



## Thesis Project Form

**Title (tentative):** Multi-user body-machine interface development and assessment for cervical spinal cord injury rehabilitation

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### Description

#### Motivation and application domain

Cervical spinal cord injuries (cSCI) severely disrupt the connection between the brain and the body below the lesion site, resulting in varying degrees of upper extremity motor deficits. This impairment profoundly affects the daily lives of those affected, necessitating effective rehabilitation interventions to preserve and restore upper limb mobility. Traditional rehabilitation methods often face challenges in addressing the diverse needs of cSCI individuals and are resource-intensive due to the requirement for specialized personnel. Recent advancements in rehabilitation technology, particularly Body-Machine Interfaces (BoMIs), offer promising solutions for cSCI rehabilitation. BoMIs leverage the many degrees of freedom of the body to translate movements into control signals for external devices. These systems are cost-effective and customizable, making them suitable for addressing the heterogeneous nature of cSCI impairments. Studies have demonstrated the efficacy of BoMIs in improving mobility and muscle strength in individuals with cSCI. However, the current rehabilitation landscape requires interventions that are not just effective but also efficient and motivating. Limited specialized personnel and high costs associated with traditional cSCI therapy highlight the need for innovative approaches. To address these challenges, we propose the development of a multi-user BoMI for cSCI rehabilitation. This setup aims to enhance efficiency by engaging multiple users simultaneously, reducing the burden on therapists and healthcare facilities. Moreover, group training can increase motivation and engagement, crucial factors for successful rehabilitation outcomes, especially given the high prevalence of psychological conditions among SCI survivors.

#### General objectives and main activities

The long-term goal is to develop a BoMI for cSCI rehabilitation capable of promoting individual recovery through interactive group therapy. Specifically, we aim to:

Aim 1. Investigate the impact of multi-day dyadic training with a BoMI on motor skill acquisition in individuals with SCI.

Aim 2. Develop and test a BoMI capable of accommodating interactions among more than two users concurrently.

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

1. Software development (Unity, C#)
2. Testing on unimpaired and cSCI individuals
3. Data analysis (Matlab)

**Place(s) where the thesis work will be carried out:** DIBRIS, UNIGE - SCILL, Santa corona Ospital

### Additional information

**Maximum number of students:** 1