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.

Thesis advisor(s): Casadio Maura, F. Mussa-Ivaldi (USA), C. Pierella (EPFL, svizzera)

E-mail: Maura.Casadio@unige.it

Address: Via Opera Pia 13, 16145 Genova (ITALY)

Phone: (+39) 010353 - 2749

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 tool 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 a therapy for survivors of cervical spinal cord injury (cSCI).

General objectives and main activities

Aim1: 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 subjects, 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.

Maximum number of students: 1