

Postdoctoral position in graph signal processing for monitoring spatio-temporal dynamics of brain activity

Télécom Bretagne, Brest, France

1 Context

The present proposal is funded by the Neural Communication project, which is part of the Labex¹ CominLabs. This project started in November 2015 for a duration of two years as a continuation of the Neural Coding project, also founded by the Labex CominLabs from November 2012 to October 2015. The main goal of the project is to propose models for communications between cortical areas in the brain and to develop novel methodologies for identifying spatio-temporal patterns in brain activity.

The project takes advantage of the expertise of two internationally renowned teams. The first one is led by Fabrice Wendling, director of research at LTSI in Rennes, and aims at proposing innovative methods for extracting connectivity graphs from EEG signals. The second one (host team) is led by Claude Berrou, professor at Télécom Bretagne, and aims at proposing novel models for information processing in neural networks. The host team is also active in the new field of graph signal processing. The host team is composed of three permanent researchers as well as two postdocs and six PhD students.

The proposed postdoctoral position is meant to take place in Télécom Bretagne, in Brest. The candidate is expected to work in collaboration with people involved in the ERC project Neucod led by Claude Berrou.

2 Proposal

It is now well-known that brain activity is structurally organised into functionally connected networks. Using functional MRI on subjects at rest, resting state networks can be defined as sets of spatially distinct brain areas with temporally correlated activity. While having been extensively studied over long time periods (e.g. 6 minutes), such networks are now investigated using dynamic analysis with a temporal resolution of a few dozens of seconds. Other works are interested in applying similar methodologies to monitoring the dynamics when performing cognitive tasks, as it has been shown that task-related functional networks are spatially similar to resting-state networks.

Recently, a novel framework has been developed that aim at exploiting graphical structures of the underlying topology the signals are projected onto, called graph signal processing. As a result, it is possible to define ad hoc harmonic operators including convolutions and wavelets. A major advantage of this approach is the ability to detect similar patterns in distinct regions of the network, despite the

¹“Laboratoires d’Excellence” (Excellence Laboratories)

inhomogeneity of the network topology. We are interested in applying graph signal processing to brain imaging to study special temporal dynamics, both in the resting state and task-related networks using EEG and fMRI.

3 Details

The head of the project is Vincent Gripon, permanent researcher with Télécom Bretagne. Please send your curriculum vitae, contacts for two references, as well as a cover letter to vincent.gripon@telecom-bretagne.eu.

Expected disposable salary is about 30k€ per year, depending on experience. The position starts in September 2016 (or sooner) and finishes in November 2017. The postdoc position is accompanied with overheads for travel expenses covering the participation to international conferences.

The candidate must have defended a Ph.D. related to neuroscience, neuroimaging and familiar with signal processing. Programming skills are essential to this position.

The deadline for applying to the position is July 17th.