Offre n°2024-08389

Post-Doctoral Research Visit F/M Real-time vessel localization in fluoroscopy for autonomous endovascular navigation

Le descriptif de l'offre ci-dessous est en Anglais

Type de contrat : CDD

Niveau de diplôme exigé : Thèse ou équivalent

Fonction : Post-Doctorant

Contexte et atouts du poste

The MIMESIS team is at the forefront of innovation in the fields of scientific computing, machine learning, medical imaging, and control. We are an interdisciplinary team that collaborates closely with clinicians to develop new technologies that can help improve healthcare, in particular through computer-assisted interventions. Our core research activities take place in the biomechanical modeling of soft tissue and developing novel numerical methods for real-time computation. Our research results pave the way towards augmented reality during interventions, autonomous medical robotics, and creating digital twins for personalized operation planning.

MIMESIS and LN Robotics, a South Korean medical robotics company, previously collaborated on a research project on autonomous endovascular navigation. LN Robotics has developed AVIAR, a robotized intervention system that reduces clinician radiation exposure during cardiovascular procedures. Building on their successful initial collaboration, both partners are now launching a new project to integrate artificial intelligence capabilities into AVIAR. This project aims to enhance fluoroscopic guidance through real-time vessel visualization and enable automated navigation. Our team's state-of-the-art vessel localization method will be central to this effort, with this postdoctoral position focused on advancing it toward clinical application.

Mission confiée

In fluoroscopy-guided endovascular interventions, vessel visualization traditionally relies on contrast agent injection. However, these agents are toxic at high doses and cannot be continuously injected. To overcome this limitation, we recently propose a solution based on deformable 2D-3D registration. Our method uses a preoperative 3D model of the vessels and updates it in real-time to provide clinicians with continuous vessel visualization throughout the procedure. Accurate and continuous vessel tracking is fundamental for autonomous endovascular interventions, as it enables precise robotic navigation without repeated contrast injections while ensuring safety through constant visual feedback.

Extracting vessel information from fluoroscopic images presents significant challenges: poor image contrast, limited 2D perspective, and scarcity of clinical data for training and validating deep learning approaches. Our deformable 2D-3D registration method was developed with these limitations in mind, and demonstrated promising results. The postdoctoral researcher will build upon these initial successes to develop a robust vessel tracking method suitable for clinical translation. This ambitious project requires innovative solutions at the intersection of computer vision, deep learning, and medical imaging. Success will depend on close collaboration with engineers and clinical partners to ensure that the developed method meets the robustness, accuracy, and real-time performance requirements of interventional practice

Principales activités

The successful candidate will work on improving and validating our deep learning-based deformable 2D-3D vessel registration method. Key objectives include:

1. Enhancing robustness and accuracy of vessel tracking under challenging clinical conditions (motion artifacts, varying contrast, overlapping structures)
2. Integrating vessel tracking in the AVIAR robotic system
3. Developing experimental validation protocols
4. Extending the method to handle catheter tracking
5. Creating safety measures for reliable autonomous navigation

Compétences

Technical skills and level required:

- Sound knowledge of modern computer vision techniques
- Sound knowledge of Machine Learning / Deep Learning with Artificial Neural Networks
- Basic knowledge of medical imaging modalities

Software development skills : Python programming, Pytorch.

Relational skills : team worker (verbal communication, active listening, motivation and commitment).

Avantages

- 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
- Social security coverage

Rémunération

2788 € gross/month

Informations générales

- **Thème/Domaine** : Neurosciences et médecine numériques
- **Ville** : Strasbourg (near the hospital campus)
- **Centre Inria** : [Centre Inria de l'Université de Lorraine](#)
- **Date de prise de fonction souhaitée** : 2025-02-03
- **Durée de contrat** : 12 mois
- **Date limite pour postuler** : 2024-12-20

Contacts

- **Équipe Inria** : [MIMESIS](#)
- **Recruteur** :
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A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

> **Attention** : Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Sécurité défense :
Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :
Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.