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Thesis Project Form

Title (tentative):   HD-EMG based classification of hand gestures

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Description

Motivation and application domain

This thesis originates from the Rehab Technologies laboratory (https://rehab.iit.it/it-IT/), which has been actively working since 2013 on the development and improvement of advanced devices and treatments for rehabilitation. The aim of this thesis is to collect and analyze high-density electromyographic (HD-EMG) traces on healthy subjects during the execution of basic gestures and hand grips, with the purpose of classifying the different movements based on EMG features.

General objectives and main activities

The main objective is to collect and analyze HD-EMG data from the forearm muscles in order to classify different fundamental movements and types of hand grips. This classifier will be useful for evaluating residual motor abilities in subjects requiring rehabilitation and for enhancing control of the Hannes hand prosthesis.

The student will be personally involved in acquiring HD-EMG data from healthy subjects during the performance of elementary finger and wrist movements, as well as during the execution of grips on objects of different shapes. The data will be acquired through ultra-dense EMG sensor arrays comprising up to 384 electrodes.

Subsequently, the student will be involved in extracting various features from the HD-EMG signal in the time and frequency domains, along with extracting activation patterns at the level of individual motor units. These features and the activation of individual motor units will be used to train a classification algorithm for recognizing the different executed gestures.

Training Objectives (technical/analytical tools, experimental methodologies)

1. Acquisition of high-density EMG signals.
2. Processing of HD-EMG signals and extraction of activity at the level of single motor units.
3. Design and training of a classifier.
4. Machine learning skills.
5. Mixed software skills (Matlab, Python).

Place(s) where the thesis work will be carried out: Rehab Technologies, IIT, via Morego 30, 16163 Genova

Additional information

Pre-requisite abilities/skills: Programming skills, signal processing, statistics, attitude to computational and

experimentalwork

Maximum number of students: 1