UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Body-machine interface for robot control

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Description

Motivation and application domain

Controlling a robotic manipulator can play a crucial role in improving lives of individuals especially assisting those with motor impairments (Beckerle et al 2017, Park et al 2020) or augmenting the abilities of healthy people (Penaloza et al 2018, Guggenheim et al 2020).
In recent years, body-machine interfaces (BoMIs) through a linear or non-linear mathematical function have been proven to be able to transform body signals issued by the user into 2D/3D signals to control an external device like a cursor on a screen (Casadio et al 2011), a virtual and real wheelchair (Thorp et al 2016) or a virtual robotic arm (Rizzoglio et al 2020), and it could be customized to fit the ability of each user.

General objectives and main activities

With this project we aim at expanding the potential of such BoMIs leveraging the redundancy of muscles activity and/or joint motion to control an external robotic manipulator.
In particular we want to compare linear and not linear algorithm for the BoMI that will combine kinematic and muscle signals to control multiple degrees of freedoms of a robot. Main activities:
Step 1: Developing a BoMI that can use either a linear nor a non linear algorithm to combine muscle signals and/or kinematic signal and create a personalized map transforming usersâ€™ motion data into control signals for the end-effector or the joints of the robotic manipulator.
Step 2: Interface the BoMI with the robot and develop the experimental protocol and data collection with healthy subjects that will allow comparing the two different BoMI algorithms.

Training Objectives (technical/analytical tools, experimental methodologies)

The student will learn:
1. To analyze and correlate body signals from different sources such as movement and EMG
2. To develop a decoding algorithm for controlling multiple degrees of freedom of a robot
3. To develop data analysis tools for behavioral data
4. To improve the knowledge of C++, Matlab and statistical analysis

Place(s) where the thesis work will be carried out:

Additional information

Maximum number of students: 2