

The Colorado State University Computer Science Department and ISTeC present:

## Non-Invasive Brain-Controlled Robots

**Dr. José Millán**

Swiss Federal Institute of Technology

Monday, February 9, 2009, 11:00, Computer Science Building 130

Reception at 10:30

### **Abstract**

The idea of moving robots or prosthetic devices not by manual control, but by mere “thinking” (i.e., the brain activity of human subjects) has fascinated researchers for the last 30 years, but it is only now that first experiments have shown the possibility to do so. Such a kind of brain-computer interface (BCI) is a natural way to augment human capabilities by providing a new interaction link with the outside world and is particularly relevant as an aid for physically disabled people. In this talk I will review our work on non-invasive asynchronous BCI, with a focus on how brainwaves can be used to directly control robots. Most of the hope for such a possibility comes from invasive approaches that provide detailed single neuron activity; however, it requires surgical implantation of microelectrodes in the brain. For humans, non-invasive systems based on electroencephalogram (EEG) signals are preferable but, until now, have been considered too poor and slow for controlling rapid and complex sequences of movements. Recently we have shown for the first time that online analysis of a few EEG channels, if used in combination with advanced robotics and machine learning techniques, is sufficient for humans to continuously control a mobile robot and a wheelchair. Finally, we discuss current research directions we are pursuing in order to improve the performance and robustness of our BCI system, especially for real-time control of brain-actuated robots. In particular, I’ll mention work on recognizing cognitive states that are crucial for interaction.

### **Biography**

José del R. Millán is a professor at the Swiss Federal Institute of Technology in Lausanne (EPFL) where he explores the use of brain signals for multimodal interaction and, in particular, the development of non-invasive brain-controlled robots and neuroprostheses. In this multidisciplinary research effort, Dr. Millán is bringing together his pioneering work on the two fields of brain-computer interfaces and adaptive intelligent robotics.

He received his Ph.D. in computer science from the Univ. Politècnica de Catalunya (Barcelona, Spain) in 1992, where he was an assistant professor for three years. He was also a research scientist at the Joint Research Centre of the European Commission in Ispra (Italy), a senior researcher at the Idiap Research Institute in Martigny (Switzerland), and a visiting scholar at the Universities of Stanford and Berkeley.

His research on brain-computer interfaces was nominated finalist of the European Descartes Prize 2001 and he has been named Research Leader 2004 by the journal Scientific American for his work on brain-controlled robots. The journal Science has reviewed his work as one of the worlds key researchers in the field of brain-computer interfaces. Dr. Millán is the coordinator of a number of European projects on brain-computer interfaces and also is a frequent keynote speaker at international events. His work on brain-computer interfaces has received wide media coverage around the world.