Prof. Jorge DIAS
Center of Autonomous Robotic Systems, Khalifa University, Abu Dhabi, UAE
Institute of Systems and Robotics from the University of Coimbra, Portugal

In-Memory Computing Architectures for Robot Vision and Robotic AI Applications

Computational aspects of implementing robotic and computer vision algorithms are based on multi-sensor data with spatial probabilistic distributions. The current digital tools and simulators are convenient and practical for exploring the quantitative behavior of specific computing neural networks, but their performance is largely dependent of supercomputing capacities. Even the largest supercomputing systems to date are not capable of obtaining real-time performance when running simulations large enough to accommodate multiple areas and layers of computing. Custom digital systems that exploit parallel graphical processing units (GPUs), field programmable gate arrays (FPGAs) or memristors offer good capabilities in computer efficiency, and resilience. In this talk we present the design of a memristor based hybrid-in memory processing architecture of computer vision. The design includes circuitry that controls and enables the in-memory processing of arithmetic operations through memristor cells, sense integrators and other peripheries in order to perform the needed modules for the implementation of the algorithm. In the talk we also address our current attempt to implement efficient “haze removal” CNN to remove the distortion from underwater images. Restoring the underwater images without distortion is important since it increases the quality and performance of the machine learning programs which improves the marine robotics.

Jorge Dias has a Ph.D. on EE and Coordinates the Artificial Perception Group from the Institute of Systems and Robotics from the University of Coimbra, Portugal. He is Full Professor at Khalifa University, Abu Dhabi, UAE and Deputy Director from the Center of Autonomous Robotic Systems from Khalifa University. His expertise is in the area of Artificial Perception (Computer Vision and Robotic Vision) and has contributions on the field since 1984. He has been principal investigator and consortia coordinator from several research international projects, and coordinates the research group on Computer Vision and Artificial Perception from KUCARS. Jorge Dias published several articles in the area of Computer Vision and Robotics that include more than 300 publications in international journals and conference proceedings and recently published book on Probabilistic Robot Perception that addresses the use of statistical modeling and Artificial Intelligence for Perception, Planning and Decision in Robots. He was the Project Coordinator of two European Consortium for the Projects «Social Robot» and «GrowMeUP» that were developed to support the inclusivity and wellbeing for of the Elderly generation.

Co-funded by the Erasmus+ Programme of the European Union

MIR | MARINE & MARITIME INTELLIGENT ROBOTICS

MIR SYMPOSIUM 2022

BIO-INSPIRED & MARINE ROBOTICS

June 14-15, 2022
University of Toulon
SeaTech building M

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JUNE 14, 2022 • Amphitheater M

9:00 Welcoming of participants

9:30 Introduction
Prof. **Ricard MARXER**, Director of Master Erasmus Mundus MIR

9:45 **Challenges in underwater robotics: why it's difficult to go close and shallow?**
Keynote speaker presentation 1 – Prof. **Maarja KRUUSMAA**, Vice-Rector of Research Tallinn University of Technology, Estonia & Prof. at NTNU, Centre of Excellence of Autonomous Marine Operations and Systems, Norway

10:30 Coffee break

10:45 1rst poster session – MIR students - Room M.01

11:30 UTLN President speech

12:00 **Relocalizing deep-sea autonomous underwater vehicles**
Clémentin BOITTIAUX, PhD UTLN

12:00 Lunch Cocktail

13:30 **Contributions of neuroscience to the detection and localization of objects in visual inputs**
Prof. **Emmanuel DAUCE** and Prof. **Laurent PERRINET**, Aix-Marseille University

14:30 2nd poster session – MIR students - Room M.01

15:30 **Increasing navigation of ROV by multibeam FLS**
Nicolas LALANNE, Engineer R&D, ECA Group

16:30 Bus Departure in front of SeaTech
Bus trip to Toulon Wharf

17:30 Toulon Bay - Boat tour
Les Bateliers de La Rade

18:30 Bus Departure from Toulon Wharf
Bus trip back to SeaTech

MIR SYMPOSIUM 2022 • BIO-INSPIRED & MARINE ROBOTICS

Prof. Maarja KRUUSMAA
Vice-rector of research, Tallinn University of Technology (TalTech), Estonia
Centre of Excellence of Autonomous Marine Operations and Systems, NTNU, Norway
Member of the Board, Estonian Academy of Sciences

Challenges in underwater robotics: why it's difficult to go close and shallow?

Robots go to places where humans do not want or cannot go. Underwater environment is the typical example of such a place. Technological advances have made it possible to explore oceans, very far and very deep. At the same time, many unexplored and unreachable places lie just under our nose. And these are not unexplored because they are not interesting and not important but because they are still unreachable. This talk will explore why it is difficult to make robots that go to shallow water. We discuss design and control challenges, sensing modalities as well as manufacturing and operational constraints. Finally, we discuss opportunities of possible new applications in shallow water.

Maarja Kruusmaa is a professor of Biorobotics in Tallinn University of Technology (TalTech) leading a research group of bio-inspired underwater technologies. She investigates how to gain flow information (e.g. currents, turbulence) in natural field conditions and how to use this information for navigating robots. She also works on novel actuation and control methods for underwater robot and robots for low-yield environments.

JUNE 15, 2022 • Amphitheater M

9:00 **In-Memory Computing Architectures for Robot Vision and Robotic AI Applications**
Keynote speaker presentation 2
Prof. **Jorge DIAS**, Robotics Institute and research activities on robotics, Khalifa University, U.A.E. & Prof. at Artificial Perception for Intelligent Systems and Robotics, Institute of Systems and Robotics from University of Coimbra, Portugal

10:00 **Underwater robotics : the five senses of underwater perception**
Jennifer GREER – Embedded Systems Engineer, IFREMER

10:30 Coffee break

10:45 Round table discussion
Alyeris, ECA Group, iXblue, IFREMER, Kietta, Seaowl Technology

11:45 Symposium closing & conclusion
Prof. **Ricard MARXER**, Director of Master Erasmus Mundus MIR