Topic: Development of a framework for markerset reconstruction

Optical motion capturing is the gold standard for quantitatively tracking human movement, for example gait. In this method, reflective markers are attached to anatomical landmarks of the human body. The markers reflect the light emitted by multiple infrared cameras and from this reflection the three-dimensional position of the marker is calculated. The procedure is expensive and time consuming though, for which reason most studies only measure motions from a small number of participants.

Various protocols for marker placement exist, like the Plug-in Gait, the LAMB protocol or the Helen-Hayes markerset, that differ in the number and the location of the attached markers. Some labs have even developed their own markerset which is adapted to their specific needs. This is practicable, as long as only data from the same experiment is considered for an analysis. Nevertheless, when comparing different studies or when combining multiple existing datasets for a study, differences in the markerset are problematic. Also, if already measured data is analyzed in retrospect and it is noticed that a certain marker was not considered in the original protocol, the data can not be utilized.

The goal of this thesis is to create a framework that can return the marker trajectories of an arbitrary markerset from movement data recorded with another markerset. Hereby the main focus is human gait. The framework should be implemented based on OpenSim, an open source software that uses models of musculoskeletal structures to create dynamic simulations of movement. Previous work has been conducted that allows to extract the position of virtual markers attached to an OpenSim model from an inverse kinematic analysis based on experimental data. In the thesis, this approach should be refined and expanded. The developed framework should be evaluated with own measurements.

The proposed work consists of the following parts:

- Literature research of relevant work resulting in a comprehensive list of existing markersets and protocols.

- Design of an marker protocol that incorporates at least three identified markersets.

- Conduction of optical motion capture measurement of gait using the developed marker protocol.

- Implementation of the framework based on OpenSim and existing code.

- Evaluation of the framework using the measured motion data.