Offer #2023-06340

PhD Position F/M Automated medical image segmentation

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

The Inria Grenoble research center groups together almost 600 people in 23 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (University Grenoble Alpes, CNRS, CEA, INRAE, ...), but also with key economic players in the area.

Inria Grenoble is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Context

Inria, a French research institute dedicated to digital sciences, employs 2,600 people from the best universities in the world, and takes up the challenges of computer science and mathematics. Inria has 9 centers in France, including the Inria Grenoble research center, which employs nearly 730 people. Inria is organized into “project teams” which bring together researchers with complementary skills around a focused scientific project.

The ANR Inora project in collaboration between Inria Grenoble, the Mines de St Etienne and the University Hospital of St Etienne aims to understand the mechanisms of pain in the foot of patients with rheumatoid arthritis. In particular, the project seeks to highlight the links between certain physical factors such as forces or areas of internal and external pressure on the foot with the sensation of pain.

Assignment

To carry out this task, a finite element modeling method [1] of the foot is implemented by our partners at the Mines de St Étienne. Finite element methods require very fine 3D geometric models of the musculoskeletal system to produce realistic results. It is planned to acquire CT and/or MRI scanners of the foot to construct such models.

If these medical imaging methods show a good contrast between the bones and the soft tissues, certain zones nevertheless remain ambiguous for various reasons such as losses of bone density or, conversely, welds between distinct bones.
The candidate will therefore work towards a fully automated segmentation method for foot scanners which makes it possible to segment and identify each bone, i.e. to extract the surfaces of each bone in the form of mesh from a dense and regular grid of voxels, then assign a name to each element.

To reach this purpose, the problem will be tackled simultaneously at two levels:

1. Local level segmentation based on a Convolutional Neural Networks (CNN) at voxel level [2]. This will provide some local inference about the tissue. Given the very close proximity of the foot bones, particularly in the case of RA patients, this method alone might lead to inconsistent segmentation.
2. Global level segmentation: a global foot shape prior will be modelled using CNN in order to infer a coherent 3D structure from the local segmentation.

Significant effort will go towards avoiding bias to the training models at both levels.

[1] J. Tak-Man Cheung, M. Zhang, A. Kam-Lun Leung, Y.-B. Fan. (2005) Three-Dimensional Finite Element Analysis of the Foot during Standing – a Material Sensitivity Study. Journal of Biomechanics, 38(5): 1045–1054.

[2] N. Masuzawa, Y. Kitamura, K. Nakamura, S. Iizuka, E. Simo-Serra. (2020) Automatic segmentation,

localization, and identification of vertebrae in 3D CT images using cascaded convolutional neural networks. In MICCAI.

Main activities

The PhD candidate will perform some hands-on experiments, develop novel software, and write high-impact publications.

Skills

The PhD candidate should hold a master's degree in computer science. Very good background in computer vision, 3D modelling, or medical imaging are expected. The candidate will be co-supervised by Sergi Pujades and Julien Pansiot at Inria Grenoble, France.

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 (90 days / year) 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 under conditions

Remuneration

1st and 2nd year: 2 051 euros gross salary /month

3rd year: 2 158 euros gross salary / month

General Information

- **Theme/Domain :** Vision, perception and multimedia interpretation
  Scientific computing (BAP E)
- **Town/city :** Montbonnot
- **Inria Center :** Centre Inria de l'Université Grenoble Alpes
- **Starting date :** 2023-09-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2023-07-16

Contacts

- **Inria Team :** MORPHEO
- **PhD Supervisor :**
  Pansiot Julien / julien.pansiot@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.

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

Applications must be submitted online on the Inria website.

Processing of applications sent by other channels is not guaranteed.

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.