



MATHEMATICS, COMPUTERS SCIENCES, STATISTICS

Director prof. Matteo Focardi

PROGRAMME	Centri Nazionali – CN_1	CUP	B83C22002830001
SCHOLARSHIP	1		
TITLE OF THE SCHOLARSHIP	Meshless methods for numerical simulation		
RESEARCH TOPIC	Study of meshless methods for the numerical solution of linear and nonlinear differential problems on planar, tridimensional, or surface spatial domains. Analysis of data-driven techniques for the development of adaptive meshless schemes for accurate and efficient simulation of shocks. Test and analysis of the developed algorithms and their implementation also in parallel computing environments.		
Study/Research periods abroad	3 months		
INTERVIEW			
LANGUAGE	DATE	TIME	MODE
Italian/English	30 th November 2022	9:30 a.m.	videocall

PROGRAMME	Partnership Estesi – PE_8 Age-it	CUP	B83C22004800006
SCHOLARSHIP	2		
TITLE OF THE SCHOLARSHIP	Quantitative analysis of family life courses and family complexity		
RESEARCH TOPIC	The project will address family life courses and family complexity in Italy (and in a pan-European perspective) using novel data (integration between administrative data and survey data as well as experimental data) and advanced statistical methods (methods for longitudinal data analyses and for policy evaluation). The specific project consists in the analysis of whether, and to what extent, economic factors as well as the mounting importance of uncertainty affect family life courses and family complexity. In addition, this theme analyses the impact of existing policies, at the national and (sub-)regional level, on individual and aggregate fertility in Italy, through the implementation of advanced methods for causal analysis.		
Study/Research periods abroad	3 months		
TITLE OF THE SCHOLARSHIP	Quantitative analysis of family life courses in old age		
RESEARCH TOPIC	The project will address family life courses and family complexity in Italy (and in a pan-European perspective) using novel data (integration between administrative data and survey data as well as experimental data) and advanced statistical methods (methods for longitudinal data analyses and for policy evaluation). The specific project consists in the analysis of family life courses in old		



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	age (union dissolution, re-partnering, living apart together relationships). This theme will also examine the populations of kinless older adults by (i) investigating gender and socioeconomic differences in the likelihood of experiencing kinlessness and the health characteristics of these groups, and (ii) forecasting the prevalence of different types of kinlessness patterns, focusing in particular on the number of Italians who are likely to reach different ages with and without a partner, children, grandchildren and siblings.		
Study/Research periods abroad	3 months		
INTERVIEW			
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INFORMATION ENGINEERING

Director prof. Fabio Schoen

PROGRAMME	Centri Nazionali – CN_1	CUP	B83C22002830001
SCHOLARSHIP	1		
TITLE OF THE SCHOLARSHIP	Development of an intelligent, distributed, reliable, and economic monitoring system to support the "green transition" and resilience in electricity distribution networks, based on artificial intelligence and machine learning techniques		
RESEARCH TOPIC	Considering that the electricity system is undergoing a phase of deep transformation due to the decarbonization processes, the transition to electric mobility and the wide of renewable energy, the impact on distribution networks can become critically. In this context, the research activities will be in the area of the green transition and digital transformation pillars, as defined by Regulation (EU) 2021/241. The first goal is to study the evolution of Advanced Metering Infrastructures (AMI) and their implementation under different scenarios, considering the development of loads and distributed generation. Then, the expected impacts on the infrastructures of different load profiles will be analyzed, evaluating possible investments to improve the efficiency of the electrical distribution network. The second goal will focus on the potential benefits of local flexibility schemes to level the load curve, improve the voltage profile and increase network reliability and resilience. The functional requirements of flexibility services, possible market models, and remuneration schemes will be explored. The research activity will also focus on the technological solutions needed to implement the algorithms based on artificial intelligence for detection and identification of faults in the grid and to procure local flexibility services on medium- and low-voltage networks.		
Study/Research periods abroad	1 - 3 months		
INTERVIEW			
LANGUAGE	DATE	TIME	MODE
Italian/English	1 st December 2022	09:00 a.m.	Videocall

PROGRAMME	Ecosistemi dell'Innovazione – THE Tuscany Healthcare Ecosystem	CUP	B83C22003920001
SCHOLARSHIP	3		
TITLE OF THE SCHOLARSHIP	Artificial Intelligence methods and techniques for the understanding of texts and risk estimation, Predictive models for healthcare claims management		
RESEARCH TOPIC	The student will be able to enter the context of the DISIT lab for the development of the doctoral thesis and its training in the AI, Explainable AI and NLP (natural language processing) fields, in close collaboration with the Careggi University Hospital in the context of the ecosystem of innovation of the PNRR called "The Tuscany Health Ecosystem". The PhD student will have to deal with the study and development of AI solutions for understanding the text, for example with BERT techniques, Bidirectional Encoder Representations from Transformers, explainable BERT, for understanding		



