POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 41st cycle

Research Area n. 4 - Telecommunications

THEMATIC Research Field: DESIGN AND INTEGRATION OF AI DRIVEN RECONFIGURABLE INTELLIGENT SURFACES (RIS) FOR HIGH- PRECISION SENSING SYSTEMS

Monthly net income of PhDscholarship (max 36 months)
1400.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	The objective of this research will be focused on the growing need for high-precision localization and activity recognition in smart environments, healthcare, and Industry 5.0 applications. The study explores reconfigurable intelligent surfaces (RIS) as a transformative sensing technology capable of dynamically shaping the wireless environment, enhancing signal propagation, and enabling integrated localization and communication functionalities, thereby significantly improving sensing system performance. The research aims to design and optimize RIS structures for sensing applications in the 30–60 GHz frequency band, and to develop AI-driven algorithms, including meta-learning and distributed learning, for adaptive RIS configuration in dynamic environments. By integrating RIS into end-to-end sensing systems and validating them through simulations and prototyping using tools such as MATLAB, Sionna, and Wireless InSite, the work seeks to create robust, high-precision RIS-aided sensing solutions for next-generation smart and connected environments. This PhD scholarship will be funded by the ADVISE internal project, a collaboration between CNR and POLIMI.
Methods and techniques that will be developed and used to carry out the research	The research will employ tools such as MATLAB, Sionna, and Wireless InSite to design, simulate, and evaluate RIS

	performance in the 30–60 GHz frequency band. The RIS designs will be tested at the joint CNR &POLIMI Wavelab laboratory. Advanced AI-driven methods, including personalized learning and meta-learning, will be applied to analyze simulated and experimental data for sensing applications, enabling precise localization and activity recognition in robotic cells. Python will be used for data analytics and to implement machine learning algorithms.
Educational objectives	The objective of this program is to achieve expertise in RIS design and its integration into RIS-based sensing and communication technologies, developing advanced methods for high-precision localization and robust activity recognition. The program provides a strong foundation in signal processing, wireless communications, and AI-driven algorithms, enabling the design of advanced and trustworthy sensing systems for next-generation smart environments. Its goal is to educate a researcher capable of integrating methodologies from multiple domains and applying this combined knowledge to relevant application scenarios.
Job opportunities	Career opportunities are envisioned in industry and applied R&D, as reconfigurable intelligent surfaces (RIS) are expected to play a key role in the development of 6G networks and intelligent environments. Global telecom leaders are heavily investing in RIS research to enhance communication and sensing capabilities, while major semiconductor and hardware companies are developing efficient hardware and algorithmic solutions. Beyond telecommunications, RIS technology is gaining traction in the automotive sector for autonomous vehicle sensing, in aerospace and defense for secure communications and low-power radar, and in healthcare for contactless vital-sign monitoring and elderly care. As the demand for energy-efficient, AI-driven, and high-precision sensing systems continues to grow, expertise in RIS algorithms and methods will be highly valuable for applied research roles across high-tech industries, large-scale collaborative innovation projects, and emerging startups shaping the future of smart and connected environments.

Composition of the research group	1 Full Professors 1 Associated Professors 3 Assistant Professors 3 PhD Students
Name of the research directors	Dr. Ing Sanaz Kianoush, Prof. Maurizio Magarini

Contacts
Sanaz.kianoush@cnr.it, Tel:0223994148 Maurizio.magarini@polimi.it Paolo Ravazzani (CNR-IEIIT director)

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

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EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student.

TEACHING ASSISTANTSHIP: availability of funding in recognition of supporting teaching activities by the PhD student.
There are various forms of financial aid for activities of support to the teaching practice.
The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY:
1st year: Yes
2nd year: Yes
3rd year: Yes