Title (tentative): EEG and EMG-based approach in robot-aided rehabilitation: technology development and testing.

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Description

Motivation and application domain
Natural control methods based on surface electromyography (EMG) and electroencephalography (EEG) are promising for hand prosthetics or robotic rehabilitation. Nevertheless, the control robustness offered by scientific research is still not sufficient for many real life applications. The use of EEG and EMG as input during robotic rehabilitation has been proven to improve the therapy outcomes after stroke.

General objectives and main activities
The objective is to combine EEG and EMG information in order to build a decoder to control the kinematic of an upper limb exoskeleton. The decoder will be based of deep neural network theory and the final goal will be to design an experiment in which the decoder will be able to provide a highly personalized robotic assistance during the rehabilitation therapy.

The main activity are: offline analysis of EEG and EMG data in order to develop and tune the decoder; implementation of the decoder for a real-time application; design of an experiment; data collection; data analysis.

Training Objectives (technical/analytical tools, experimental methodologies)
The student will learn
- To analyze and correlate body signals from different sources such as movement, EMG and EEG
- 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 and statistical analysis
- To work in an international team with people with different backgrounds (engineers, physicians, physical therapists)

Place(s) where the thesis work will be carried out: EFPL at Campus Biotech in Geneva

Maximum number of students: 1

Financial support/scholarship: bando giovani