POLITECNICO DI MILANO

PhD in BIOINGEGNERIA / BIOENGINEERING - 39th cycle

THEMATIC Research Field: DATA-DRIVEN DIGITAL TWIN FOR HYPERTROPHIC CARDIO-MYOPATHY PATIENTS

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	
Motivation and objectives of the research in this field	Hypertrophic cardiomyopathy (HCM) is a multifactorial and multiorgan disease with multiple manifestations, giving rise to a range of symptoms and complications including chest pain, arrhythmias, and sudden cardiac death. It affects all age groups from children to the elderly, and can cause not only cardiac, but also mental effects and various comorbidities that lower the quality of life for those affected. HCM is a leading cause of death among young athletes. HCM patient stratification and disease management is an unsolved, open challenge.
Methods and techniques that will be developed and used to carry out the research	The research will focus on developing different AI/ML methods for: a) discovering new data-driven biomarkers at the patient and population levels using heterogeneous data sources such as literature results, demographic information, patient health records, ECG signals, CMR and echocardiography images; 2) developing multilevel clustering and prediction methods for stratification, prediction of disease progression, and treatment response, for patients with HCM; and 3) validating the models internally and externally (across cohorts) using accessible retrospective datasets, and refining de novo models and methodology based on the results of evaluations for both research and clinical use. All AI/ML models and methodologies will undergo rigorous evaluation according to the FAST principles
Educational objectives	

	We are confident that the highly multidisciplinary knowledge derived from the studies undertaken during this PhD project will yield a highly specialized academic profile with both advanced technical skills for a computational precision medicine approach and a unique clinical translational potential as related to diagnostic/prognostic-driven treatment allocation.
Job opportunities	Data Scientist in Hospital and/or companies. Research Scientist expert on the processing of biomedical data at to be enrolled in Technical University and School of Medicine laboratories
Composition of the research group	1 Full Professors 2 Associated Professors 0 Assistant Professors 1 PhD Students
Name of the research directors	Proff. Luca Mainardi - Pietro Cerveri

Contacts
Prof. Luca Mainardi (https://www.deib.polimi.it/eng/people/details/252284) Prof. Pietro Cerveri (https://www.deib.polimi.it/eng/people/details/923992) Prof. Valentina Corino (https://www.deib.polimi.it/eng/people/details/155008) Eng.MarionTacconne (https://www.deib.polimi.it/eng/people/details/2121374)

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	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The candidate will engage in a comprehensive educational program encompassing specialized technical domains and essential soft skills. Additionally, he/she will actively participate in teaching assistantship, overseeing master thesis students. The research undertaken will demand the integration of interdisciplinary expertise, specifically in cardiovascular physiology and artificial intelligence tools. The expected contribution of the PhD candidate will involve making significant scientific breakthroughs in cardiovascular signal processing and analysis, with the

findings published in reputable international, peer-reviewed journals. To support the PhD program's development, the candidate will have access to state-of-the-art high-performance computing facilities.