POLITECNICO DI MILANO

PhD in BIOINGEGNERIA / BIOENGINEERING - 39th cycle

THEMATIC Research Field: AI-CORPS - TRUSTWORTHY, INTEGRATED ARTIFICIAL INTELLIGENCE TOOLS FOR PREDICTING HIGH-RISK CORONARY PLAQUES

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	Coronary artery disease (CAD) is among the leading cause of death and disability. Identification of patients at high risk of cardiovascular events is pivotal. However, current risk stratification based on imaging and known biomarkers is suboptimal. This PhD position is granted in the framework of a FRRB project AI-Corps - Trustworthy, integrated Artificial Intelligence tools for predicting high-risk CORonary PlaqueS - in collaboration with centro Cardiologico Monzino and the project objective is to develop a multicriteria decision model for non-invasive assessment of vulnerable atherosclerotic patients and to evaluate its ability to predict the occurrence of an adverse event in intermediate-to-high risk patients with suspected or known CAD. The planned workflow consists inusing a retrospective cohort of patients undergoing clinically indicated coronary angiography (CCTA) to develop an integrated application for automatic coronary artery segmentation, quantitative plaque analysis, biomechanics and fluid dynamics.
Methods and techniques that will be developed and used to carry out the research	The project will consists of 2 tasks. The first one will consists in the development of a 3D U-Net architecture to segment CCTA images and extract both plaque and vessel lumens. The second Task will consist in running CFD simulations using the geometries extracted in Task 1 to automatically compute the coronary Flow Fractional Reserve and in particular the 3D pressure fields at specific regions of interest

	specific regions of interest
Educational objectives	The PhD candidate will learn 1) how to process clinical images using deep learning techniques and to assess the quality of the obtained results; 2) how to run CFD simulation using semiautomated pipelines and 3) how to relate to clinicians in order to make the process of transferring skills and information effective in both directions
Job opportunities	The PhD student will acquire useful skills for a future employment in a) academic contexts, b) in research contexts in clinical laboratories, c) in companies that deal with image processing and data mining, d) in companies that offer simulation services
Composition of the research group	1 Full Professors 2 Associated Professors 2 Assistant Professors 3 PhD Students
Name of the research directors	PROF. ALBERTO CESARE LUIGI REDAELLI

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	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
The PhD student will be hosted in the doctoral open space and will receive a laptop for daily activities; he will also have access to the biomechanics research laboratory and to the computational facilities of the research group