Workshop: Wearable and Assistive Robots

Code: WAM06 | Wednesday, 26th June

Royal Geographical Society

Co-Chairs and Organisers:

Shane Xie, University of Leeds, Uk
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Zhiqiang Zhang, University of Leeds, UK
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08:30-09:00	**Registration and Coffee**
09:00	**Opening: Welcome & Introduction**
09:10	**Sensing and Understanding for Wearable and Assistive Systems** *(Keynote) Honghai Liu, University of Portsmouth, UK*
09:40	**Wearables for Position Tracking and Motion Intent Recognition** *Sanja Dogramadzi, UWE Bristol, UK*
10:10	**Musculoskeletal Mechanics and Mechatronics: Biomechanical Engineering from Human and for Human** *(Keynote) Lei Ren, University of Manchester, UK*
10:40-11:15	**Coffee Break**
11:15	**Smart Lower Limb Prosthetics** *Abbas Dehghan, University of Leeds, UK*
11:45	**A Wearable Device for Ankle Sprain Prevention and Rehabilitation** *Daniel Fong, Loughborough University, UK*
12:15	**Wearable Technology to Transform Patient Care in Hospital and Home Environments** *Delarm Jarchi, University of Essex, UK*
12:35	**Panel Discussion**
13:00	**Lunch**

Keynote Speaker:

Honghai Liu, University of Portsmouth, UK

Title:

Sensing and Understanding for Wearable and Assistive Systems

Abstract:

It requires innovative technologies and theoretical foundation of sensing and understanding to meet increasing complexity of modern human centred systems. The state of the art in human machine interface is largely dominant by solutions that are ad-hoc and applications dependent. This talk attempts to summarize challenges of sensing and analytics from the perspective of human-machine systems. Two projects will be presented to showcase human hand skill transfer and interaction with autism children. The talk will conclude with comments on open issues and challenges.

Biography:

Honghai Liu received his Ph.D from King's College, University London, UK. He is a Professor in Human Machine Systems at the University of Portsmouth, UK. He previously held research appointments at the Universities of London, University of Aberdeen, and project leader appointments in large-scale industrial control and system integration industry. He is interested in sensing and understanding for human machine systems and their applications with an emphasis on approaches that could make contribution to the intelligent connection of perception to action using contextual information. His research has been funded by UK research councils, EU FP7, the Leverhulme Trust, the Royal Society and industry partners. He has authored/co-authored more than 200 per-reviewed journals and conference papers. He is an IET Fellow and JSPS Fellow.

Keynote Speaker:

Lei Ren, University of Manchester, UK

Title:

Musculoskeletal Mechanics and Mechatronics: Biomechanical Engineering from Human and for Human

Abstract:

A wide variety of physical movements can be achieved by the human neuromusculoskeletal system, from normal walking to the skillful performance of a professional dancer. All these motor tasks involve the load transmission and distribution through the body, balance and coordination. The quest toward understanding how these tasks are achieved by the human body has been of interest to scientists for centuries. This talk presents our recent attempts to explore the in-vivo working condition of the human musculoskeletal system during different motor activities, and also to develop human-centred

robotics based on learnt biomechanical principles. This involves a range of researches into the biomechanics and motor control of human motions at different system levels using an integrated experimental, computational and bio-robotic approaches. Our long term aim is to gain comprehensive understanding of the functions of musculoskeletal systems and the interactions between the musculoskeletal and neuromotor systems. Such research provide solid scientific foundation for the development of novel preventative and rehabilitative programs and devices, clinical diagnostic and surgical techniques, and also human-centred robotics, e.g. prosthetics, exoskeleton systems based on bio-inspired principles.

Biography:

Dr Lei Ren is a Reader in Biomechanics and Biorobotics at School of Mechanical, Aerospace and Civil Engineering, University of Manchester. He received his B.Eng., M.Eng. in Mechanical Engineering and Ph.D. in Vehicle Engineering from National Laboratory of Automotive Dynamic Simulation, Jilin University, China. He then came to Centre for Rehabilitation and Human Performance Research, University of Salford, and worked on a UK Ministry of Defense project on human locomotor biomechanics and received a Ph.D. in Biomechanics. Thereafter, he worked at Structure and Motion Laboratory, Royal Veterinary College, University of London, as a BBSRC research fellow on comparative musculoskeletal biomechanics. From 2007 to 2010, he was with Centre for Robotics Research, Division of Engineering, King's College London as a lecturer. Dr. Ren joined the School of MACE, University of Manchester in 2010, and also works as a research scientist at Structure and Motion Laboratory, University of London. He is the founding member of the International Society of Bionic Engineering, and also a member of the International Society of Biomechanics, European Society of Biomechanics, the Society of Experimental Biology and European Society for Movement Analysis in Adults and Children.

