Offer #2024-07436

PhD Position F/M Robotics Whole-Body Planning, Control, and Learning for Loco-Manipulation Actions

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

Level of experience : Recently graduated

Context

LARSEN is a robotics team, located in Inria Nancy / Loria, that develops human-centered technologies, at the frontier between humanoid robotics, control, learning, and interaction with humans.

The team develops learning and control algorithms for teleoperated / semi- / autonomous robots, where mobile manipulators and humanoids are involved in complex manipulation tasks in a remote location to replace humans. The team is also developing advanced humanoid robotics control and learning techniques to enable human-humanoid collaboration.

The laboratory has state-of-the-art robotics equipment: 2 full body humanoid robots (Talos and iCub), 3 Franka manipulators, drones of different sizes, 2 Xsens motion capture sensorized suits, passive and active exoskeletons, 6 AMTI force plates, 3 experimental rooms with motion capture (Qualisys, Vicon), several wearable sensors (EMG Delsys, force sensors, EKG, etc.). The laboratory has a 3D printing facility and a mechatronic workshop for prototyping and maintenance.

The team consists of many research scientists, postdocs, PhD and has the support of 1 software and 1 mechatronics engineer. The team is international - English and French speaking. French is not required, although free French classes are available in the institute for non-French speakers.

The laboratory is located in the Science and Technology Campus of the University of Lorraine, next to the Botanical Gardens, at 20 minutes by public transportation or bike from the Nancy train station and City Center. Nancy is a University town, with a high quality of life and a vibrant student and expat community.

Assignment

Fully-funded PhD position in the field of Robotics, focusing on Whole-Body Planning, Control, and Learning for Loco-Manipulation Actions. The successful candidate will join our dynamic research team and contribute to cutting-edge advancements in robotics.

Project Description:

The Ph.D. Thesis aims to develop innovative methodologies and algorithms exploiting model-based optimization, optimal control, and learning for whole-body planning and control in generic multi-limbed robotic systems interacting with the environment, with a particular focus on agile and dynamic locomotion and manipulation actions.

The research will address the challenges associated with agile and heavy loco-manipulation tasks, such as motion and contact planning and control. The goal is to enable robots to perform complex locomotion and manipulation tasks in unstructured and dynamic environments, with applications ranging from industrial automation to service robotics.

The student will have the opportunity to perform the research using laboratory robotic assets including the omniTiago++ robot and the humanoid bipedal robot TALOS.

Main activities

- Review literature on model-based optimization and learning algorithms for whole-body planning and control in robotic systems.
- Familiarize oneself with existing methodologies and algorithms used in locomotion and manipulation tasks.
- Develop a theoretical framework for integrating model-based optimization and learning techniques for agile loco-manipulation.

- Design and implement algorithms for motion planning in contact-rich environments, considering dynamic stability constraints.
- Validate the developed methodologies and algorithms through simulations using software platforms such as ROS (Robot Operating System).
- Conduct experiments with laboratory assets, including the omniTiago++ robot and the humanoid bipedal robot TALOS, to test the effectiveness of the proposed approaches.
- Analyze experimental results and iterate on the developed methodologies to improve performance and robustness.
- Document research findings in academic papers and present them at conferences and workshops.
- Collaborate with other researchers and engineers to integrate the developed algorithms into practical robotic systems.
- Explore potential applications of the developed methodologies and algorithms in industrial automation and service robotics domains.

Skills

Good to have:

- Experience with real robots.

- Proficiency in programming languages ⬚⬚such as C/C++ and Python.

- Ability to work independently and as part of a team.

- Good communication and writing skills.

Preferred Qualifications:

- Experience with whole-body control, optimal control, optimization techniques, and reinforcement learning.

- Familiarity with robotic platforms and simulation environments (eg, ROS2, Gazebo, MuJoCo, CasADi, Eigen, Pinocchio, Nvidia Isaac GYM).

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 (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

Remuneration

2100 € gross/month the 1st year

General Information

- **Theme/Domain :** Robotics and Smart environments
  Software Experimental platforms (BAP E)
- **Town/city :** Villers lès Nancy
- **Inria Center :** Centre Inria de l'Université de Lorraine
- **Starting date :** 2024-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2024-04-30

Contacts

- **Inria Team :** LARSEN
- **PhD Supervisor :**
  Mingo Hoffman Enrico / enrico.mingo-hoffman@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

Master's degree (or equivalent) in Robotics, AI, Computer Science, Electrical Engineering, Mechanical Engineering, or a related field.

> **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.