Offer #2023-07008

Development of a new measuring device for indirect estimation of hand grip forces

Contract type: Fixed-term contract
Level of qualifications required: Graduate degree or equivalent
Function: Temporary scientific engineer
Corps d'accueil: Ingénieur d'Etudes / Ingénieur de Recherche (IE/IR)
Level of experience: Recently graduated

About the research centre or Inria department

The Inria centre at Université Côte d'Azur includes 37 research teams and 8 support services. The centre's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regiona economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Context

As part of a partnership with the European AI-HAND project, the CAMIN team is working to restore functional grasping movements in people with tetraplegia. The technology developed by the team and its partners combines an implanted neuroprosthesis that electrically stimulates the muscles of the forearm, with control and measurement interfaces to enable the user to interact with the assistive device. To be able to grasp objects autonomously, users need to be informed about the quality of the grasp they have made, information they are deprived of because of the spinal cord injury at the origin of their paralysis (motor and sensory). This information will enable users to modulate the intensity of their muscle stimulation and thus control their neuroprosthesis adaptively. For reasons of user acceptability, and with a view to developing a realistic technology that can be used in the field, we do not intend to use a solution that directly measures forces between the hand and the object (pressure plates, strain gauges, etc.).

The aim is to develop a new solution for indirect estimation of hand grasping forces around everyday objects. In order to exploit the mechanical information linked to the contraction of the numerous muscles of the forearm, we wish to develop a new measuring device associated with an estimation algorithm enabling us to find the forces applied by the hand on an object. The team is currently working on a thesis to develop a digital simulator of the stimulated arm. The evaluation of the forces generated will provide important information for enriching the model. In addition, combining this information with the measurement of muscle activity evoked by the stimulation will improve our understanding of the relationship between electrical stimulation and the muscles involved.

Bibliography

https://www.mdpi.com/1424-8220/20/7/2104
https://www.mdpi.com/1424-8220/20/17/4883

Assignment

Missions:

As a member of the CAMIN team, the successful candidate will be entrusted with the following tasks:

1. The first mission associated with this position will be to carry out a scientific and technological review of existing solutions, then to develop an experimental platform (hardware + software) to
test the chosen solution.

2. A comparative study will then be carried out between direct measurement of clamping forces via existing sensors and the indirect estimation developed above. This comparative study will include experiments with both able-bodied and quadriplegic participants.

3. Finally, an interface will be developed to provide force information to the user in a way that is adapted and compatible with the chosen control modality, in order to propose a realistic solution suitable for everyday use by users.

Main activities

The activities associated with the position include bibliographic research and technology scouting, software and hardware development of the indirect force measurement solution chosen, and the development of an experimental platform to conduct a validation protocol and process the data collected. The experimental protocol will also need to be finalized, and approved by an ethics committee. In the case of clear technological innovation, a patent may be filed.

Skills

Scientific and technical skills:
Electronics and automatic control
Good knowledge of physics
Software development (C++, Python)
Knowledge of the Do It Yourself (DIY) approach: embedded programming (Arduino, drivers), sensors and electronic interface, 3D printing.

Languages:
Fluency in English (reading articles, communication with European project partners)

Interpersonal skills:
Teamwork
Interaction with participants in clinical environment

Additional skills appreciated:
Modeling and 3D printing
Knowledge of biomechanics
Knowledge of signal processing and instrumentation, in particular those used to measure human movement: EMG, force sensors, IMU, MOCAP.

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 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

From 2692 € gross monthly (according to degree and experience)

General information

- Theme/Domain: Computational Neuroscience and Medicine
  Instrumentation et expérimentation (BAP C)
- Town/city: Montpellier
- Inria Center: Centre Inria d'Université Côte d'Azur
- Starting date: 2024-03-01
- Duration of contract: 1 year, 6 months
- Deadline to apply: 2024-03-31

Contacts

- Inria Team: CAMIN
- Recruiter: Azevedo Coste Christine / Christine.Azevedo@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. Collecting applications by other channels is not guaranteed.

The position is open to:
- Inria internal mobility, remuneration according to statutory conditions
- mobility from other public body, by posting for a period of three years, renewable, remuneration according to statutory conditions
- in short term contract from service fixed-term

**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.