Speaker:

Abbas Dehghan, University of Leeds, UK

Title:

Smart Lower Limb Prosthetics

Biography:

Abbas Dehghani-Sanij is Chair in bio-mechatronics and medical robotics at the University of Leeds and has worked in this area for >15 years. He was the Director of the Centre for Mechatronics and Robotics (2012-2017) at UoL. Current research includes soft robotic design and 3ptimization, soft actuators, machine intelligence and control, for a wide range of applications in healthcare, assistive technologies and other industries with particular focus on bio-inspired robotic locomotion. He has supervised >10 post docs and 40 research students and received funding of >£15M. He has >150 refereed publications and relevant contributions to book chapters. He leads a number of EPSRC and Industry funded projects including: intelligent control of a multi-site research project on “Wearable Soft Robotics for Independent Living (EP/M026388/1)”, “Intelligent Modular full Body Assistive and Enhancive Robotic Exoskeletons”, and is a Co-I on “A Platform for Hybrid Manufacturing Process

Research (EP/P027687/1)". These projects aim to improve the quality of life for people with disabilities and the growing aging population worldwide.

Speaker:
Sanja Dogramadzi, Bristol Robotics Laboratory, UK

Title:
Wearables for Position Tracking and Motion Intent Recognition

Biography:

Prof Sanja Dogramadzi is a Chair of Medical Robotics and Director of Robotics Engineering and Computing for Healthcare Centre at BRL since 2012. Her research focuses on surgical and rehabilitation/assistive robotics, haptic feedback, soft sensing and soft robotic technologies with 120 refereed papers, 2 books (1000 citations, H-index 18) and 3 international patents. She is leading a team of 3 junior academic staff, 5 post-doctoral and 7 PhDs with diverse capabilities in design, control, sensing, biomechanics and machine learning in healthcare engineering and robotics applications. She has received over £5M research funding from EU (FP7, H2020), EPSRC, NIHR, Innovate UK and charities (Above&Beyond, Anchor Society, etc.). Her work on robot-assisted fracture surgery has been awarded the best health innovation award in Bristol and Bath in 2018, best medical robotics paper at ICRA 2016, and was also selected as one of innovative healthcare technology case studies by EPSRC in 2018. She also worked on hand exoskeletons for post-stroke rehabilitation. Her team also built first soft sensing structures for muscle activity detection during hand grasping.

Speaker:
Daniel Fong, Loughborough University, UK

Title:
A Wearable Device for Ankle Sprain Prevention and Rehabilitation

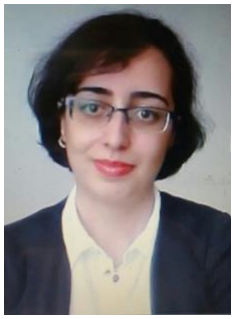
Abstract:

Ankle sprain is very common in sports; however, patients do not often seek treatment and repeated injuries can lead to long term ankle joint instability. In this talk, Dr Daniel Fong will introduce a wearable device that monitors ankle joint orientation and delivers electrical stimulation to the lateral shank muscles in order to prevent ankle sprain. The device can also be used for patients with chronic ankle instability for rehabilitation purpose.

Biography:

Dr Daniel Fong has an interdisciplinary background. He has his BSc in Physics, MSc in Exercise Science, PhD in Orthopaedics and Traumatology. He is currently a Senior Lecturer in the National Centre for

Sport and Exercise Medicine, Loughborough University. He is a fellow and former vice president of the International Society of Biomechanics in Sports, and is currently the editor of the society's journal, Sports Biomechanics. He is also a core member of the International Ankle Consortium, a life member of The World Association of Chinese Biomedical Engineers and a fellow of The Hong Kong Association of Sports Medicine and Sports Science.



Speaker:
Delarm Jarchi, University of Essex, UK

Title: *Wearable Technology to Transform Patient Care in Hospital and Home Environments*

Abstract:
Continuous monitoring of physiological changes of patients inside the intensive care units (ICU), following ICU discharge or their home environments is a crucial step to transform the current healthcare systems. To identify deteriorating patients in the hospitals and avoid patient death, detecting changes in vital signs is significantly important. One important vital sign that has recently attracted many research studies is the respiratory rate (RR). Validation of this vital sign obtained from wearable sensors in the clinical environment during continuous monitoring over few hours/days is an extremely important and challenging task.
On the other hand, estimation of RR from wearable sensors is significantly useful in various home-base monitoring applications such as monitoring patients with chronic obstructive pulmonary disease (COPD) at their home environments to manage their symptoms. In this talk, we look into methods for estimation of RR from patients in the hospital ward following ICU discharge using three different simultaneous recordings including photoplethysmography (PPG), electroencephalography (ECG) and accelerometer signals with a focus on accelerometry based estimation of RR. In addition, we look into method for developing wearable sensing platforms for managing the rehabilitation of COPD patients.

Biography:
Delaram completed her PhD in biomedical signal processing at the University of Surrey, UK in 2011. Her research was focused on processing of brain signals using electroencephalography (EEG). She was a member of Body Sensor Network (BSN) at Imperial College London and involved in development of algorithms for motion analysis using body worn sensors and unobtrusive heart rate monitoring from peripheral sites at University of Manchester. She was also a member of computational health informatics lab at University of Oxford and worked on wearable sensors to contribute to the design of a wearable multivariate patient monitoring system for use at scale in clinical practice. Her research interests include time-series analysis, adaptive signal processing and machine-learning for bio-signal processing.