36 months PhD Position

Title: Intelligent inference of MSK tissues from markerless Motion Capture (MoCap) and Statistical Shape-Intensity Models (S2IM)

Location: LaTIM, INSERM UMR 1101, Brest, France

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Grant: LABEX CAMI, http://cami-labex.fr/

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Application deadline: 31 May 2021 Reference: **PhD-S2IM**

Motivations: The determination of musculoskeletal information (MSK) is of great interest for several clinical specialties, e.g. in functional rehabilitation to detect possible deficiencies, or in orthopaedic surgery to diagnose pathology or determine relevant intraoperative clinical parameters. This clinical information is usually assessed today using optical markers that can be recognised by three-dimensional (3D) locators. These markers can either be attached to instruments or placed directly on the bone or skin depending on the clinical application. Although these systems have been shown to significantly improve clinical benefits in many settings, they are not widely adopted by the clinical community today mainly due to their price and complexity of use

Objectives: The objective of this thesis is therefore to develop new algorithms for markerless localisation of MSK tissue from skin envelope analysis in order to provide physicians with clinically relevant parameters in a non-invasive manner.

Scientific content: Several studies have analysed the impact of skin movement on the accuracy of locating underlying bony structures using skin markers alone. It has been shown that by increasing the number of skin markers, improving their positioning and incorporating a priori modelling of the bone joint, accuracy can be significantly improved. More recently, it has been shown, in the context of a research work emerging from the labex CAMI, that it would be possible to estimate with sufficient accuracy the mechanical axis of the femur, using sparse markers and a statistical shape model (SSM). Based on these preliminary results, we would like to investigate the use of RGB-D motion capture (MoCap) to markerlessly acquire the skin envelope and extract some skin patterns related to the underlying MSK tissue. Based on this information, we want to derive clinically relevant and interpretable parameters.

Candidate profile

- Strong knowledge of image processing and applied mathematics
- Knowledge in biomechanics or robotics is an advantage.
- Strong knowledge of object-oriented programming languages (C++, Java), python.
- Knowledge of VTK, CAMI-TK and Scalismo libraries is an advantage.
- English, read and written, is mandatory - French is an asset.
- Good communication skills and ability to work in a team.

Interested candidates (Please use the subject **PhD-S2IM** *in your message*)

Send to guillaume.dardenne@chu-brest.fr **before 31 May 2021**

- Detailed CV and cover letter
- Main diplomas
- All transcripts (Bachelor and MSc or DNM or Engineering School)
- Two letters of recommendation