Séminaires ISIR

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Characterization of the neurovascular coupling: modeling and estimation

Abstract : Functional magnetic resonance imaging (fMRI) allows the mapping of the brain activation through measurements of the Blood Oxygenation Level De- pendent (BOLD) contrast. The characterization of the pathway from the input stimulus to the output BOLD signal requires the selection of an adequate hemodynamic model and the calibration of the model. After an overview of research activities in my group Estimation Modeling and ANalysis (EMANG), I will recall the relation between the BOLD signal and the neural activity and describe some of the existing models with their limitations. I will also introduce the inverse problem consisting in estimating the neural activity and the hemodynamic states from BOLD measurements. Then, I will present some of our contributions. First, I will introduce a new model of the neurovascular coupling based on fractional differential equations. Then, I will introduce a new parameters and state estimation for fractional systems based on modulating functions, which I will use to solve the inverse problem. Finally I will present some numerical simulations and experimental validation results.

Short bio : Taous Meriem Laleg-Kirati is an assistant professor in the division of Computer, Electrical and Mathematical Sciences and Engineering at KAUST in the EMAN group (http://emang.kaust.edu.sa), on leave from INRIA Bordeaux. She joined KAUST in December 2010. From 2009 to 2010, she was working as a research scientist at the French Institute for research in Computer Sciences and Control Systems (INRIA) in Bordeaux. She earned her Ph.D in Applied Mathematics from INRIA Paris, in 2008. She holds a Master in control systems and signal processing from University Paris 11 in France. Her research interests include, modeling, estimation, and control of physical systems, inverse problems, and signal and image analysis. She considers applications in engineering and biomedical fields.

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