

PhD in FISICA / PHYSICS - 41st cycle

INTERDISCIPLINARY Research Field: TRAINING METHODS FOR ENERGY-EFFICIENT NEUROMORPHIC ANALOG PROCESSORS

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	
	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "INFORMATION TECHNOLOGY". See https://www.dottorato.polimi.it/?id=422&L=1 for further information.
Motivation and objectives of the research in this field	The project aims to develop ultra-low-power neural networks for wearable device applications. To achieve the sub-microwatt operating powers required to ensure long battery life, the neural network will be implemented with a spiking analog neuromorphic processor in CMOS technology. The peculiarity of the hardware implementation demands a rethinking of standard neural network training algorithms designed for digital computers, taking into account the constraints imposed by the limited and imperfect computing resources available and making the best use of the potential of an analog approach.
Methods and techniques that will be developed and used to carry out the research	 design a hardware-aware simulator of analog SNNs without requiring resource-intensive physics-based simulations of the neuromorphic hardware; develop algorithms and methods for training analog SNNs, taking into account the non-idealities of the physical implementation; experimentally validate the training methods on a custom neuromorphic CMOS chip.



Educational objectives	The student will develop expertise in the emerging and interdisciplinary field of unconventional low-power computing, combining a solid understanding of the physics of the neuromorphic processor with the use of state-of-the-art machine learning techniques for analyzing temporal signals from sensors. It is expected that the student will learn to conduct an independent research project, from conception to experimental validation and the writing of results for publication.
Job opportunities	The broad applicability of the skills acquired during this research project will give the opportunity for a career in companies focused on the R&D of low-power electronic systems, particularly in the field of wearable devices.
Composition of the research group	1 Full Professors 1 Associated Professors 2 Assistant Professors 6 PhD Students
Name of the research directors	Prof. Giorgio Ferrari, Dr. Fabrizio Pittorino

Contacts

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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

Educational activities Educational activities (purchase of study books and material, funding for

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participation to courses, summer schools, workshops and conferences). Financial aid per PhD student per 3 years: max 5.707 euros per student.

Teaching assistantship: 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 and desk availability: individual use of computer and desk.