Cyber-physical system for gait posture and motion analysis

Project Leader
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1. Objective

This project is aimed at:

Development of a small-scale cyber-physical system that supports well-being for individual users; this will contribute greatly to the fields of healthcare, medical welfare and sports. So far, systems for evaluation of gait posture and proposal of statistical improvement plan based on the use of monocular camera video have been put on the market. However, those systems are not highly accurate and their output does not reflect individual characteristics. Therefore, in this study, we propose a system that quantitatively visualizes clinically useful gait ability without interfering with the user's movement, and provides feedback on optimal motion and posture for the specific user, with less load on the body than in other systems.

2. Project Outline

To achieve the above objectives, the project will consist of the following phases:

(a) Experiments to acquire human body data (web camera, motion capture, force plate, wearable sensors, etc.)
(b) Creation, implementation, and refinement of novel algorithms for determining load on the human body, using deep learning and musculoskeletal model simulation
(c) Establishment and implementation of a methodology for personalized derivation of the optimal form of gait improvement
(d) Construction of a database for accumulating gait information
(e) Development of a web application, with secure cording
(f) Experiments to verify improvement in gait motion and posture

3. Expected Performance

In this project, the successful candidate would be expected to:

(a) identify issues and make research plans to achieve related research goals;
(b) survey and develop an understanding of related international journal papers independently;
(c) work independently on a research topic and implement a novel system; and
(d) present research results at international conferences, and publish them in three or more papers in international journals.

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

(a) excellent programming skill in C, C++, Python, MATLAB and the like;
(b) a deep understanding of human dynamics and deep learning; and
(c) deep knowledge of musculoskeletal model simulation, signal processing, image processing, databases, web application, and security.

References

1） S Hontama, K Shibata et al.: "Estimation of Body Part Acceleration While Walking Using Frequency Analysis", *CENTRIC 2020, The Thirteenth International Conference on Advances in Human-oriented and*

Personalized Mechanisms, Technologies, and Services, 2020.

2） Himeda, H., Shibata, K., Satoh, H.: "Estimation of Load on Lumbar Spine While Walking by Using Multiple Regression Analysis." *Advances in Intelligent Systems and Computing*, Volume 1205, pp 282-288, AHFE Virtual Conference on Human Factors and Ergonomics in Healthcare and Medical Devices, 2020.

See our admission guidelines:

https://www.kochi-tech.ac.jp/english/admission/ssp_aft19oct/ssp_application_guideline.html

Contact

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