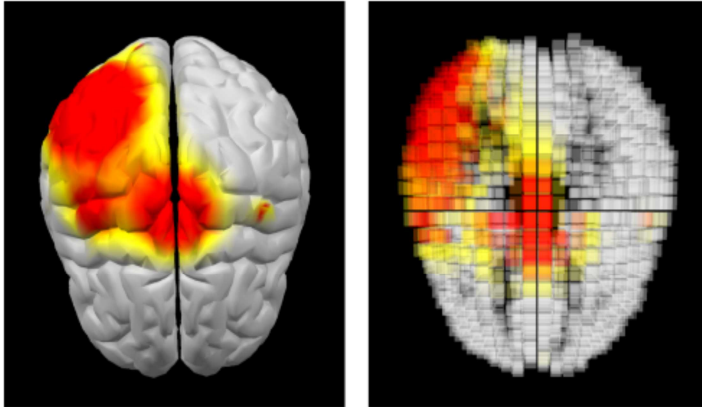# Postdoctoral position at Inria (Hybrid research group, Rennes, France)

Title : "Real-time 3D visualization of brain activity (EEG)"

Context

This postdoctoral offer is in the frame of the collaborative research project "SABRE" funded by the French "laboratoire d'excellence" CominLabs. The SABRE project involves three partners (Hybrid team at Inria Rennes, electronics and microwaves groups at Telecom-Bretagne Brest). The goal of SABRE is to improve computational power of current real-time processing pipelines of cerebral data (electroencephalography, EEG). The SABRE project investigates innovative, real-time EEG source imaging methods empowered and speeded-up by novel algorithms as well as the ad-hoc, transistor-level implementations of the key algorithmic operations. A completely new family of fully-hardware-integrated, computational EEG imaging methods will be developed that are expected to speed up the imaging process of an EEG device by several orders of magnitude in actual use. Illustrative applications and use cases of the project are Brain-Computer Interfaces, Neurofeedback applications, and Medical/Scientific visualization.

The postdoctoral position is hosted at Inria, Rennes, France, in Hybrid research group under the supervision of Dr Anatole Lécuyer (head of Hybrid) and Dr Jussi Lindgren (lead software engineer of the OpenViBE platform for real-time EEG processing – http://openvibe.inria.fr). Inria (www.inria.fr) is the French National Institute for Research on Computer Science and Control, with around 3,500 researchers in 8 research centers in France. Hybrid (https://team.inria.fr/hybrid/) is an Inria research team located in Rennes, France. The scientific field of Hybrid is 3D interaction and virtual Reality. The research of the team focuses on multiple user inputs, and intends to exploit both motor activity (gesture and motion-tracking) and mental activity (brain-computer interfaces). Applications of this research are in the field of industry (virtual prototyping), medicine (surgical simulation, rehabilitation), design (architectural mock-ups), digital art, and videogames.

Mission

The postdoctoral program aims at designing and testing innovative 3D visualization techniques for representing brain activity as measured with EEG (electroencephalography). Partners of the project have access to various kinds of EEG acquisition systems, ranging from low-cost mobile systems with 8 electrodes to highly elaborated devices of 256 electrodes. The SABRE project focuses on brain activity related to motor functions, such as when imagining a motion of the hands or feet. Such brain activity can be particularly relevant in Brain-Computer Interfaces (BCI) applications that can provide assistance to disabled people (eg control of prostheses or wheelchair) or for re-education applications (eg neurofeedback and stroke re-education).

The novel visualization techniques that we envision in this postdoctoral work would leverage on the real-time source localization methods that will be designed and made available in SABRE project. These methods will allow a significant increase in the spatial resolution of such visualizations, enabling to precisely identify and locate the regions of interest in the cerebral volume in real-time.

The recruited postdoctoral fellow will therefore design and propose various novel visualization methods for representing, in real-time, the processed cerebral activity and the identified brain regions. Various representations could be proposed and tested such as anthropomorphic or anatomic 3D models, or more symbolic approaches relying on classical gauges or other visual metaphors. The candidate could also exploit the various virtual reality facilities of the Inria Rennes research center, including head-mounted displays, multi-sensory devices (audio/haptic/tactile interfaces), and our high-end Immersia room - a 10-meter wide CAVE-like highly immersive stereoscopic configuration. The postdoctoral developments could also benefit from our open-source OpenViBE software platform (http://openvibe.inria.fr) that can potentially be an established platform and context for public dissemination of the proposed tools.

Several applications are targeted for the visualization techniques, including: education, diagnosis, and neurofeedback/re-education. A strong link is envisioned with other on-going projects and collaborations with medical partners at Rennes University Hospital (CHU) in either re-education or psychiatric domains. Clinical evaluations of the designed approaches could therefore be envisioned in the frame of the postdoctoral stay with real patients and/or healthy participants.

Profile

The candidate must have a PhD and excellent background in either: 3D Visualization, Scientific Visualization, Human-Computer Interaction, 3D User Interfaces, or Virtual Reality.

Information

Duration: 18 months

Position open/start : end 2015
Salary: around 2 620€ gross/month.
Monthly salary after taxes : around 2130€ (note: medical insurance fully included).
Location: Rennes, France

Contact

Interested candidates should send a CV, a motivation letter, and 3 references directly to:

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Dr. Jussi Lindgren, INRIA/IRISA, Email: jussi-tapio.lindgren@inria.fr