

### Workshop on Brain Computer Interfaces

BRAIN-COMPUTER interfaces (BCIs) are systems that allow translation in real time the electrical activity of the brain in commands to control devices. They do not rely on muscular activity and can, therefore, provide communication and control for people with devastating neuromuscular disorders, such as the amyotrophic lateral sclerosis (ALS), brainstem stroke, cerebral palsy, and spinal cord injury among many others. This direct connection between the human brain and computer is what research groups all over the world are working on feverishly and successfully.

The present hands-on workshop will allow students from engineering and clinical areas to understand the principles of this technology, to use the most widely spread techniques to decode the human intention from brain oscillations, to use of the technology in real applications for control of devices, and to plan and execute real clinical interventions for neurorehabilitation. Two companies focused on BCI's will participate in the workshop demonstrating the technology covering the four major axes: hardware, software, development of engineering, and clinical practice. The students will participate actively along the workshop and will be invited to join the live demonstrations.

In particular, the workshop will demonstrate the major concepts for BCI control like motor imagery, P300 and steady state evoked potentials (SSVEP) for spelling and robot control. New trends like active and dry EEG electrodes and invasive ECoG based systems will be explained. This allows the audience to see all required hardware and software, the typical training and classifier setup and the achievable accuracies. In addition to this the workshop will demonstrate BCI technology from the clinical practice point of view, which will allow the audience to have a complementary perspective of the technology out-of the lab and ready to use by non-experts.

#### TimeTable (4 hours):

gTec (Fundamentals of BCI) – 45 min  
Equipment for BCI research (20 min)  
Fundamental concepts (10 min)  
Mounting EEG electrodes correctly (15 min)

gTec (BCIs control demos) – 2h 05min  
Demo: Motor imagery BCI (30 min)  
Real-time analysis of P300: Spelling with the BCI (45 min)  
Controlling a smart home with the BCI (20 min)  
Real-time analysis of SSVEPs: Robot control (30 min)

BitBrain (BCIs neurorehabilitation demos) – 1h 10 min  
Requirements for BCI in clinical practice (15 min)  
Plan an intervention with BCI (5 minutes)  
Demo of real intervention (40 minutes)