

Proposition of Post-Doc position:

**R&D POSITION FOR NEUROFEEDBACK AND BRAIN
REHABILITATION BASED ON EEG AND FMRI**

Deadline for application: July 15th, 2017

Research teams: VISAGES and HYBRID Teams, Inria Rennes (<http://www.inria.fr/>)

Associate Supervisors:

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Keywords: Neurofeedback/Brain-Computer Interface, Real-time Signal and Image Processing, Real-Time fMRI, EEG, Medical Imaging, Visualization

Description:

The HYBRID and VISAGES teams at Inria Rennes are seeking a highly qualified young researcher with engineering experience and motivation in Brain Computer Interface and real-time medical image processing for set-up and operation of a computational platform design in a high technological environment.

This position is open by Inria, Rennes, France, within the frame of the HEMISFER collaborative project. The HEMISFER project aims at coupling functional Magnetic Resonance Imaging (fMRI) and Electro-encephalography (EEG) in order to improve the state-of-the-art in brain rehabilitation for neurological and psychiatric disorders. The used methodological paradigm is neurofeedback will have close connections to Brain-Computer Interfaces (BCI), visualization and medical image and signal processing. In the scope of the project, novel computational/statistical models, signal processing, empirical protocols and visualizations will be proposed and studied, partly via their computational implementations and tested on ambitious clinical protocols.

The selected post-doc will collaborate with the other members of the project in specifying and designing an integrative software architecture that allows the modelling of fMRI and EEG data jointly. The significance and the effectiveness of the computational platform will be tested through a large set of home-made in-vivo experiments (normal controls, psychiatric disorders and stroke patients). Further, the selected post-doc may be requested to implement additional data processing algorithms, software components and computational improvements as needs arise from the research progress.

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 a computational platform associating brain imaging sensors of functional and metabolic especially real-time Magnetic Resonance Imaging (rtfMRI) and Electro-encephalography (EEG).

This work will be conducted in collaboration between the Unit/Project VISAGES U1228 (INSERM / INRIA / CNRS / University of Rennes I) whose research activities are directed towards neuroimaging and medical image processing, and the HYBRID research team (Inria / CNRS) whose research activities focus on Virtual Reality and Computer Human Interactions.

This work will benefit 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 clinical departments of Radiology, Rehabilitation and Psychiatry of the Hospitals of Rennes.

Skills and applicant profile

The ideal applicant should have a strong background in computer sciences, numerical analysis, and statistics. A very good practice in programming, especially in Matlab and in object-oriented programming (C++) and/or Python is required. 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 range of gross salary starting from 2600€ per month, according to experience.

Application package

Applicants should send their complete application package by email to <Christian.Barillot@irisa.fr; Anatole.Lecuyer@inria.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.
- Recommendation letters (preferably directly sent by the mentor)
- **Incomplete applications will not be processed.**



Figure: (Left) installation design of the EEG-fMRI environment and (right) a view through the magnet of a fMRI-EEG Neurofeedback experiment

References:

1. M. Mano, A. Lecuyer, E. Bannier, L. Perronnet, S. Noorzadeh, and C. Barillot, "How to Build a Hybrid Neurofeedback Platform Combining EEG and fMRI," *Front Neurosci*, vol. 11, p. 140, 2017.
2. M. Mano, E. Bannier, L. Perronnet, A. Lécuyer, and C. Barillot ; Hybrid EEG and fMRI platform for multi-modal neurofeedback, *ISMRM 2017*, Honolulu, HI
3. L. Perronnet, A. Lecuyer, M. Mano, E. Bannier, F. Lotte, M. Clerc, and C. Barillot, "Unimodal Versus Bimodal EEG-fMRI Neurofeedback of a Motor Imagery Task," *Front Hum Neurosci*, vol. 11, p. 193, 2017.
4. L. Perronnet, A. Lécuyer, F. Lotte, M. Clerc, and C. Barillot, "Brain training with neurofeedback," in *Brain-Computer Interfaces / Les Interfaces Cerveau-Ordinateur*. vol. 1, M. Clerc, L. Bougrain, and F. Lotte, Eds., ed: ISTE-Wiley, 2016, pp. 291-309.
5. M. Mano, E. Bannier, L. Perronnet, A. Lécuyer, and C. Barillot, "Design of an Experimental Platform for Hybrid EEG-fMRI Neurofeedback Studies," presented at the 22nd Annual Meeting of Human Brain Mapping, Geneva, CH, 2016.