



PhD in MODELLI E METODI MATEMATICI PER L'INGEGNERIA / MATHEMATICAL MODELS AND METHODS IN ENGINEERING - 38th cycle

**PNRR_351_DOTT_RICERCA Research Field: PHYSICS-INFORMED STATISTICAL
LEARNING FOR HIGH-DIMENSIONAL AND COMPLEX NEUROIMAGING DATA**

Monthly net income of PhDscholarship (max 36 months)
€ 1325.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
<p>Motivation and objectives of the research in this field</p>	<p>Neurosciences require the analysis of increasingly complex and high-dimensional data, coming from neuroimaging modalities such as functional Magnetic Resonance Imaging (fMRI) and MagnetoEncephaloGraphy (MEG). The analysis of these complex data poses new challenging theoretical and methodological problems to data science and calls for the definition of new statistical learning methods, capable to handle complicated data structures and to account for the available problem-specific knowledge on the phenomena under study. Innovative data analysis methods, that merge approaches and ideas from statistics and scientific computing, may lead to groundbreaking advances in our knowledge of brain functioning, as well as on basic underlying mechanisms of neuronal disorders and of rare neuronal pathologies and emerging mental diseases. As such, the proposed activity fully meets some of the objectives of the National Recovery and Resilience Plan (PNRR) concerning the mission M6C2 (Innovazione, Ricerca e Digitalizzazione del Servizio Sanitario Nazionale). Moreover, it contributes to the PNRR aim to increase knowledge and competencies on big data as a key enabling technology. Finally, the proposed project strongly fosters interdisciplinarity and participation to international research networks.</p>



<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The PhD candidate will define new functional data analysis methods for complex data arising from current neuroimaging modalities such as fMRI and MEG. These will include regression and classification methods for these high-dimensional functional data and will permit the inclusion of the available problem-specific knowledge on the phenomena under study, including the complicated brain anatomy. The research will be carried out in collaboration with the Fondazione IRCCS (Istituto di Ricovero e Cura a Carattere Scientifico) Istituto Neurologico Carlo Besta, that to the consolidated collaboration with Dr. Eng. Ferruccio Panzica, Responsabile della struttura di Ingegneria Clinica, Dipartimento di Diagnostica e Tecnologia, Unità Operativa Complessa di Neurofisiopatologia. Moreover, the research will also profit of the consolidated collaboration with Prof. John Aston (University of Cambridge), expert of the statistical analysis of complex neuroimaging data and member of Cambridge Neuroscience, the Interdisciplinary Research Centre for Neurosciences of the University of Cambridge.</p>
<p>Educational objectives</p>	<p>The research will be carried out within a team of statisticians and neuroscientists. Within this lively and stimulating academic and research environment, the doctoral student will become a skillful data scientist, with expertise in advanced statistical learning and neuroimaging data.</p>
<p>Job opportunities</p>	<p>Data scientists are the most in-demand job today, among high-qualification jobs. In all industrial and business sectors, the demand for data scientists continues to outpace supply and dominates both the US and the European job market.</p>
<p>Composition of the research group</p>	<p>3 Full Professors 4 Associated Professors 2 Assistant Professors 14 PhD Students</p>
<p>Name of the research directors</p>	<p>Laura M. Sangalli</p>

<p style="text-align: center;">Contacts</p>	
<p>Prof. Laura M. Sangalli: laura.sangalli@polimi.it,</p>	



tel. 02 2399 4554, <http://mox.polimi.it/users/sangalli>

Additional support - Financial aid per PhD student per year (gross amount)			
	1st year	2nd year	3rd year
Housing - Foreign Students	1500.0 € per student	0.0 € per student	0.0 € per student
max number of financial aid available: 3, given in order of merit ..			
Housing - Out-of-town residents (more than 80Km out of Milano)	--		

Scholarship Increase for a period abroad	
Amount monthly	662.5 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	
By number of months at the company	0
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	6

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

Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year

1st year: max 1.800,47 euros

2nd year: max 1.800,47 euros

3rd year: max 1.800,47 euros

The PhD students are encouraged to take part in activities related to teaching, within the limits allowed by the regulations. 1 individual PC per student + several shared PC.

Access to one cluster with 32 processors and 384 GB RAM, and to several multi-processor servers and 1 individual desk per student are granted.