- Development of network features for brain-computer interfaces

Mots clés : Array

Directeur de thèse : Fabrizio DE VICO FALLANI
Co-encadrant(s) :
Unité de recherche : Centre de recherche de l'Institut du cerveau et de la moelle épinière
École doctorale : École Doctorale Informatique, Télécommunications, Électronique de Paris
Domaine scientifique principal : Sciences pour l'ingénieur

Résumé du projet de recherche (Langue 1)

Brain-computer interfaces (BCIs) are increasingly explored for control and communication, as well as for treatment of neurological disorders, particularly via the ability of subjects to voluntarily modulate their brain activity through mental imagery (MI) [1].

Despite this technique has gained a wide territory in the last years, the community is still facing a critical issue in terms of performance as measured by the correct classification of the user’s intent [2]. While much of the efforts to solve this problem have focused on the classification block of the BCI, the research of alternative features has been poorly explored and rather crude univariate measurements, such as the signal band power of single brain areas, have been used so far [3].

However, the brain is not just a collection of isolated pieces working independently, but it rather consists of a distributed complex network that integrates information across differently specialized regions [4]. It turns out that examining the signal of one specific region – while neglecting its interactions with other regions – oversimplifies the real phenomenon and one must instead obtain an understanding of the system’s collective behavior to fully capture the brain functioning. This project aims to extract new features from brain connectivity networks derived from functional neuroimaging data during BCI-related tasks.

References


Informations complémentaires (Langue 1)
Local environment and resources

This project will be realized in the Inria ARAMIS team “Algorithms, models and methods for images and signals of the human brain” at the Institut du Cerveau et de la Moelle (ICM) in Paris. The team has a privileged position within a unique scientific and technological environment with a strong program on neurofeedback and BCIs as well as with a comprehensive neuroimaging core facility (eg, M/EEG, fMRI, DTI, NIRS), including a powerful centralized cluster computer system to realize big-data analysis and simulation. All the MI-based BCI data needed to validate the methodology, as well as the authorization to perform new EEG experiments on stroke patients, are already available in the framework of existing research projects granted to the PI’s team.