POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 40th cycle

Research Area n. 4 - Telecommunications

PARTENARIATO PNRR Research Field: SEMANTIC COMMUNICATION SYSTEMS IN SMART RADIO ENVIRONMENTS

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	Future wireless communication systems will benefit from the development of smart radio environments (SREs). These are electromagnetic environments where it is possible to control and modify the propagation characteristics of the channel from the transmitter to the receiver. Key components in SREs are reconfigurable intelligent surfaces (RISs), which consist in metasurfaces with atomic elements able to modulate the behavior of the incident electromagnetic waves. This important feature of RISs has recently contributed to increase the interest in their potential use to improve system capacity and coverage. Meanwhile, semantic communication, which focuses on the conveying the information meaning rather than the precise bit reconstruction, has gained considerable attention. The main goal of this research activity consists in the definition of a SRE-aided semantic communication model where transmitter, RIS, and receiver can be jointly optimized to cope with channel noise and semantic distortion. The development of appropriate models involving RISs will be considered for the range of frequencies that have emerged as a focal point in 6G. These include both the more traditional frequencies below 6 GHz (sub-6 GHz) and those in the range between 30 GHz and 300 GHz (millimeter waves, mmWave) band, which are specialized in 5G new radio

	(NR) as frequency range (FR) 1 and 2, respectively, and the upper mid-band spanning from 7 GHz to 24 GHz, also known as FR3.
Methods and techniques that will be developed and used to carry out the research	The research methodology shall include: 1) Study of the literature about semantic communication and RIS, outline of the relevant SRE scenarios, and definition of KPIs and requirements. 2) Theoretical analysis and numerical simulations. 3) Development of novel algorithms. 4) Performance evaluation of designed algorithms and comparison with existing ones available in the literature.
Educational objectives	1) acquire an expertise in technologies for next generation of wireless cellular networks; 2) develop state-of-the-art skills concerning the application of signal processing techniques to improve the performance of wireless communication systems and reduce power consumption; 3) disseminate research results (oral presentations/written publications); 4) ability to identify research problems and to conduct research in a highly focused fashion; 5) develop team working skills through the collaboration with the research groups on both theoretical and practical topics; and 6) develop skills for life-long learning and professional development
Job opportunities	For the ambitious and disruptive objectives of the research, as well as for the reputation of the involved research groups, it is expected that after completion of the PhD program the candidate will be ready for being part of any research team in public and private institutions and centers, universities, and industry.
Composition of the research group	0 Full Professors 4 Associated Professors 2 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Maurizio Magarini

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

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

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.
5.707,20 Euro

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

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

List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research: Università di Bologna, Università degli Studi di Napoli Federico II, Università di Padova, Università Mediterranea di Reggio Calabria, Politecnico di Torino, Consiglio Nazionale delle Ricerche.

This research project is in the framework of

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RESTART
PARTENARIATO ESTESO RESEARCH AND INNOVATION ON FUTURE TELECOMUNICATION SYSTEMS AND NETWORKS TO MAKE ITALY MORE SMART
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