IDLab

INTERNET & DATA LAB

IDLab UGent – PhD Hardware-Aware Control Algorithms for Robot Reflexes

ABOUT GHENT UNIVERSITY

Ghent University is a world of its own. Employing more than 15.000 people, it is actively involved in education and research, management and administration, as well as technical and social service provision on a daily basis. It is one of the largest, most exciting employers in the area and offers great career opportunities.

With its 11 faculties and more than 85 departments offering state-of-the-art study programmes grounded in research in a wide range of academic fields, Ghent University is a logical choice for its staff and students.

Job description

The DECIDE research group of IDLAB is seeking a highly motivated and talented PhD student to join its team. DECIDE conducts research on Distributed and Embodied Computing in Dynamic Environments. Our research spans several related areas of expertise: generative AI for robotic planning and control, cognitive control, distributed perception and control, and HW-SW co-design of algorithms. Our research is applied across diverse sectors, including agriculture, manufacturing and remote sensing. Check out the team website at https://decide.ugent.be

 Topic

As robots move from caged industrial settings to dynamic environments shared with humans, safety becomes paramount. To minimize the impact of a collision with a human, robots should require low-latency "reflexes". Upon a tactile sensation, the robot must immediately perform active control, such as retracting its arm, to mitigate.

To meet the strict timing constraints, these control algorithms cannot rely on centralized processing. Instead, they must be embedded locally within each join or limb. Moreover, since a reflex often involves coordination between multiple joints, a distributed compute solution is required.

In this PhD, you will design distributed control algorithms tailored for real-time robot operation. A core focus of this research is hardware-algorithm co-design: your algorithms must be optimized for mapping onto hardware accelerators, ranging from conventional embedded systems to emerging unconventional platforms (e.g. probabilistic computing). The research will define the architectural requirements for the next generation of robotic hardware.

Prospective candidates must thus have a strong interest in algorithmic development as well as embedded hardware integration.

Role and responsibilities

This PhD project will be executed in close cooperation with researchers from IDLab-AIRO (robotic experts) and imec.

Your main tasks include:

· Reviewing literature on decentralized control frameworks in the domain and machine learning algorithms compatible with conventional embedded platforms as well as unconventional compute technologies.

· Designing and simulating controllers that balance high performance with hardware efficiency

- Mapping your algorithms to hardware and asses compute, memory and communication requirements.

- Integrating the controllers into a physical prototype, in cooperation with the IDLab-AIRO research group.

- Writing high quality publications, targeting top journals and international conferences.

In addition to your primary research responsibilities, you will actively contribute to the educational mission of our institution by providing support for various courses in areas such as machine learning, reinforcement learning and algorithm design. In addition, you can take on a mentoring role by supervising bachelor and master theses related to the subject of this PhD.

Job profile

We are looking for a highly creative and motivated PhD student with the following qualifications and skills:

- You have (or will obtain in the next months) a European master's degree in Computer Science or Electronics Engineering, with excellent ('honors'-level or above) grades.

- You have a strong foundation in control theory, deep learning or computer architecture.

- A demonstratable interest or experience in mapping algorithms onto embedded hardware.

- You have strong analytical skills to interpret the obtained research results.

- You are a team player and have strong communication skills.

- Your English is fluent (C1 CEFR level), both speaking and writing.

Our offer

The selected candidate will be offered a one-year employment, which may be renewed for an additional three years on condition that a the first year was given a positive evaluation. Your renumeration will be determined according to predefined salary scales of our university Click here for more information about our salary scales . In addition, staff members can count on a number of benefits, such as a broad range of training and educational opportunities, 36 days of vacation leave, bicycle allowance, and more. Click here for a complete overview of all the staff benefits

We offer the opportunity to do this research in an international and stimulating environment. The research will be conducted at the premises of IDLab, located in Ghent.

Ghent University consistently ranks among the best 100 universities in the world. Located in the heart of Europe, Ghent is a beautiful and welcoming city (https://www.lonelyplanet.com/articles/ghent-belgiums-best-kept-secret) with plenty of cultural and leisure activities.

How to apply

You should apply via https://jobs.idlab.ugent.be/en/ph-d-hardware-aware-control-algorithms-for-robot-reflexes/apply

For more information you can email to Prof. Pieter Simoens (pieter.simoens@ugent.be). Applications should include:

- An academic/professional resume

- Transcripts of study results, with indication of the percentile of your study results

- A short overview describing your earlier research or technical work (e.g., scientific papers, link to GitHub repository, master thesis, report on project work, etc.). These documents need not be on the topic of the advertised position.

After a first screening, selected candidates will be invited for an interview (also possible via Teams). The selection process will involve multiple steps.

Application deadline: continuous evaluation until the vacancy is filled. Starting date: as soon as possible.

https://idlab.ugent.be