Scientific/Educational Workshop

Workshop title

Non-invasive BCI-controlled grasp neuroprosthesis for people with high SCI – the MoreGrasp approach

Workshop organizer

PD Dr.-Ing. Ruediger Rupp (Heidelberg University Hospital - Spinal Cord Injury Center)

Speakers

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Workshop goals

The workshop is intended to
1) provide an overview of the current challenges of non-invasive grasp neuroprostheses,
2) give the state of the art of non-invasive brain-computer interfaces (BCIs),
3) outline end user requirements and challenges for successful use of a BCI-controlled grasp neuroprosthesis in individuals with tetraplegia due to high spinal cord injury (SCI), and
4) give an overview including a hands-on demonstration of the BCI-controlled grasp neuroprosthesis and the associated technology of the European MoreGrasp project

Abstract

The bilateral loss of the grasp function associated with a complete or nearly complete lesion of the cervical spinal cord severely limits the affected individuals' ability to live independently and retain gainful employment. Any improvement of a lost or limited function is highly desirable not only from the patients point of view but also for economical reasons. Motor neuroprostheses based on Functional Electrical Stimulation (FES) provide a non-invasive option to compensate for the loss of voluntary upper extremity function. Non-invasive, EEG (electroencephalogram)-based BCIs represent a valuable component of a neuroprosthetic user interface with the major advantage over other assistive devices that it can be operated independently from residual motor functions. The European MoreGrasp project (www.moregrasp.eu) bringing 3 academic and 3 industrial partners together aims to overcome the limitations of current non-invasive grasp neuroprostheses, which are 1) the variations in grasp patterns based on static or dynamic shifts in electrode positions and 2) the non-intuitive control. Array electrodes were integrated into a textile sleeve and wrist rotation angle was measured by inertial measurement units to switch between electrode locations and thereby achieve a robust grasp pattern independent from wrist position. Movement-related cortical potential (MRCP)-based BCIs were used for natural control of a key and cylinder grasp as well as hand opening. Water-based EEG-electrodes together with a wireless EEG amplifier allow for real-life applications. The MoreGrasp registration web platform was implemented to allow end users to directly register for the clinical proof-of-concept study. The workshop will provide an overview of the MoreGrasp technology, report on the first results and challenges from independent use of the BCI-controlled neuroprosthesis at end users' homes and give workshop participants the opportunity to self-experience the MoreGrasp technology.