



## Thesis Project Form

**Title (tentative):** Robot Avatars to assist people with physical impairments: novel control paradigms and interfaces

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### Description

#### Motivation and application domain

One of the most spread problems over the years is related to motor impairments because of spinal cord injuries, brain injuries and limb loss due to accidents or congenital factors. In subjects with such disabilities even simple motor activities can represent an actual problem and to overcome these issues many research lines based on rehabilitation or assistive machines are carried on with the main goal of helping people in performing activities of daily living (ADLs) and reducing their assistance need. A crucial point has to be found in the control of such devices that involves the participation of available body parts leading to high physical and cognitive load of the subject. Indeed, one of the main issues within the Body Machine Interfaces (BoMI) branch is related to find the most optimal mapping strategy between the bodily Degrees of Freedom (DoFs) and the robotic ones. To overcome this problem, a specific study is trying to exploit compensatory movements performed by the residual motions of the user to control assistive devices aiming to significantly enhance the usability and efficiency of these technologies for individuals with motor impairments.

#### General objectives and main activities

The general objectives will be to:

- use IMU sensors to track residual motions at shoulder level in a non-invasive way to intuitively control the devices and reduce the cognitive load associated with the learning of the new control
- use AlterEgo robot as assistive device in both virtual and real environments to evaluate the new control algorithm based on compensatory movements performed by user's residual movements
- examine differences observed between healthy subjects and subjects with spinal cord injuries (SCI) by comparing performance metrics of both populations extracted after a predefined assessment procedure

#### Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn to:

- use Robot Operating System (ROS)
- perform experiments with human participants (able-bodied and impaired subjects)
- personalize the training and define the experimental protocol
- administer cognitive evaluation tests
- perform data analysis the performance metrics and the respective statistical analysis

**Place(s) where the thesis work will be carried out:** DIBRIS, UNIGE "Center for Robotics and Intelligent Systems, IIT via S. Quirico 19d, Genova" Unit<sup>2</sup> Spinale Unipolare, Pietra Ligure

### Additional information

**Maximum number of students:** 1