Offre n°2024-08061

Software development engineer for causal machine learning

Contract type : Fixed-term contract

Renewable contract : Yes

Level of qualifications required : Graduate degree or equivalent

Fonction : Temporary scientific engineer

Level of experience : From 3 to 5 years

About the research centre or Inria department

The Inria center at Université Côte d'Azur includes 42 research teams and 9 support services. The center's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regional economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Context

The Experimentation and Development Service (SED) of the Inria research center at Université Côte d'Azur consists of research engineers who develop, maintain, and disseminate multidisciplinary software platforms in close collaboration with the research teams at the center.

The PREMEDICAL project team, which you will join, is a mixed Inria and Inserm (Idesp) team located in Montpellier. It is composed of researchers in statistics, machine learning, AI, as well as clinicians. A distinctive feature of this team is the presence of doctoral students in applied mathematics who also hold a medical degree, combining medical expertise and AI research. These profiles are essential to improve the adoption, use, and transfer of new technologies, as well as to foster innovation development.

PREMEDICAL specializes in developing precision medicine methods through causal learning and federated learning, ensuring the confidentiality of medical data. Its objectives include accelerating the availability of targeted drugs on the market and deploying decision support algorithms with highly precise confidence quantification in predictions. It aims to bridge the gap between fundamental research and its effective use, particularly through software development and involving all stakeholders (patients, clinicians, regulators, companies, etc.).

The innovative project you will participate in, TRAUMATRIX, will enable the acquisition, processing, storage, and exploitation of data from "traumatized" patients. These patients, who have road accidents, fall from trees, etc., often suffer from traumatic brain injuries and hemorrhagic shocks. Very granular information is collected from the moment the patient is taken care of at the accident site until their discharge from the hospital. These data have been used to develop causal machine learning algorithms to evaluate the effectiveness of interventions or treatments and recommend therapeutic strategies (transfusion dose, what treatment to give to whom and when, which center to direct patients to, etc.). The statistical challenges include managing missing information and quantifying uncertainty to direct patients to an appropriate structure (Traumacenter) in a very uncertain framework with multiple stakeholders where every minute counts.

We are starting the real-time evaluation of our models in collaboration with the SAMU to quantify the improvement in patient care. The objective is to develop an application that will be used at the SAMU control center to collect patient information and deploy predictive models in real-time.

There are many scientific challenges associated with the projects: Are the predictive models robust to changes in practices and patients? Are the algorithms fair? How to present the results to doctors? How to integrate data from European counterparts?

At the end of this experience, you will have consolidated a wide range of skills in software engineering applied to a high-level scientific context. This experience will enable you to consider careers as a research

and development engineer in national organizations (Inria, INRAE, CNRS, CEA), industrial research centers, SMEs, and digital start-ups.

Assignment

In the context of this project, you will participate in:

Development of the TRAUMATRIX Backend:

- Consolidating the Traumabase data and verifying data quality to achieve a single usable dataset for statistical studies and the development of artificial intelligence algorithms.
- Consolidating/extending existing causal machine learning algorithms.
- Generalizing their implementation by addressing the specific case of application frameworks.
- Creating documentation for the predictive models.
- Creating documentation for data formalization.
- Implementing a proof of concept on federated learning with the academic and industrial collaborators of the project team.

Development of the TRAUMATRIX Frontend:

The frontend will come in various forms: web application and mobile applications that will be primarily deployed by clinical partners.

- For the first part, this involves evolving and maintaining a web application that allows real-time patient regulation and displays the result of a predictive model (estimation). The mockups and backlog are ready. The application will be deployed as part of a clinical research project, used by more than 30 regulation centers.
- Creating an interactive dashboard for clinicians to visualize data from each center. Participating in the deployment within the OVH environment of APHP.
- For the second part, this will eventually involve turning visual mockups into cross-platform mobile applications that interact with the backend via the same APIs as the web frontend.

Main activities

The recruited engineer will work 100% of their time on the development of the software platform. The work will be conducted using agile methodologies (SCRUM or simplified agile depending on the context).

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 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
- Contribution to mutual insurance (subject to conditions)

Remuneration

From 2692 € gross monthly (according to degree and experience)

General Information

- **Theme/Domain :** Computational Neuroscience and Medicine
  Instrumentation et expérimentation (BAP C)
- **Town/city :** Montpellier
- **Inria Center :** Centre Inria d'Université Côte d'Azur
- **Starting date :** 2024-10-01
- **Duration of contract :** 1 year, 11 months
- **Date limite pour postuler :** 2024-09-01

Contacts

- **Inria Team :** PREMEDICAL
- **Recruiter :**
  Josse Julie / julie.josse@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

Common Software Skills

- Agile Methodology
- Agile Terminology
- Agile Development
- Artificial Intelligence Techniques
- Machine Learning
- Data Science
- Data Analysis
- Data Engineering
- Data Visualization
- Software Development
- DevOps
- Fullstack Development
- Relational Databases
- Technical Documentation
- MVC (Model View Controller)
- Object-Oriented Programming
- RESTful API
- Database
- Structured Query Language (SQL)
- Programming Languages
- Bash Scripting
- HTML
- Python
- JavaScript
- R
- User Interface Design

Specific Skills

AI Frameworks

- scikit-learn
- TensorFlow
- PyTorch

Web Development Frameworks

- Django
- Flask
- React.js

Additional Skills

- Software development expertise, particularly in the following areas:
  - Understanding object-oriented design and programming paradigms, especially Design Patterns.
  - Implementing methods and tools for compilation, version control, continuous integration, and testing in an agile context.
  - Ability to communicate with stakeholders from various communities.
  - Working effectively in a multidisciplinary team.
  - Autonomy in personal organization and initiative. Good command of written and spoken English.
  - Strong writing skills in both English and French.
  - Interest in health applications and knowledge in statistics are appreciated.

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.