PhD Project

Job Title: PhD Student (Fully funded)

Location: NATO STO Centre for Maritime Research and Experimentation, La Spezia, Italy, and Department of Information Engineering, University of Pisa, Pisa, Italy

Deadline for application: August 7, 1300 CEST

About the Role:

We are seeking a highly motivated PhD Student to join our team at the joint project between the NATO STO Centre for Maritime Research and Experimentation in La Spezia, Italy, and the Department of Information Engineering at the University of Pisa, Italy.

The successful candidate will be part of a dynamic and international team of scientists and engineers working on exciting robotics projects, including underwater vehicles and autonomous systems. This position requires great dedication, the ability to work independently, and the flexibility to adapt to evolving project requirements.

If you are passionate about robotics and have the skills and experience to excel in this role, we want to hear from you.

Applications from NATO and NATO-Partner Nations are encouraged.

You are encouraged to share your application with a cover letter and CV to *andrea.munafo@unipi.it, riccardo.costanzi@unipi.it, gabriele.ferri@cmre.nato.int* before you apply (see Section: How to Apply).

PhD title and Brief Description

Towards Robust Artificial Intelligence Approaches for Robotic Mission Planning and Execution

A PhD Proposal for a Collaboration between the University of Pisa and NATO STO Centre for Maritime Research and Experimentation

Robotic technology has advanced significantly in recent years and has found applications in various domains, including the maritime sector. The deployment of autonomous underwater vehicles (AUVs) and other types of robots in this environment is challenging due to the complexity of the underwater environment and the need for robust decision-making in real-time, often requiring fast mission re-planning.

In robotic mission planning and execution, the synergetic integration of different artificial intelligence (AI) techniques, ranging from symbolic AI rule-based strategies to data-driven machine learning and reinforcement learning (RL) methods, has the potential to improve the capabilities of these systems, making them more autonomous and flexible in accomplishing a variety of tasks.

Additionally, environmental constraints, such as the physics of acoustic propagation that impact the robot's perception and communication, must be considered to enhance the advanced decision-making and adaptability of the methods in real-world scenarios.

The proposed PhD project aims to advance the state of the art in the field of autonomy and AI for robotic mission planning and execution. The goal is to develop mission planning and execution algorithms that provide strong and formal guarantees on stability and performance, while maintaining state of the art performance on relevant tasks. The PhD candidate will work closely with researchers from the University of Pisa and the NATO STO Centre for Maritime Research and Experimentation to design, implement, and evaluate novel planning and mission execution approaches for a network of marine robots.

Existing methods have achieved state of the art performance in several tasks, but they often lack strong and formal guarantees on stability and performance. The proposed PhD project will address this limitation by exploring novel approaches which provide robustness guarantees, and by combining them with more traditional methods will investigate more effective algorithms for robotic mission planning and execution.

The PhD candidate will have the opportunity to work with a diverse team of experts from both academia and industry, including experts in robotics, autonomy, machine learning, and

real-time software design. The proposed project is interdisciplinary and will leverage the strengths of both organizations, providing the candidate with unique training opportunities and access to state-of-the-art equipment and facilities.

This PhD project has the potential to have a significant impact in the field of autonomous machines, providing robots with new and effective solutions for autonomous decision-making in the maritime domain. The results of the project will be disseminated through high-quality publications in top-tier conferences and journals, and the candidate will have the opportunity to present his/her work at international conferences and workshops.

The successful candidate will hold a Master's degree, preferably in computer science, electrical engineering, or a related field, with a strong background in robotics, autonomy, machine learning and programming. They should also have good communication and teamwork skills, and a strong motivation to pursue a PhD degree.

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How to apply

Deadline for application: August 7, 1300 CEST

The online registration for the competition is divided into the following stages:

1. Register your details on the web by connecting to the address **www.studenti.unipi.it.** Those who have obtained a degree from the University of Pisa (or have in any case used the web services in the past) do not need to register, but go directly to the next phase 2 related to the competition registration.
2. Online registration for the competition by connecting to the address **www.studenti.unipi.it**, and entering the required data during the online procedure.

