

The 50th International Seminar on Experiments and Surveys in Economics and Related Social Sciences

Date: Wednesday, May 2nd, 15:00-17:00

Speaker: Nicola SOLDATI, CIMeC-Center for Mind/Brain Sciences-University of Trento, Trento, Italy

Title: Real-Time fMRI: Signal Processing Perspectives

Venue: Room 706, West 9 Building, O-okayama Campus, Tokyo Tech

Moderator: Hiroyuki AKAMA (Department of Human System Science)

Abstract:

Functional Magnetic Resonance Imaging (fMRI) emerged as a breakthrough technology for high quality insights of the human brain. Due to its intrinsic nature of temporal and spatial-resolution monitoring of brain activity, shortly after its development it has successfully pursued the possibility of performing real-time analysis.

This target had to face several technical and theoretical issues, ranging from hardware acquisition problems to signal measurement optimizations, closed loop data transfer and signal processing. Although limited by the complexity of the problem, several techniques have been proposed in literature to achieve real-time fMRI exploiting model-based data analysis techniques. Recently, the attention has been focused on data processing techniques, looking for novel powerful algorithms. In this context, data-driven methods are shown to be suitable in finding and monitoring the spatiotemporal dynamics of the relevant brain activations, which is the ultimate goal of the real-time fMRI.

In this talk the state-of-the-art in real-time fMRI analysis will be introduced. First a basic discussion on the theoretical background pointing out the main limitations and constraints from a signal processing perspective will be held. Thereafter we will pass to an in-depth comparison of different methods proposed in literature, justifying the need of more sophisticated methods of signal processing and data analysis.

Last but not least a review of our current work on novel proposed data-driven based methods, an extension of ICA algorithms will follow, showing how to overcome the presented limitations and pushing further the boundaries of this emerging technique.

About the speaker:

Nicola Soldati's current interests include, without being limited to, machine learning based and Multivariate Data-Driven method development for real-time fMRI

(Independent Component Analysis, ICA), integration of multimodal brain imaging techniques (fMRI/EEG/MEG) for translational medicine and high performance computation and data visualization methods. His research is a fruit of ongoing collaboration among the worlds most advanced and prestigious research centers (RIKEN, MIT, Mind Research Network).

#### References:

N. Weiskopf, R. Sitaram, O. Josephs, R. Veit, F. Scharnowski, R. Goebel, N. Birbaumer, R. Deichmann, K. Mathiak, "Real-time functional magnetic resonance imaging: methods and applications", *Magnetic Resonance Imaging*, Volume 25, Issue 6, July 2007, Pages 989-1003, ISSN 0730-725X, 10.1016/j.mri.2007.02.007.

N. Soldati, V. Calhoun, L. Bruzzone, J. Jovicich "Real-time fMRI using ICA: optimization study for dynamically monitoring a target IC with different types of a priori information. 18th Annual Meeting of the Organization for Human Brain Mapping June 10-14, 2012 in Beijing, China.

N. Soldati, V. Calhoun, L. Bruzzone, J. Jovicich. "Real-time fMRI using ICA: optimization study for defining a target IC from a functional localizer".18th Annual Meeting of the Organization for Human Brain Mapping to be held June 10-14, 2012 in Beijing, China