UNIVERSITY OF BRESCIA

PhD Program
in
TECHNOLOGY FOR HEALTH

Wearable technologies and biomechanical modeling: a subject-specific approach to the analysis of human movement

PhD Candidate: **Giorgio Cassiolas**

Email: *g.cassiolas@unibs.it*

XXXIV Cycle

Tutor: Prof. Nicola Francesco Lopomo

Background

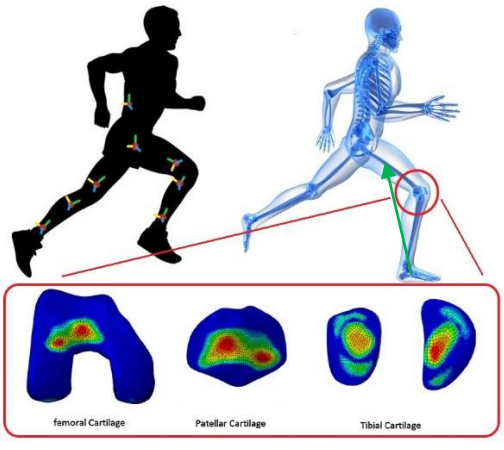
Gait analysis is a common tool exploited in clinical practice for the assessment of gait disturbances, evolution of neuromusculoskeletal diseases, and personalized rehabilitative treatment. Nevertheless, classical gait analysis methodologies are intrinsically indoor evaluation instruments, which may be not representative of everyday outside world. In order to overcome this limitation, the use of wearable sensors is emerging as solution for kinematics monitoring in realistic daily life conditions, thereby allowing the acquisition of a larger amount of individual data for better diagnostic and prognostic purposes.

Objectives

The main objective of the project is the development and optimization of an Inertial Measurement Units (IMUs) system able to accurately quantify both kinematics and ground reaction forces during various motor tasks. A multifactorial analysis of the collected data will provide information about pathophysiological conditions of articulation tissues.

Methodologies

Wearable sensors technology will be calibrated against video-based gait analysis and an algorithm for the ground reaction forces detection will be implemented. Subject-specific multiscale modelling will elaborate kinematic and kinetic data, allowing the assessment of various parameters such as joint contact forces, joint contact areas and stresses on articular tissues. The relationship between kinematics and kinetics with tissues condition will be investigated in order to develop an injury risk algorithm.



Expected Results and Impact

The exploitation of wearable technologies in gait analysis will contribute to the improvement of knowledge around load bearing capacities of body articulations. An early individuation of aberrant modifications of gait pattern will have the potentiality to support the planning of the most appropriate corrective treatment for prevention of joint degenerative pathologies or injuries.