



# PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 1 - Computer Science and Engineering

PNRR 118 PNRR Research Field: MULTIMODAL MULTISENSORY ENVIRONMENTS FOR CHILDREN WITH NEUROCOGNITIVE DISORDERS

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1400.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<p>Neurocognitive Disorders (ND) are impairments in cognitive abilities including learning, memory, language, perception, problem solving, and social cognition, leading to severe limitations in everyday life. Research indicates that i) early interventions can mitigate such impairments; ii) incorporating game-based physical tasks, cognitive tasks, and multisensory stimuli into therapy/learning activities for children with ND improves attention, communication skills, sensory integration capability, and motor coordination, and makes the treatment more engaging. This PhD develops cutting-edge technologies and methods at the crossroad of computer science and bio-engineering to 1) provide new therapy/learning treatments for children with ND, encompassing game-based activities that stimulate multiple senses and involve body movements as well as problem-solving tasks; 2) offer innovative means for acquiring and analyzing data about children with ND that inform the design of more personalized intervention and of new methods of ND screening, and can be exploited in foundational research on how cognitive processes and physical/sensory experience are linked.</p>
<b>Methods and techniques that will be developed and used to carry out the research</b>	<p>The research involves methods and techniques related to cyber-physical systems, sensor networks, bio-sensing,</p>



	<p>bio-signal and motion-signal analysis, UX design, as well as psychometrics and neuro-psychology, and calls for an interdisciplinary approach at the crossroad of multiple disciplines: ICT engineering, HCI, Bio-Medical Engineering, psychology and neuroscience, contributing to advance these fields. The main outcomes are 1) an innovative scalable technological platform; it integrates multiple types of sensors (of body motion, gestures, force, and bio-signals) and actuators (of visual, audio, aroma stimuli) orchestrated by a modular computing system and combined with tools for the analysis of automatically gathered data about children’s motion, their physical behavior, and their emotional state; 2) a novel set of physical+cognitive multisensory activities for children with ND developed using the above platform; 3) the rigorous validation - through empirical studies - of the effectiveness of such tools for ND treatment; 4) a unique corpus of data about ND resulting from such studies.</p>
<p><b>Educational objectives</b></p>	<p>The candidate will develop a multi-disciplinary engineering profile based on advanced methodological and technical competences in cyber-physical systems, interaction design, bio-sensing, and data analysis along which specific know-how about mental health and digital health services. The candidate will also develop research skills in the above fields, and an attitude to research for social impact.</p>
<p><b>Job opportunities</b></p>	<p>The need for digital tools supporting mental health interventions has been growing enormously in the past 5 years (with COVID-19 accelerating this demand and promoting, for examples, the development of virtual mental health services). Increased awareness and social acceptance of mental health problems, and the increasing attention of companies about monitoring and supporting employers’ mental health, are providing favorable business opportunities: globally, the mental health services market is expected to reach US\$ 500 billion by 2025.</p> <p>This situation is raising an enormous - and growing - interest of industry and investors in the field. It is therefore</p>



	<p>evident that this PhD opens up a huge number of top level professional opportunities - in large enterprises that are worldwide leaders in the digital health field, as well as in small startups devoted to develop new niche solutions.</p> <p>The research interest in digital innovation for mental health is also growing, as witnessed by the increasing number of dedicated conferences/journals/articles in the area. This suggests that for a candidate willing to undertake the academic carrier, there will be many opportunities for publication, and - potentially - several university venues where to apply for post-doc research positions.</p>
<b>Composition of the research group</b>	<p>0 Full Professors                  1 Associated Professors                  4 Assistant Professors                  3 PhD Students</p>
<b>Name of the research directors</b>	FRANCA GARZOTTO

<b>Contacts</b>	
<p>E-mail: <a href="mailto:franca.garzotto@polimi.it">franca.garzotto@polimi.it</a>                      Tel: +39 023 23993505;  <a href="https://i3lab.polimi.it/">https://i3lab.polimi.it/</a></p>	

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

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

<b>National Operational Program for Research and Innovation</b>	
<b>Company where the candidate will attend the stage (name and brief description)</b>	MIT- Mac Govern Institute for Brain Research, Cambridge
<b>By number of months at the company</b>	6
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	MIT- Mac Govern Institute for Brain Research, Cambridge
<b>By number of months abroad</b>	6



**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

Neurocognitive Disorders (ND) are impairments in cognitive abilities including learning, memory, language, perception, problem solving, and social cognition. ND affects 15-20% of the child population. This PhD develops cutting-edge technologies and methods to provide new therapy/learning treatments, and to offer innovative means for acquiring and analyzing data about children with ND that inform the design of more personalized intervention and of new methods of ND early screening.

Neurocognitive Disorders (ND) is a mental health disease that is estimated to affect 15-20% of the child population. It has a devastating impact on children's and their families' life, and represents a heavy burden at social and economic level at large. Early interventions are known to mitigate the ND impairments and their effects, which in turn improves children's well-being, autonomy, and quality of life, helps them learn to manage their symptoms and achieve their full potential, and alleviates the social and family burden of taking care of them. By providing innovative methods and tools for therapy/learning/screening of children with ND, this research contributes to achieve the above goals. The research is fully in line with PNRR goals related to Mission 6 (Health) - M6C2 (Innovation, research, and digitalization of national health service). Citing the PNRR strategic plan concerning Mission 6, there is a strong need for "identifying qualitative, TECHNOLOGICAL and organizational standards" "restructuring" a range of services ranging from primary care, to family counseling, to the MENTAL HEALTH area.?"

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 per 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.