PhD in BIOINGEGNERIA / BIOENGINEERING - 39th cycle

THEMATIC Research Field: DEVELOPMENT AND APPLICATION OF ADVANCED ARTIFICIAL INTELLIGENCE METHODS FOR THE PROCESSING AND ANALYSIS OF MR IMAGES FOR THE STUDY OF SKELETAL MUSCLE

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	MRI is a technique that enables the anatomical, structural and functional investigation of various organs and tissues in the human body. However, MRI images need complex and time-consuming processing and analysis to derive meaningful information and insights. AI, and in particular deep learning, is a field that is advancing rapidly and can facilitate the enhancement and automation of MRI image processing and analysis. Deep learning is a branch of machine learning that employs artificial neural networks to learn from large data sets and accomplish tasks such as image segmentation, classification, reconstruction, restoration, registration, and synthesis. Deep learning has shown remarkable results in various domains of medical imaging.The main objectives of deep learning in MR image processing and analysis are: •To enhance the quality and resolution of MR images by removing artefacts and noise. •To segment and classify MR images into different regions or categories based on anatomical or functional features •To synthesize and register MR images from different modalities or perspectives •To interpret and diagnose MR images based on quantitative or qualitative measures The PhD course will cover fundamental principles and applications of deep learning to MRI image processing and analysis, with a specific focus on skeletal muscle

Methods and techniques that will be developed and used to carry out the research	During his/her PhD, the student will develop advanced Deep Learning methods for processing and analysis of MR images of the skeletal muscle. Specifically, DL approaches, such as CNN, RNN, transformer AI, will be used to improve muscles segmentations and parametric maps generations. Multiparametric MRI data will be used to find biomarkers for the assessment of muscle atrophy, fat infiltration, inflammation/edema and microstructural modifications in healthy and pathological individuals. The PhD candidates will gain competencies in image processing and analysis, using multiparametric data, and artificial intelligence in biomedical applications. The PhD project will be carried out in cooperation with the Institute of Biomedical Technologies of the National Research Council.
Educational objectives	We provide doctoral candidates with high-level scientific training, fostering and refining research and problem-solving abilities by focusing on both theoretical and experimental skills. A PhD in Bioengineering will be trained to layout, draft and carry-on original research, by leading a research group or working in a team. The didactic offer of the PhD in Bioengineering (https://www.phdbioengineering.polimi.it/) will be integrated by schools and workshops specific to the research topic.
Job opportunities	The skills and expertise developed during the PhD Program are suitable for national and international academic institutions, research organizations and high-tech SMEs committed to innovation, fundamental/applied research and technical development both in imaging and AI. Examples: product specialist, application specialist, R&D.
Composition of the research group	2 Full Professors 2 Associated Professors 7 Assistant Professors 3 PhD Students
Name of the research directors	GIUSEPPE BASELLI - ALFONSO MASTROPIETRO

POLITECNICO DI MILANO

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
ITB-CNR will provide a desk and a PC to the candidate during the whole PhD period.