Offer #2022-05450

Software Development Engineer - MEG signal processing and visualization

Contract type : Fixed-term contract

Renewable contract : Yes

Level of qualifications required : Graduate degree or equivalent

Other valued qualifications : PhD, post-doc

Fonction : Temporary scientific engineer

Level of experience : From 3 to 5 years

About the research centre or Inria department

The Inria Université Côte d'Azur center counts 36 research teams as well as 7 support departments. The center's staff (about 500 people including 320 Inria employees) is made up of scientists of different nationalities (250 foreigners of 50 nationalities), engineers, technicians and administrative staff. 1/3 of the staff are civil servants, the others are contractual agents. The majority of the center's research teams are located in Sophia Antipolis and Nice in the Alpes-Maritimes. Four teams are based in Montpellier and two teams are hosted in Bologna in Italy and Athens. The Center is a founding member of Université Côte d'Azur and partner of the I-site MUSE supported by the University of Montpellier.

Context

The Experimentation and Development Department of the Inria center at Université Côte d'Azur has 18 research engineers. These engineers develop, maintain and distribute multi-disciplinary software platforms in close collaboration with the centre's research team.

The Athena project team, which you will integrate, develops mathematical and computer tools to model the brain and its functioning from non-invasive neuroimaging data (anatomical, functional and diffusion MRI, electro-encephalography, magneto-encephalography, etc.). These different tools allow for the exploration of the central nervous system (brain and spinal cord) and its functioning.

The innovative project in which you will participate will make possible the acquisition, processing, storage and exploitation of signals from an innovative MEG device using sensors at ambient temperature (contrarily to more classical sensors which operate at cryogenic temperatures). The use of this technology makes it possible to place the sensors closer to the head and therefore to improve the quality of the measured signal. This project aims in particular to see if this type of sensor makes it possible to identify pathological activities in epileptic patients. It is carried out in collaboration with a startup which designed the innovative MEG sensor and INSERM Lyon which provides patient data with this sensor. Detecting these activities reliably and non-invasively in real time would be a first in the field, for trained majors, in the medical field (epilepsy in particular), but also in technology (brain-machine interfaces).

This offer implies two recruitments on the following two missions described in the following section. At the end of this experience, you will have obtained a wide range of skills in software engineering with application to a high-level scientific context. This experience will allow you to consider careers as an engineer in research and development in national organizations (Inria, INRAE, CNRS, CEA), industrial research centers, SMEs and digital start-ups.

Assignment

Mission A

As part of this project, you will take part in the development of a real-time processing platform for signals from magnetoencephalographic acquisition.

Specifically, you will implement real-time MEEG signal visualization, processing and storage tools, and integrate them into a signal processing library.

Signal processing (real time):

- Implementation of latency tests on the signal processing chain
- Definition of the computer resources (hardware or software) necessary for proper real-time

processing according to the number of channels

Visualization:

- 2D visualization of the activity of many MEG sensors. The considerable amount of data to be displayed, updated at high frequencies, will lead you to propose low-level graphical implementations for drawing curves.

Software platform:

- You will facilitate the distribution of the software to the project partners. This will go through the study of its ergonomics (user interface), and its installation (packaging).
- To guarantee the quality of the deliverable, you will implement of the continuous integration chain of the product, in the vein of agile methods.

You will be supported by the Experimentation and Development Department (SED) of the Inria research center at the Université Côte d'Azur.

Mission B

As part of this project, you will identify epileptic events (epileptic peaks) in real time and then locate them in the cortex.

These developments will be carried out in close collaboration with the researchers of the team who will be able to guide the algorithm.

Signal processing (offline then real time):

- Identification, in the MEG signal, of interictal epileptic activity (inter-ictal spikes): implementation of strategies (deviation from the mean, dictionaries, neural networks, etc.) and their comparison.
- Localization of this activity at the level of the cortex.

Visualization:

- 3D representation of the cortex (invaginated, swollen...)
- 3D visualization of the location of epileptic activity in the cortex
- 3D visualization of epileptic activity in the cortex
- 3D interaction with the locations of epileptic events

You will also be supported by the Experimentation and Development Department (SED) of the Inria research center at the Université Côte d'Azur.

Main activities

The recruited engineer will work 100% of his time on the development of the signal processing software platform. The work will be carried out according to agile methods (SCRUM or simplified agile depending on the context).

Skills

Common software skills

- Agile terminology
- C++
- Qt
- OpenGL (shaders)
- Git
- CMake (cross-platform compilation)
- Debugging tools

Additional software skills Mission A:

- Notions of real-time development
- CI, conda

Additional software skills mission B:

- High level visualization frameworks (VTK, Qt3D, etc...)

Additional skills:

- Skills in software development, in particular among the following items:
  - Knowledge of the paradigms of design and object programming, in particular Design Patterns.
  - Knowledge of how to implement the methods and use tools underlying compilation, version management, continuous integration and development through testing in a context of agile methods.

- Ability to work in a multidisciplinary team.
- Be autonomous regarding one's own organization and show initiative.
- Ability to speak and write professionally in English.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Employer's contribution to mutual insurance (subject to conditions)

Remuneration

From 2652 euros gross monthly (according to degree and experience)

General Information

- **Theme/Domain :** Computational Neuroscience and Medicine
  Software engineering (BAP E)
- **Town/city :** Sophia Antipolis
- **Inria Center :** Centre Inria d'Université Côte d'Azur
- **Starting date :** 2022-12-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2023-05-14

Contacts

- **Inria Team :** ATHENA
- **Recruiter :**
  Wintz Julien / Julien.Wintz@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

A previous in-depth experience in the development of signal processing platforms will give an advantage to the candidate as well as to the engineer recruited as part of his mission.

An interest in brain-machine interfaces would be a real plus.

The desire to acquire new development practices and to communicate on previous practices will promote exchanges and enrich the project.

> **Warning** : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.