# Decoding Multi-electrode Array Data

Wu Jianhua* Feng Jianfeng**
Department of Computer Science, University of Warwick
Coventry CV4 7AL UK
*jianhua@dcs.warwick.ac.uk
**jianfeng@dcs.warwick.ac.uk

Multi-electrode array is a powerful experimental tool to explore holistic issues related to neural coding, both at cellular and local field potential level [1]. One of the key issues to decipher the meaning of the data [1] is to find the variable changes (hot-spots) in response to the applied stimuli. We develop a new algorithm [2] to tackle this issue. The algorithm is applied to the recorded MEA data of the local field potentials of the sheep's prefrontal cortex, both left and right hemisphere. By applying power and coherence analysis to the hot-spots, synchronized beta frequency (14-30 HZ) oscillations are observed. Granger causality spectra [3] are used to measure the directional influences among the hot-spot variables and a dynamical information flow chart is plotted. The flow chart allows us to discern how the information flows from one variable to another. In addition to analyzing the data in the frequency domain, moving-window MANOVA statistic test is employed in the temporal domain to characterize sheep's response time to the vision stimulus. Response time shows the reaction time of neurons to the stimuli and the dynamical flow chart revealed by Granger causality illuminate the detailed relationships among the neurons during the response.

**Reference**

[1] P.M. Horton, L. Bonny, A.U. Nicol, K.M. Kendrick and J.F. Feng (2005), MEANOVA–Applications of MANOVA to MEA Data, *J. Neurosci. Methods*. (In press)

[2] Wu J.H., Kendrick K. and Feng J.F. (2005) Detecting hot-spot in spatio-temporal patterns of Complex Biological Data. (In preparation)

[3] Chen Y.H., Rangarajan G., Feng J.F. and Ding M.Z. (2004) Analyzing multiple nonlinear time series with extended Granger causality, *Phys. Lett. A*, vol. **324**, 26-35.