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Department	School of Engineering and the Built Environment
Supervisors	Professor Hongnian Yu, Dr Pelagia Koufaki and Professor Michael Vassallo
Funding Status	Funded PhD Project (Worldwide)
Application Deadline	14/04/2022
Project Title	Design and implementation of an automatic lower limb gait features extraction method to support evaluation and rehabilitation of patients with gait abnormality and poor mobility at their own home

PROJECT DESCRIPTION

Gait asymmetry (GA) is an indicator of different diseases and disease progression. It results in reduced gait efficiency and activity levels. GA objective assessment is important in the treatment and rehabilitation of patients with various conditions such as falls or orthopaedic surgery. Gait is the result of a series of rhythmic alternating movement of arms, legs, and trunk which create forward movement of the body. GA can be a determinant of recovery in patients with different diseases such as Parkinson's disease and stroke. It can be used to monitor and improve an athlete's performance as well as a patient's progress in orthopedics and rehabilitation. In biometrics and biomedical engineering areas, gait analysis is used as an assistive tool to characterize human locomotion. GA is important in elderly patient fall risk assessment, and is a predictor of functional and cognitive decline.

In order to broaden the use of accurate quantitative GA monitoring in clinical screening and research, an affordable GA tool is required which can be used in clinic or home. This project aims to investigate and develop a healthcare technology to support evaluation and rehabilitation of patients with gait abnormality and poor mobility at their own home.

This project is supervised by the multidisciplinary team which includes research expertise, clinical experience and the networks of people from Edinburgh Napier University, QueenMargaret University, and Royal Bournemouth Hospital. Building on our previous work, we will implement new methodologies and develop new tools to record and monitor quantity and quality of human movement, incorporating data analysis, with state-of-art wearable devices, to offer novel insights into gait pattern of elderly and frail individuals and the relationship to health and wellbeing outcomes.

Academic qualifications

A first degree (at least a 2.1) ideally in Computing, or Computing Engineering, or Electronics and electrical engineering, or Robotics, or Mathematics or Health and Exercise related disciplines with a good fundamental knowledge of wearable sensors and quantitative data analysis and experience with working with human participants in research or practice settings..

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.

Essential attributes:

- Experience of fundamental sensor technology and data analysis
- Competent in statistics and data modelling
- Knowledge of applied statistics
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

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Indicative Bibliography	[1] Arif Reza Anwary, Hongnian Yu , Andrew Callaway, Michael Vassallo, Validity and consistency of concurrent extraction of gait features using inertial measurement units and motion capture system, IEEE Sensors Journal, 21 (2), Pages 1625-1634, 2021 [2]. Yan Wang, Shuang Cang, Hongnian Yu, A survey on wearable sensor modality centred human activity recognition in health care, Expert Systems with Applications, Volume 137, Pages 167-190, 2019 [3]. Arif Reza Anwary, Hongnian Yu and Michael Vassallo, Gait Evaluation using Procrustes and Euclidean Distance Matrix Analysis, IEEE Journal of Biomedical and Health Informatics, 2019 [4]. Yan Wang, Shuang Cang, Hongnian Yu, Improving Daily Activity Recognition Accuracy for Older People: Data fusion based on a case study in a Hybrid Sensory Environment, IEEE Sensors Journal, 18(16), pp. 6874 – 6888, 2018 [5]. Arif Reza Anwary, Hongnian Yu and Michael Vassallo, Optimal foot location for placing wearable IMU sensors and automatic feature extraction for gait analysis, IEEE Sensors Journal, pp. 2555 – 2567, 18(6), 2018 [6]. Arif Reza Anwary, Hongnian Yu and Michael Vassallo, Automatic gait feature extraction method for identifying gait asymmetry using wearable sensors, Sensors 2018, 18(2), 676 [7]. Saisakul Chernbumroong, Shuang Cang and Hongnian Yu, A practical multi-sensor activity recognition framework for home-based care, Decision Support Systems, 66, pp. 61-70, 2014, [8]. Saisakul Chernbumroong, Shuang Cang, Anthony Atkins, Hongnian Yu, Elderly activities recognition and classification for applications in assisted living, Expert Systems with Applications, 2013
Funding notes	This project may be funded by a scholarship of the School of Engineering and Built and Environment. Please see School-funded PhD scholarships - RESEARCH AND INNOVATION (napier.ac.uk) for information on the scholarships and how to apply for them.
Enquiries	For informal enquiries about this PhD project, please contact Professor Hongnian Yu (Email: h.yu@napier.ac.uk) or Dr Pelagia Koufaki (Email: PKoufaki@qmu.ac.uk)
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process

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