**Proposition of Post-Doc position:**

# SPARSE LEARNING for MULTI-SENSOR SOURCE DETECTION in BRAIN IMAGING

**Deadline for application**: May 30th, 2015

**Research teams**: PANAMA and VISAGES Teams, Inria Rennes (http://www.irisa.fr/)

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**Keywords**: Signal and Image Analysis, Sparse Representation, Machine Learning, Inverse problem, Super resolution, Non linear estimation, Real-Time fMRI, EEG, Medical Imaging

## Description:

The VISAGES and PANAMA teams at Inria Rennes are seeking a highly qualified young researcher with strong background in applied mathematics, machine learning and image processing for a post-doctoral research project around inverse problems in neuro-imaging.

The post-doc will design a coupling model in the context of multi-sensor (fMRI & EEG) brain imaging. The model will combine a linear inverse problem formulation with sparse regularizations through efficient proximal algorithms.

We primarily envision to learn a coupling model able to extract the useful signals by combining a) a common high-resolution spatio-temporal representation of brain activity, characterized by sparsity in an appropriate dictionary; b) models of the acquisition process in each of the considered sensors. Learning a multi-sensor coupling model will therefore consist in learning both the dictionary in which brain activity is sparse, and in learning the parameters of the acquisition process (this can be seen as a calibration process).

Different learning algorithms and sparsity-enforcing penalties will be evaluated in order to exhibit which brain areas are activated at a certain time. The significance of the methods and the effectiveness of the algorithms will be demonstrated through numerical investigations and in-vivo experiments (normal controls, psychiatric disorders and stroke).

## Research environment

The proposed position arises in the context of the HEMISFER project of the Labex "CominLabs" (http://hemisfer.cominlabs.ueb.eu) which aims at making full use of the neurofeedback (NF) paradigm in the context of novel neuro-rehabilitation procedures. The major expected breakthrough of HEMISFER will come from the design and use of the envisioned coupling model associating real-time brain imaging sensors of functional and metabolic especially real-time Magnetic Resonance Imaging (rtfMRI) and Electro-encephalography (EEG).

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This work will be conducted in collaboration between the Unit/Project VISAGES U746 (INSERM / INRIA / CNRS / University of Rennes I) whose research activities are directed towards neuroimaging and medical image processing, and the PANAMA research team (Inria / CNRS) whose research activities focus on machine learning and compressive sensing.

This work will benefits from research-dedicated 3T MRI and EEG/MRI compatible system provided by the NeurInfo platform on which these new research protocols will be set up (http://www.neurinfo.org). The experimental part will be conducted in close collaborations with the Engineering staff of Hemisfer and Neurinfo, and the medical doctors involved in this project (Radiology, Rehabilitation and Psychiatry Dept. of the University Hospital of Rennes).

## Skills and applicant profile

The ideal applicant should have a strong background in applied mathematics, numerical analysis, and statistics. Experience in sparse representation and convex optimization will be a definite bonus. A good practice in programming, especially in Matlab and in object-oriented programming (C++) will also be appreciated. The applicant should have obtained the PhD degree prior to take the position. The position is opened for an initial period of 12 months (with a possibility to extend for an additional period) with a range of salary around 2100€ net per month (tax free).

## Application package

Applicants should send their complete application package by email to <Christian.Barillot@irisa.fr; Remi.Gribonval@inria.fr; Pierre.Maurel@irisa.fr> This includes:

- Motivation letter
- Complete CV with publication list
- PDF of **one** representative paper (or slideshow) of the candidate in connection with this project.
- At least two recommendation letters (preferably directly sent by the mentor)
- **Incomplete applications will not be processed.**

## References:


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