POLITECNICO DI MILANO

PhD in BIOINGEGNERIA / BIOENGINEERING - 38th cycle

PARTENARIATO PNRR Research Field: COMPUTATIONAL NEURAL MODELS OF LEARNING VIA REALISTIC SYNAPTIC PLASTICITY RULES

Monthly net income of PhDscholarship (max 36 months)
€ 1250.0
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	To tame brain complexity, the European Human Brain Project (HBP) is building a research infrastructure to help advance neuroscience, medicine, computing and brain-inspired technologies: EBRAINS. The HBP is developing EBRAINS to create lasting research platforms that benefit the wider community. The project teams transfer the acquired knowledge to make an impact in health and innovation: insights from basic research are translated into medical applications, to prepare the ground for new diagnoses and therapies. Discoveries about learning and brain plasticity mechanisms are used to inspire technologic progress, e.g. in artificial intelligence. In addition, the project studies the ethical and societal implications of the advancement of neuroscience and related fields. EBRAINS-Italy is a project funded under the PNRR aiming at launching the Italian node of EBRAINS to create a nationwide, widespread research infrastructure. https://www.ebrains.euhttps://www.humanbrainproject.eu/en/ This project research is in the framework EBRAINS INFRASTRUTTURE DI RICERCA -EBRAINS-Italy - European Brain ReseArch InfrastructureS-Italy (DEIB) CUP B51E22000150006 Decreto di Concessione D.D. 117 del 21/06/2022

	D.D. 3264 del 28/12/2021 Avviso pubblico per la presentazione di proposte progettuali per "Rafforzamento e creazione di Infrastrutture di Ricerca" da finanziare nell'ambito del PNRR Missione 4, "Istruzione e Ricerca" - Componente 2, "Dalla ricerca all'impresa" - Linea di investimento 3.1, "Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione", finanziato dall'Unione europea - NextGenerationEU
Methods and techniques that will be developed and used to carry out the research	The student?s overall research goal is to develop and test synaptic plasticity mechanisms and learning rules, designed for spiking neural network models of different brain areas (developed by other consortium partners): e.g., cerebellum, thalamus, hippocampus, basal ganglia, neocortex. The student will use point-neuron spiking neural network simulators (e.g., NEST) to develop bio-inspired and realistic short- and long-term plasticity rules, starting from existing phenomenological models and enriching them with biological features. The validated synaptic plasticity models will be made available to all users of the EBRAINS platform for future exploitation and enrichment of the brain models developed. A mechanistic understanding of synaptic plasticity underlying learning processes will impact elucidating the origin of synaptopathies. i.e., synaptic defects, which are causally associated with early appearing neurological diseases, including autism spectrum disorders, schizophrenia, and bipolar disorder, but also neurodegenerative diseases, such as Alzheimer's, Parkinson's, and Huntington's.
Educational objectives	We provide doctoral candidates with high-level scientific training, fostering and refining research and problem-solving abilities by focusing on both theoretical and experimental skills. A PhD in Bioengineering will be trained to layout, draft and carry-on original research, by leading a research group or working in a team.

	The didactic offer of the PhD in Bioengineering (https://www.phdbioengineering.polimi.it/) will be integrated by schools and workshops specific to the research topic.
Job opportunities	The skills and expertise developed during the PhD Program are suitable for national and international academic institutions, research organizations and SMEs committed to innovation, fundamental/applied research and technical development both in brain-inspired computing and AI.
Composition of the research group	2 Full Professors 1 Associated Professors 2 Assistant Professors 15 PhD Students
Name of the research directors	PROF. ALESSANDRA PEDROCCHI

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	625.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
Educational activities: funding for participation in courses, summer schools, workshops and conferences. **Teaching assistantship**: availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial of 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 regulation. A **desk** and a **PC** will be given to the student for the time needed to carry out research, with accesso to HPC resources (internal and external, e.g., from CINECA).

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