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School of Kinesiology and Health Studies

NSERC Undergraduate Summer Research Award (USRA): 2024

Faculty supervisor: Dr. Pouya Amiri

Marker-less Motion Capture Systems for Biomechanical Analysis

Marker-based motion capture systems have long been considered the gold standard for accurately measuring body segment motion during various activities. Nevertheless, their use of reflective markers, which need to be placed on numerous anatomical landmarks, makes them challenging and time-consuming to set up. Additionally, they are prone to errors due to inaccuracies in marker placement and skin movement artifacts. Recent advancements in machine learning have given rise to marker-less systems, which are considerably easier and faster to use and generally do not suffer from the aforementioned drawbacks. However, biomechanists still harbor concerns about their accuracy and performance, particularly in scenarios where their algorithms are not trained (e.g., with assistive devices). Therefore, the objective of this project is to compare the results of a comprehensive biomechanical analysis using both marker-less and marker-based motion capture systems during gait.

To achieve this, we will conduct walking and running experiments with both able-bodied and amputee individuals, simultaneously recording their data using a marker-less and marker-based motion capture system. The acquired data will then be utilized in musculoskeletal modeling software to assess movement kinematics, kinetics, and muscle forces. Statistical analysis will be carried out to compare differences between the two systems and to existing literature.

This research investigates whether marker-less motion capture systems can match the performance of marker-based systems in biomechanical analysis. The utilization of a marker-less motion capture system significantly diminishes the time and expertise needed for conducting biomechanical analysis. This facilitates the application of the system in clinics for improved diagnosis, training, and monitoring of musculoskeletal disorders.

Student Role and Responsibilities

- Undergo training for the secure operation of various biomechanics laboratory equipment, including marker-less and marker-based motion capture systems, force platforms, and electromyography.
- Receive instruction on biomechanical analysis and musculoskeletal modeling.
- Complete training sessions covering ethical considerations, conduct, and safety protocols for human data collection.
- Contribute to the execution of human experiments

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- Acquire skills in proper data management and analysis techniques
- Compile weekly progress summaries.
- Participate in team meetings
- Assist with any required ethics applications.
- Support the preparation of scientific documents.
- Contribute to participant recruitment.
- Maintain full compliance with Tri-Council Policy Statement requirements.