



PhD in BIOINGEGNERIA / BIOENGINEERING - 40th cycle

INAIL Research Field: EVALUATION OF THE EFFECTIVENESS OF REHABILITATION PATHS FOR PEOPLE WITH WORK-RELATED PATHOLOGIES: MOVEMENT ANALYSIS AND ARTIFICIAL INTELLIGENCE APPROACHES FOR MOVEMENT CLASSIFICATION AND CHARACTERIZATION

Monthly net income of PhDscholarship (max 36 months)

€ 1600.0

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

The PhD Scholarship is sponsored by INAIL, the National Institute for Insurance against Accidents at Work, a public non-profit entity safeguarding workers against physical injuries and occupational diseases.

INAIL objectives are reducing injuries, protecting workers performing hazardous jobs, and facilitating the return to work of people injured at the workplace. In particular, INAIL has active movement analysis laboratories throughout the country that use integrated technologies for the biomechanical evaluation of postural and motor alterations resulting from the musculoskeletal pathologies. In this context, a need emerges to develop structured and standardized methods for evaluating functional recovery following traditional and innovative rehabilitation therapies, to characterize and classify motor phenotypes in specific pathological conditions and to implement movement acquisition methods using systems that can work in outdoor conditions.

This PhD project aims to analyze movement patterns of people with musculoskeletal disorders assisted by INAIL, focusing on the evaluation of movement phenotypes and on new treatment outcomes detections.

The specific aims of the PhD project are:



	<ul style="list-style-type: none"> - pre-post rehabilitation/orthotic/prosthetic treatment evaluation through the use of movement analysis systems; - use of methods specific to artificial intelligence for the automatic classification of movement and for the extraction of features specific to different pathologies; - application of markerless approaches for the three-dimensional reconstruction of human movement; - analysis of the impact of sport on rehabilitation paths of people with orthopedic/neurological/amputation pathologies.
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>Empirically, the research will be structured into four main phases.</p> <p>Preliminarily, the candidate will carry out a thorough literature review to define the state of the art in the fields of</p> <ol style="list-style-type: none"> 1) protocols definition for the evaluation of upper and lower limbs tasks to detect specific joint movement alterations based on marker-based motion analysis tests 2) previous studies about the application of AI methods to dataset with motion analysis data (kinematics, kinetics, EMG) 3) markerless systems able to detect three-dimensional reconstruction of the human movement 4) previous studies about the effect of sport as possible rehabilitation therapy. <p>The second step will be an in-depth analysis of databases already available in the INAIL motion analysis Lab.</p> <p>The third step will be the definition of improvement scenarios in terms of both processes in data acquisition (pre and post-treatment) and data analysis. This will include designing enhanced processes for data collection, integration, and analysis, as well as exploring</p>



	<p>the application of advanced machine learning and artificial intelligence techniques. The goal will be to develop innovative frameworks that enable more precise pathological patterns and prediction of pathological evolution, evaluating specific cases and predictive modeling.</p> <p>Finally, the fourth step will involve the identification of equipments and algorithm for a quantitative analysis based on markerless systems.</p> <p>The PhD Project will be carried out in cooperation with INAIL, in all phases, hence with a presence in Rome at the headquarters and in the motion analysis Labs of INAIL.</p>
Educational objectives	<p>The PhD project will be developed in close relationship with INAIL and it will be academically rigorous and innovative. The candidate will be trained in the methodologies to best develop not only the project but also her/his skills to become a leading researcher. In the end the candidate will have the skills and abilities to operate as a researcher and innovator mastering the problems to be addressed with qualitative and quantitative approaches.</p> <p>The PhD project requires written and oral knowledge of a fluent Italian language and compliance with INAIL data privacy regulations.</p>
Job opportunities	The PhD student will have the opportunity to create a background and skills useful for further job applications.
Composition of the research group	1 Full Professors 1 Associated Professors 4 Assistant Professors 2 PhD Students
Name of the research directors	Manuela Galli; Giorgia Chini; Alberto Ranavolo

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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	800.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>The PhD student will have a desk at INAIL and at Politecnico di Milano.</p> <p>Some training courses and activities will be planned together with the participation in national and international conferences and events.</p> <p>Opportunities in terms of teaching activities and support to students during thesis preparation will be considered.</p>