Title (tentative): Development and testing of technology for a hybrid human-machine interface based on mapping body motion sensors and EMG signals into the control of rehabilitative devices.

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Description

Motivation and application domain

Body-machine interfaces (BMIs) decode upper-body motion for operating devices, such as computers and wheelchairs. In the last decades, body machine interfaces have been developed as tools to investigate neural control of movement and/or to empower disabled people to reach assistive and rehabilitative goals. BMI based on body movement have been proved effective to support personalized therapy for survivors of cervical spinal cord injury (cSCI).

General objectives and main activities

Aim 1: Developing the technology for a hybrid human-machine interface based on mapping body motion sensors and EMG signals onto a variety of control tasks. The combination of EMG and movement signals will be mapped to the lower-dimensional motion of the external device via linear and nonlinear methods.

Aim 2: Assessing the activation and/or deactivation of targeted muscles and muscle synergies through a movement and EMG analyses.

Aim 3: Building a map between body space and control space of the machine that takes into account the time history of the body signals.

The study will begin with a control subject, but will be tested also in stroke survivors and/or spinal cord injury subjects.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn
- To analyze and correlate body signals from different sources such as movement and EMG
- To develop the control of an external device based on body signal coming from different sources
- To develop data analysis tools for behavioral data
- To improve the knowledge of Matlab/Simulink, machine learning algorithms (e.g. auto encoders networks) and statistical analysis
- To work in an international team with people with different backgrounds and with people with disability

Place(s) where the thesis work will be carried out: DIBRIS department of the University of Genova.

Additional information

Maximum number of students: 1