



PhD Course in ROBOTICS AND INTELLIGENT MACHINES

Curriculum: Healthcare and Wellness of Persons (Code 11659)

Research Themes

1. TOUCH SENSING AND AI – SCUOLA SANT’ANNA AND UNIVERSITÀ CAMPUS BIO-MEDICO 2

The main goal of the curriculum “Robotics and Intelligent Machines for Healthcare and Wellness of Persons” is to contribute to improving people’s wellness and quality of life, as well as to prevent the risk of injuries and occupational diseases.

Projects within the curriculum will focus on the development and experimental validation of methods, conventional, biomimetic, and bio-inspired models, components, subsystems, systems, and intelligent strategies for information analysis and telemedicine in the following areas:

- Medical robotics with imaging support
- Rehabilitation robotics
- Assistive robotics and functional replacement
- Robotics for health and safety in the workplace
- Innovative medical devices
- Human-robot interaction

The research theme offered by Sant’Anna School of Advanced Studies and Università Campus Bio-Medico di Roma will be awarded to the top applicants selected for this theme.

Ideal candidates are students with a Master’s degree (or equivalent/higher qualification) in a STEM (Science, Technology, Engineering, and Mathematics) field, ideally with a background in Robotics.

Students will conduct their research project at the hosting institution (as described in the research project sheet). Interested applicants are encouraged to contact the tutors and/or the Unit’s Principal Investigators for clarifications prior to submitting their application.

International applications are welcome, and applicants will receive logistical support for visa issues, relocation, and other related matters.

1. Touch Sensing and AI – Scuola Sant’Anna and Università Campus Bio-Medico

Curriculum: Healthcare and wellness of persons	 
Hosting Institution: - Sant'Anna School of Advanced Studies (Pisa, Italy, SSSA) - Università Campus Bio-Medico di Roma (Rome, Italy, UCBM)	
Department: - The Biorobotics Institute, Department of Excellence in Robotics & AI (SSSA) - Facoltà Dipartimentale di Ingegneria (UCBM)	
Tutors: - Prof. Dr. Calogero Maria Oddo (SSSA) - Prof. Dr. Loredana Zollo (UCBM)	
Description: This doctoral project focuses on developing and integrating AI solutions for the elaboration of data generated by tactile sensors. Specific research questions include robust calibration of tactile sensors, with AI inferences being resilient across different replicas of sensors with the same design or with structural variations. Target applications scenarios will be in humanoid robotics, medical robotics and bionic limb prostheses, to enable effective bidirectional interactions among machines, persons, and their surrounding.	
Requirements: Applicants are expected to have a background in biomedical, electronic, control, mechatronic, mechanical, electronic, or computer engineering or related fields. However, this is not limiting, and other STEM MSc degrees could be considered. The ideal candidate has competences on applications of AI strategies to data generated by tactile sensors (e.g., with meta- and transfer- learning). Relevant technical skills include proficiency with most diffused programming and machine learning tools (Python, Matlab, Labview, PyTorch, TensorFlow, Keras, Deep Learning Toolbox), and programming of edge-platforms (STM 32, Arduino).	
References: - Massari, L., Fransvea, G., D'Abbraccio, J., Filosa, M., Terruso, G., Aliperta, A., ... & Oddo, C. M. (2022). Functional mimicry of Ruffini receptors with fibre Bragg gratings and deep neural networks enables a bio-inspired large-area tactile-sensitive skin. <i>Nature Machine Intelligence</i>, 4(5), 425-435. - Zollo, L., Di Pino, G., Ciancio, A. L., Ranieri, F., Cordella, F., Gentile, C., ... & Guglielmelli, E. (2019). Restoring tactile sensations via neural interfaces for real-time force-and-slippage closed-loop control of bionic hands. <i>Science robotics</i>, 4(27), eaau9924. - Romeo, R. A., Rongala, U. B., Mazzoni, A., Camboni, D., Carrozza, M. C., Guglielmelli, E., Zollo, L., & Oddo, C. M. (2018). Identification of slippage on naturalistic surfaces via wavelet transform of tactile signals. <i>IEEE Sensors Journal</i>, 19(4), 1260-1268.	

Number of positions available: 1
Main Research Site The activities of the PhD will be undertaken in the premises of the two institutions that are collaborating in the activation of this position. Particularly, the main research sites will be: • Neuro-Robotic Touch Laboratory, The Biorobotics Institute and Department of Excellence in Robotics & AI, Scuola Superiore Sant'Anna (Pisa and Pontedera, Italy) • CREO Laboratory, Facoltà Dipartimentale di Ingegneria, Università Campus Bio-Medico di Roma (Rome, Italy)
Contacts: calogero.oddo@santannapisa.it l.zollo@unicampus.it
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Scholarship Amount: Fascia 4: 19,500 €/year