Internship proposition

Academic Year: 2024-2025

Acronym: ECOMOCAP

Project title:

Markerless motion capture for biomechanical and ergonomic workstation assessment

Supervisor:

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Pedagogic team: Jelena Petronijevic, Associate professor, ENSAM Metz.

Collaborations: This project is part of a collaboration with the laboratory LCFC (Laboratoire Conception Fabrication Commande) of Arts et Métiers Institute of Technology, Metz Campus.

Project description:

Motion analysis can be a decisive factor in the management of certain musculoskeletal pathologies or in the prevention of musculoskeletal disorders in the context of occupational health. For reasons of complexity and cost, reference systems based on reflective markers and infrared cameras, such as the VICON system, are rarely used in clinical or industrial settings and remain tools for R&D (biomechanics, ergonomics, cobotics, etc.) and entertainment (movies, video games). In this context, a marker-less system without constraints for the subject could have a major impact on the use of motion analysis in clinical and occupational health applications.

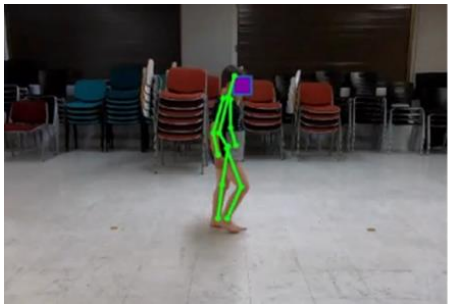

Figure 1 Left. Marker-less gait capture in Bicêtre Hospital (Le Kremlin-Bicêtre). Right. Marker-less handling motion capture in lab environment.

Through two Ph.D. theses, our research on this subject has led us to introduce an Artificial Intelligence based system equipped with 4 cameras, also called ECOMOCAP (1-3). This system is promising for clinical gait analysis (see Figure 1 left) and ergonomic assessment (see Figure 1 right). However, this system is currently limited to a laboratory environment, which is not representative of the real situation in industry.

The aim of this internship is therefore to transfer and evaluate this technology in a realistic industrial environment. For this purpose, video data will be collected in our partner laboratory, LCFC at ENSAM Metz. This project is a satellite project of an ongoing PhD thesis in collaboration between our 2 laboratories.

We believe that this internship can contribute to the extensive use of quantitative movement analysis in occupational healthcare. Computer programming skills, particularly in Python, are required for applying to this internship. Interest in deep learning and computer graphics is a plus.

References

1. Vafadar S, Skalli W, Bonnet-Lebrun A, Khalifé M, Renaudin M, Hamza A, et al. A novel dataset and deep learning-based approach for marker-less motion capture during gait. Gait Posture. 1 mai 2021;86:70-6.

2. Vafadar S, Skalli W, Bonnet-Lebrun A, Assi A, Gajny L. Assessment of a novel deep learning-based marker-less motion capture system for gait study. Gait Posture. 1 mai 2022;94:138-43.

3. Jiang J. Contribution à l'analyse biomécanique et ergonomique de poste de travail par capture du mouvement sans marqueurs et vision par ordinateur. PhD dissertation.

4. Pavlakos G., Choutas V., Ghorbani N., Bolkart T., Osman A., Tzionas D., Black M., Expressive Body Capture: 3D Hands, Face, and Body From a Single Image. 2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)