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

Research Area n. 2 - Electronics

THEMATIC Research Field: MICROFLUIDIC AND SMART ELECTRONIC PLATFORMS FOR BIO-MOLECULAR DETECTION

Monthly net income of PhDscholarship (max 36 months)
1500.0 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 work is motivated by the need to increase the adoption and robustness of portable micro-analytical devices with bio-molecular selectivity. The objective is to leverage the new generation of photo-detectors in combination with AI and machine vision algorithms, as well as microfluidics (based on materials and processes which are scalable to industrial domain), in order to deliver full demonstrators, serving also as validation platforms and benchmarks for alternative sensing technologies such as the electrochemical ones.
Methods and techniques that will be developed and used to carry out the research	The research will focus on the development of lab-on-a-chip optoelectronic technologies for detection of molecules of bio-medical relevance such as DNA. It will develop in 3 major directions: (1) adoption of novel imaging sensors in the portfolio of STMicroelectronics, including both fast silicon photomultipliers (SiPM), combined with time gating for filter-less fluorescent detection, as well as CMOS camera sensors; (2) development of novel embedded signal processing solutions, mostly addressing image processing, leveraging in-sensor pre-preprocessing and hardware accelerators for machine learning such in advanced microcontrollers as STM32N6, (3) design of microfluidic platforms to be combined with the optical detection

POLITECNICO DI MILANO

	system, for sample preparation and handling fluids to be analyzed.
Educational objectives	The educational objectives are multiple: (1) strengthening a technological expertise on the combination of photodetectors, image sensors, machine vision, embedded machine learning and microfluidics, (2) opening the candidate to cross-disciplinary research, spanning from sensors, electronics and microfluidics to image processing and biomedicine, including academic and industrial R&D perspectives, (3) learning to self-organize, lead a research project, interact with several other teams, and disseminate scientific results.
Job opportunities	PhD candidates with expertise sensors and embedded signal processing, in particular machine vision and machine learning, are highly requested by companies developing electronic systems in multiple application areas spanning from industry, IoT and medical domains.
Composition of the research group	1 Full Professors 2 Associated Professors 0 Assistant Professors 15 PhD Students
Name of the research directors	Prof. Marco Carminati

Contacts
marco1.carminati@polimi.it +39.02.2399.6102

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	750.0 €
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.

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