



PhD in BIOINGEGNERIA / BIOENGINEERING - 39th cycle

PARTENARIATO PNRR Research Field: DEVELOPMENT OF PREDICTIVE MONITORING FROM ROUTINELY COLLECTED VITAL SIGNS FOR RISK STRATIFICATION IN CRITICALLY ILL 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

It is estimated that annually 31.5 million people have sepsis and 19.4 million have severe sepsis, with a hospital mortality of 17% and 26%, respectively. Among survivors, a high percentage experiences physical and psychological sequelae, including cognitive impairment. Sepsis has therefore been called a "hidden" healthcare disaster. Survivorship from sepsis is increasing, but the burden of survivorship is high: among 3-years severe sepsis survivors, up to 75% suffer from functional disability and about 17% suffer from cognitive impairment. The ensuing definition of new targets will enable to overcome the shortcomings of current therapies, which are mainly based on empirical evidence and not to act on the root causes. Critical care physicians rely heavily on the monitoring of hemodynamic signals, or measures which convey system-wide information on the cardiovascular status or organ functionality of the patient, but they do not provide any insight into any specific mechanisms. The effectiveness of interventions such as fluid resuscitation and vasopressor administration is limited. Fluid and vasopressors may restore blood pressure within minutes, but the target of hemodynamic stability alone doesn't assure the fully recovery. This project has the ambitiousness to provide new models for complex data collected at different biological levels so to have algorithms for a better stratification of the patients integrating standard clinical scores and indices and to



	<p>provide new therapy target</p> <p>This project research is in the framework of?ANTHEM: AdvaNced Technologies for Human-centrEd Medicine?Codice PNC0000003 CUP B53C22006720001PIANO NAZIONALE COMPLEMENTARE (PNC)Decreto Direttoriale n. 931 del 6 giugno 2022 AVVISO PER LA CONCESSIONE DI FINANZIAMENTI DESTINATI AD INIZIATIVE DI RICERCA PER TECNOLOGIE E PERCORSI INNOVATIVI INAMBITO SANITARIO E ASSISTENZIALE da finanziare nell?ambito del PNC</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>Hemodynamic signals, such as invasive arterial blood pressure (ABP), are continuously recorded in intensive care unit (ICU) patients and may contain dynamic signatures of the cardiovascular status of the subject, they can give insights on vascular function and blood flow propagation, adding important and complementary information to the static hemodynamic indices typically measured (e.g. mean values). The morphological characteristics of the ABP and flow convey the changes in cardiac properties and in arterial properties and represent an important source of information to investigate the interactions among heart, conduit vasculature and microvascular beds.The project consist in improving cardiovascular models to extract useful indices to better stratify critically ill patients so to tailor the therapy and prevent long term sequaleae of the pathology.The techniques involve clinical monitoring, mathematical modelling and machine learning techniques.The candidate will work with top faculty and researchers from hospitals, e.g. Humanitas Hospital.</p>
<p>Educational objectives</p>	<p>The PhD candidate will work with top faculty and researchers from clinical research unit and hospitals, and assist in experimental setting-up and/or data acquisition in order to gain familiarity with the clinical context. The candidate will work in international and multidisciplinary team and will enhance the communication skills by presenting results at internal meetings and national or international conferences.</p>



Job opportunities	The doctor of philosophy in bioengineering prepares students for bioengineering careers in industry, government or academia. An advanced degree in this area provides numerous opportunities to work in health care, biomedical industry, government regulatory agencies and academia.
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	PROF. MANUELA FERRARIO - PROF. MARTA CARRARA

Contacts	
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Prof. Marta Carrara, Politecnico di Milano Marta.carrara@polimi.it	

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
<p>The PhD student will be involved in educational activities along with teaching assistantship covering topics of signal processing, mathematical modeling and machine learning. A shared desk and a computer will be given to the student at B3Lab for the time needed to carry out the research. The research group will be composed by 1 associate professor and 1 assistant professor from Politecnico di Milano, along with other PhD students involved in related projects. The candidate will be involved in the activities of B3Lab. The candidate will collaborate with medical doctors involved in the project.</p>



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