Seminar

MULTISCALE BAYESIAN STATE-SPACE MODEL FOR GRANGER CAUSALITY ANALYSIS OF BRAIN SIGNAL

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Abstract: [www.stat.unipd.it/fare-ricerca/seminari](http://www.stat.unipd.it/fare-ricerca/seminari)
Often, brain signal data are recorded during an experimental situation where stimuli are presented at fix time and are expected to induce a subject reaction. The causal links between recorded signals (e.g. from different part of the brain) may therefore vary in time and be frequency specific and the ability to compute a dynamic and frequency specific statistic of "causality" is essential. Granger causality comes very naturally as a strong statistical tool allowing us to test for dynamical causal relationships, its properties being assessed a few decades ago (Granger, 1969, Geweke, 1984). However, Granger's original model is neither time varying, nor frequency specific. We propose its extension based on a Bayesian vector autoregressive model with time varying coefficients. Many issues will be discussed, including the estimation through the variational Bayesian approximation methodology, the selection of the priors and the way to select the model order. The frequency part is achieved through the use of the Multiscale Haar “a trous" wavelet transform. I will present an application of this methodology to real intracranial electroencephalogram data recorded in the regions of amygdala and medial orbitofrontal cortex during an experimental task of emotional auditory stimuli recognition.