POLITECNICO DI MILANO

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

Research Area n. 4 - Telecommunications

PARTENARIATO PNRR Research Field: GREEN AND AUTONOMIC OPTICAL NETWORKS

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 constant growth in traffic brought by 5G-and-beyond applications is pushing the industry towards novel technologies to cope with such a high-capacity demand while guaranteeing the Quality-of-Transmission (QoT) and minimizing costs. Moreover, today?s optical networks leverage the growing availability of monitoring data to improve network management in terms of optimization of physical resources, and in terms of prevention and management of malfunctions. The objectives of the research activity include the development of Machine Learning approaches for failure management in optical networks, the design of novel sustainable optical network architectures based on emerging technologies, such as Multi-Band and Hollow Core Fiber (HCF).
Methods and techniques that will be developed and used to carry out the research	Methodologies to ensure a reliable design and management of optical networks will come from the fields

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	of Machine Learning (ML) and Optimization Research (OR). In particular, ML-based approaches will include latest techniques such as eXplainable Artificial Intelligence (XAI), Reinforcement Learning (RL), Active Learning (AL), Transfer Learning (TL), and Federated Learning (FL). OR-based approaches will include Integer Linear Programming (ILP) models, heuristics such as greedy, and meta-heuristics such as Genetic Algorithms (GA). Moreover, ML can be jointly employed with OR in which ML is constantly queried by OR methodologies for taking multiple low-level decisions.
Educational objectives	The PhD student will learn how to apply optimization and Machine Learning (ML) techniques to optimize the management of optical networks. Additionally, the PhD student will develop an understanding on the interplay of physical layer and network layer, to then develop appropriate ML techniques for network optimization.
Job opportunities	There is a very strong request of PhD students with specific background knowledge in the application of Machine Learning – based approaches applied to network optimization. Recently, some of our former PhD students have been hired in top high-tech companies as Google, Nokia and Facebook.
Composition of the research group	1 Full Professors 4 Associated Professors 2 Assistant Professors 4 PhD Students
Name of the research directors	Massimo Tornatore

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
LIST OF UNIVERSITIES, COMPANIES, AGENCIES AND/OR NATIONAL OR INTERNATIONAL INSTITUTIONS THAT ARE COOPERATING IN THE RESEARCH: Politecnico di Milano; Scuola Superiore Sant'Anna di Pisa; Consiglio Nazionale delle Ricerche   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   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: individual use   DESK AVAILABILITY: individual use   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