responses into independent components. Proc Natl Acad Sci U S A 94, 10979-84 (1997).
49. Dehaene, S. et al. Imaging unconscious semantic priming. Nature 395, 597-600 (1998).

50. Liu, A. K., Belliveau, J. W. & Dale, A. M. Spatiotemporal imaging of human brain activity using functional MRI constrained magnetoencephaolography data: Monte Carlo simulations. Proceedings of the National Academy of Sciences of the United States of America 95, 8945-8950 (1998).
51. Demb, J. B., Boynton, G. M. & Heeger, D. J. Functional magnetic resonance imaging of early visual pathways in dyslexia. J Neurosci 18, 6939-51 (1998).
52. Gandhi, S. P., Heeger, D. J. & Boynton, G. M. Spatial attention affects brain activity in human primary visual cortex. Proc.Natl.Acad.Sci.USA 96, 3314-3319 (1999).
53. Miltner, W. H., Braun, C., Arnold, M., Witte, H. & Taub, E. Coherence of gamma-band EEG activity as a basis for associative learning. Nature 397, 434-436 (1999).
54. Skoczenski, A. M. & Norcia, A. M. Development of VEP Vernier acuity and grating acuity in human infants. Invest Ophthalmol Vis Sci 40, 2411-7 (1999).
55. Frot, M. & Mauguiere, F. Timing and spatial distribution of somatosensory responses recorded in the upper bank of the sylvian fissure (SII area) in humans. Cereb Cortex 9, 854-63 (1999).
56. Worden, M., Foxe, J. J., Wang, N. & Simpson, G. V. Anticipatory biasing of visuospatial attention indexed by retinotopically specific alpha band electroencephalography increases over occipital cortex. J.Neurosci. 20, 1-6 (2000).
57. Polonsky, A., Blake, R., Braun, J. & Heeger, D. J. Neuronal Activity in human primary visual cortex correlates with perception during binocular rivalry. Nat Neurosci 3, 1153-1159 (2000).
58. Ogawa, S. et al. An approach to probe some neural systems interaction by functional MRI at neural time scale down to milliseconds. Proc Natl Acad Sci U S A 97, 11026-31 (2000).
59. Birbaumer, N. et al. The thought translation device (TTD) for completely paralyzed patients. IEEE Trans Rehabil Eng 8, 190-3 (2000).
60. Quiroga, R. & Garcia, H. Single-trial event-related potentials with wavelet denoising -. Clin Neurophysiol 114, 376-390 (2003).

Universidad de Buenos Aires
Facultad de Ciencias Exactas y Naturales

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Buenos Aires, 26 JUL 2010

VISTO:

las notas presentadas por el Dr. Juan Pablo Paz, Director del Departamento de Física, mediante las cuales eleva, al Sr. Decano la Información y el Programa del Curso de Posgrado **NEUROCIENCIAS DE SISTEMAS,** que fue dictado en el Primer cuatrimestre de 2010, por el Dr. Rodrigo Quian Quiroga (Universidad de Leicester, UK) y el Dr. Mariano Sigman

CONSIDERANDO:

lo actuado por la Comisión de Doctorado el 07/07/2010,

lo actuado por la Comisión de Enseñanza, Programas, Planes de Estudio y Posgrado,

lo actuado por este cuerpo en Sesión Ordinaria realizada en el día de la fecha,

en uso de las atribuciones que le confiere el Artículo Nº 113º del Estatuto Universitario,

EL CONSEJO DIRECTIVO DE LA FACULTAD DE CIENCIAS EXACTAS Y NATURALES
R E S U E L V E:

Artículo 1º: Dar validez al dictado del Curso de Postgrado **NEUROCIENCIAS DE SISTEMAS**, de 28 hs. de duración.

Artículo 2º: Aprobar el Programa del Curso de Postgrado **NEUROCIENCIAS DE SISTEMAS** obrante de fs 4 a 8 en el Expediente de la Referencia.

Artículo 3º: Aprobar un Puntaje Máximo de un punto y medio (1,5) para la Carrera del Doctorado.

Artículo 4º: Aprobar un Arancel de 20 Módulos. Disponer que los fondos recaudados en concepto de Aranceles deberán ser utilizados conforme a la Resolución CD 072/2003.

Artículo 5º: Comuníquese a la Dirección del Departamento de Física, a la Biblioteca de la FCEyN y a la Subsecretaría de Postgrado (con fotocopia del programa incluida, fs 4 a 8). Comuníquese al Departamento de Alumnos y Graduados sin fotocopia del Programa. Cumplido Archívese.

Resolución CD Nº 1746
SP/med 07/07/2010

Dr. JAVIER LÓPEZ DE CASENAVE
SECRETARIO ACADEMICO ADJUNTO

Dr. JORGE ALIAGA
DECANO