Offer #2025-08723

PhD Position F/M Advancing Grasp for people with upper limb paralysis: a shared control approach between the user and the assistive device

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

Level of experience : From 3 to 5 years

About the research centre or Inria department

Inria is a national research institute dedicated to digital sciences that promotes scientific excellence and transfer. Inria employs 2,400 collaborators organised in research project teams, usually in collaboration with its academic partners.
This agility allows its scientists, from the best universities in the world, to meet the challenges of computer science and mathematics, either through multidisciplinarity or with industrial partners.
A precursor to the creation of Deep Tech companies, Inria has also supported the creation of more than 150 start-ups from its research teams. Inria effectively faces the challenges of the digital transformation of science, society and the economy

Context

The researcher will be part of the CAMIN team at INRIA Montpellier.

The position will be funded by INRIA under the national PEPR O2R PI3

"ASSISTMOV"

The integrated project PI3 "ASSISTMOV," composed of a multidisciplinary team of engineers and social sciences and humanities (SSH) researchers, focuses on the use case of assistive robotics for the assisting movement of people with disabilities. Through the development of an upper-limb exoskeleton, this project aims to create a breakthrough technology for smooth and robust interaction with the user.

The proposed PhD follows a previous work of the CAMIN team on the development of an algorithm for estimating the intention to grasp based on observing the approach movements toward an object [1]. Operating within a collaborative grasping control paradigm, the users naturally move their hand towards an object they wish to grasp and the algorithm identifies the target of the movement and selects an appropriate grip for the assistive device to perform (timing and shape of grasp). This approach contrasts with more traditional control paradigm which classicaly rely on finite state machines [2] controlled by switch buttons [3], myoelectric sensors, inertial measurement units installed on the contralateral shoulder, or even on voice control [4]. Similarly to prosthesis control, such interfaces are associated to an important cognitive load on the user, in addition to lack of fluidity, resulting in sequential motions due to the state machine approach. The motivation of this project is to offer a more intuitive control interface which adapts to the user’s behavior without requiring any dedicated or stereotypical action.

After a familiarization with existing materials: publications, algorithms, tools (virtual reality programming, etc.), the objective is to define new objectives to improve on the existing solution and adapt it to the project "ASSITMOV" context. One of the important objectives will be to improve the usability of the solution. Among the limiting aspects of the existing algorithm is that it uses a predefined set of objects (YCB dataset). The PhD student will work on a new generic approach that allows interaction with any everyday objects. Another significant limitation of the current approach to hand motion analysis is the bias of existing tools, which are primarily trained on data from able-bodied individuals [5]. Our goal is to propose a neural architecture capable of extracting and analyzing the hand kinematics of individuals with physical disabilities. This involves creating a dataset of atypical hand movements to train new networks.

The developed framework will be experimentally tested on able-bodied participants and people with upper-limb paralysis, in two use cases requiring several practical implementations:

- virtual reality to evaluate the interaction of the user with the control algorithm
- computer vision for real-world interaction with everyday-life objects

[1] Moullet, E., Carpentier, J., **Azevedo-Coste, C.**, & **Bailly, F.** (2024). I-GRIP, a Grasping Movement Intention Estimator for Intuitive Control of Assistive Devices. In 2024 IEEE-RAS 23rd International Conference on Humanoid Robots (Humanoids) (pp. 957-964). IEEE.

[2] Light, C. M., Chappell, P. H., Hudgins, B., & Engelhart, K. (2002). Intelligent multifunction myoelectric control of hand prostheses. Journal of medical engineering & technology, 26(4), 139-146.

[3] Trotobas, C., Ferreira, F. M. R. M., de Faria Moraes, M. R., Valladao, A. M., Martins, H. R., Fattal, C., & **Azevedo Coste, C. A.** (2024). Combining Functional Electrical Stimulation (FES) to Elicit Hand Movements and a Mechanical Orthosis to Passively Maintain Wrist and Fingers Position in Individuals With Tetraplegia: A Feasibility Test. IEEE Transactions on Medical Robotics and Bionics.

[4] Tigra, W., Navarro, B., Cherubini, A., Gorron, X., Gelis, A., Fattal, C., ... & **Azevedo Coste, C. A.** (2016). A novel EMG interface for individuals with tetraplegia to pilot robot hand grasping. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 26(2), 291-298

[5] Zhang, F., Bazarevsky, V., Vakunov, A., Tkachenka, A., Sung, G., Chang, C. L., & Grundmann, M. (2020). Mediapipe hands: On-device real-time hand tracking. arXiv preprint arXiv:2006.10214.

Assignment

Collaboration :

The recruited person will be in connection with the with SHS researchers and Approche associations, partners of the PEPR PI3 consortium.

Main activities

Main activities:

- Literature review on assistive robotic grasping and shared control
- Implementation of a shared control algorithm included in a VR environment
- Participation in experimentation with healthy participants and people with upper limb paralyses
- Dissemination of results (publications and scientific communications, interactions with the national PEPR team)

Benefits package

- Subsidized meals
- 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 (few days per week) 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

Gross Salary:

1st year : 2200 € per month

2nd and 3rd year : 2300 €per month

General Information

- **Theme/Domain :** Modeling and Control for Life Sciences
  Instrumentation et expérimentation (BAP C)
- **Town/city :** Montpellier
- **Inria Center :** Centre Inria d'Université Côte d'Azur
- **Starting date :** 2025-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-05-13

Contacts

- **Inria Team :** CAMIN
- **PhD Supervisor :**
  Bailly François / francois.bailly@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

Excellent programming skills :

- Python, C, C++
- Linux, Windows
- Unity, Unreal engine
- CMAKE

Good communication skills :

- Team work
- Written and oral skills in English and French

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.