



# PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 38th cycle

Research Area n. 4 - Telecommunications

**PARTENARIATO PNRR Research Field: SYNTHETIC APERTURE METHODS FOR JOINT  
COMMUNICATIONS AND SENSING**

**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**

This research project is in the framework of  
RESTART  
PARTENARIATO ESTESO RESEARCH AND  
INNOVATION ON FUTURE TELECOMUNICATION  
SYSTEMS AND NETWORKS TO MAKE ITALY MORE  
SMART  
CUP D43C22003080001  
Decreto di Concessione D.D. 1549 del 11/10/2022

The ultimate goal of this project consists in the  
development of a new concept of distributed Synthetic  
Aperture Radars (SAR) intended for operation onboard  
Autonomous Vehicles (AVs) and Unmanned Aerial  
Vehicles (UAVs) of the next generation, operating in  
synergy with communication devices and/or re-using part  
of such technologies. In this context communication and  
sensing devices are intended cooperate in an  
orchestrated fashion, in order to provide unprecedented  
performance concerning detection, localization, tracking,  
and recognition of static and moving targets in urban and  
extra-urban scenarios. The project is intended to build on  
two pillars. Part of the activities will be dedicated to  
investigating all degrees of freedom provided by modern  
Radar sensors. Hence, we will consider the use of smart



	<p>MIMO antennas to enable multi-polarization, multi-view, and wide-angle multi-static SAR imaging, so as to increase the information space in which target detection and recognition processes take place. The other strand of the research will focus on joint communication and sensing. We will investigate synergies and re-use of resources allocated to communications to the aim of operating multiple devices on different platforms as a single multi-static imaging Radar, so as to make up for the lack of sensing resources in individual vehicles (e.g.: in terms of resolution and SNR) and guarantee increased protection against interference from the environment</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research methodology shall include:</p> <ul style="list-style-type: none"> <li>Evaluation of the current SoA and definition of relevant scenarios</li> <li>Theoretical analysis and numerical simulations</li> <li>Experimental work with Software Defined Radio (SDR) devices installed onboard vehicles and commercial drones</li> <li>Experimental demonstration</li> </ul>
<p><b>Educational objectives</b></p>	<p>In pursuing the proposed research, it is expected that the candidate will develop state-of-the-art skills concerning the design of signal processing methods for the treatment of Radar data, as well as their application in an operative context. The candidate is expected to develop team working skills through the collaboration with the research groups on both theoretical and experimental topics, and the capability to conduct her/his research in a highly focused fashion, yet flexible enough to keep account for changing boundary conditions.</p>
<p><b>Job opportunities</b></p>	<p>For the ambitious and interdisciplinary objectives of the research, as well as for the reputation of the research groups the candidate will collaborate with, it is expected that after completion of the PhD program the candidate will be ready for being a part of any research teams in the Academy, Research Agencies, and the Industry</p>
<p><b>Composition of the research group</b></p>	<p>2 Full Professors 2 Associated Professors 0 Assistant Professors</p>



	1 PhD Students
<b>Name of the research directors</b>	Stefano Tebaldini

<b>Contacts</b>
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<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p>LIST OF UNIVERSITIES, COMPANIES, AGENCIES AND/OR NATIONAL OR INTERNATIONAL INSTITUTIONS THAT ARE COOPERATING IN THE RESEARCH: Politecnico di Milano; Politecnico di Torino; Università degli Studi di Napoli Federico II; Sapienza Università di Roma</p> <p>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 5.707,13 Euro</p> <p>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.</p> <p>COMPUTER AVAILABILITY: individual use</p> <p>DESK AVAILABILITY: individual use</p> <p>D.D. 341 del 15/03/2022 Avviso pubblico per la presentazione di Proposte di intervento per la creazione di "Partenariati estesi alle università, ai centri di ricerca, alle aziende per il finanziamento di progetti di ricerca di base" - nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 "Istruzione e ricerca" - Componente 2 "Dalla ricerca all'impresa" - Investimento 1.3, finanziato dall'Unione europea - NextGenerationEU</p>