“Integrating EEG and fMRI in epilepsy”

Seminar

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The lecture will take place at 14:30 pm in the Sala Verde of the Facoltà di Scienze MM.FF.NN

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Abstract:

Integrating electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) studies enables to non-invasively investigate human brain function and to find the direct correlation of these two important measures of brain activity. Presurgical evaluation of patients with epilepsy is one of the areas where EEG and fMRI integration has considerable clinical relevance for localizing the brain regions generating interictal epileptiform activity. The conventional analysis of EEG-fMRI data is based on the visual identification of the interictal epileptiform discharges (IEDs) on scalp EEG. The convolution of these EEG events, represented as stick functions, with a model of the fMRI response, i.e. the hemodynamic response function, provides the regressor for general linear model (GLM) analysis of fMRI data. However, the conventional analysis is not automatic and suffers of some subjectivity in IEDs classification. We present an easy-to-use and automatic approach for combined EEG-fMRI analysis able to improve IEDs identification based on Independent Component Analysis and wavelet analysis. EEG signal due to IED is reconstructed and its wavelet power is used as a regressor in GLM. The method was validated on simulated data and then applied on real data set consisting of patients with partial epilepsy. In all continuous EEG-fMRI recording sessions a good quality EEG was obtained allowing the detection of spontaneous IEDs and the analysis of the related BOLD activation. The main clinical finding in EEG-fMRI studies of patients with partial epilepsy is that focal interictal slow-wave activity was invariably associated with increased focal BOLD responses in a spatially related brain area. Our study extends current knowledge on epileptic foci localization and confirms previous reports suggesting that BOLD activation associated with slow activity might have a role in localizing the epileptogenic region even in the absence of clear interictal spikes.