Project Description

Purpose

Human movement disorders affect one-third of Australians. However, the traditional methods of measuring movement, such as video motion capture systems, are expensive and have many limitations. Although we already have a deep neural networks model that can convert the data of wearable internal measurement units (IMUs) into ankle joint angles, which is low-cost and remove the restriction, this model still cannot be directly available to non-IT users (Senanayake, Halgamuge and Ackland, 2021). This project will build a user-friendly system for this model so that it can be applied to more daily and research scenarios.

Acronyms and Abbreviations

Terminology	Description
IMU	Internal measurement units
IK	Inverse kinematics
NN	Neural networks

About the Client

A/Prof David Ackland

A/Prof Ackland's background is in biomechanics and orthopaedics. His research focuses on computational modelling and experimentation of human movement biomechanics, with a particular emphasis on the structure and function of the upper and lower extremities, and jaw. He employs medical imaging, human motion experiments, musculoskeletal modelling, and in vitro biomechanical experiments as his primary research techniques. His research outputs to date have had a strong focus on the measurement and modelling of muscle and joint function during human movement, as well as the design and evaluation of joint replacement prostheses.

Source: David Ackland

Damith Senanayake

Damith Asanka Senanayake is a research fellow In artificial intelligence and biomedical engineering. He is the first author of the paper *Real-time conversion of inertial measurement unit data to ankle joint angles using deep neural networks*. The model in this paper is also the core conversion model to be used in this project.

Source: Damith Asanka Senanayake

System

Existing resource

A mature neural network model to convert IMU data to joint angles is ready to be used.

Desired System

The system will be in the form of a website, considering the heterogeneity of the system. This is because the website can be used on various OS and mobile devices rather than software that may be restricted by other operating systems or device types.

Scope

In Scope Features

1. Website introduction section: This section includes the introduction to the aim of this website and also the method of how to use this website.

2. Login and Registration section: In this section logged-in users can use all functions of this website. If a user does not have an account, he can register, but it needs administrator approval to register successfully.

3. Data processing section: In this section, the system will use NNs to convert raw IMU data to joint angles and potentially other biometrics and data filtering may also be processed. Ideally, these are done in real-time.

4. Data logging, and conversion section: In this section, the visualisation of data will be shown in real-time too. The visualization format can be plotting trends or using a skin/avatar to visualise movement.

Out of Scope Features

1. Share data between users: Users of this website can use the data conversion function and view the visualization of data through login, but these data can not be shared.

2. Give professional opinions through data transformation: The purpose of this website is to transform and display data, but if more results and opinions are needed based on the data, more research is needed.

References

Senanayake, D., Halgamuge, S. and Ackland, D.C. (2021). Real-time conversion of inertial measurement unit data to ankle joint angles using deep neural networks. *Journal of Biomechanics*, 125, p.110552. doi:10.1016/j.jbiomech.2021.110552.