**Offer #2023-06981**

**Analysis of liver vascular tree architectures to characterize the development of a disease.**

**Contract type:** Internship  
**Level of qualifications required:** Bachelor's degree or equivalent  
**Fonction:** Internship Research

**Context**

The project is an ongoing collaboration between Ghent University (Ghent, Belgium) and Inria team Simbiotx. It is part of the European project MoDeLLiver (grant agreement id 864313). The internship will be co-supervised by Irene Vignon-Clémentel (Directrice de recherche) and Jérôme Kowalski (PhD student).

**Assignment**

**Context:**

A crucial aspect in the surgical decision process is organ perfusion and functional assessment. In this context, a very active medical imaging field is dynamic functional imaging. Functional imaging often involves a tracer, which is transported in the blood circulation, with a certain time-dynamics as it goes through the different components of the circulatory system. However, following a disease or a major surgery, the time-dynamics of the different components is subject to change. A better knowledge of the impact of a disease on the time-dynamics of a tracer would enhance the interpretation of the tracer measured signals and thus help radiologists and surgeons to detect abnormal behaviors. This internship project aims at characterizing a change in the architecture of the liver following the development of cirrhosis, combining clinical data and mathematical models.

**Objectives:**

- Browse and select an algorithm to extract the centerline of a vascular network.  
- Build a pipeline that, from a scanned liver cast:  
  - Extracts the tree structure  
  - Derives morphological features  
  - Computes blood flow and transport  
  - Builds an equivalent simplified tree  
- Compare and classify the vascular trees depending on their diseased state.

**Main activities**

**Main tasks:**

- Scan the literature for available centerline extraction algorithms.  
- Compare the performances of the algorithms on the selected tasks.  
- Implement an analysis pipeline combining new and already existing codes.  
- Develop a classification algorithm focusing on vascular trees.

**Main tools:**

- Image analysis  
- Numerical methods  
- Python

**Skills**

**Technical skills:**

- Python (advanced)  
- VS-code or equivalent IDE (advanced)  
- Machine learning for classification tasks (intermediate)  
- Knowledge in Graph neural networks, partial differential equations and numerical resolution (basic)

**Communication skills:**

- English (fluent)
• Communicate scientific content orally to a reduced audience.

Misc:
• Team work
• Autonomy

General Information

• **Theme/Domain:** Vision, perception and multimedia interpretation
  Biologie et santé, Sciences de la vie et de la terre (BAP A)
• **Town/city:** Palaiseau
• **Inria Center:** Centre Inria de Saclay
• **Starting date:** 2023-01-02
• **Duration of contract:** 6 months
• **Deadline to apply:** 2024-01-31

Contacts

• **Inria Team:** SIMBIOTX
• **Recruiter:** Vignon Clementel Irene / Irene.Vignon-Clementel@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

The ideal candidate has a strong background in computer vision, data structures and machine learning; has experience in coding (mostly python) and developing an automatic learning pipeline; and a taste for multidisciplinary work.

Fluent english is a must.

Experience in medicine or bio-engineering is a plus.

**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.