



Integrated Approaches based on Human Movement Analysis to support Functional Evaluation of Subjects with Neuro-Musculo-Skeletal Disorders

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XXXV Cycle

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Background

By means of quantitative motion analysis, we can obtain an accurate and detailed measurement of a patient's posture and movement, detect their alterations due to a pathology and the effect of a specific rehabilitative treatment. Conventionally, the assessment is performed by means of marker-based optoelectronic systems and force plates in specially designed laboratories. In recent years, the availability of low-cost wearable devices, mainly based on inertial measurement units, has facilitated also the possibility of assessment in outpatient context.

Objectives

The aim of my research is to apply the most actual approaches to improve the functional assessment through the paradigm of motion analysis considering several clinical contexts. To achieve this aim, my project integrates different technologies and methodologies related to movement acquisition, statistical modelling (e.g. machine learning) and data analysis.

Methodologies

This project considers data about human movement to support functional evaluation of subjects with neuro-muscular-skeletal disorders. Within this work, I collect information about human motion by using both tridimensional marker-based optoelectronic systems and wearable devices. Starting from this data and introducing statistical models, such as machine learning approaches, it is possible to identify and recognize patterns that are specific for each pathology. This approach allows to acquire a general knowledge starting from previous experience and creating a statistical model of the space of the events; in this way the model can formulate a coherent prediction when new data are received. Furthermore, through different structured and hierarchical learning methodologies I focus on the possibility to classify and predict properties that are "hidden" within the data and which can be used to support the assessment of different pathological conditions related to the neuro-musculo-skeletal system.

Expected Results and Impact

Thanks to this research, in the close future a computer-aided system will be able to automatically identify parameters related to a specific movement realized by a subject, thus to support the diagnosis and suggest patient-specific treatments, ensuring faster and more efficient clinical protocols.