Title (tentative): Development and testing of dynamic environments for robotic rehabilitation after stroke using an exoskeleton

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Description

Motivation and application domain

Exoskeletons follow the arm in its natural workspace, allowing the monitoring of position, speed and torque at each joint of the limb and the control of their independent or synergistic motion during movements execution. Nevertheless, the outcome of robotic rehabilitation still does not significantly differ from the one of conventional therapy. Thus, there is the need of investigate and exploit the potential of 3D robot-based rehabilitation to tackle the problem of motor recovery in stroke.

General objectives and main activities

The general objective is to investigate how the central nervous system learns to control natural 3D movements in different dynamic conditions. This project will focus on the upper limb and will involve the use of an exoskeleton and the recruitment of healthy and stroke subjects. A set of dynamic environments will be designed, i.e. force fields, that will act on different levels of the kinematic chain of the arm: end-effector, shoulder and elbow. The expected outcome is an insight on how the healthy CNS represents information about the body and the environment for the purpose of skilled action. The obtained results will then be used to develop force field personalized to stroke subjects' impairment and residual abilities for therapeutic interventions to enhance the outcomes of robotic training.

The main activities are: programming of an exoskeleton, development of the experiment, data collection, offline analysis of kinematic and EMG data.

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 the control of an exoskeleton
3. To develop data analysis tools for behavioral data
4. To improve the knowledge of C++, Matlab and statistical analysis
5. 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: EPFL at Campus Biotech, Geneva

Additional information

Pre-requisite abilities/skills: Basic knowledge of C++ and Matlab programming Knowledge of English

Maximum number of students: 1

Financial support/scholarship: possibilitÄ di far richiesta per fondo giovani