You will need to upload:

- **CV and a Photo ID card (e.g., Passport or National ID) and any additional documentation useful**

- **A research project:** The research project should provide a concise description (no more than 5 pages of text and figures) of the general idea, methodology, development phases, and expected results of a research project in the field of Information Engineering that the candidate intends to develop within the scope of the doctoral program.

Note that failure to upload the curriculum and/or the research project is not a reason for exclusion. The candidate must submit separate curricula for each selection he or she is competing for. Simply sending the curriculum does not constitute registration for the competition.

- (only for those with a degree obtained abroad) the degree accompanied by the documents indicated in article 3 of the competition announcement.

You will need to indicate (only if specified in the attachment of the specific competition available at the bottom of the page) any names and their contacts (email addresses and phone numbers) of teachers or scholars available to provide references.

Payment of the registration fee of 30 Euros with the Pago PA system, which is accessed at the end of online registration, by the deadline of August 7, 2023, at 23:59 (Italian time). In the case of doctoral courses with several competitions, the candidate will have to pay a single competition fee; this payment, in fact, will make his or her position regular, for the purposes of the competition fee, for all the selections activated on the same doctoral course. If the payment of the fee has been made but is not finalized, candidates will be admitted pending verification of the regularity of the payment. The competition fee cannot be refunded except in the case where the competitive exams cannot be held for the reasons indicated in article 1, paragraph 2, of the competition announcement.

Print, at the end of the procedure, the corresponding receipt of successful registration. This constitutes proof of successful registration and reports a "pre-registration number" that will be essential to view the evaluation of the curriculum and any written test in an anonymous form, on the web page http://dottorato.unipi.it/ - "Admission and registrations".

More information about this opportunity is available at https://dottorato.unipi.it/index.php/it/concorsi-d-ammissione-a-a-2023-2024/item/773.html

For any question on the application process please contact "Sportello virtuale": http://sportellovirtuale.unipi.it/ .

For any question on the PhD programme, please contact: Gabriele.Ferri@cmre.nato.int, Andrea.Munafo@unipi.it, Riccardo.Costanzi@unipi.it

About us

The **NATO STO CMRE**, or the NATO Science and Technology Organization Centre for Maritime Research and Experimentation, is a research and development center located in La Spezia, Italy, dedicated to advancing maritime science and technology for NATO and its member nations. The CMRE focuses on conducting research and experimentation in the areas of undersea robotics, maritime situational awareness, and environmental assessment. It collaborates with industry, academia, and other research organizations to develop and evaluate innovative technologies, tools, and methods that can enhance maritime security, safety, and efficiency. The center also serves as a hub for knowledge exchange and training, offering a range of educational and outreach programs to promote scientific and technological excellence in the maritime domain.

The **Department of Information Engineering (DII) of the University of Pisa** is an Excellence Center for Research and Higher Education in the field of Information and CommunicationTechnology (ICT), Robotics and Bioengineering.

95 professors and 50 post-doc are member of the Department. The main research fileds iclude Electronics, Applied Electromagnetism, Communication Systems, Information Engineering, Automation and Robotics and Biomedical Engineering.

DII has promoted six spin-off projects, and it cooperates with private and public institutions to provide innovative solutions to key issues in different ICT sectors, and to bridge the gap between academic and industrial research. The Department is involved in about 20 European

projects (49 in the last three years), 2 ERC, 25 Regional Projects. It runs an intense activity in Higher Education for about 4000 students and 200 PhD students.

In 2018 and 2023 DII was selected by the Italian Minister of Education as "Department of Excellence" with the project CrossLab and ForeLab, aiming to support future human-centric technology.

We offer a great working environment with the opportunity to work with cutting-edge robotics technologies and participate in experimental campaigns. The joint project between the NATO STO Centre for Maritime Research and Experimentation and the Department of Information Engineering at the University of Pisa promotes a diverse and inclusive work environment.