Title (tentative): Low cost EEG electrodes for assistive Brain-Computer interfaces

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Description

Motivation and application domain
This project will be carried on in the framework of the TEEP-SLA - http://teep-sla.eu/ - project, supported by Istituto Italiano di Tecnologia (IIT) and by Fondazione Roma. TEEP-SLA aims to create novel assistive technologies for ALS (Amyotrophic Lateral Sclerosis) patients, who present severe motor impairments, either with residual motor functions limited to gaze control or with total paralysis.

General objectives and main activities
The main objective is to develop a low cost electrode for acquisition of electroencephalographic signals (EEG) with signal quality sufficient to detect motor imagery (e.g. "I am imagining to move the right hand"). Motor imagery will be then associated with commands for user interfaces – in this case Brain-Computer Interfaces (BCIs) – to allow communication and control of external devices. The strategy proposed to the student is to compare customized semi-dry electrodes exploiting different types of conductive materials with professional EEG electrodes, both gel-based and dry, measuring the electrode impedance and extracting meaningful features related to motor imagery. Successful completion of this project will lead to the development of electrodes for an efficient low-cost EEG headset, that will be tested online for real-time motor imagery detection.

Training Objectives (technical/analytical tools, experimental methodologies)
The student will learn
1. Development of low-cost efficient sensors for measuring biosignals.
2. Designing, implementing and performing BCI experiments.
3. Designing and testing real-time EEG signal acquisition and processing algorithms for intention detection.

Place(s) where the thesis work will be carried out: Biomedical Robotics Lab, Istituto Italiano di Tecnologia, Genova. Neurolab, DIBRIS, University of Genova.

Additional information
Pre-requisite abilities/skills: programming skills in Matlab, experience with Arduino prototyping preferred.

Maximum number of students: 1