2022-05241 - Post-Doctoral Research Visit F/M Causal data analysis of in-silico trials

**Contract type:** Fixed-term contract

**Level of qualifications required:** PhD or equivalent

**Function:** Post-Doctoral Research Visit

**About the research centre or Inria department**

The Inria Sophia Antipolis - Méditerranée center counts 34 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**

Despite massive investment in healthcare, huge R&D cost increase and regulatory pathway complexity hamper tremendously commercialisation of new devices & medicines, putting patient populations at risk of not receiving adequate therapy. Computer modelling and simulation (CM&S) can create scientific evidence based on controlled investigations including variability, uncertainty quantification, and satisfying demands for safety, efficacy & improved access. Cardiac modelling has dramatically improved over the last decades, with personalisation to clinical data enabling validation. The proposed position is embedded within the SimCardioTest project, launched on January 1st 2021, and funded by the European Union H2020 program, to demonstrate feasibility, effectiveness and benefits of in-silico trials for cardiac devices & drugs, with a broad aim to gain the trust of scientists, companies, regulatory bodies, physicians, patients and to promote healthcare innovation in Europe and beyond. We selected three cardiac use cases where CM&S is mature enough and that represent the most common cardiac pathologies, to demonstrate a statistically rigorous approach for in-silico clinical trials. SimCardioTest aims to develop a unified standardised and secure cloud-based platform where in-silico trials for the selected cardiac use cases run seamlessly. SimCardioTest gathers exceptional representatives of expertise of European and American computer modeling and simulation and in the field of medical devices. Ten partners from Belgium, France, Italy, Norway, Spain and USA collaborate to SimCardioTest: 2 large companies (Microport – CRM and Boston Scientific), 2 SMEs (ExactCure and InSilicoTrials), 2 research organizations (Inria and Simula), 3 Universities (University of Bordeaux, Universitat Pompeu Fabra, Polytechnic University of Valencia) and 1 international non-profit organisation (The Virtual Physiological Human Institute).

**Assignment**

The scope of the proposed project is to develop advanced statistical analysis of the in-silico generated data to maximize the extraction of relevant information from in-silico trials, and support the adoption of CM&S as reliable tools to generate scientific evidences relevant for the clinical evaluation of the targeted cardiac drugs and devices. In particular, leveraging on recent advances on causal machine learning techniques (Bayesian Causal Networks, Variational Causal DYNAMICS), we aim at discovering the causal pathways linking the multimodal generated variables for selection of biomarkers of interest, but also patient phenotyping and stratification. We expect that the obtained results will be key to inform clinical trials design, for instance in terms of data collection and inclusion criteria, and also to improve and guide clinical trials assessment.

**Main activities**

During the project, the candidate will be in charge of:

- Master, implement and test causal machine learning methods for causal discovery on the in-silico generated data
- Propose and develop improvement of state-of-the-art methods to tackle challenges such as multimodality and heterogeneity of the available datasets, and the longitudinal component
- Focus on interpretability and transferability of methods/results to inform clinical trials design and assessment
- Present the work in conferences and journals
- Write and publish scientific works (international conferences and journals)

The successful candidate will integrate the EPIONE (e-patient for e-medicine) research project, at the Centre Inria d'Université Côte d'Azur. During the internship the candidate will have the opportunity to interact with researchers and students from the EPIONE team and participate to the scientific life of the team and of the Inria Sophia-Antipolis center.

**Skills**

The candidate should hold a PhD in computer science, statistics or applied mathematics. We are looking for a highly motivated candidate with a proven experience in statistics, Bayesian learning and biomedical data analysis. Programming skills (Python) are mandatory. Previous work experience in the medical field context is highly recommended, and a previous work on cardiac modeling and/or pharmacokinetics modeling is appreciated. Strong communication abilities are required.

**Benefits package**

- Subsidized meals

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**General Information**

- **Theme/Domain:** Computational Neuroscience and Medicine Statistics (Big data) (BAP E)
- **Town/city:** Sophia Antipolis
- **Inria Center:** CRI Sophia Antipolis - Méditerranée
- **Starting date:** 2022-10-01
- **Duration of contract:** 2 years, 3 months
- **Deadline to apply:** 2022-09-18

**Contacts**

- **Inria Team:** EPIONE
- **Recruiter:** Balelli Irene / irene.balelli@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 by 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**

The ideal candidate should be able to work effectively as part of a team, but also to develop independent ideas. A taste for biomedical applications and interdisciplinary topics is highly recommended. The successful candidate should be motivated to take responsibilities such as events and meetings organization, and supervision.

**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). Authorization to enter an area is granted by the director of the unit, following a favourable 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.

**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.
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
Social security coverage
Supplementary social protection

Remuneration
Gross Salary: 2,653 € per month