Post-doctoral position at INRIA (Rennes, France)

TITLE: "Interactive and immersive 3D visualisation of cerebral activity for Brain-Computer Interfaces"

BACKGROUND:
Typical computer-user interfaces include a keyboard and a mouse. Research in Human Computer Interface (CHI) has always tried to improve and to simplify the control of electronic devices. Brain-Computer Interface (BCI) aims to use a new communication channel offered by the activity of the brain. The goal is to achieve the so called "think and make it happen without physical effort" paradigm. A typical BCI system consists of a brain signal acquisition device (typically using Electroencephalography (EEG)) and a signal processing device. The latter outputs device-control commands. During a training phase, the participant tries repeatedly to accomplish a specific mental task. After a sufficient number of trials, given that the brain activity can be extracted in the form of a consistent, valid, and specific feature, a classification algorithm is able to translate it into a unique command. At this point participants are able to issue simple commands (usually binary) to an electronic device. Published study could demonstrate a transfer rate up to around 20 bits per minute, that is, around 20 "1" or "0" commands per minute.
The post-doc is part of an ongoing research effort for the connection and integration of Brain-Computer Interfaces (BCI) in Virtual Environments (VE) and with Virtual Reality set-ups (VR). The BUNRAKU team, through the Open-ViBE project (www.irisa.fr/siames/OpenViBE), aims at using this new mean of interaction for manipulating virtual object or navigating and exploring virtual worlds. In this framework BUNRAKU is developing a software platform for the acquisition, processing and visualization of EEG activity in virtual reality. The visualisation engine is considered as an essential component of the overall system, since every BCI system faces the problem of learning.

DESCRIPTION OF THE POST-DOC ACTIVITY:
Aim of the post-doc will be the development of efficient 3D visualisation techniques for the interactive exploration of cerebral activity. Such a tool has to be efficient so to work in real-time and on-line, i.e. when the user is connected to an EEG acquisition machine.
The successful candidate will propose and compare several representations for the mental activity including, for instance, a realistic and holistic 3D model of the brain, with symbolic and schematic display of electrical and band power activities inside the volume of the virtual brain model. He/she will propose interactive tools to explore, interact and navigate in this virtual brain model. The system will be used together with an immersive and stereoscopic "Reality Center" (large cylindrical visualisation screen).
The candidate will work in a multi-disciplinary environment in collaborations with other members of the team and other team in France working on complementary subjects.

PROFILE OF THE IDEAL CANDIDATE:
The candidate should have a PhD in Visualisation, Computer Graphics, and/or Virtual Reality. Knowledge and expertise with visualization, virtual reality and interactive techniques is thus the main requirement. Strong skill in computer programming (in C++) is also an important prerequisite. Specific experience with EEG, Neuroscience and Cognitive Sciences is not required, but would represent an important advantage over other candidates.

RESEARCH UNIT:
INRIA (National Institute for Research In Informatics and Control),

LOCATION:
Rennes (Bretagne), France.

DURATION: 12 to 24 months

LABORATORY:

BUNRAKU (www.irisa.fr/bunraku)

OPEN-VIBE PROJECT:
Open-Vibe website : www.irisa.fr/siames/OpenViBE/
Open-Vibe description : C. Arrouet, M. Congedo, J.E. Marvie, F. Lamarche, A. Lécuyer, and B. Arnaldi, "Open-ViBE: a 3D Platform for Real-Time Neuroscience", Journal of Neurotherapy, Vol. 9, Num. 1, 2005 http://www.irisa.fr/siames/GENS/alecuyer/Open-ViBE.pdf

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