**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 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

- **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 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

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

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**Maximum number of students:** 1