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	<p>the text as well as the development of AI risk prediction models. The application domain is that of the medico-legal area, which specializes in medico-legal terminology and the assessment of the risk of litigation. Integrations are envisaged with ontologies and knowledge bases in the medical field, and with graph neural network techniques, GNN, as well as transfer learning, generative techniques, etc. The objectives can be multiple, the prediction of the risk of litigation, the assessment of complexity, the assessment of influence of the various factors (type of error and damage, discipline, competence of consultants and lawyers, type of patient, etc.), classification of disputes, production of summaries, prediction of evolution and economic impact, automatic anonymization, etc.</p> <p>The University Hospital of Careggi is a national center and the primary hospital structure for Tuscany. DISIT Lab is one of the most active labs in Tuscany on AI / XAI and NLP issues, it is involved in the CBDAl (Big Data AI Tuscany regional center), CINI Big data node, etc., also in relation to the platforms https://www.snap4city.org and Twitter Vigilance of DISIT, and to the collaboration with various bodies on these issues of AI and NLP.</p>
Study/Research periods abroad	1 - 3 mesi
TITLE OF THE SCHOLARSHIP	Implementing a novel computational framework for the diagnostic use of future generation sequencing
RESEARCH TOPIC	<p>The advent of second-generation sequencing, and more recently of third generation long read sequencing platforms has completely changed our capability to capture the molecular characteristics underlying diseases at a fine grade. However, the data generated by these technologies requires very complex and standardized computational methods, especially when used for diagnostics and precision medicine applications. The research will focus on developing a software platform that stakeholders of the regional health system can exploit for different types of omics data analysis (genomics, epigenomics and transcriptomics). The platform will provide tools for classification, interpretation, visualization, and reporting as well as AI-based methods for the identification of diagnostic, prognostic, and predictive biomarkers. The system will incorporate state-of-the-art computational methods for the analysis of genomics, epigenomics, transcriptomics.</p>
Study/Research periods abroad	1 - 3 mesi
TITLE OF THE SCHOLARSHIP	Integration of multimodal imaging for development of automated diagnosis decision support
RESEARCH TOPIC	<p>Medical imaging techniques such as X-rays, CT, and MRI generate large amounts of data that form the basis of radiomics, that allows the extraction of qualitative and quantitative information not directly available from clinical doctors. Recent research aims at creating innovative image and data fusion techniques. The research will focus on the integration of standardized omics and imaging data, and analytic software components to support medical diagnosis. This platform will be based on a sophisticated system design to meet clinicians' requirements and support customization of the analysis pipeline, while at the same time providing an adequate usability in clinical practice. The research will contribute to the development of a software platform that stakeholders of the regional health system can exploit for different types of omics data (genomics, transcriptomics, radiomics) and integrate them in order to create comprehensive models of the pathology of interest. The</p>

	platform will provide tools for classification, interpretation, visualization, and reporting as well as AI-based methods for the identification of diagnostic, prognostic, and predictive biomarkers. The main activities that will be carried out during the research project are: 1. Improve the usability of images generated by different imaging techniques, making it easier the visual analysis of complex data by clinicians. 2. Creation of a prototype of an integrated visualization system for displaying 3D multimodal images, deriving from different methods, both conventional and - omics and decision cues superimposed with the images. 3. Development of novel computational strategies based on AI for exploiting omics data for early diagnosis.		
Study/Research periods abroad	1 - 3 months		
INTERVIEW			
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PROGRAMME	Partnersiati Estesi – PE_8	CUP	B83C22004800006
SCHOLARSHIP	1		
TITLE OF THE SCHOLARSHIP	Biosignal processing and ad-hoc systems design for psychophysiological evaluation in fragile people		
RESEARCH TOPIC	This research topic is aimed at the 'implementation of advanced methods of multivariate signal analysis and the design of dedicated tools for comprehensive assessment of psychophysiological state in frail subjects. Specifically, the methods and tools should aim at maintaining the state of well-being in healthy subjects or those affected by aging-related diseases. Mathematical characterization of neurophysiological state through analysis of biosignals such as electroencephalogram (EEG), electrocardiogram (ECG), and electrodermal response (EDA) and beyond, and extraction of parameters through the time domain, frequency domain, and through time-varying dynamical systems theory is required. Dedicated model-based artificial intelligence algorithms will be implemented with the goal of predicting and anticipating possible changes in health status.		
Study/Research periods abroad	3 months		
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